Mayur Sejpal (C2071044)

University of Law

Data and Decision Making

Prof. Waseem Haider

September 5th, 2023

Link for Working detail Excel File (Google drive)

https://docs.google.com/spreadsheets/d/1fdQgqIInLXeUHW8q36Jgi4dpKTwph_bo/edit?usp=sharing&ouid=104403414581086061099&rtpof=true&sd=true

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➢ Introduction

Under this assignment, I am going to pick up on a problem generally faced by an investment management firm under wealth Management team in providing recommendations to its clients for future Investment decisions. The well-known firm called "Black Rock" manages $9.1 Trillion in Assets under management, which is almost equal to half of the size of the GDP of the US economy. Sonner Vanguard and Black Rock together will manage to manage more than the GDP of Japan, Germany, and the UK.

So, Black Rock will identify the requirements of the different clients who approach them and provide the best investment solution to meet their future needs or contingent requirements.

In the Year 2021, at the time of the pandemic, most institutional investors made a huge loss as the stock market fell, but a few companies and banks made profits as Black Rock's technical and expert team was managing the fund and was able to generate a huge profit for them.

The company approached Black Rock for Financial Advisory and Risk Management services to help them manage Risk and Financial aspects during the pandemic.

1) Massachusetts General Hospital of USA
2) Astra Zeneca (Bio-pharmaceutical) of UK
3) Siemens Healthineers of Germany
4) Tata Consumer Products of India
5) Bank of China Limited of Republic of China

Note: They were other companies as well, but I have picked up top firms from different sectors or industries.

➢ Recommendation

The Black Rock is one of the oldest and most renounced Asset Management firms in the world. Which also have different Index funds from different investment categories that are invested across the globe in various sectors. So, the wealth management team suggests all of its clients pick up one of the newly launched ETFs (Exchange Traded Fund-Global) for investment that is best suited to them.

- Client – 1 - Massachusetts General Hospital of USA

- Client – 2 - Astra Zeneca (Bio-pharmaceutical) of UK

- Client – 3 - Siemens Healthineers of Germany

- Client – 4 - Tata Consumer Products of India

- Client – 5 - Bank of China Limited of, Republic of China

➢ Analysis

The Black Rock wealth management team has well-experienced professionals from different parts of the world who have deep experience and deep knowledge in portfolio Management and wealth management.

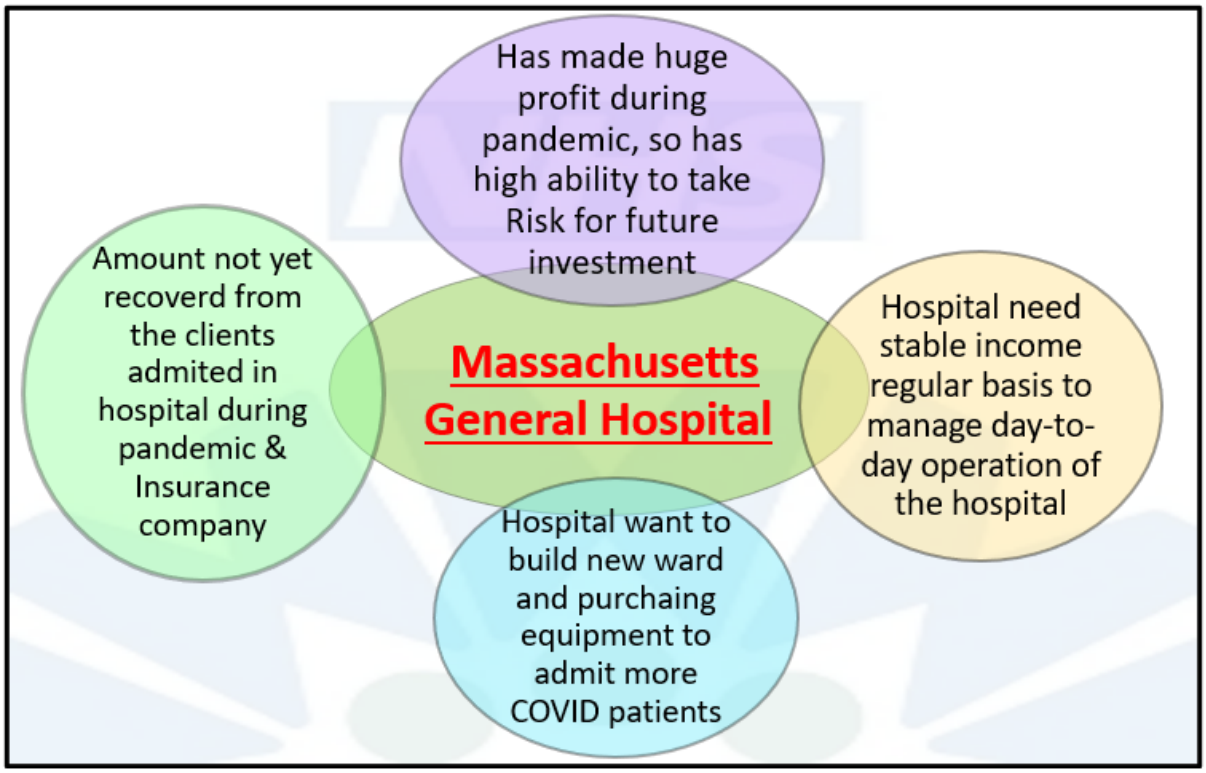
So, this expert carries out deep analysis using a modern tool called Python and a traditional tool called Excel to perform various calculations, analyses, forecasts, and make Business decisions about which client among the five is most suitable to adapt the requirements of the new ETF Global fund for the Investment.

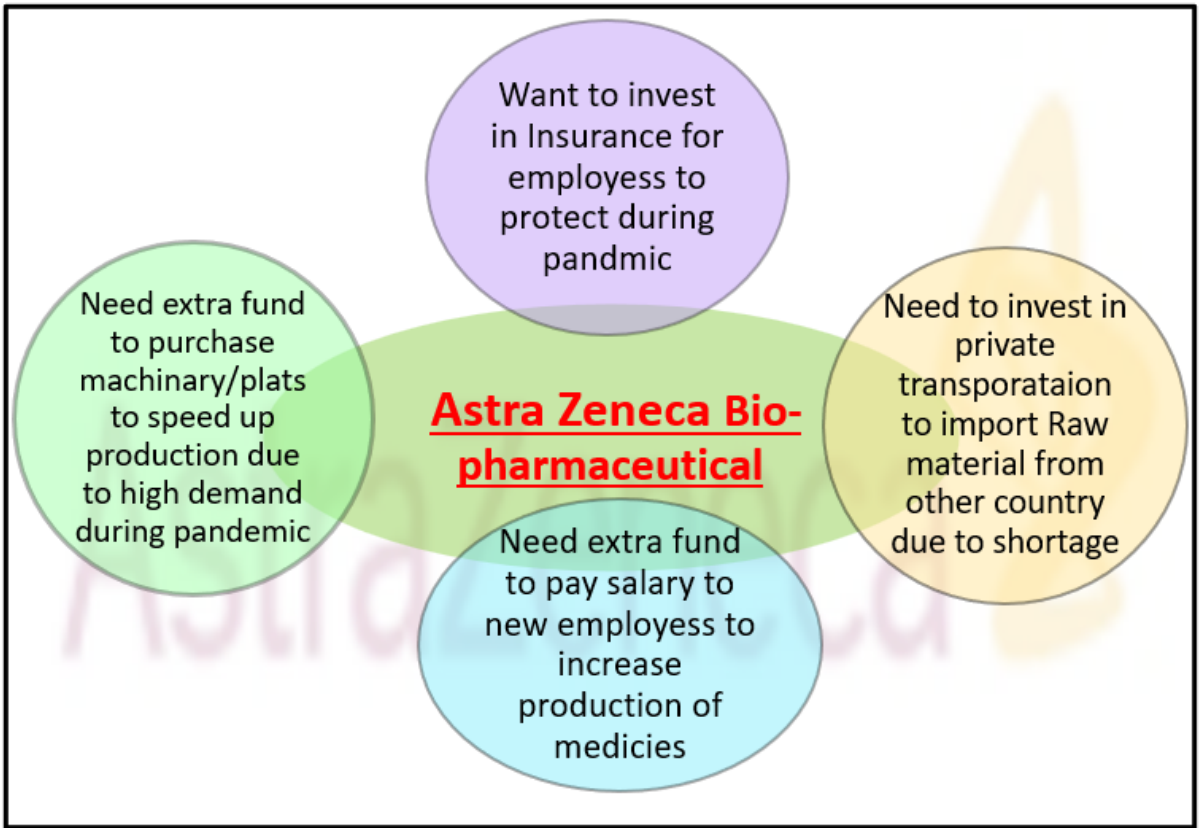
✓ 1st STEP:

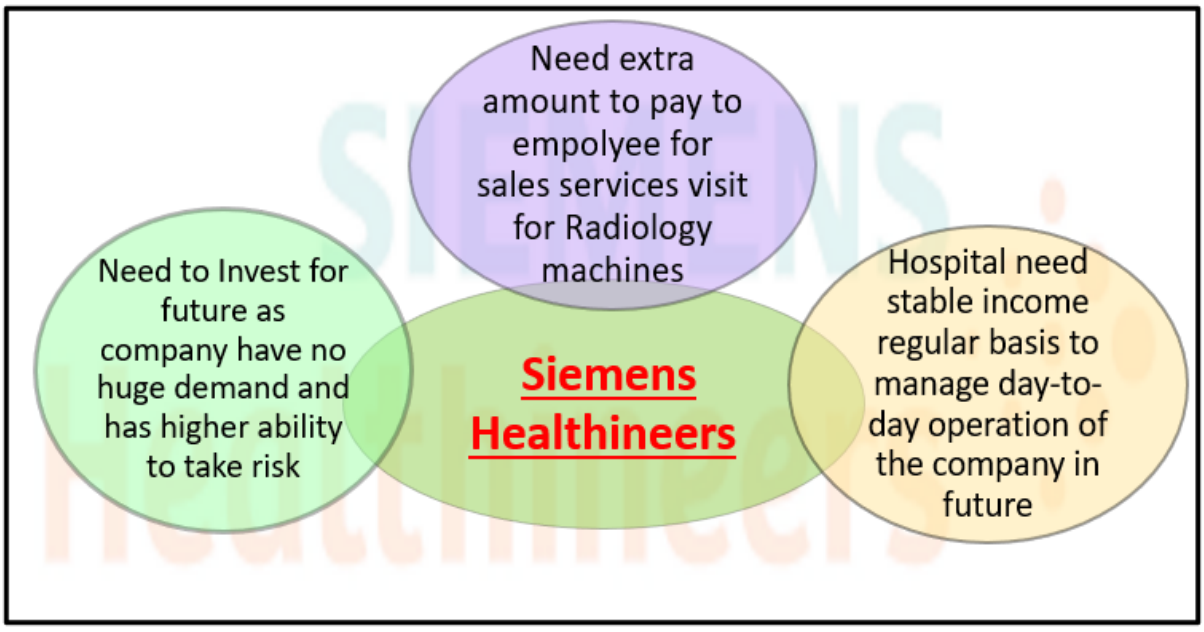
A relationship manager from the Black Rock wealth management team approaches the above client to understand the requirements and purpose of the investment.

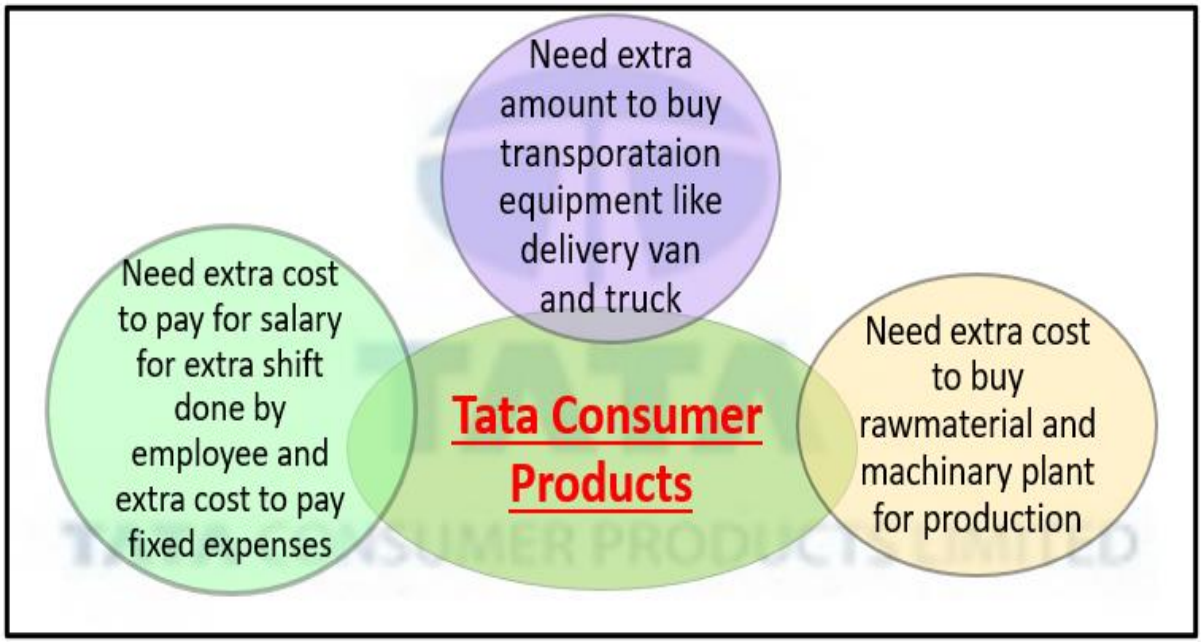
The Team perform Risk and Return analysis of the client from the provided financial statement and holds meeting with its head of Finance department to understand the purpose of the investment and requirement to meet contingent obligation, during and after pandemic.

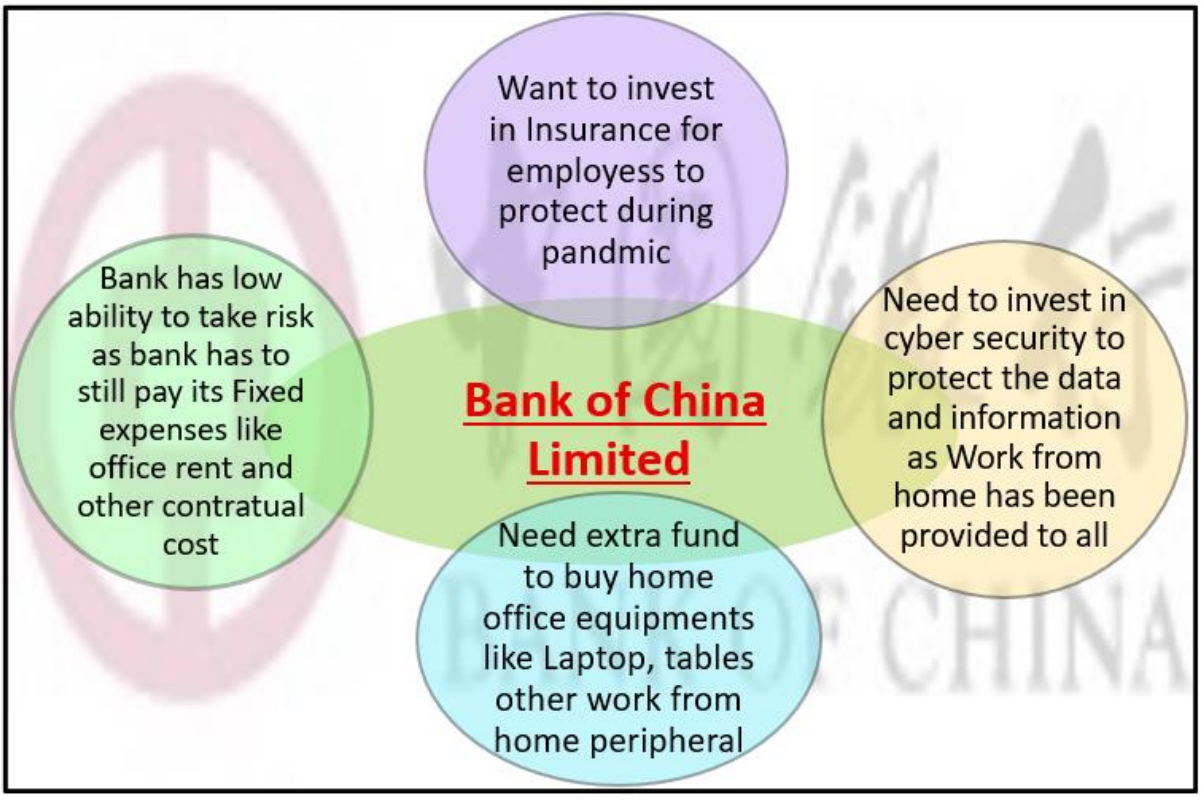
During Meeting with each of 5 clients the Black rock team able to figure it out the given below expectations and requirement.




Want to invest in Insurance for employess to protect during pandmic
Need extra fund to purchase machinary/plats to speed up production due to high demand during pandemic
Astra Zeneca Bio-pharmaceutical
Need to invest in private transporataion to import Raw material from other country due to shortage
Need extra fund to pay salary to new employess to increase production of medicies


Need extra amount to pay to empolyee for sales services visit for Radiology machines
Need to Invest for future as company have no huge demand and has higher ability to take risk
Siemens Healthineers
Hospital need stable income regular basis to manage day-to-day operation of the company in future





Note: The Relationship manager does this through scrutiny and deep analysis of each and every requirement and element of the client and will forward the information to the junior portfolio manager, who will further draft out the investment mandate as per the various investment criteria and the organization and statutory regulatory guidelines.

✓ 2nd STEP:

- **Investment Mandate**

Making Analysis of the various below element to understand the risk and return requirement of the client to find out best suitable investment.

❖ Massachusetts General Hospital

1) Investment Amount - 130 million EUR
2) Ability to take Risk – 7.7%
3) Tax constrains - Not more than 20%
4) Investment Horizon – 3.3 Year
5) Expected Return – 12%
6) Total Investment * Ability to take risk → (130 * 7.7% = 10.01 max loss)

❖ Astra Zeneca (Bio-pharmaceutical)

1) Investment Amount - 115 million EUR
2) Ability to take Risk – 6.8%
3) Tax constrains - Not more than 22%
4) Investment Horizon – 2.1 Year
5) Expected Return – 10%
6) Total Investment * Ability to take risk → (115 * 6.8% = 7.82 max loss)

❖ Siemens Healthineers

1) Investment Amount - 95 million EUR
2) Ability to take Risk – 6.2%
3) Tax constrains - Not more than 24%
4) Investment Horizon – 1.8 Year
5) Expected Return – 9.6%
6) Total Investment * Ability to take risk → (95 * 6.2% = 5.89 max loss)

❖ Tata Consumer Products

1) Investment Amount - 150 million EUR
2) Ability to take Risk – 9.2%
3) Tax constrains - Not more than 26%
4) Investment Horizon – 2.8 Year
5) Expected Return – 13.9% to 15.2%
6) Total Investment * Ability to take risk → (150 * 9.2% = 13.8 max loss)

❖ Bank of China Limited

1) Investment Amount - 70 million EUR
2) Ability to take Risk – 5.9%
3) Tax constrains - Not more than 22%
4) Investment Horizon – 3.2 Year
5) Expected return - 8%
6) Total Investment * Ability to take risk → (70 * 5.9% = 4.13 max loss)

Portfolio Management Team is performing a given below analysis to decide which stock can be invested in this ETF fund.

Note, deeper analysis will be carries out based on real life scenario and real-life problem to take business decision at various stages of analysis and calculation.

✓ 3rd STEP:

- Analysis by portfolio Management Team.

The portfolio manager is making the decision to include BMW and Deutsch stocks in the Euro global ETF. Therefore, the fund manager has to decide how much investment has to be made between BMW and Deutsch Bank to achieve the best optimum investment at the given level of return.

Yahoo Finance "Deutsche Bank" and "BMW Motors"
https://query1.finance.yahoo.com/v7/finance/download/DB?period1=1514764800&period2=1691971200&interval=1mo&events=history&includeAdjustedClose=true

https://query1.finance.yahoo.com/v7/finance/download/BMW.DE?period1=1514764800&period2=1691971200&interval=1mo&events=history&includeAdjustedClose=true

NOTE: I have performed this calculation in Excel file and found out the efficient frontier using mean variance optimum portfolio stimulation.

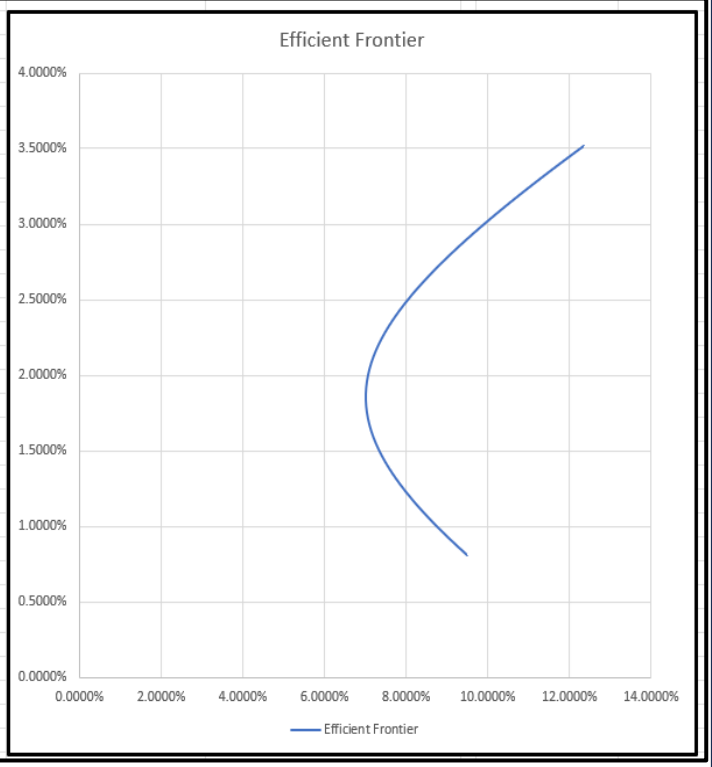
- **Steps how this calculation has been performed.**

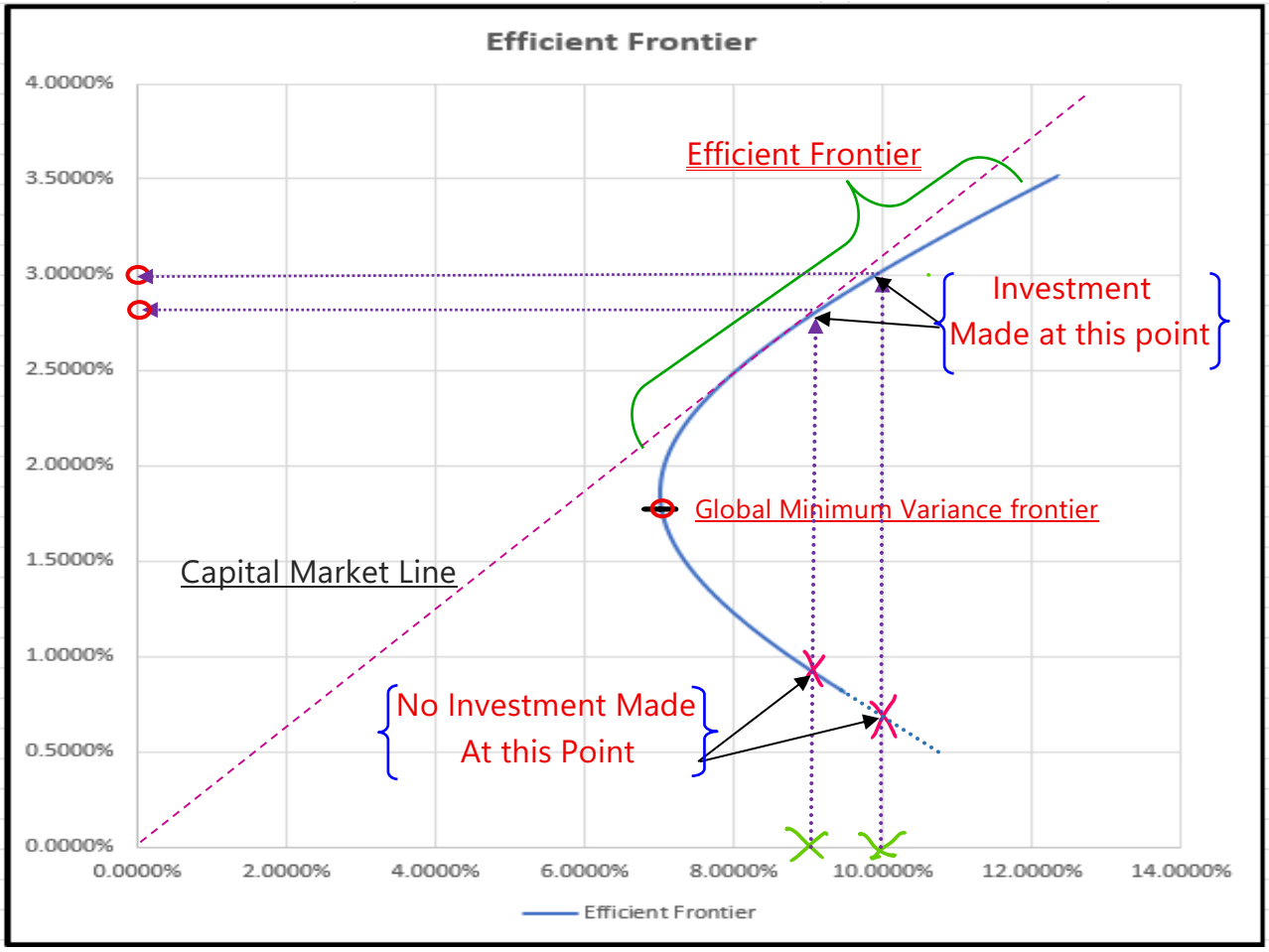
I. Download historical data from Yahoo finance or DEX index website.
II. Filer data and calculate return using Holding period return (HPR calculation)
III. Calculate the Average mean and variance (Standard deviation) & correlation
IV. Assign different weights to the various monthly return in a proposition of 2%
V. Calculate Portfolio Return & Portfolio Standard deviation using these weights
VI. The generated line chart is calculated using S.D (Risk/Variance) in X axis
VII. Generate the line chart using this data points for Portfolio Return and Risk.
VIII. The portfolio optimizer will help you to generate the line charts at various data points and this line chart is called "Markovits efficient frontier"
IX. Now portfolio manager will plot the risk and return of the client at various datapoints to find out bunch of best suitable optimum portfolio.
X. Also, PM will identify the global minimum efficient frontier & will chose the best available portfolio within efficient frontier using Sharp ratio if required.

- *Excel Fine calculation and Analysis*

Date	Clo. Price for BMW	Clo. Price for DEX Index	Clo. Price Deutsch Bank	% Return for BMW	% Return for Deutsch Bank	% Return for DEX stock	% Weight of Invet. In BMW	% Weight of Invet. In Deutsch Bank	Return in Portfolio	S.D of Portfolio
01-01-2018	64.76	13189.48	16.93	-	-	-				
01-02-2018	61.13	12435.85	14.71	-5.60%	-5.71%	-13.09%	0%	100%	0.8097%	9.4962%
01-03-2018	62.07	12096.73	12.90	12.30%	12.00%	-12.30%	2%	98%	0.8507%	9.3287%
01-04-2018	65.11	12612.11	12.61	4.90%	4.26%	-2.29%	4%	96%	0.8917%	9.1651%
01-05-2018	60.12	12604.89	10.23	-7.67%	14.00%	-18.89%	6%	94%	0.9327%	9.0055%
01-06-2018	57.11	12306.00	9.91	-5.00%	13.00%	-3.13%	8%	92%	0.9736%	8.8502%
01-07-2018	60.83	12805.50	12.18	6.52%	4.06%	22.98%	10%	90%	1.0146%	8.6994%
01-08-2018	61.36	12364.06	10.50	9.00%	-3.45%	-13.78%	12%	88%	1.0556%	8.5532%
01-09-2018	57.17	12246.73	10.60	-6.83%	10.00%	0.89%	14%	86%	1.0966%	8.4120%
01-10-2018	56.08	11447.51	9.11	-1.90%	-6.53%	-14.00%	16%	84%	1.1376%	8.2760%
01-11-2018	53.12	11257.24	8.54	-5.27%	-1.66%	-6.24%	18%	82%	1.1785%	8.1455%
01-12-2018	52.01	10558.96	7.60	12.00%	-6.20%	-11.03%	20%	80%	1.2195%	8.0208%
01-01-2019	54.04	11173.10	8.28	3.90%	5.82%	8.96%	22%	78%	1.2605%	7.9020%
01-02-2019	54.67	11515.64	8.62	1.16%	3.07%	4.05%	24%	76%	1.3015%	7.7895%
01-03-2019	50.58	11526.04	7.57	-7.48%	10.65%	-12.12%	26%	74%	1.3425%	7.6836%
01-04-2019	55.83	12344.08	7.72	10.40%	7.10%	1.97%	28%	72%	1.3834%	7.5845%
01-05-2019	45.62	11726.84	6.32	-18.29%	-5.00%	-18.24%	30%	70%	1.4244%	7.4926%
01-06-2019	50.41	12398.80	7.24	10.49%	5.73%	14.65%	32%	68%	1.4654%	7.4080%
01-07-2019	51.76	12189.04	7.41	2.67%	-1.69%	2.36%	34%	66%	1.5064%	7.3310%
01-08-2019	47.10	11939.28	6.88	-9.01%	-2.05%	-7.17%	36%	64%	1.5473%	7.2619%
01-09-2019	50.02	12428.08	7.12	6.22%	4.09%	3.45%	38%	62%	1.5883%	7.2009%
01-10-2019	53.21	12866.79	6.88	6.38%	3.53%	-3.33%	40%	60%	1.6293%	7.1481%
01-11-2019	56.77	13236.38	6.84	6.68%	2.87%	-0.55%	42%	58%	1.6703%	7.1039%
01-12-2019	56.64	13249.01	7.38	-0.22%	0.10%	7.91%	44%	56%	1.7113%	7.0683%
01-01-2020	49.83	12981.97	8.68	-12.03%	-2.02%	17.61%	46%	54%	1.7522%	7.0416%
01-02-2020	45.64	11890.35	8.28	-8.41%	-8.41%	-4.70%	48%	52%	1.7932%	7.0236%
01-03-2020	36.49	9935.84	6.09	-20.05%	-16.44%	-26.38%	50%	50%	1.8342%	7.0147%
01-04-2020	41.86	10861.64	7.03	14.72%	9.32%	15.42%	52%	48%	1.8752%	7.0147%
01-05-2020	40.74	11586.85	7.97	-2.68%	6.68%	13.36%	54%	46%	1.9162%	7.0237%
01-06-2020	46.47	12310.93	9.03	14.08%	6.25%	13.33%	56%	44%	1.9571%	7.0416%
01-07-2020	44.74	12313.36	8.47	-3.73%	0.02%	-6.30%	58%	42%	1.9981%	7.0684%
01-08-2020	49.20	12945.38	9.04	9.96%	5.13%	6.84%	60%	40%	2.0391%	7.1040%
01-09-2020	50.70	12760.73	7.97	3.06%	-1.43%	-11.86%	62%	38%	2.0801%	7.1482%
01-10-2020	47.99	11556.48	8.78	-5.34%	-9.44%	10.12%	64%	36%	2.1211%	7.2010%

Average	2.8587%	0.8097%	0.5766%
Varience	0.8703%	0.9018%	2.6056%
Standard Deviation	9.3290%	9.4962%	16.1419%
Correlation	0.110699843		





The efficient frontier, according to contemporary portfolio theory, is a set of investments that straddle the "efficient" portions of the risk-return spectrum. Formally speaking, it is the group of portfolios that meet the requirement that no other portfolios exist with higher expected returns but with the same standard deviation of return.

From the above chart, we can understand that the wealth manager will choose the best-suited portfolio as per the risk and return of the client's investment. In the above-given graph, we can see that investment will be made above the GMVF (global minimum variance frontier) and not below it because below the GMVF, clients will get maximum return at the same level of risk of approx. 9% for Tata Consumer Products Limited and at approx. 10% for Massachusetts General Hospital.

As per your risk point, only these two firms would like to go head-to-head for investment, which is clearly and deeply explained in the below analysis. Whereas other firms would not make a rational decision to invest further at the given level of risk if they continued to also invest their funds, unlike Tata Consumer and Massachusetts Hospital, in the Black Rock Global ETF fund.

- *Correlation between (BMW Motors & Deutsche Bank with DAX index)*

  We will perform Linear regression using Python script and generate ANOVA Table to understand the linearity between two variable and how is dependent with its independent variable called DAX Index (Note, DAX is German index listed in Frankfurt stock exchange)

Linear Regression....

Will do Liner Regression to find relation between DAX and BMW Moters.

This dataset consists of information about month end stock price of BMW Moters Stock and DAX Index. This can be understood as a simple connection between the two variable at given date: "BMW Moters stock closing price" VS "DAX Index closing price" recorded on monthly basis.

Let's first do a simple regression to understand the connection of those two values. On the x-axis is the DAX_Closing_Price , and on the y-axis is BMW Moters_Closing_Price.

In [67]:
```
## Here x = DAX index closing price AND y = BMW Moters stock closing price

x = np.array([13189.48,12435.849609,12096.730469,12612.110352,12604.889648,12306,12805.5,12364.05957,12246.730469,11447.509766,11
y = np.array([64.756042,61.129929,62.066383,65.108086,60.11602,57.107586,60.829922,61.359581,57.166443,56.077702,53.120434,52.009
```

In [68]:
```
linreg = LinearRegression()
```

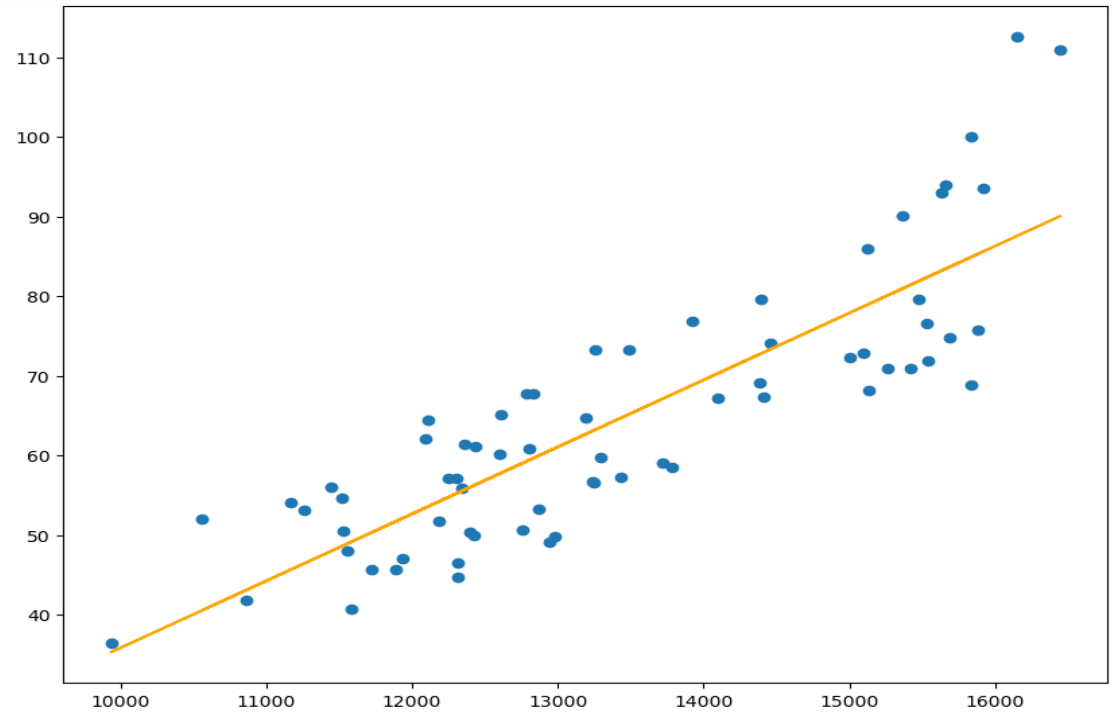
In [69]:
```
x = x.reshape(-1, 1)
```

In [70]:
```
linreg.fit(x, y)
```

Out[70]:
```
LinearRegression()
```

In [71]:
```
y_pred = linreg.predict(x)
```

In [72]:
```
plt.scatter(x,y)
plt.plot(x, y_pred, color="orange")
plt.show()
```



As we can see, the standard error is high and the dataset is highly scattered, as there seems to be no relationship between BMW Moters stock price performance and the performance of the DAX Index. Even though BMW Moters is part of DAX, it has little influence on the price movement of the DAX Index.

Linear Regression....

Will do Liner Regression to find relation between DAX and Deutsche Bank.

This dataset consists of information about month end stock price of Deutsche Stock and DAX Index. This can be understood as a simple connection between the two variable at given date: "Deutsche stock closing price" VS "DAX Index closing price" recorded on monthly basis.

Let's first do a simple regression to understand the connection of those two values. On the x-axis is the DAX_Closing_Price , and on the y-axis is Deutsche_Closing_Price.

In [61]:
```
## Here x = DAX index closing price AND y = Deutsche Bank stock closing price

x = np.array([13189.48,12435.849609,12096.730469,12612.110352,12604.889648,12306,12805.5,12364.05957,12246.730469,11447.509766,11
y = np.array([16.928278,14.713017,12.903889,12.608521,10.227116,9.90685,12.183,10.503873,10.597157,9.113929,8.54489,7.602714,8.28
```

In [62]:
```
linreg = LinearRegression()
```

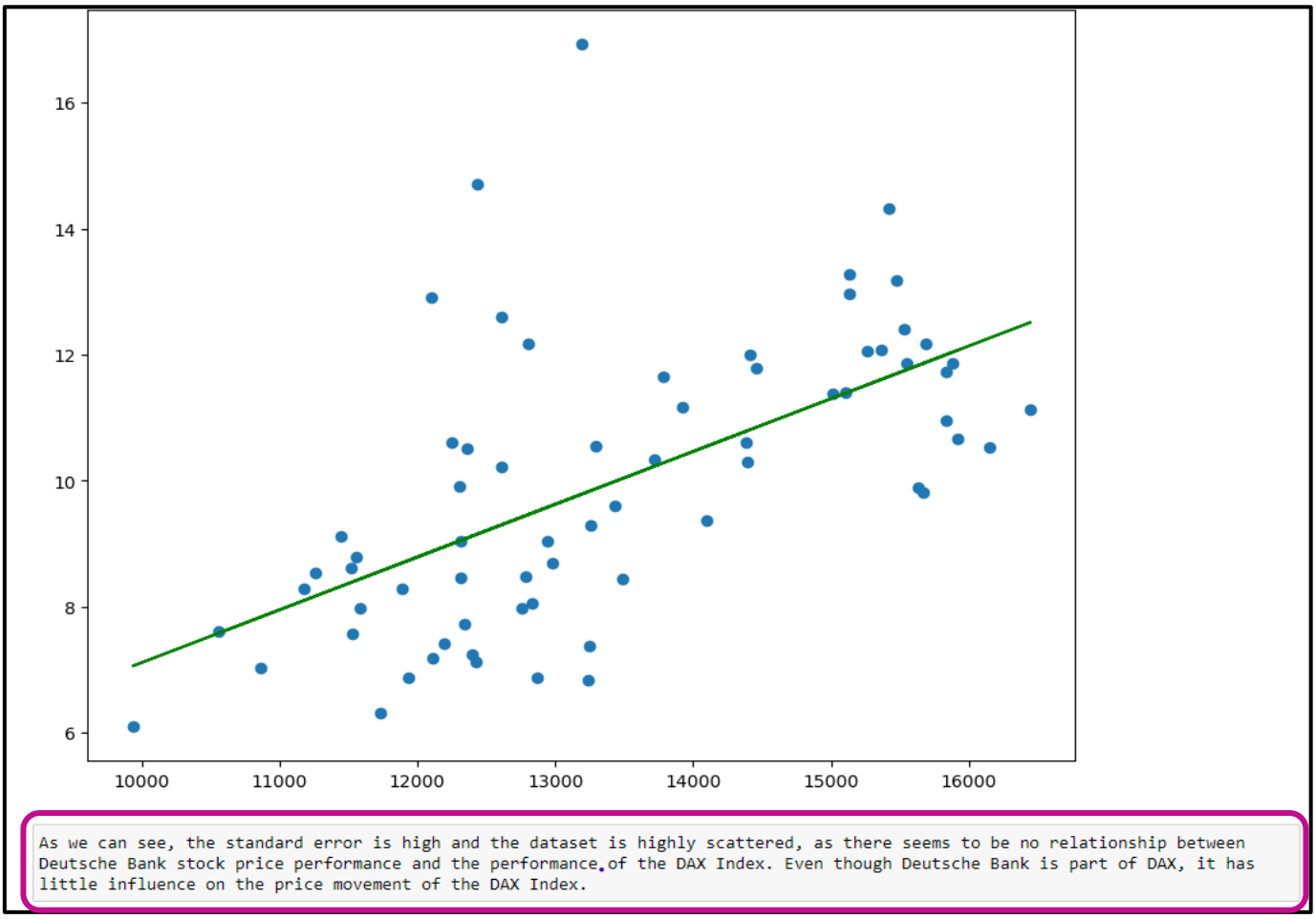
In [63]:
```
x = x.reshape(-1, 1)
```

In [64]:
```
linreg.fit(x, y)
```

Out[64]:
```
LinearRegression()
```

In [65]:
```
y_pred = linreg.predict(x)
```

In [66]:
```
plt.scatter(x,y)
plt.plot(x, y_pred, color="green")
plt.show()
```




```
As we can see, the standard error is high and the dataset is highly scattered, as there seems to be no relationship between
Deutsche Bank stock price performance and the performance of the DAX Index. Even though Deutsche Bank is part of DAX, it has
little influence on the price movement of the DAX Index.
```

- *Conclusion of Regression Analysis*

  After performing linear regression between (BMW Motors vs DAX Index) and (Deutsche Bank vs DAX Index) we could figure it out that data points are scattered showing no linear relation with DAX Index by both the companies.

  Thus, the wealth Management Team of Black rock will Independently invest in Dax index passively using Passive Management Strategy. The firm may invest some portion in DAX index and either BMW 0r Deutsche bank if correlation between is between -1 to 0 (not between -1 to +1).

  Team wants to carry out further Analysis to understand the datapoint information via an ANOVA Table.

```
In [91]: dataframe3['Intercept'] = 1

         ols_model = sm.OLS(dataframe3['Adj Close Price of BMW'], dataframe3[['Adj Close Open Price of Deutsche Bank', 'Intercept']])

         results = ols_model.fit()

         results.summary()
```

Out[91]:

OLS Regression Results

Dep. Variable:	Adj Close Price of BMW	**R-squared:**	0.268
Model:	OLS	**Adj. R-squared:**	0.257
Method:	Least Squares	**F-statistic:**	24.16
Date:	Wed, 16 Aug 2023	**Prob (F-statistic):**	6.16e-06
Time:	16:05:56	**Log-Likelihood:**	-274.40
No. Observations:	68	**AIC:**	552.8
Df Residuals:	66	**BIC:**	557.2
Df Model:	1		
Covariance Type:	nonrobust		

	coef	std err	t	P>|t|	[0.025	0.975]
Adj Close Open Price of Deutsche Bank	3.6780	0.748	4.916	0.000	2.184	5.172
Intercept	27.8699	7.648	3.644	0.001	12.601	43.139

Omnibus:	22.066	**Durbin-Watson:**	0.159
Prob(Omnibus):	0.000	**Jarque-Bera (JB):**	30.771
Skew:	1.325	**Prob(JB):**	2.08e-07
Kurtosis:	4.960	**Cond. No.**	46.8

Notes:
[1] Standard Errors assume that the covariance matrix of the errors is correctly specified.

1. *Outcome*: The independent variable's variation's impact on the movement of the dependent variable is measured by R-squared. It is the amount by which securities move in the stock market as a result to the movement of a benchmark index, such as the DAX Index. Data that fully fit the linear model have an R2 of 1.0. R2 values below 1.0 show that the model cannot fully account for the data's variability at least in some cases. Indicator 0.268 shows that the model cannot account for 26.8% of the variability in the outcome data. That means there is something exist between BMW Motors stock and Deutsche Bank stock whose relationship is not captured nor strength of the relationship explained via a correlation.

✓ 4th STEP:

- **Risk Analysis for "BMW vs DAX index" & "Deutsche Bank Vs DAX index"**

Risk is another element which has to be deeply analysed by Wealth management team for maximining the returns and minimising the loss.

VAR (Value at Risk) is the most widely suitable analysis tool used by Portfolio Manager to analyse maximum possible loss in the portfolio at the given point of time. The FRM experts at Black Rock wealth management Team will make a deeper analysis using various tools to calculate the Var.

Most commonly Var is calculated using three common methods,

a) Historical Stimulation – What has been in the past will be consider in future.
b) Montecarlo Stimulation – future will be analysed using statical distribution.
c) Bootstrap Sampling – Using datapoint from available data source for analysis

- *HISTORICAL STIMULATION*

The value at risk is predicted via historical simulation in finance's value at risk analysis by "simulating" or building the cumulative distribution function of asset returns over time.

In our case of calculation, we would find out if Black rock invest money in BMW and Deutsche Bank, how much maximum loss it can incur at given point of time, thus Var (Risk analysis tool) will help Risk management team to find out whether BMW motors and Deutsche stock together is good combination to include this in new Black Rock ETF fund, which can be further listed in market for a public for future investment.

In the below diagram we have calculated first Beta to calculate Var using LN regression analysis between Stock and Index, then at various confidential interval we have calculated Var for both the Stock in a proposition to Index. In the above simple regression, we understood that Black Rock will not only invest in DAX Index.

SUMMARY OUTPUT FOR BMW vs DAX	This means if DAX index price increase by 1 then share price of BMW will increase by 0.484247

Regression Statistics	
Multiple R	0.762406576
R Square	0.581263788
Adjusted R Square	0.574821692
Standard Error	0.035615471
Observations	67
ANOVA	

	df	SS	MS	F	Significance F
Regression	1	0.11445203	0.11445203	90.22899169	6.60905E-14
Residual	65	0.082450018	0.00126846		
Total	66	0.196902047			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-0.002151768	0.004381316	-0.4911238	0.624993097	-0.01090186	0.00659832	-0.01090186	0.006598324
X Variable 1	0.484247933	0.0509794	9.49889424	6.60905E-14	0.38243504	0.58606083	0.38243504	0.586060826

Stimulations of Return using Beta				Stimulation of VAR		Formula = Percentile of Gain/Loss * CI	
Historical	Returns for DAX	Return for DB	Returns for BMW	Stimulated Returns for DB	Stimulated Returns for BMW motors		
1	BETA	0.286	0.484	Latest SP for DB = 10.950	Latest SP for BMW motors = 99.990	VAR (Value at Risk) For Deutsche Bank	
2	-0.059	-0.016850	-0.028491	-0.184510157	-2.848844882	CI -Confidence Interval	Values
3	-0.028	-0.007918	-0.013389	-0.086704683	-1.338724097	99.90%	-0.550463399
4	0.042	0.011949	0.020204	0.130841013	2.020190963	99.00%	-0.436207286
5	-0.001	-0.000164	-0.000277	-0.001795941	-0.0277294	95.00%	-0.256339928
6	-0.024	-0.006873	-0.011621	-0.075257241	-1.161975087	90.00%	-0.191033704
7	0.040	0.011395	0.019267	0.124774529	1.926524181	85.00%	-0.155328991
8	-0.035	-0.010047	-0.016988	-0.110013718	-1.698616607		
9	-0.010	-0.002731	-0.004617	-0.029901246	-0.461676552		
10	-0.067	-0.019328	-0.032680	-0.211638435	-3.267706675	Formula = Percentile of Gain/Loss * CI	
11	-0.017	-0.004800	-0.008116	-0.052561592	-0.81155327		
12	-0.064	-0.018340	-0.031010	-0.200819024	-3.100654499	VAR (Value at Risk) For BMW motors	
13	0.057	0.016191	0.027377	0.177291418	2.73738724	CI -Confidence Interval	Values
14	0.030	0.008648	0.014623	0.094697779	1.462137843	99.90%	-8.499178924
15	0.001	0.000259	0.000437	0.00283101	0.043710915	99.00%	-8.499178924
16	0.069	0.019637	0.033204	0.215028428	3.320048313	95.00%	-8.499178924
17	-0.051	-0.014691	-0.024840	-0.160865373	-2.483768384	90.00%	-8.499178924
18	0.056	0.015958	0.026982	0.174736131	2.697933495	85.00%	-8.499178924
19	-0.017	-0.004887	-0.008262	-0.053507932	-0.826164805		
20	-0.021	-0.005929	-0.010026	-0.064925711	-1.002455819		
21	0.040	0.011491	0.019430	0.125830701	1.942831514		
22	0.035	0.009935	0.016799	0.108791361	1.679743361		
23	0.028	0.008110	0.013714	0.088809948	1.37122948		
24	0.001	0.000273	0.000462	0.002990879	0.046179299		
25	-0.020	-0.005831	-0.009860	-0.063853204	-0.985896258		

SUMMARY OUTPUT FOR DB vs DAX	This means if DAX index price increase by 1 then share price of DB will increase by 0.28639

Regression Statistics	
Multiple R	0.629734581
R Square	0.396565643
Adjusted R Square	0.387282038
Standard Error	0.04275466
Observations	67
ANOVA	

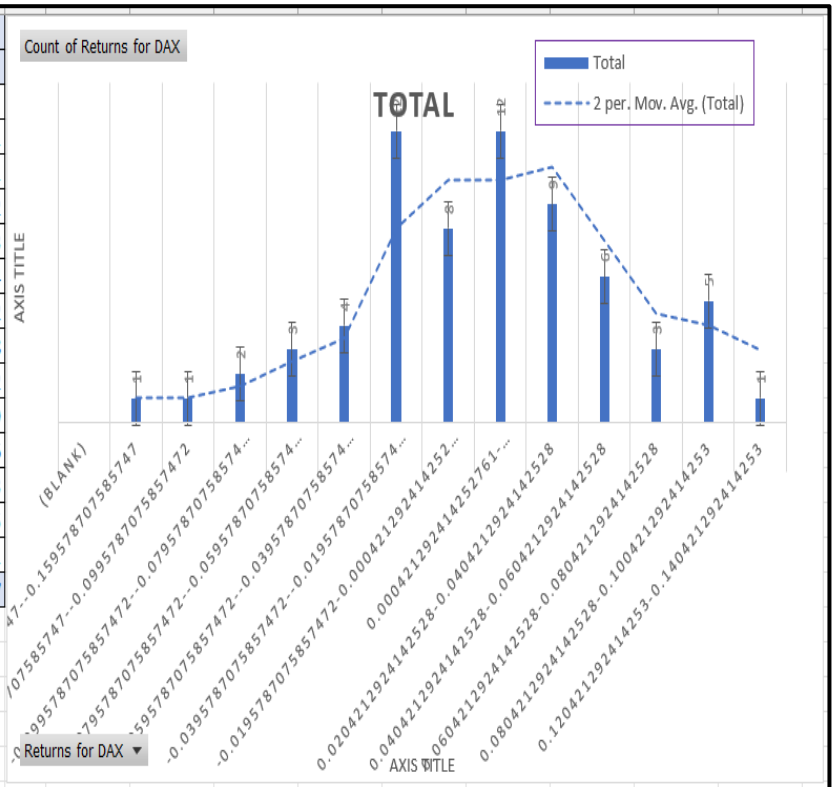
	df	SS	MS	F	Significance F
Regression	1	0.078084587	0.07808459	42.71677027	1.137E-08
Residual	65	0.11881746	0.00182796		
Total	66	0.196902047			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	0.002536448	0.0052234	0.4855939	0.6288880	-0.0078954	0.0129683	-0.0078954	0.0129683
X Variable 1	0.286392539	0.0438190	6.5358068	0.000000011	0.1988799	0.3739051	0.1988799	0.3739051

- *MONTECARLO STIMULATION*

  A mathematical method for predicting the potential outcomes of an unknown event is the Monte Carlo simulation. This technique, which is regarded as one of the best tools for risk analysis, is used by computer programs to examine historical data and forecast a range of future events based on a choice of action. One of the basic rules of Monte Carlo stimulation is that it can be used when data points follow a normal distribution. But the Black Rock team analysed that Monte Carlo stimulation cannot be carried out as data points follow no normal distribution.

Returns for DAX	Count of Returns for DAX	
-0.058836179	**Returns for DAX**	**Total**
-0.027648192	(blank)	
0.041722284	-0.179578707585747--0.159578707585747	1
-0.000572685	-0.119578707585747--0.0995787075857472	1
-0.023997858	-0.0995787075857472--0.0795787075857472	2
0.039787818	-0.0795787075857472--0.0595787075857472	3
-0.035080924	-0.0595787075857472--0.0395787075857472	4
-0.009534841	-0.0395787075857472--0.0195787075857472	12
-0.067486782	-0.0195787075857472-0.000421292414252771	8
-0.016760721	0.000421292414252761-0.0204212924142528	12
-0.064036713	0.0204212924142528-0.0404212924142528	9
0.056534284	0.0404212924142528-0.0604212924142528	6
0.030197012	0.0604212924142528-0.0804212924142528	3
0.000902746	0.0804212924142528-0.100421292414253	5
0.068567775	0.120421292414253-0.140421292414253	1
-0.051296384	**Grand Total**	**67**
0.05571946		
-0.017062487		
-0.020703363		
0.040124607		
0.034691141		
0.028319514		
0.000953725		
-0.020361364		
-0.087834337		
-0.179578708		



You can notice from the above histogram chart that when DAX Index Data points are taken as proxies for BMW Motors and Deutsche Bank, they do not follow normal distribution; they follow somewhat like normal distribution but not exactly like normal distribution, so the team would not use Monte Carlo stimulation; instead, it may proceed with Historical stimulation or Bootstrap sampling for Risk analysis (VAR calculation).

- *BOOTSTRAP SAMPLING*

  Any test or measurement that employs random sampling with replacement is regarded as using bootstrapping and is categorized under resampling techniques as a whole. Sample estimates are rated for accuracy via bootstrapping. This method enables the use of random sampling to estimate the sampling distribution of nearly any statistic. This is one of the best acceptable techniques for the Var calculation for Risk analysis.

Bootstrap sampleeing						
S.No	Random Number	Values for Index	Return for DB	Return for BMW	Share Price for DB	Share Price for BMW
1	30	0.06061666	0.017360159	0.029353492	0.190093742	2.93505568
2	9	-0.009534841	0.000160664	0.00027166	0.001759275	0.027163284
3	18	0.05571946	-0.0004412	-0.000746004	-0.004831138	-0.074592983
4	39	0.084931413	0.001014841	0.001715948	0.011112512	0.171577674
5	52	-0.022227565	3.64561E-06	6.16419E-06	3.99194E-05	0.000616357
6	7	0.039787818	-0.00027345	-0.000462371	-0.002994321	-0.046232453
7	33	-0.014366436	-0.0001637	-0.000276801	-0.001792565	-0.027677286
8	18	0.05571946	-0.00055981	-0.000946555	-0.006129905	-0.094646
9	38	0.025969926	-7.0916E-05	-0.000119909	-0.000776533	-0.011989706
10	36	0.031666553	-0.00061204	-0.001034874	-0.00670186	-0.103477005
11	11	-0.016760721	8.04539E-05	0.000136036	0.00088097	0.013602218
12	44	0.018528575	-0.00033981	-0.000574565	-0.00372089	-0.057450708
13	18	0.05571946	0.000902154	0.00152541	0.009878582	0.152525738
14	29	0.064633517	0.000558964	0.000945126	0.006120651	0.094503111
15	5	-0.000572685	-1.4806E-07	-2.50351E-07	-1.62128E-06	-2.50326E-05
16	8	-0.035080924	-0.00068889	-0.00116482	-0.007543396	-0.116470362
17	57	-0.05778114	0.000848857	0.001435293	0.009294985	0.143514969
18	6	-0.023997858	-0.00038295	-0.000647511	-0.004193293	-0.064744624
19	24	0.000953725	-4.6604E-06	-7.88013E-06	-5.10318E-05	-0.000787934
20	42	0.007101965	-4.211E-05	-7.12012E-05	-0.0004611	-0.007119406
21	44	0.018528575	0.000212919	0.000360015	0.002331464	0.035997899
22	33	-0.014366436	-0.00014273	-0.000241343	-0.001562944	-0.024131925
23	11	-0.016760721	-0.00013594	-0.000229851	-0.001488519	-0.022982794
24	65	-0.016359327	-4.4684E-06	-7.55538E-06	-4.89288E-05	-0.000755462
25	50	-0.067523522	0.000393753	0.000665778	0.004311593	0.066571188

Formula = Percentile of Gain/Loss * CI	
VAR (Value at Risk) For Deutsche Bank	
CI -Confidence Interval	Values
99.90%	-0.017014435
99.00%	-0.016641756
95.00%	-0.007248858
90.00%	-0.005939668
85.00%	-0.00391371

Formula = Percentile of Gain/Loss * CI	
VAR (Value at Risk) For BMW motors	
CI -Confidence Interval	Values
99.90%	-0.262703616
99.00%	-0.262703616
95.00%	-0.262703616
90.00%	-0.262703616
85.00%	-0.262703616

Conclusion

Based on boot strap sampling, we understood that it is a similar method to historical stimulation; the only difference is that it will generate data points for sampling from its own data source via random sampling technique, so from less available data points, we can generate so many sampling outcomes to bring out a result close to accuracy. Then Var is calculated based on the randomly generated datapoint instead of using historical data, unlike historical stimulation.

Final Outcome of Risk Analysis

To Invest in any portfolio the wealth management team will analyse both Risk and return and will match this risk and retune with one individual ability to choose best investment for themselves. By three different method we could analyse the Var which is shown below. We can see Tata Consumer and Massachusetts General Hospital are the both the entities which has ability to take risk as per the mandate.

- Massachusetts General Hospital
  1) Total Investment * Ability to take risk → (130 * 7.7% = 10.01 max loss)
- Astra Zeneca (Bio-pharmaceutical)
  1) Total Investment * Ability to take risk → (115 * 6.8% = 7.82 max loss)
- Siemens Healthineers
  1) Total Investment * Ability to take risk → (95 * 6.2% = 5.89 max loss)
- Tata Consumer Products
  1) Total Investment * Ability to take risk → (150 * 9.2% = 13.8 max loss)
- Bank of China Limited
  1) Total Investment * Ability to take risk → (70 * 5.9% = 4.13 max loss)

VAR (Value at Risk) For Deutsche Bank		Massachusetts General Hospital	Astra Zeneca	Siemena Healthineers	Tata Consumer Products	Bank of China Limited
CI -Confidence Interval	Values	130	115	95	150	70
99.90%	-0.188569113	-24.51398471	-21.68544802	-17.91406575	-28.28536698	-13.19983792
99.00%	-0.078319918	-10.18158929	-9.006790524	-7.440392172	-11.74798764	-5.482394232
95.00%	-0.013796342	-1.793524473	-1.586579341	-1.310652499	-2.069451315	-0.965743947
90.00%	-0.009302089	-1.209271563	-1.069740229	-0.88369845	-1.395313342	-0.651146226
85.00%	-0.004424817	-0.575226162	-0.508853913	-0.42035758	-0.663722495	-0.309737164

Formula = Percentile of Gain/Loss * CI		Confidence Interval Values X Value of Investment by each entity				
VAR (Value at Risk) For BMW motors		Massachusetts General Hospital	Astra Zeneca	Siemena Healthineers	Tata Consumer Products	Bank of China Limited
CI -Confidence Interval	Values	130	115	95	150	70
99.90%	-2.911515344	-378.4969947	-334.8242645	-276.5939577	-436.7273016	-203.8060741
99.00%	-1.209262949	-157.2041833	-139.0652391	-114.8799801	-181.3894423	-84.6484064
95.00%	-0.213016125	-27.6920962	-24.49685433	-20.23653184	-31.95241869	-14.91112872
90.00%	-1.209262949	-157.2041833	-139.0652391	-114.8799801	-181.3894423	-84.6484064
85.00%	-0.068319362	-8.881517068	-7.856726637	-6.490339396	-10.24790431	-4.782355344
	TOTAL of DB & BMW	Massachusetts General Hospital	Astra Zeneca	Siemena Healthineers	Tata Consumer Products	Bank of China Limited
	99.90%	-403.0109794	-356.5097125	-294.5080234	-465.0126685	-217.005912
	99.00%	-167.3857726	-148.0720296	-122.3203723	-193.1374299	-90.13080063
	95.00%	-29.48562067	-26.08343367	-21.54718434	-34.02187	-15.87687267
	90.00%	-158.4134549	-140.1349793	-115.7636786	-182.7847556	-85.29955262
Risk Ability	85.00%	-9.45674323	-8.365580549	-6.910696976	-10.9116268	-5.092092508

✓ 5th STEP:

- **Final Conclusion**

1. what exactly is the business decision you want to support with this solution?
   In this assignment, I want to carry out a portfolio and risk analysis and decide which firm among five entities is suitable to make an investment as per their business requirements or as per the nature of the investment.

2. Why did you select this as an excellent data-driven decision-making problem?
   I have chosen this data-driven decision-making problem because this is the most common challenge faced by global asset management firms during market contractions, for example, the COVID pandemic, to help the firm and business keep sustaining during crises in the market collusion phase.

3. What data will you use, and where will you get it? Please use Python to analyse at least two data cleaning tasks, including data cleaning of text & numbered data.
   I have used historical data for BMW Motors and Deutsche Bank Company to make an analysis of whether these two stocks best suit the investment into the global ETF of Black Rock or not. If yes, then which company among the five entities would go head-to-head for their further investment? → And as per the Analysis we could figure out Tata consumer and Massachusetts general hospital would be able to take further Investment decision.

4. Why and how do you expect your solution will add value?
   During times of global crises, for example, the COVID pandemic, we noticed that most firms had to shut down, some evolved out of it, and there were still a few firms that needed to keep sustaining until the pandemic was over so that they could keep functioning normally outside of crises. So, there were top firms that reached out to the asset management firm to help them get funds from the market, and the Black Rock Wealth Management/Asset Management team helped this firm generate regular income to pay off their fixed expenses even during market crises.

5. Explain all the steps towards the deployment of your solution?
   All the steps for this analysis are mentioned above in detail, along with the analysis and final conclusion, along with the data analysis models and statistical support for the analysis.

6. What type of data analytic tasks do you need to perform?
   I have performed the portfolio optimization process to find out the best suitable portfolio for the client based on risk and return analysis and also performed regression along with risk analysis (statistical variance) calculation to support my judgment.

7. What is your target variable, and what are the features (if any)?
   My target variables are the historical return of the stock price for BMW Motors and Deutsche Bank, along with the relationship with its parent (German DAX index), and all of the data is taken from Yahoo Finance on a historical basis for future analysis.

8. What exactly would be your training data?
   My training data will be stock prices for both companies, which would be intended to be included in the global ETF of Black Rock along with its parent index data (the DAX German Index).

9. How will you evaluate model performance.

Final Conclusion

Based on the above analysis, the Black Rock wealth management team will perform two major analyses: identifying the optimum portfolio based on return and then analysing risk factors to determine which firm can adapt to make investments in the BMW and Deutsche Bank stock composite into the Black Rock Global ETF.

The third step of analysis is finding or identifying whether the given investment chosen is compatible as per the calculated risk factor or not, and during the risk analysis of the VAR, we could notice that only Tata Consumer and Massachusetts General Hospital could make suitable investments, whereas other entities would reject them and only invest 100% of their investment in the DAX index but not in BMW Motors or Deutsche Bank. Also, these two entities, Tata Consumer and Massachusetts General Hospital, may split the portion of their fund into two parts and invest in the Global ETF either equally or in a split percentage system, which is further determined by other tactical asset management methods, which is not the point of the discussion in this assignment.

➢ References

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- WWW.BlackRock.com

- Python script – www.python.org