Project report
on

"Evaluation of stock performance of InfoTech companies which have maximum Return with minimum Risk."

UNIVERSITY OF NORTH TEXAS

TOULOUSE GRADUATE SCHOOL
MSc in Advanced Data Analytics

Data Analytics I

Submitted by:

Team Name: DATA TRACKER

1) Bhuvana Sibbala - 11737701 (Team Leader)

2) Kannamreddy Neeraj – 11749755

3) Vishnu Vardhan Reddy Golamari – 11682425

4) Navya Gogula – 11750201

Abstract

Evaluating the stock performance of company stocks before investing helps the investors to find the amount risk and return associated with the stocks. The stock market is always high volatile and difficult to predict the returns without any analysis. In this paper, we are analyzing the stock performance of specific IT sector companies to calculate their expected return with the use of CAPM model, which is ultimately used to find the associated systematic risk involved in investing a stock. The analysis is done on 7 companies for over 7-year period from 2015 to 2023. The stock returns are compared with their index market returns of S&P 500 to find whether the trend is in line with the market return. We performed the Exploratory data analysis which helps in making assumptions for analysis. Also, the Regression, descriptive analysis and ANOVA analysis is performed to find out the slope and Beta which is risk factor and standard errors in the historical returns. Research on Hypothesis test was done to determine the change in the stock returns compared to the Market returns.

Table of Contents:

1.Introduction: 6
1.1.ORACLE: 7
1.2. Salesforce Inc: 7
1.3 Cisco Systems Inc: 8
1.4 Accenture: 8
1.5 Adobe: 9
1.6 Broadcom: 9
1.7 Intel Corporation: 9
1.8 S&P 500: 10
2.Statement of the Problem: 10
3.Objectives of the Study: 11
4.Exploratory Data Analysis (EDA): 11
4.1.Graphical methods: Line Graph 14
4.2.Histogram: 15
4.3.Heatmap: 16
4.4.Box Plot: 17
5.Regression Analysis and ANOVA: 18
6.Risk – Return analysis using CAPM: 23
7.Hypothesis T-test: 32
8.Conclusion: 34
9.References and Sources: 35

List of Tables:

Table 1: Summary of Descriptive Statistics of Stock and Index returns……12

Table 2: Statistics of Stocks and Index using Describe function……14

Table 3: Regression statistics for 7 stocks over 8 years period……..19

Table 4: ANOVA for ORCL vs S&P 500 returns……...19

Table 5: ANOVA for CRM vs S&P 500 returns…….20

Table 6: ANOVA for CSCO vs S&P 500 returns……20

Table 7: ANOVA for ACN vs S&P 500 returns……..21

Table 8: ANOVA for ADBE vs S&P 500 returns……21

Table 9: ANOVA for AVGO vs S&P 500 returns……22

Table 10: ANOVA for INTC vs S&P 500 returns……22

Table 11: Risk-Return analysis for all companies…….31

Table 12: T-Test hypothesis test results……33

List of Figures:

Figure 1: Line chart showing Stock price movement for all periods……14

Figure 2: Histogram showing Stock and Index Returns for all periods……15

Figure 3: HeatMap showing Stock and Index Return for all periods……16

Figure 4: Boxplot showing Stock and Index Return distribution for all periods ……..17

Figure 5: Scatter plot showing ORCL vs S&P 500 index Return……..25

Figure 6: Scatter plot showing CRM vs S&P 500 index Return……..26

Figure 7: Scatter plot showing CSCO vs S&P 500 index Return……27

Figure 8: Scatter plot showing ACN vs S&P 500 index Return……..28

Figure 9: Scatter plot showing ADBE vs S&P 500 index Return……29

Figure 10: Scatter plot showing AVGO vs S&P 500 index Return……..…30

Figure 11: Scatter plot showing INTC vs S&P 500 index Return……...31

1.Introduction:

The stock market is very fluctuating depending on several types of risks. While making investments, it is very crucial for the investors to predict the nature of the stock. Any investment includes return along with risk. Therefore, it is important to understand the risk which is necessary to maximize the profits. The best stocks are those that have lowest risk with high returns. So, the risk-return analysis can be carried out for making suitable decision.

In this report, we have selected 7 prominent companies from the IT sector of S&P 500 index which are trading in NYSE and Nasdaq stock exchanges. The S&P 500 is an index that tracks the top 500 publicly traded companies, and it is one of the best indices used to measure the US stock market performance. Information technology sector plays a key role in introducing and developing new technologies in the world. So, we choose to analyze the companies from IT sector for better investments. For analysis, we choose to perform CAPM (Capital Asset Pricing Model) model to analyze the Risk- Return performance of the stocks which helps in finding the amount Risk which is Beta value and it's expected return. Before this, we are going to perform an Exploratory Data Analysis to find out the key descriptive statistics and understand the dataset.

Dataset:

In the dataset, we first downloaded the daily closing price data of 7 companies along with S&P index price from a notable website called Yahoo Finance from 1/2/2015 to 12/29/2023 trading days data. It consists of total 2265 rows and 18 columns of data. We represented the companies with their trading tickers as ORCL(Oracle), CRM(Salesforce), CSCO(Cisco), ACN(Accenture), ADBE(Adobe), AVGO(Broadcom), and INTC (Intel corporation). With the closing price columns, we calculated the daily Price return with the following formula in excel.

Price Return = [(Current Price – Previous price)/Previous price] *100

The Price data columns are represented as ticker name with price as suffix and the Return data columns are represented as ticker name with Return as suffix. Further, we downloaded another column daily 7 years of U.S. Treasury data from official U.S. department of treasury web link which considered as Risk free rate data in calculating CAPM model.

For finding the Risk factor in CPAM and variance, we ran Regression and ANOVE models in excel. Also, we conducted Hypothesis test to find the Null hypothesis rejection and the relation of stock returns in comparison to Market returns for better investment decision.

Hence, the **Target variable** would be the **Expected return**.

The main **Target Audience** would be the **Investors** who are interested in the stock performance for better investment opportunities.

The list of the companies are as follows:

1.1. ORACLE:

The Oracle corporation named as Oracle is a technology company currently trading in NYSE with a ticker ORCL. Larry Ellison along with Bob Miner and Ed Oates has co-founded Oracle corporation in the year 1977 as Software Development Laboratories (SDL). Now, the headquarter is located at Austin and have multiple branches worldwide. The Initial public offering was made on March 12, 1986, with an IPO price of $15. In 2013, its stock listing got transferred from Nasdaq to NYSE and as of 3/28/2024, the stock was trading at $125.61 which has increased drastically over the years. As of 2023-year end, it has total Revenue of US $49.95 billion, Net Income of US$8.503 billion, Total Assets of US$ 134.4 billion and Total Equity of US$1.556 billion.

1.2. Salesforce Inc:

The Salesforce Inc is an American software company currently trading in NYSE with a ticker CRM. The headquarter is in San Francisco and was founded in 1999 by Marc Benioff. It provides

several cloud services like CRM, Marketing cloud, Sales cloud, and technologies like Slack. Later, it went IPO in the year 2004 and listed in NYSE with an opening price of USD $11. Before IPO, the revenue of the stock has dramatically increased from USD $5.4 million in 2001 to USD $100 million in 2003 and stood as one of the largest software companies in the market. In 2009, it reached USD $1 billion of revenue. As of 30/28/2024, the stock is trading at USD $301.18 with Total Revenue of USD $34.86 billion, Net income of USD $4.136 billion and Total Assets of USD $99.82 billion.

1.3 Cisco Systems Inc:

The Cisco systems Inc is an American digital communications technological company established in 1984 currently trading in Nasdaq with the ticker CSCO. The headquarter is in San Jose, California. It provides several hardware and software equipment along with other technology services. It also offers a few great products like Jabber, Webex, Jasper, Silicon one, OpenDNS, Duo Security. It went IPO in the year 1990 and listed in Nasdaq with an opening price of USD $18 per share. As of 30/28/2024, the stock price of Cisco is trading at USD $49.91 with a Net Revenue of USD $56.99 billion, Net Income of USD $12.61 billion, and Total assets of USD $101.8 billion.

1.4 Accenture:

The Accenture is a service-based company founded in 1989 and currently trading in NYSE with the ticker ACN. It provides business strategies, software with emerging technologies and cloud based and IT services to the industries. It went IPO in the year 2001 with an opening price of USD $14.50 per share. The headquarter is in Dublin. As of 3/28/2024, it is trading at the share price of USD $346.61 and in the year end 2023, its annual Revenue is USD $64.11 billion, Net income of USD $7 billion, Total Assets of USD $51.25 billion.

1.5 Adobe:

Adobe Inc. is an American software company headquartered in California and currently trading in Nasdaq with the ticker ADBE. It was founded in the year 1982 and provides various products like Adobe Photoshop, Acrobat Reader, Portable document format. It primarily provides the software for content creation, publishing, and editing along with SaaS and Adobe Creative cloud service. It went IPO in the year 1986 with an opening price of USD $11 per share. As of 3/28/2024, it is trading at USD $504.60 and at the end of 2023 the total Revenue is USD $19.41 billion, Net Income of USD $5.428 billion, and Total Assets of USD $29.78 billion.

1.6 Broadcom:

Broadcom is a multinational company previously known as Avago technologies. It provides several infrastructure and semiconductor products, broadband, wireless and storage services. The headquarter is in Palo Alto and currently listed in Nasdaq and trading with the ticker AVGO. It went IPO in the year 2009 with an offering price of USD $15 per share. Avago technologies has acquired Broadcom corporation in 2016 and the ticker is still trading with respect to the old company Avago which represents the merged company now. As of 3/28/2024, it is trading at USD $1325.41 which is a huge upward trend in the stock price since IPO. As of 2023 year end, the Total Revenue is at US $35.82 billion, Net Income is US $14.08 billion and Total Assets is US $72.86 billion.

1.7 Intel Corporation:

Intel (Integrated Electronics) Corporation is one of the largest multinational software companies which manufactures semiconductors and devices. It provides all software and hardware components like CPU, memory cards, graphics processing units, chips and includes different segments like IoT, computing, Data center and programmable solutions. It was established in 1968

and listed in Nasdaq with the ticker INTC. It went public in the year 1971 at an opening price of US $0.23. As of 3/28/2024, it was trading at USD $44.17 and as of 2023 year end, the Total revenue is at USD $54.23 billion, Net Income is at USD $1.68 billion and Total Assets value is at USD $191.6 billion.

1.8 S&P 500:

The S&P 500 is an index which is know as Standard & Poor's 500 that holds the performance of top 500 stocks that are listed in all stock exchanges in the United States. It is most used as a benchmark for all public companies and holds 80% of total Market Cap. The index also includes Mutual funds, derivatives, and Electronic Traded Funds. It is founded in the year 1957 with a trading symbol as SPX. As of 3/28/3024, it trading price was USD $5254.35 and at 2023-year end, it is holding a Market Cap of USD $42.0 trillion. In this paper, we have analyzing all companies from the S&P 500 index, so we are considering it as benchmark market price.

2.Statement of the Problem:

Return and Risk and correlated and have linear relationship. Risk in general considered as a investment in a stock may or may not increase in future that generates high returns. In order to assess the investment opportunities which is easily understandable to the financial specialists, the analysis of risk and return is necessary. The research presented here aims to give investors the knowledge they need to weigh the risk and return when selecting the stocks while investing. There is a need to understand the historical trend of the stock returns to predict the future trend also, it is crucial to find the test significance to evaluate the performance of the sample.

3.Objectives of the Study:

To evaluate the CAPM Risk-Return analysis helps to find the expected return of the stock and risk associated with it.

Run the Regression analysis to find out the intercept and beta risk factor value of the stock with respect to the Market risk.

To analyze and find out the best stock with yields maximum returns while considering minimum amount of risk.

To test the Null and Alternative hypothesis to check if there is any difference in the Index and Stock returns.

4.Exploratory Data Analysis (EDA):

The analysis is done on the daily price returns of the stock instead of closing price to evaluate the accurate returns of the stock. The Exploratory Data analysis is done by the data analysts to examine, interpret and summarize the datasets and its features. It helps in finding the correlation or relationship between the variables, to understand the trends and patterns in the data and to find the outliers if there are any. This EDA analysis is further used to determine the hypothesis testing by doing simple linear regression, t-test and ANOVA to statistical analysis. It gives the Descriptive statistics data of a variable in the dataset to know, the mean, median, standard deviation, kurtosis, skewness, min, and max values. There are different types of EDA analysis tools available like Graphical, Non-Graphical, Univariate and Multivariate.

Below are tables that shows the brief analysis of descriptive statistics data of all individual stock returns and S&P 500 index which is done in excel Data Analysis.

	ORCL Return	*CRM Return*	*CSCO Return*	*ACN Return*	*ADBE Return*	*AVGO Return*	*INTC Return*	*S&P 500 Return*
Mean	0.060	0.091	0.053	0.080	0.115	0.143	0.048	0.045
Standard Error	0.036	0.046	0.034	0.033	0.043	0.047	0.044	0.024
Median	0.091	0.090	0.057	0.129	0.166	0.119	0.071	0.060
Mode	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Standard Deviation	1.696	2.194	1.618	1.568	2.064	2.212	2.108	1.153
Sample Variance	2.878	4.813	2.619	2.459	4.261	4.894	4.445	1.330
Kurtosis	20.047	13.463	11.241	6.708	8.456	8.358	10.604	14.469
Skewness	0.528	0.635	-0.360	0.196	-0.233	-0.081	-0.157	-0.518
Range	33.923	41.933	27.104	21.247	34.512	35.747	37.563	21.367
Minimum	-13.495	-15.888	-13.730	-8.390	-16.793	-19.913	-18.042	-11.984
Maximum	20.427	26.045	13.373	12.857	17.719	15.834	19.521	9.383
Sum	134.800	205.026	119.629	181.804	259.969	324.221	109.143	101.016
Count	2262	2262	2262	2262	2262	2262	2262	2262

Table 1: Summary of Descriptive Statistics of Stock and Index returns

- The Mean is an average value of all the data points in the variable.
- The Standard error is the amount of dispersion and shows the likelihood of the population mean deviating from the sample or linear regression. Lower the Standard error better the measure.
- Median is the median value of the column.
- Mode is the most repeated value in the column.
- Standard deviation is also a measure of dispersion with respect to its mean. If the standard deviation is high means the stock is high volatile and vice versa.
- Sample variance is the amount of distribution or spread of the data in the sample.
- Kurtosis explains how much data is dispersed in the tails of the distribution.
- Skewness is the distribution of the data from the mean, if the stock returns are positively skewed then the losses would be less.
- Range is calculated as Maximum value minus minimum value of the variable.

Interpretation:

If we observe various statistics from the above table, the standard deviation 1.568 and standard error 0.033 is low for ACN(Accenture) ticker mean the risk would be less followed by CSCO(Cisco) and ORCL(Oracle) where the AVGO (Broadcom) has the highest value of standard deviation 2.212 and standard error 0.047. If the Skewness is between -05 to 0.5, then it is said that the data is symmetric and if it is less than -0.5, then it is negatively skewed and if it is greater than 0.5, then it is positively skewed. Generally, the data is symmetric have less risk and high chances to get more returns. From the table, ACN seems to by symmetric data and ADBE, AVGO seems to be negatively skewed. The Kurtosis is also less (6.708) for ACN (Accenture) and very high (20.047) for ORCL(Oracle).

There is another descriptive analysis named Describe in Python code used to know the Percentile, mean, minimum and maximum values of the data set.

- Count is the total number of data points available in the variable.
- Mean is the average value.
- Min is the Minimum value and Max is the maximum value of the variable.
- 25% is the 25^{th} percentile, 50% is the 50^{th} percentile and 75% is the 75^{th} percentile.

	ORCL Return	***CRM Return***	***CSCO Return***	***ACN Return***	***ADBE Return***	***AVGO Return***	***INTC Return***	***S&P 500 Return***
count	2263	2263	2263	2263	2263	2263	2263	2263
mean	0.0589	0.0898	0.0519	0.0795	0.1146	0.1425	0.0477	0.0438
min	-13.495	-15.888	-13.7303	-8.3898	-16.7931	-19.9128	-18.0415	-11.9840
25%	-0.648	-0.8729	-0.6624	-0.6344	-0.7571	-1.0103	-0.9443	-0.3894
50%	0.0905	0.0897	0.0557	0.1270	0.164	0.1188	0.0687	0.059

75%	0.8118	1.1459	0.8065	0.8434	1.1163	1.2769	1.0930	0.5809
max	20.4271	26.044	13.3734	12.8573	17.7192	15.8336	19.5213	9.3827
Std	1.6963	2.1936	1.6184	1.5683	2.0638	2.212	2.108	1.1537

Table 2: Statistics of Stocks and Index using Describe function.

Interpretation:

The Maximum values are very high than 75th percentile for all companies, which means there are outlier in the price returns of the data. Also, the mean value is less than the median which is 50th percentile for all companies except AVGO, this also resembels there are outliers in the data. The standard deviation is less for Accenture with 1.568 and high for Broadcom with 2.212.

4.1.Graphical methods: Line Graph

We can perform the Exploratory data analysis with the help of graphs which are very helpful in finding the trends, patterns, outliers and relation between the variables in the dataset.

Below is a time series line chart plotted for the entire 8 year period which shows the daily stock price movement of all stocks. The x-axis is labelled with year and the Y-axis is labelled with the stock price. We created this chart with the help of Tableau to visualize clearly.

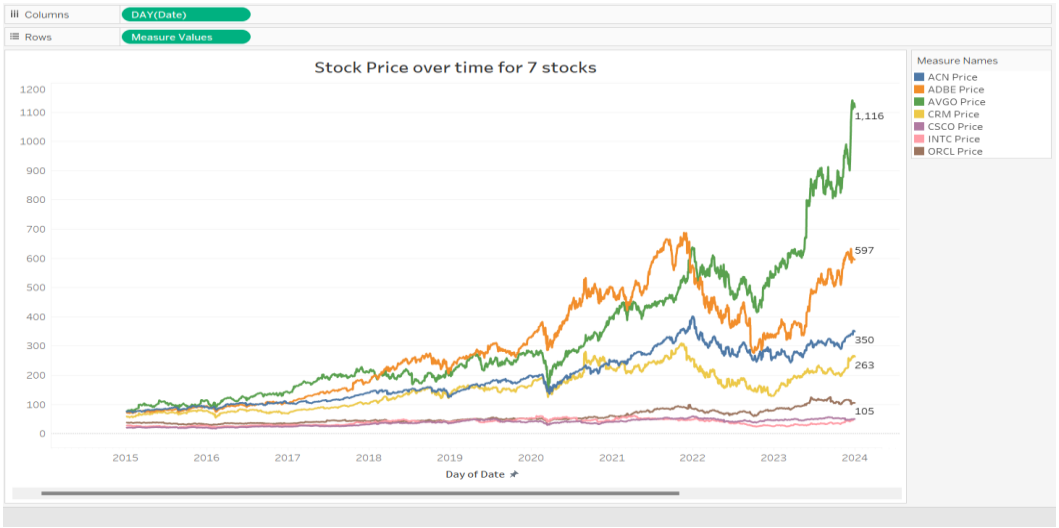

Figure 1: Line chart showing Stock price movement for all periods

Interpretation:

From the chart, we can observe that price of AVGO(Broadcom) has steady upward trend from October 2022 with USD $410 to end of 2023 with USD $1,116 followed by ADBE (Adobe) which has little upward trend and ends at USD $597 which represents high risk with returns. The Accenture(CAN) and Salesforce(CRM) has fluctuations in last 2 years with downward and updward trends. The Cisco(CSCO), Intel (INTL) and Oracle (ORCL) does not show either upward or downward trend over the time period and maintained some steady movement which represents less risk with less returns.

4.2.Histogram:

The below chart represents the Histogram that shows the Price returns of the stocks and Index for entire period. The X-axis denotes the stock returns and the Y-axis denotes density. We created this chart using Python code.

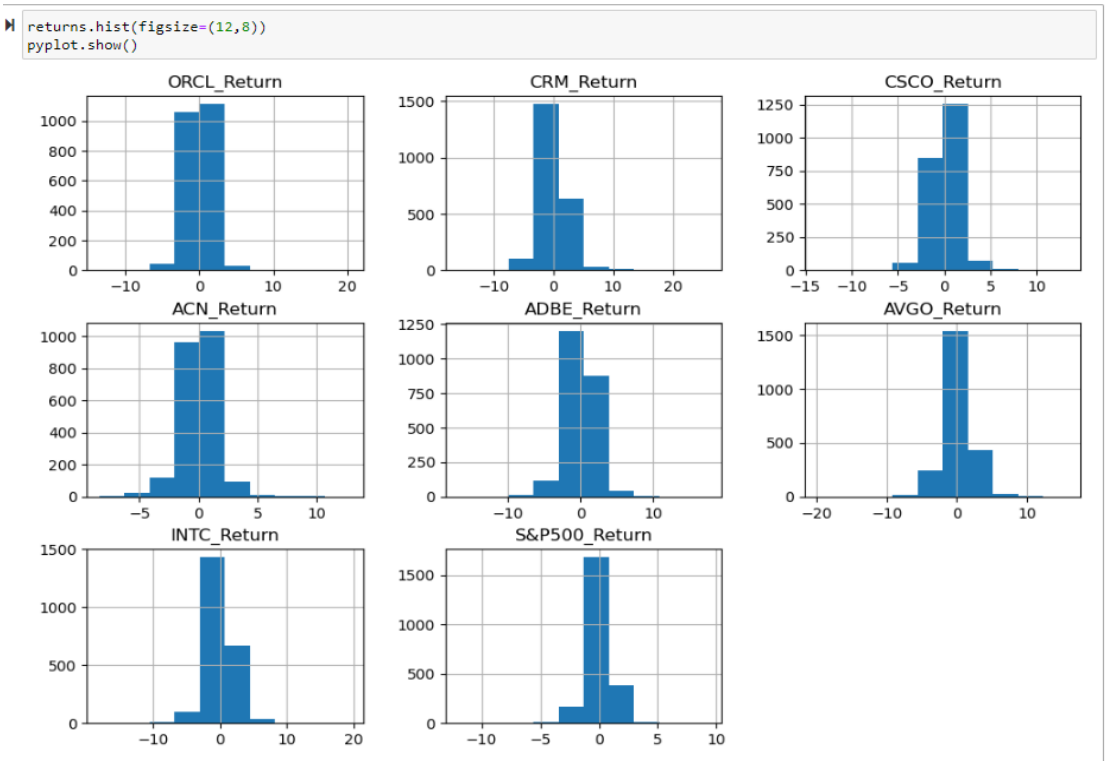

Figure 2: Histogram showing Stock and Index Returns for all periods

Interpretation:

The above Histogram chart that distributes the stock returns as bins. It represents how many stock returns of each bin relates to all the returns. The higher bar indicates the strong density with the given stock return range. This helps to find if the stock returns are normally distributed around the mean or not. If the distribution is asymmetrical, we can say that the chart is skewed to the right or left based on the spread of the data. From the chart, we can say that the data is not much skewed to the left or right. CRM and ORCL seems to be positively skewed and CSCO and ADBE are negatively skewed.

4.3.Heatmap:

The below chart is the Heatmap that shows the correlation coefficeint between the variables, the color of the cell represents the strength of the correlation. The cells which have darker shade have high correlation and lighter shade have less correlation. If the 2 variables are highly correlated, then there is a chance that if 1 stock return increases then the other stock returns tends to increase. This chart is created using Python code.

Figure 3: HeatMap showing Stock and Index Return for all periods

Interpretation:

From the above Heatmap, we can say that all stock returns are positively correlated. The ADBE and CRM price return is strongly correlated with 0.69 which means if the stock return of ADBE increases then the stock return of CRM tends to increase and the CRM and INTC are less correlated with 0.43. Also, if we compare the stock returns with the Index return, then ACN is strongly correlated with S&P 500 with 0.8 which means if the benchmark Index return increases, then ACN returns tend to increase and ORCL is less correlated with 0.64 among all 7 companies.

4.4.Box Plot:

The below chart shows the Boxplot diagram of the stock returns for the entire period. It is mainly used to identify if there are any outliers available in the dataaset and to understand the price and return distributions over time.

- The middle line in the box plot is the median value and represents the midpoint of the data.
- The box conatins 2 quartiles, Q1 and Q3 along with median line. There are 2 tails for each box and at the end, there will be Max and Min values of the dataset.
- The dots which are outside of the box are called as outliers.

```
fig,ax =plt.subplots(figsize=(14,8))
sns.boxplot(returns,palette='rainbow',ax=ax,orient='h' )
plt.xlabel('Price Return')
plt.title("Boxplots Showing the Price Return for the Entire Period")
plt.show()
```

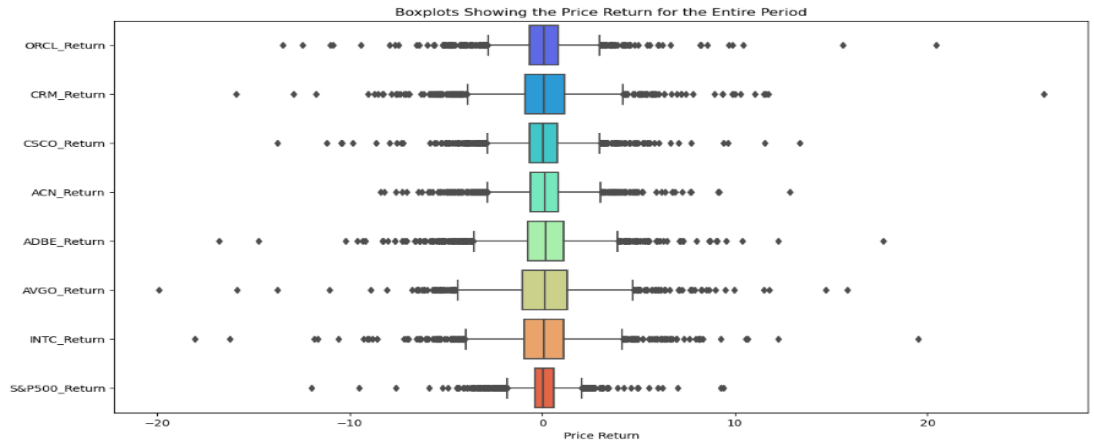

Figure 4: Boxplot showing Stock and Index Return distribution for all periods

Interpretation:

From the graph, we can observe that there are outliers in each stock which means the returns are either too positive or negative from the rest of the data points. The box plot with wide spread refers to have more variability and risker, AVGO, CRM, INTC seems to have wide range and more variability. Whereas, ACN and CSCO have smaller spread and variability.

5.Regression Analysis and ANOVA:

Since there are outliers in the dataset, we can not completely depend only on the descriptive statistics as those are not much reliable in this case. Hence, we are analysing through Regression and Hypothesis.

We are performing a simple linear Regression model for analysing the relationship and significance between the variables of stock returns and index retruns. In the analysis, we first check the multiple R which defines the correlation coefficient and R square. It measures the proportion of the variation on how the dependent variable is explained by the independent variable. The R2 value lies between 0 and 1 and if the value is close to 1 or higher value refers to a good fit and statistically significant that the prediction of dependent varaible is well explained by the independent variable. Next is the F-value confirm the level of significance and high F-valeu and low significance of F value confirm the good statistical significance. Then we consider T-test which determines the significance if the variable is different from zero, the higher in value, the more confidence in explaining the dependent variable based on its independent variable. It considers the Null hypothesis that the coefficients of independent variable is equal to 0. The P-value is used to find the significance level and if the P-value is less than the choosen significance generally 0.05, then we will reject the null hypothesis and can say that independent and dependent

variables are significant.

We have done the regression analysis in excel to explain the significance of each stock returns based on its market index return (S&P 500).

The equation of Simple linear Regression model is shown as below:

$$\mathbf{Y = \beta 0 + \beta 1 X + \varepsilon}$$

Here, Y is the dependent variable which is individual Stock returns.

X is the independent variable which is index return (S&P 500 return).

β0 is the intercept and β1 is the coefficient.

ε is the standard error.

Regression Statistics	ORCL Return	CRM Return	CSCO Return	ACN Return	ADBE Return	AVGO Return	INTC Return
Multiple R	0.644	0.651	0.711	0.798	0.717	0.685	0.665
R Square	0.415	0.424	0.505	0.638	0.513	0.470	0.442
Adjusted R Square	0.414	0.423	0.505	0.637	0.513	0.469	0.442
Standard Error	1.298	1.666	1.139	0.944	1.440	1.611	1.575
Observations	2262	2262	2262	2262	2262	2262	2262

Table 3: Regression statistics for 7 stocks over 8 years period.

ANOVA table:

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2697.436	2697.44	1600.315	4.7272E-265
Residual	2260	3809.379	1.69		
Total	2261	6506.815			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Alpha	0.01730	0.02732	0.63325	0.52663	-0.03627	0.07087
Beta	0.94707	0.02367	40.00394	4.7E-265	0.90064	0.99349

Table 4: ANOVA for ORCL vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0173 + 0.94707(X).

The t stat is different from 0 and P-value for the coefficient (4.7E-265) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 0.94707 times increase in the ORCL stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4609.680	4609.680	1661.157	9.8975E-273
Residual	2260	6271.459	2.775		
Total	2261	10881.139			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0354	0.0351	1.0085	0.3133	-0.0334	0.1041
Beta	1.2381	0.0304	40.7573	9.9E-273	1.1785	1.2976

Table 5: ANOVA for CRM vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0354 + 1.2381(X).

The t stat is different from 0 and P-value for the coefficient (9.9E-273) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 1.2381times increase in the CRM stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2990.594771	2990.595	2306.352	0
Residual	2260	2930.491039	1.296677		
Total	2261	5921.085811			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0084	0.0240	0.3486	0.7274	-0.0386	0.0553
Beta	0.9972	0.0208	48.0245	0.0000	0.9565	1.0379

Table 6: ANOVA for CSCO vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0084 + 0.9972(X).

The t stat is different from 0 and P-value for the coefficient (0) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 0.9972 times increase in the CSCO stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3545.576297	3545.576	3976.176	0
Residual	2260	2015.253435	0.891705		
Total	2261	5560.829732			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0319	0.0199	1.6046	0.1087	-0.0071	0.0708
Beta	1.0858	0.0172	63.0569	0.0000	1.0520	1.1196

Table 7: ANOVA for ACN vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0319 + 1.0858(X).

The t stat is different from 0 and P-value for the coefficient (0) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 1.0858 times increase in the ACN stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4946.182057	4946.182	2384.34	0
Residual	2260	4688.245849	2.074445		
Total	2261	9634.427907			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0577	0.0303	1.9025	0.0572	-0.0018	0.1171
Beta	1.2824	0.0263	48.8297	0.0000	1.2309	1.3340

Table 8: ANOVA for ADBE vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0577 + 1.2824(X).

The t stat is different from 0 and P-value for the coefficient (0) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 1.2824 times increase in the ADBE stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	5196.8307	5196.831	2001.537	0
Residual	2260	5867.9087	2.59642		
Total	2261	11064.7394			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	0.0846	0.0339	2.4960	0.0126	0.0181	0.1511
Beta	1.3145	0.0294	44.7385	0.0000	1.2569	1.3722

Table 9: ANOVA for AVGO vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = 0.0846 + 1.3145(X).

The t stat is different from 0 and P-value for the coefficient (0) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 1.3145 times increase in the AVGO stock returns.

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4442.216248	4442.216	1790.509	1.144E-288
Residual	2260	5607.012312	2.480979		
Total	2261	10049.22856			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-0.0060	0.0331	-0.1818	0.8558	-0.07102	0.05897
Beta	1.2154	0.0287	42.3144	1.1E-288	1.15903	1.27168

Table 10: ANOVA for INTC vs S&P 500 returns

Interpretation:

The liner regression equation would be Y = -0.0060 + 1.2154(X).

The t stat is different from 0 and P-value for the coefficient (1.1E-288) is less than significance level 0.05, hence the variables are statistically significant. Which means for every 1 unit increase in the index return, there is 1.2154 times increase in the INTC stock returns.

Report:

From the above Regression and ANOVA analysis results, we can determine the Goodness of Fit measures based on R square, adjusted R which indicated the accuracy with which the data fitted by the regression model. The Multiple R, R square and adjusted R lies between 0 to 1 for all company returns data and when compare ACN (Accenture) has the highest R square value and ORCL (Oracle) is the least value. The standard error is also less for ACN (0.944) and highest for CRM (1.666) followed by AVGO (1.611) which means the least value indicates low variability.

All stock returns seem to be fit in the model since the F values are higher than 0 and low significance level. Among all stocks, ACN has the highest F value (3976.176) and significance of 0 which means the stock returns of ACN has linear relation with index returns. Whereas the ORCL has the least value (1600.315) mean it has less significance with the index returns.

6.Risk – Return analysis using CAPM:

The CAPM model is know as Capital Asset Pricing Model which is a method to calculate the Expected return of the stock and shows the relationship between the expected return and risk associated with it. So, we can find out the relation between Risk and Return parameters of the stock.

The equation to calculate CPAM is as shown below.

$$\mathbf{Re = Rf+\beta(Rm-Rf)}$$

Re = Expected Return

Rf = Risk free rate

Rm-Rf = Risk premium

Rm = Market Return

β = Beta/risk of the stock

The Risk-free rate which is generally referred to a 10-year US government bond yield rate.

Here, we consider the Market return as the S&P 500 index return.

Here, we can calculate the value of beta in excel in 2 ways.

- The Covariance of stock return and Index return to the Variance of the index for entire time period.
- Second method is through Regression analysis, the coefficient of the variable can be considered as Beta or Risk factor for the entire period.

It is defined that if Beta = 1, then the stock return is in line with the market return which means if the market goes up the stock price will likely go up and vice versa. If Beta < 1 which means lower risk that returns in lower profit. If the Beta > 1 which is higher risk and ultimately results in high returns.

We have downloaded the daily 7-year Risk free rate of US Government bond yield rate and took average for 7 years of data.

In order to use the Market return for CAPM calculation, we should convert daily market return data into yearly market return. First took average of all Market return data as denote it as MR_{da}

Now, the Rm (yearly) = $[(1+MR_{da})^{252}] -1$.

The Expected return for Oracle (ORCL) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 0.94707

$$Re = 2.29 + 0.94707\ (11.68 - 2.29)$$

$$= 11.18\%$$

We can further draw a scatter plot matrix for ORCL return and S&P 500 market return to show the linear relationship between the variables.

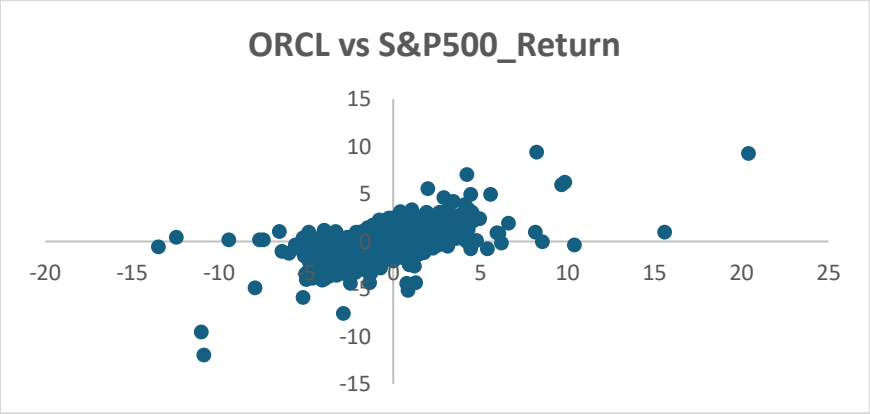

Figure 5: Scatter plot showing ORCL vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 0.94707 and the expected return is 11.18%. Also, from the regression analysis table, the slope value is 0.01730 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in ORCL stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

The Expected return for Salesforce (CRM) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 1.2381

$$Re = 2.29 + 1.2381\ (11.68 - 2.29)$$

$$= 13.91\%$$

We can further draw a scatter plot matrix for CRM return and S&P 500 market return to show the linear relationship between the variables.

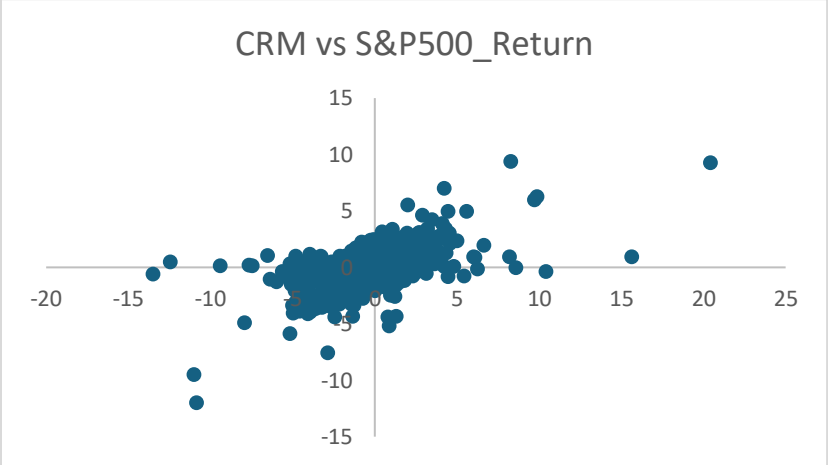

Figure 6: Scatter plot showing CRM vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 1.2381 and the expected return is 13.91% which is higher than Oracle. Also, from the regression analysis table, the slope value is 0.0354 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in CRM stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

The Expected return for Cisco (CSCO) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 0.9972

$$Re = 2.29 + 0.9972\ (11.68 - 2.29)$$

$$= 11.64\%$$

We can further draw a scatter plot matrix for CSCO return and S&P 500 market return to show the linear relationship between the variables.

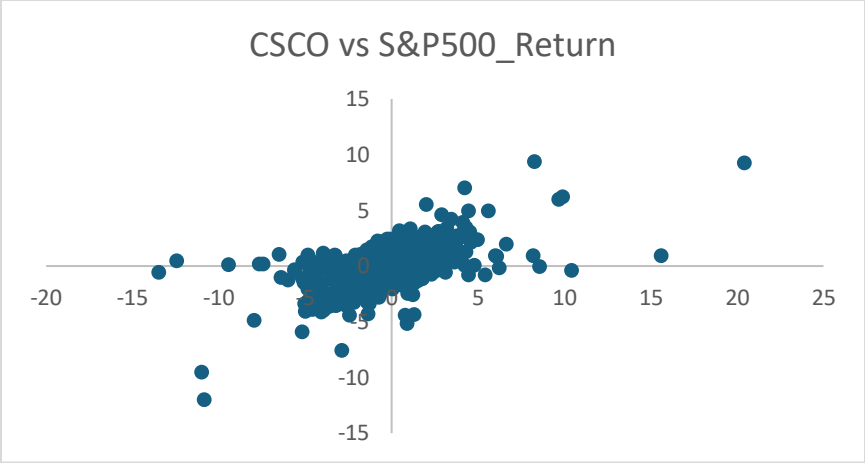

Figure 7: Scatter plot showing CSCO vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 0.9972 and the expected return is 11.64% which is slight higher than Oracle but less than Salesforce. Also, from the regression analysis table, the slope value is 0.0084 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in CSCO stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

The Expected return for Accenture (ACN) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 1.0858

$$Re = 2.29 + 1.0858\ (11.68 - 2.29)$$

$$= 12.48\%$$

We can further draw a scatter plot matrix for ACN return and S&P 500 market return to show the linear relationship between the variables.

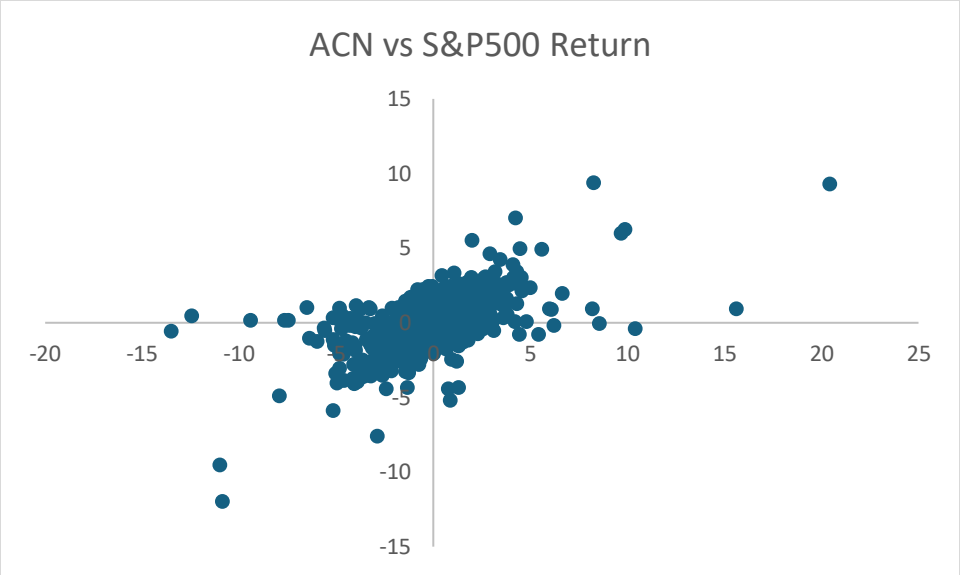

Figure 8: Scatter plot showing ACN vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 1.0858 and the expected return is 12.48% which is slight higher than Salesforce and Oracle but less than Cisco. Also, from the regression analysis table, the slope value is 0.0319 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in ACN stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

The Expected return for Adobe (ADBE) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 1.2824

$$Re = 2.29 + 1.2824\ (11.68 - 2.29)$$

$$= 14.32\%$$

We can further draw a scatter plot matrix for ADBE return and S&P 500 market return to show the linear relationship between the variables.

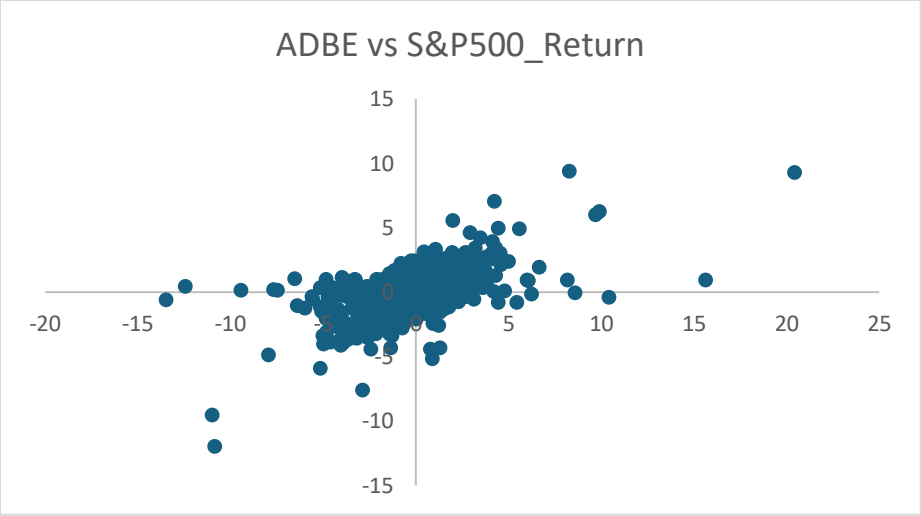

Figure 9: Scatter plot showing ADBE vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 1.2824 and the expected return is 14.32%. Also, from the regression analysis table, the slope value is 0.0577 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in ADBE stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

The Expected return for Broadcom (AVGO) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 1.3145

$$Re = 2.29 + 1.3145\ (11.68 - 2.29)$$

$$= 14.62\%$$

We can further draw a scatter plot matrix for AVGO return and S&P 500 market return to show the linear relationship between the variables.

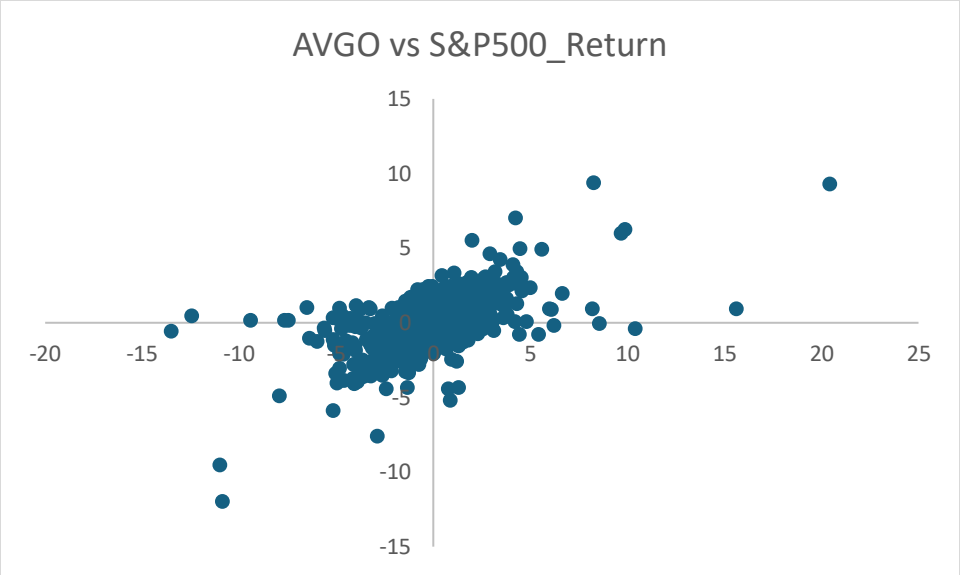

Figure 10: Scatter plot showing AVGO vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 1.3145 and the expected return is 14.62%. Also, from the regression analysis table, the slope value is 0.0846 and the p-value for Beta and Alpha is less than the significance level 0.05, hence we can say that if we invest in AVGO stock, there will be good excess returns as the CAPM model but we should also consider the risk factor which is very high compared to all stocks.

The Expected return for Intel (INTC) from CAPM is:

Rm(daily) = 0.0438, Rm (Yearly) = 11.68, Rf = (2.29), β = 1.2154

$$Re = 2.29 + 1.2154\ (11.68 - 2.29)$$

$$= 13.69\%$$

We can further draw a scatter plot matrix for INTC return and S&P 500 market return to show the linear relationship between the variables.

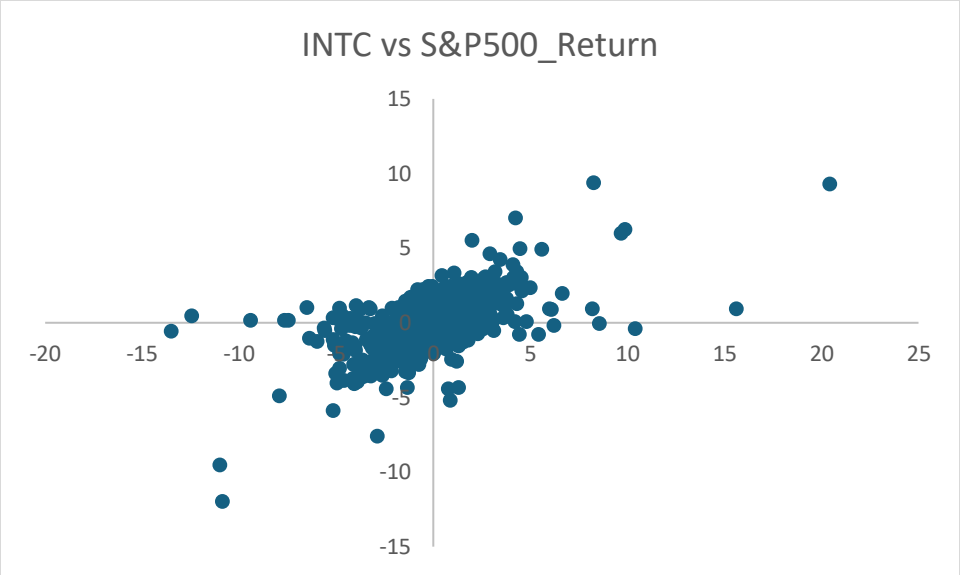

Figure 11: Scatter plot showing INTC vs S&P 500 index Return

From the correlation chart and equation, the beta value which is risk of the stock is 1.2154 and the expected return is 13.69. Also, from the regression analysis table, the slope value is -0.006 and the p-value for Beta is less than the significance level 0.05 but the p-vaue for alpha is greater than 0.05, hence we can not say that if we invest in INTC stock, there will not be much excess returns as the CAPM model and scatter plot does not explain the relationship much.

Stocks	Risk	Return
Oracle (ORCL)	0.9470	11.17%
Salesforce (CRM)	1.2381	13.91%
Cisco (CSCO)	0.9972	11.64%
Accenture (ACN)	1.0858	12.48%
Adobe (ADBE)	1.2824	14.32%
Broadcom (AVGO)	1.3145	14.62%
Intel (INTC)	1.2154	13.69%

Table 11: Risk-Return analysis for all companies

From the Risk-Return table, we can observe that the Oracle(ORCL) stock is less risker 0.947 than other stocks but the returns are also less 11.17%. Broadcom (AVGO) is the most risker stock with 1.3145 and have higher returns 14.62%. The beta value for Accenture (ACN) is almost near to 1 which means the risk is stable and we can expect moderate returns. If the investors are looking at high returns with considerable risk, we can suggest Salesforce (CRM) would be the best with moderate risk (1.23) with high returns 13.91%. If the investors are looking at low risk stocks, then Accenture (ACN) would be the better stock to invest.

7.Hypothesis T-test:

It is also important to check the hypothesis test to find out how the individual stock returns relate to the index return by considering the Null and Alternate hypothesis. In the stock market, we consider the stock return in relative to the index returns.

Here, the Null hypothesis would be there is no difference between the index return stock returns.

The Alternative hypothesis is that is a difference between the index return stock returns.

So, we are performing two- tail hypothesis test.

$$\mathbf{H_0: \mu_{stock} = \mu_{Index}} \quad \textbf{and} \quad \mathbf{H_A: \mu_{stock} \neq \mu_{Index}}$$

Let's consider the statistical significance level is 0.05 which is 95% confidence interval level.

We performed the t-test: Two sample assuming unequal variances in the excel.

	ORCL Return	CRM Return	CSCO Return	ACN Return	ADBE Return	AVGO Return	INTC Return	S&P 500 Return
Mean	0.060	0.091	0.053	0.080	0.115	0.143	0.048	0.045
Variance	2.878	4.813	2.619	2.459	4.261	4.894	4.445	1.330
Observations	2262	2262	2262	2262	2262	2262	2262	2262
Hypothesized Mean Difference	0	0	0	0	0	0	0	
df	3983	3422	4087	4153	3547	3406	3503	
t Stat	0.346	0.882	0.197	0.873	1.413	1.881	0.071	
P(T<=t) one-tail	0.365	0.189	0.422	0.191	0.079	0.030	0.472	
t Critical one-tail	1.645	1.645	1.645	1.645	1.645	1.645	1.645	
P(T<=t) two-tail	0.729	0.378	0.844	0.383	0.158	0.060	0.943	

Table 12: T-Test hypothesis test results

From the table, we can observe that all p-value is greater than the chosen significance level 0.05 for all stocks except AVGO with 0.03 which is less than 0.05, so we fail to reject the null hypothesis. Hence, we can say that there is no difference between the index and stock returns except for all stock except for Broadcom (AVGO).

8.Conclusion:

In the conclusion, the interpretations are generally categorized in our study to assess and analyze the return generated in corresponding to the risk pattern of all 7 companies from the IT sector in the time of 2015 – 2023. It is recommended that investors choose their securities according to the risk and return of the stocks. Because a stock which has high beta generally not advised to invest as it can not be diversified and is therefore subject to more market risk. From Descriptive statistics, Risk-return analysis and Hypothesis testing, we can say that if the investors are looking for high returns with moderate risk, then the Intel (INTC) and Salesforce (CRM) would be the options where the risk is less than other 2 risker stocks and can expect high returns than Accenture.

The Adobe (ADBE) and Broadcom (AVGO) are high risk stock with 1.28 and 1.31 Beta value respectively with expected return of 14.32% and 14.62% respectively. The standard deviation and variance is also high for these stocks.

From this study, we observed that the Accenture (ACN) is the best that has less Beta value (1.08) means less risker and earns moderate expected return of 12.48% while investors are looking for low risk stocks. Also, the variance, standard deviation, kurtosis is also less for ACN when compared to the other stocks.

9.References and Sources:

We sourced the pricing data and stock information from the below trusted sources.

S&P 500 price: S&P 500 INDEX (^SPX) Stock Historical Prices & Data - Yahoo Finance

Accenture data: Accenture plc (ACN) Stock Historical Prices & Data - Yahoo Finance

Oracle: Oracle Corporation (ORCL) Stock Historical Prices & Data - Yahoo Finance

Intel: Intel Corporation (INTC) Stock Historical Prices & Data - Yahoo Finance

Broadcom: Broadcom Inc. (AVGO) Stock Historical Prices & Data - Yahoo Finance

Cisco: Cisco Systems, Inc. (CSCO) Stock Historical Prices & Data - Yahoo Finance

Salesforce: Salesforce, Inc. (CRM) Stock Historical Prices & Data - Yahoo Finance

Adobe: Adobe Inc. (ADBE) Stock Historical Prices & Data - Yahoo Finance

Oracle information: https://en.wikipedia.org/wiki/Oracle_Corporation

Accenture: https://en.wikipedia.org/wiki/Accenture

Intel: https://en.wikipedia.org/wiki/Intel

Salesforce: https://en.wikipedia.org/wiki/Salesfoce

Cisco information: https://en.wikipedia.org/wiki/Cisco

Broadcom: https://en.wikipedia.org/wiki/Broadcom

Adobe: https://en.wikipedia.org/wiki/Adobe

US Treasury Rates data: Resource Center | U.S. Department of the Treasury

Afreen Tabassum, S.Baskaran,(August 2022), Risk and Return analysis of Equity Stocks of Selected IT companies. International Journal of research Publication and reviews.

Zoran Ivanovski(2016), The Regression analysis of Stock Returns at MSE. Journal of Modern Accounting and Auditing.