

## Questions

### RISK AND RETURN

#### Instructions

1. The report/essay must use the Harvard system of referencing with in-text referencing and must be word processed.
2. The Workings **must be in Excel format** and embedded formulas must be showing.
3. The Report must be processed in **word**.
4. Two Documents must be submitted
  - a. **Excel document (Workings)**
  - b. **Word document (Report)**
5. The expected length of the report is approximately 2,500 words (Excluding Appendices).

#### Assessment criteria

For reports/essays that achieve the expected presentation standard, the assessment criteria will be:-

1. Evidence of relevant research (current publications and statistics where appropriate) and demonstrated understanding of research materials.
2. The structure, coherence and logic of arguments, calculations and analysis presented.
3. Demonstrated understanding of the subject matter that is the focus of the topic.

#### ASSIGNMENT DETAILS

1. Download **DAILY** stock (share) prices from the Dow Jones Industrial Average (DJIA).
2. To download the prices, you can go through Yahoo Finance, Google Finance, etc.

3. The prices must be for four (4) years up to the day of download.
4. The stock prices to be downloaded are for the following companies (Corporations)
  - a. Chevron Corporation
  - b. Exxon Mobil Corporation
  - c. Apple Incorporated
  - d. Microsoft Corporation
5. Also Download the Dow Jones Industrial Average Data for the same period as the stocks mentioned above.
6. Save the data as **excel workbook** and not as the downloaded **CSV (Comma delimited)**.
7. Use **Adjusted Close prices (AdjClose)** for all required calculations.
8. Note that the data downloaded is **sample data** and **not population data**.

#### Required:

1. Calculate the following for all the listed stocks
  - a. Daily Returns (4 Marks)
  - b. Average (Mean) (4 Marks)
  - c. Variance of Returns (4 Marks)
  - d. Standard Deviation of Returns (4 Marks)
  - e. Descriptive Statistics (10 Marks)

**[Total: 26 Marks]**
2. Find out what the Beta Coefficient is for each of the stocks listed above. (4 Marks)
3. What does the Beta coefficient for each stock mean in relation to the benchmark stock exchange under consideration? (4 Marks)
4. Based on the Beta coefficient, which security is more risky and which one is less risky? (5 Marks)
5. Given the industry or sector that each security is operating in, can you say with certainty and authority that the security you have indicated to be very risky, is the most risky. Your response should be based on the beta coefficient results and other factors you are going to consider? (5 Marks)
6. Which security will you invest in based on:
  - a. The Coefficient of Variation (CV) (8 Marks)

b. The Gaussian Standardization.

(8 Marks)

[Total Marks: 16 Marks]

7. Form an equally weighted portfolio made up of the stocks below and critically evaluate which portfolio you would go for based on the expected return of the portfolios as well as the standard deviation of the portfolios.
- Chevron Corporation and Apple Incorporated
  - Chevron Corporation and Microsoft Corporation
  - Exxon Mobil and Chevron Corporation
  - Exxon Mobil and Apple Incorporated
  - Exxon Mobil and Microsoft Corporation
  - Apple Incorporated and Microsoft Corporation

[Total: 40 Marks]

**NB:**

**For the calculation of the Standard deviation of the portfolios you need to calculate the covariance between the securities (stocks) or the correlation coefficient between the securities (stocks).**

**END OF ASSIGNMENT!!!!**

## Introduction

Investments are associated with both return and risk. In investment, there also exist a risk – return spectrum which defines the relationship between two key elements i.e. the return gained on an investment and risk associated with the investment. As a general principle, higher return is generally associated with higher risk (BREALEY et al. 2006).

With the above premise, the report is intended to examine the risk and return of equity based investment. Initially the risk and return of the stocks are examined independently. Later the risk and return of portfolio of two stocks are also examined. For the purpose of calculation, 4 stocks namely Chevron Corporation, Exxon Mobil Corporation, Apple Incorporation , Microsoft Corporation have been selected. The daily adjusted closing price is downloaded from Yahoo Finance. The window of 4 years is considered i.e. from October 2, 2014 to October 4, 2018.

In addition to it, a benchmark namely Dow Jones Industrial Average (DJIA) is also selected. Similar to above daily adjusted closing price is downloaded from Yahoo Finance. The window of 4 years is considered i.e. from October 2, 2014 to October 4, 2018.

After downloading the data of 4 stocks and one benchmark, daily returns, average, variance of returns, standard deviation of returns, and descriptive statistics is determined.

All the calculations and data processing done in Microsoft excel and submitted along with report. Post that beta coefficients of 4 selected stocks i.e. Chevron Corporation, Exxon Mobil Corporation, Apple Incorporation is determined.

After the calculation mentioned above, the most and least risky stock is determined based on beta coefficient, coefficient of variation and on Gaussian Standardization. Lastly, risk and return of equally weighted portfolio made up of two stocks is determined. Since there are 4 stocks, so number of combinations are 6 i.e.  ${}^4C_2$  (BREALEY et al. 2006). The combinations are as follows:

- Chevron Corporation and Apple Incorporation
- Chevron Corporation and Microsoft Corporation
- Exxon Mobil and Chevron Corporation
- Exxon Mobil and Apple Incorporation
- Exxon Mobil and Microsoft Corporation

- Apple Incorporation and Microsoft Corporation

Once risk and return is determined, best portfolio is determined in terms of risk return trade-off

## Downloading and processing data

As mentioned above, the daily data of 4 stocks namely Chevron Corporation, Exxon Mobil Corporation, Apple Incorporation, Microsoft Corporation, and one benchmark namely Dow Jones Industrial Average is downloaded. The window of 4 years is considered i.e. from October 2, 2014 to October 4, 2018. The downloaded data has following column Date, Open, High, Low, Close, Adjusted Close, and Volume. For the purpose of calculation Adjusted Close data is considered. The rationale for using adjusted close price for a given day of trading is obtained from closing day price only. The closing day price is adjusted with all distributions and corporate actions that occurred before next day will open. In Excel six Columns of data is copied which is described as follows:

1. Date
2. DJIA stands for Dow Jones Industrial Average
3. CVX stands for Chevron Corporation
4. XOM stands for Exxon Mobil Corporation
5. APPL stands for Apple Incorporation
6. MSFT stands for Microsoft Corporation

Processed data is put into Excel and submitted for reference.

## Estimation of Return risk and other descriptive statistics parameters

### Question 1 a.

As a first task, the daily returns of the stock and bench mark is calculated. It is calculated using following framework:

$$\text{Daily Return} = (P_{t+1} - P_t) / P_t$$

Where

$P_{t+1}$  = Stock price of today

$P_t$  = Stock Price of yesterday (BREALEY et al. 2006).

Using above formulae daily returns are computed and workings are submitted. However for the purpose of illustration, few rows of workings are shown below:

Table 1: Stocks prices and its daily return

Date	DJIA	CVX	XOM	APPL	MSFT	Daily Return				
						DJIA	CVX	XOM	APPL	MSFT
02-10-2014	16801.05	99.37	80.83	93.09	41.61					
03-10-2014	17009.69	99.88	81.36	92.83	41.91	1.2%	0.5%	0.7%	-0.3%	0.7%
06-10-2014	16991.91	100.20	81.88	92.83	41.91	-0.1%	0.3%	0.6%	0.0%	0.0%
07-10-2014	16719.39	98.45	80.89	92.02	41.40	-1.6%	-1.8%	-1.2%	-0.9%	-1.2%
08-10-2014	16994.22	100.09	81.96	93.93	42.53	1.6%	1.7%	1.3%	2.1%	2.7%
09-10-2014	16659.25	97.17	79.54	94.13	41.69	-2.0%	-2.9%	-2.9%	0.2%	-2.0%
10-10-2014	16544.10	96.64	79.35	93.86	40.03	-0.7%	-0.5%	-0.2%	-0.3%	-4.0%
13-10-2014	16321.07	95.06	78.70	93.01	39.69	-1.3%	-1.6%	-0.8%	-0.9%	-0.9%
14-10-2014	16315.19	93.15	78.44	92.02	39.76	0.0%	-2.0%	-0.3%	-1.1%	0.2%
15-10-2014	16141.74	92.72	78.16	90.89	39.30	-1.1%	-0.5%	-0.4%	-1.2%	-1.2%
16-10-2014	16117.24	94.24	78.49	89.70	38.86	-0.2%	1.6%	0.4%	-1.3%	-1.1%
17-10-2014	16380.41	94.87	79.02	91.01	39.67	1.6%	0.7%	0.7%	1.5%	2.1%
20-10-2014	16399.67	94.60	79.50	92.96	40.08	0.1%	-0.3%	0.6%	2.1%	1.0%
21-10-2014	16614.81	97.66	81.13	95.49	40.81	1.3%	3.2%	2.0%	2.7%	1.8%
22-10-2014	16461.32	96.73	80.68	95.97	40.35	-0.9%	-0.9%	-0.6%	0.5%	-1.1%
23-10-2014	16677.90	98.59	81.53	97.68	40.93	1.3%	1.9%	1.1%	1.8%	1.4%
24-10-2014	16805.41	98.35	81.86	98.05	41.94	0.8%	-0.2%	0.4%	0.4%	2.5%
27-10-2014	16817.94	97.60	81.18	97.95	41.74	0.1%	-0.8%	-0.8%	-0.1%	-0.5%
28-10-2014	17005.75	99.39	82.39	99.46	42.27	1.1%	1.8%	1.5%	1.6%	1.3%
29-10-2014	16974.31	99.40	81.94	100.02	42.39	-0.2%	0.0%	-0.5%	0.6%	0.3%
30-10-2014	17195.42	99.45	81.82	99.69	41.87	1.3%	0.1%	-0.1%	-0.3%	-1.2%

**Question 1 b.**

Further daily average return is calculated which computed as follows:

$$\text{Daily average return} = \frac{1}{n} \sum_{i=1}^{i=n} Ri$$

Where Ri is Daily Return computed above (BREALEY et al. 2006). The daily average return of four stocks and benchmark is shown below:

Table 2: Daily Average return

	Average Return
Dow Jones Industrial Average	0.05%

Chevron Corporation	0.03%
Exxon Mobil Corporation	0.01%
Apple Incorporation	0.10%
Microsoft Corporation	0.11%

Therefore, it may be inferred that daily average return is mean of daily returns.

**Question 1 c.**

Further variance of daily return is computed. It is also consider as measure of risk. The formula used for the computation is shown below:

$$\sigma^2 = \frac{\sum(X - \mu)^2}{N}$$

Where  $\sigma^2$  is variance of daily returns

X is daily return

$\mu$  is average daily return

N is number of elements minus 1 (BREALEY et al. 2006). The above calculation is done in Microsoft Excel using VAR.S command. The output is shown below:

Table 3: Variance of daily returns

	Variance of Return
Dow Jones Industrial Average	6.57092E-05
Chevron Corporation	0.000203855
Exxon Mobil Corporation	0.000141169
Apple Incorporation	0.000205844
Microsoft Corporation	0.000204765

**Question 1 d.**

Further, standard deviation of daily returns is computed using following formula:

$$\sigma = \sqrt{\text{Variance}}$$

where  $\sigma$  is standard deviation of return (BREALEY et al. 2006). The above calculations are done in Microsoft Excel. The output for the same is shown below:

Table 4: Standard Deviation of daily returns

Standard deviation of Return	
Dow Jones Industrial Average	0.0081061
Chevron Corporation	0.0142778
Exxon Mobil Corporation	0.0118814
Apple Incorporation	0.0143473
Microsoft Corporation	0.0143096

**Question 1 e.**

Finally Descriptive statistics parameters are estimated for five daily returns and shown in subsequent tables. The estimation of descriptive parameters are estimated in Microsoft Excel and shown below:

Table 5: Descriptive Statistics Table of Dow Jones Industrial Average

<i>DJIA</i>	
Mean	0.00032883
Standard Error	0.000449485
Median	8.71528E-05
Mode	0
Standard Deviation	0.01427779
Sample Variance	0.000203855
Kurtosis	1.916995047
Skewness	0.030126543
Range	0.117918276
Minimum	-0.055666137
Maximum	0.062252139
Sum	0.331789523
Count	1009
Confidence Level (95.0%)	0.000882034

Table 6: Descriptive Statistics Table of Chevron Corporation

<i>CVX</i>	
Mean	0.00032883
Standard Error	0.000449485
Median	8.71528E-05
Mode	0
Standard Deviation	0.01427779



Sample Variance	0.000203855
Kurtosis	1.916995047
Skewness	0.030126543
Range	0.117918276
Minimum	-0.055666137
Maximum	0.062252139
Sum	0.331789523
Count	1009
Confidence Level 95.0%)	0.000882034

Table 7: Descriptive Statistics Table of Exxon Mobil Corporation

<i>XOM</i>	
Mean	0.000127182
Standard Error	0.000374045
Median	0
Mode	0
Standard Deviation	0.011881441
Sample Variance	0.000141169
Kurtosis	2.976103907
Skewness	-0.021593772
Range	0.112062613
Minimum	-0.056902942
Maximum	0.055159671
Sum	0.128327129
Count	1009
Confidence Level (95.0%)	0.000733996

Table 8: Descriptive Statistics Table of Apple Incorporation

<i>APPL</i>	
Mean	0.000991
Standard Error	0.000452
Median	0.000626
Mode	0
Standard Deviation	0.014347
Sample Variance	0.000206
Kurtosis	2.876068
Skewness	0.064971
Range	0.13067
Minimum	-0.06571
Maximum	0.064963
Sum	0.999764
Count	1009
Confidence Level (95.0%)	0.000886

Table 8: Descriptive Statistics Table of Microsoft Corporation

<i>MSFT</i>	
Mean	0.001091
Standard Error	0.00045
Median	0.000684
Mode	0
Standard Deviation	0.01431
Sample Variance	0.000205
Kurtosis	8.950354
Skewness	0.413252
Range	0.197056
Minimum	-0.09253
Maximum	0.104522
Sum	1.100565
Count	1009
Confidence Level (95.0%)	0.000884

## Beta Coefficient of Stocks

### Question 2

Beta Coefficient is a measure of market risk i.e. it is a risk arising from exposure to general market movements as opposed to idiosyncratic factors. Therefore it indicates that whether the selected stock is more or less risky with respect to market.

There are two ways to estimate the beta coefficient. First method is ordinary least squared regression and second method is direct formula.

#### Regression Based approach

In this method daily stock returns would be regressed against the benchmark index. In this case dependent variable is daily stock returns and independent variable is daily benchmark index.

Alternatively the beta can be estimated as follows:

$$\beta = \frac{\text{Cov}(r_a, r_b)}{\text{Var}(r_b)}$$

Where  $r_a$  is daily return of stocks while  $r_b$  is daily return of benchmark (BREALEY et al. 2006). The beta coefficient of four mentioned stocks are as follows:

Table 9: Beta coefficient of selected stocks

Stock	Beta
Chevron Corporation	1.10
Exxon Mobil Corporation	0.94
Apple Incorporation	1.03
Microsoft Corporation	1.18

**Question 3.**

Further, the beta coefficient is validated using regression methodology as shown below:

Table 10: Beta coefficient of Chevron Corporation

<i>Regression Statistics</i>					
Multiple R	0.624279014				
R Square	0.389724288				
Adjusted R Square	0.389118254				
Standard Error	0.011159367				
Observations	1009				
<i>ANOVA</i>					
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	0.080082936	0.080083	643.0739	4.1367E-110
Residual	1007	0.125403195	0.000125		
Total	1008	0.205486131			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>
Intercept	-0.000209312	0.000351953	-0.59472	0.552167	-
DJIA	1.099579128	0.043360678	25.3589	4.1E-110	1.014491493

As mentioned above, the coefficient of DJIA is 1.009 which means the equation is

Return of Chevron Corporation = 0.0002 + 1.0995(DJIA). Therefore beta coefficient of Chevron Corporation is approximately equal to 1.10. It may also be noted that p-value of the estimate is less than 0.05 which means there are enough statistical evidence to reject the null hypothesis and it can be concluded that coefficient is significant. Also R-square of regression is 0.3897 which means 38.97% changes in dependent variable is explained by changes in independent variable.

Table 11: Beta coefficient of Exxon Mobil

<i>Regression Statistics</i>						
Multiple R	0.642465904					
R Square	0.412762437					
Adjusted R Square	0.412179282					
Standard Error	0.009109437					
Observations	1009					
<i>ANOVA</i>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	0.058735264	0.058735	707.8086	1.5475E-118	
Residual	1007	0.083562724	8.3E-05			
Total	1008	0.142297988				
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-0.000333686	0.000287301	-1.16145	0.245734	0.000897462	0.000230091
DJIA	0.941685662	0.0353955	26.60467	1.5E-118	0.872228274	1.011143049

As mentioned above, the coefficient of DJIA is 0.94 which means the equation is

Return of Exxon Mobil = 0.0003 + 0.9416 (DJIA). Therefore beta coefficient of Exxon Mobil is approximately equal to 0.94. It may also be noted that p –value of the estimate is less than 0.05 which means there are enough statistical evidence to reject the null hypothesis and it can be concluded that coefficient is significant. Also R-square of regression is 0.4127 which means 41.27% changes in dependent variable is explained by changes in independent variable.

Table 12: Beta coefficient of Apple Incorporation

<i>Regression Statistics</i>	
Multiple R	0.581137
Adjusted R Square	0.085

R Square	0.337720					
Adjusted R Square	0.337062					
Standard Error	0.011681					
Error	682					
Observations	1009					

  

ANOVA						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	0.07007385	0.070073	513.5056	3.38502E-	92
Residual	1007	0.13741693	0.000136			
Total	1008	0.20749079	0.000206			

  

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.000487	0.00036842	1.323074	0.186111	-	0.001210
DJIA	1.028571	0.04539017	22.66066	3.38502E	0.9395013	1.117641

As mentioned above, the coefficient of DJIA is 1.0286 which means the equation is

Return of Apple Incorporation = 0.0004 + 1.0286 (DJIA). Therefore beta coefficient of Apple Incorporation is approximately equal to 1.0286. It may also be noted that p –value of the estimate is less than 0.05 which means there are enough statistical evidence to reject the null hypothesis and it can be concluded that coefficient is significant. Also R-square of regression is 0.3377 which means 33.77% changes in dependent variable is explained by changes in independent variable.

Table 13: Beta coefficient of Microsoft Corporation

<i>Regression Statistics</i>	
Multiple R	0.6681764
R Square	0.4464598
Adjusted R Square	0.4459101
Standard Error	0.0106516

Observations	1009					
<b>ANOVA</b>						
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>	
Regression	1	0.09215079	0.0921	812.19949	1.7803E-131	
Residual	1007	0.11425253	0.0001	7	13	
Total	1008	0.20640333	4			
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	0.0005134	0.00033594	1.5284	0.1267062	-	0.0011727
DJIA	1.1795219	0.04138802	28.499	1.7803E-131	1.09830533	1.2607386

As mentioned above, the coefficient of DJIA is 1.179 which means the equation is

Return of Microsoft Corporation = 0.0005 + 1.179 (DJIA). Therefore beta coefficient of Microsoft Corporation is approximately equal to 1.179. It may also be noted that p –value of the estimate is less than 0.05 which means there are enough statistical evidence to reject the null hypothesis and it can be concluded that coefficient is significant. Also R-square of regression is 0.4464 which means 44.64% changes in dependent variable is explained by changes in independent variable.

**Question 4.**

It should be noted that higher beta leads to higher price movement in the stock with respect to market. Therefore higher beta stocks are more risky relative to low beta stocks. Therefore stocks of Microsoft Corporation is most risky among the four selected stocks followed by Chevron Corporation followed by Apple Incorporation. Stock of Exxon Mobil is least risky among the lot.

**Question 5.**

Primarily these stocks belongs to two different sectors – energy and technology. Chevron Corporation and Exxon Mobil Corporation belongs to energy sector while Apple Incorporation and Microsoft Corporation belongs to Technology sector. The stocks of technology sector is

being driven by brand value, technological upgradation, innovation etc. Therefore the price of technology stocks are more sensitive to market. On the other hand Energy stocks are bit stable as its prices are driven by policies, consumer demand (quite stable being essential product) etc. Therefore it can be argued that share price of technology companies are more sensitive than that of energy companies. However, same approach cannot be applied if comparison is done between two technology stocks. Therefore, it is expected that stocks of Microsoft Corporation is more risky than that of Chevron Corporation and Exxon Mobil Corporation. However same could not be said with conviction for Apple Incorporation

**Question 6.**

**Investment Decision**

Coefficient of variation is defined as the ratio of standard deviation to the mean. It is used to measure relative variability (BREALEY et al. 2006). The coefficient of variation of daily stock returns of four selected stocks is tabulated below:

Table 14: Coefficient of variation of stocks

Stock	Coefficient of variation
Chevron Corporation	43.42
Exxon Mobil Corporation	93.42
Apple Incorporation	14.48
Microsoft Corporation	13.12

The coefficient of variation is quite useful if researcher wants to compare the risks with respect to return. Therefore higher coefficient of variation means the selected stock has more variation. Therefore, in this case Microsoft Corporation’s stock has least variability while variability of Exxon Mobil Corporation is most. Therefore stock of Microsoft Corporation may be selected as it has least variability per unit return

Gaussian standardization is used to standardized the stocks daily average return and standard deviation (BREALEY et al. 2006). Gaussian Standardization of daily stock returns of four selected stocks is tabulated below:

Table 14: Gaussian Standardization of stocks

Stock	Coefficient of variation
Chevron Corporation	0.023
Exxon Mobil Corporation	0.011
Apple Incorporation	0.069

Microsoft Corporation	0.076
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Higher Gaussian Standardization means the selected stock has more returns. Therefore in this case Microsoft Corporation has highest Gaussian standardization. Therefore stock of Microsoft Corporation may be selected as it has highest return per unit risk.

**Question 7.**

**Portfolio formulation**

The risk and return of the portfolio comprising of two asset may be estimated using following formula:

$$E(R) = w_1R_1 + w_2R_2 + \dots + w_nR_n$$

Where E (R ) is expected return of portfolio (GHYSELS et. al. 2005).

$w_1$  is weight of 1<sup>st</sup> security and so on

$R_1$  is the return of 1<sup>st</sup> security and so on.

Similarly risk of the portfolio having two assets may be calculated using formula mentioned below:

$$\text{Portfolio Variance} = w_A^2 * \sigma^2(R_A) + w_B^2 * \sigma^2(R_B) + 2 * (w_A) * (w_B) * \text{Cov}(R_A, R_B)$$

*Where:  $w_A$  and  $w_B$  are portfolio weights,  $\sigma^2(R_A)$  and  $\sigma^2(R_B)$  are variances and  $\text{Cov}(R_A, R_B)$  is the covariance*

Based on formula mentioned above ((GHYSELS et. al. 2005), risk and return of equally weighted portfolio of two assets are shown below:

Table 15: Risk and return of two asset portfolio

	Covariance	Risk (variance )	Return	Risk ( Standard Deviation)
Chevron Corporation and Apple Incorporation	6.05636E-05	0.000132707	0.066%	1.15%



Chevron Corporation and Microsoft Corporation	7.49349E-05	0.000139623	0.071%	1.18%
Exxon Mobil and Chevron Corporation	0.000132031	0.000152271	0.023%	1.23%
Exxon Mobil and Apple Incorporation	5.29114E-05	0.000113209	0.056%	1.06%
Exxon Mobil and Microsoft Corporation	6.05973E-05	0.000116782	0.061%	1.08%
Apple Incorporation and Microsoft Corporation	0.000106423	0.000155864	0.104%	1.25%

Table indicates that portfolio of Apple Incorporation and Microsoft Corporation would fetch highest returns however risk is also highest. Therefore a risky investor might select a portfolio of Apple Incorporation and Microsoft Corporation. However based on risk –return trade-off also the portfolio of Apple Incorporation and Microsoft Corporation fetch highest return per unit risk borne by investor.

Further a risk averse investor might select a portfolio of Exxon Mobil and Apple Incorporation as it is least risky amongst all.

Alternatively, portfolio managers generally estimate correlation coefficient among the stocks to build a portfolio. The correlation coefficient of stocks taken two at time is given below:

Table 16: Correlation coefficient

	<i>DJIA</i>	<i>CVX</i>	<i>XOM</i>	<i>APPL</i>	<i>MSFT</i>
DJIA	1.000				
CVX	0.624	1.000			
XOM	0.642	0.779	1.000		
APPL	0.581	0.296	0.311	1.000	
MSFT	0.668	0.367	0.357	0.519	1.000

If the correlation coefficient between return of two stock is higher then risk of portfolio is also higher. A hedged portfolio can be achieved if correlation coefficient of stock is -1. However, selecting such combination is practically very difficult. Therefore for hedging portfolio managers select stocks having minimum correlation.

## Conclusion

Based on the analysis conducted above, it may be concluded that any rational investor picks a stock which provide higher return at same degree of risk. Therefore ratio of return and standard deviation may be considered for evaluating different stock performance. For example, in this case stock of Microsoft Corporation offered highest return per unit of risk and therefore may be selected. Beta is yet another measure of risk. It measures risk of stock associated with market. Higher beta indicates the stock is more prone to market risk. For example, in this case beta of Microsoft Corporation is highest which means stock is most sensitive to market risk. Further it may be noted that portfolio of more than stocks may be constructed and return and risk of portfolio may be estimated using standard statistical methods.

## Reference

BREALEY, R. A., MYERS, S. C., & ALLEN, F. (2006). *Principles of corporate finance*. New York, NY, McGraw-Hill/Irwin.

GHYSELS, E, PEDRO S, & ROSSEN V. (2005) "There is a risk-return trade-off after all." *Journal of Financial Economics* 76.3: 509-548