

MA374

LAB-5

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1. Obtain the required weights w using the following relation –

$$w = \frac{\begin{vmatrix} 1 & uC^{-1}M^T \\ \mu_v & MC^{-1}M^T \end{vmatrix} uC^{-1} + \begin{vmatrix} uC^{-1}u^T & 1 \\ MC^{-1}u^T & \mu_v \end{vmatrix} MC^{-1}}{\begin{vmatrix} uC^{-1}u^T & uC^{-1}M^T \\ MC^{-1}u^T & MC^{-1}M^T \end{vmatrix}}$$

where, μ_v = return,

u = $[1, 1, 1, \dots, 1]$ (with same dimension as that of number of assets)

Obtain the risk using following relation–

$$\sigma_v^2 = wCw^T$$

and then take square root to obtain the risk in terms of std. deviation. Now, the minimum variance portfolio has weights:

$$w = \frac{uC^{-1}}{uC^{-1}u^T}$$

Using this, we find the corresponding point on the minimum variance curve.

Now, the efficient frontier is the one with higher expected return and lower standard deviation (lower risk). So, the points with higher return than the minimum variance portfolio point shows the efficient frontier on the curve (denoted by yellow).

The equation of CML is obtained using the following formula:

$$\mu = \frac{\mu_M - \mu_{rf}}{\sigma_M} \sigma + \mu_{rf}$$

where,

$$\begin{aligned}\mu_M &= \text{return corresponding to market portfolio} \\ \mu_{rf} &= \text{risk free return} \\ \sigma_M &= \text{risk corresponding to market portfolio}\end{aligned}$$

The Security market line is obtained using the following formula:

$$\mu = (\mu_M - \mu_{rf})\beta + \mu_{rf}$$

where,

$$\begin{aligned}\mu_M &= \text{return corresponding to market portfolio} \\ \mu_{rf} &= \text{risk free return}\end{aligned}$$

The value of β return corresponding to market portfolio risk free return can be evaluated by using following relation:

$$\beta_k = \frac{Cov(R_k, R_M)}{\sigma_M^2}$$

$$\begin{aligned}\text{where, } \beta_k &= \text{beta of the asset k} \\ R_k &= \text{return of the asset k} \\ R_M &= \text{return of the entire market portfolio} \\ \sigma_M^2 &= \text{variance of the market portfolio}\end{aligned}$$

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***** Market portfolio for BSE using Index *****
Market return  = 0.18828521206023865
Market risk    = 0.9858488532026951 %

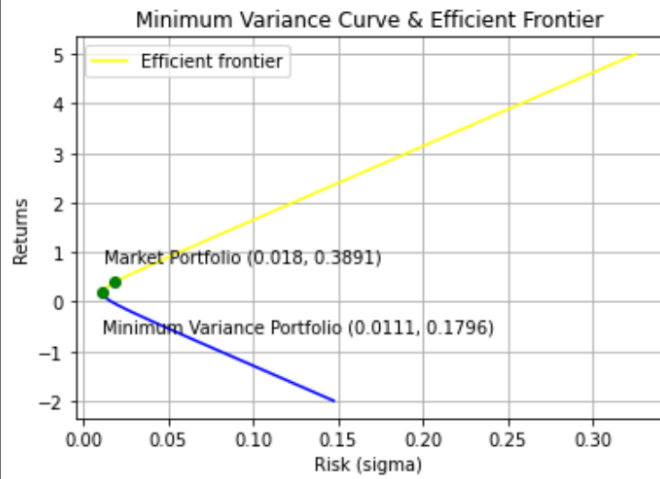
***** Market portfolio for NSE using Index *****
Market return  = 0.2691388127952176
Market risk    = 1.021122580243631 %

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***** 10 stocks from the BSE Index *****

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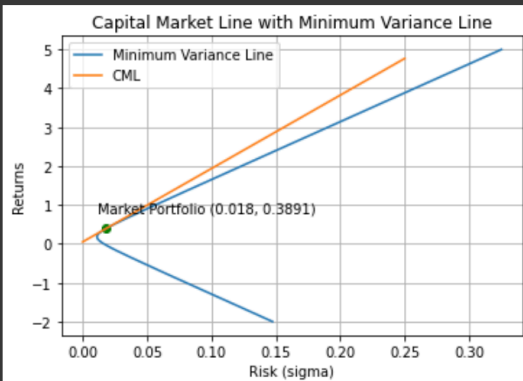


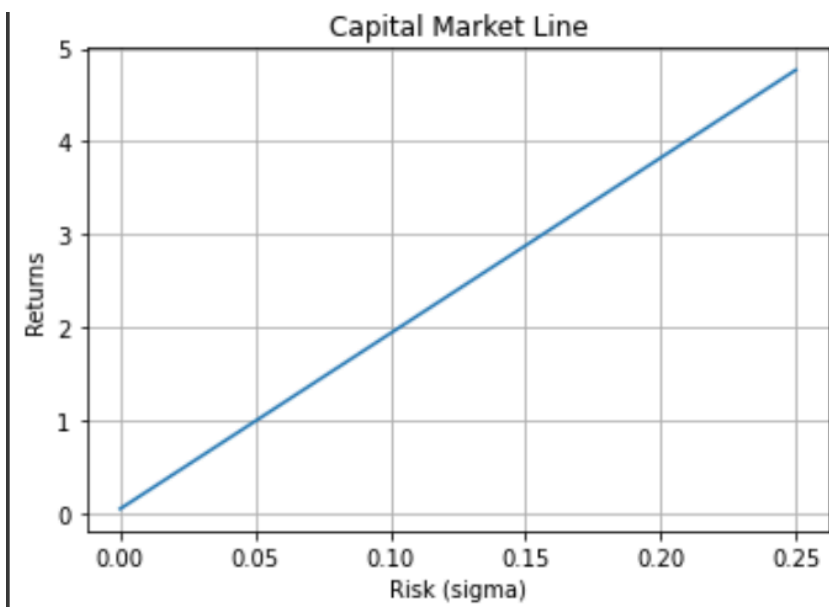
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Market Portfolio Weights = [-0.13836107  0.00239926  0.13150299 -0.35485775  0.27998497  0.42669864
0.54610275 -0.30735634  0.42348177 -0.00959522]
Return                  = 0.3891320730462697
Risk                    = 1.796729807687594 %

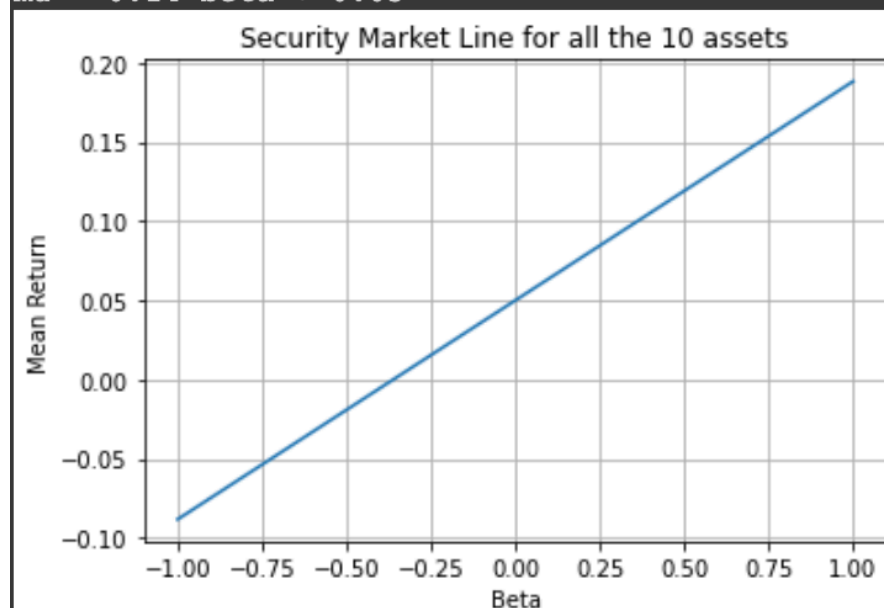
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Equation of CML is:
 $y = 18.8750 x + 0.0500$

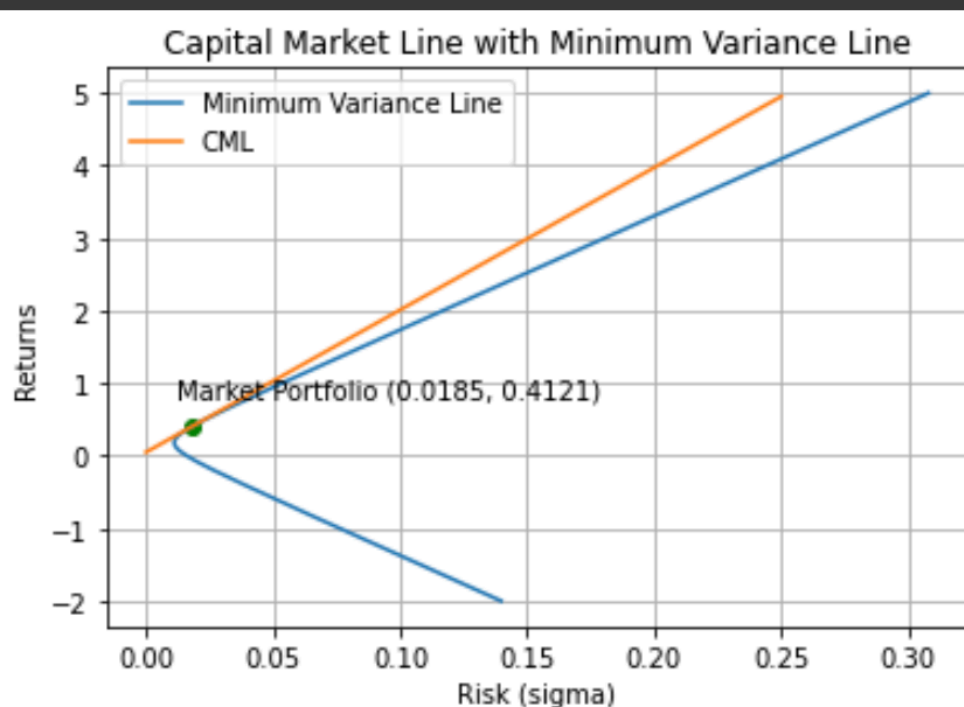


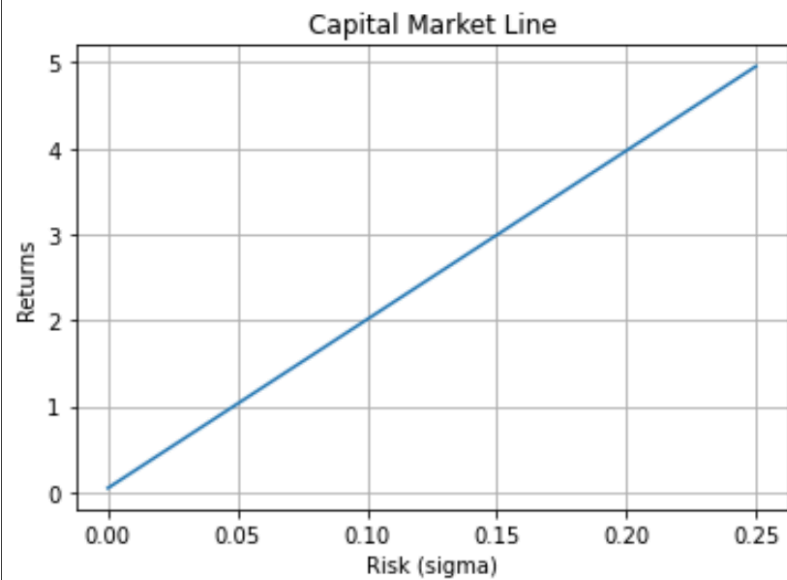


Eqn of Security Market Line is:
 $\mu = 0.14 \text{ beta} + 0.05$

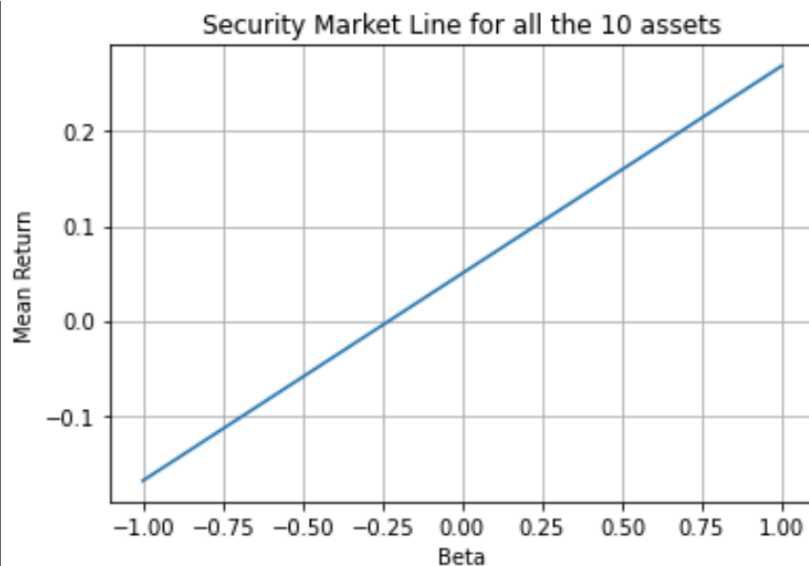


Equation of CML is:
 $y = 19.6189 x + 0.0500$

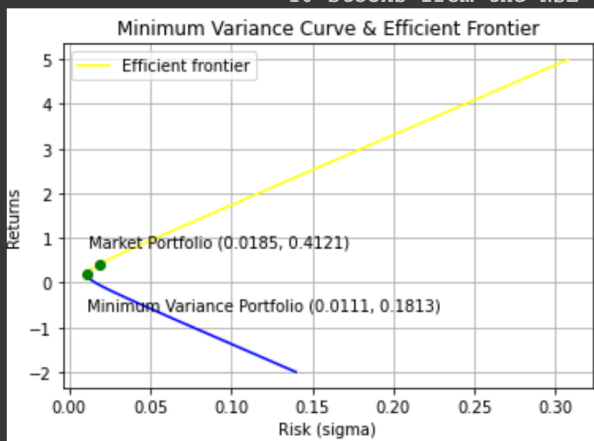




Eqn of Security Market Line is:
 $\mu = 0.22 \text{ beta} + 0.05$

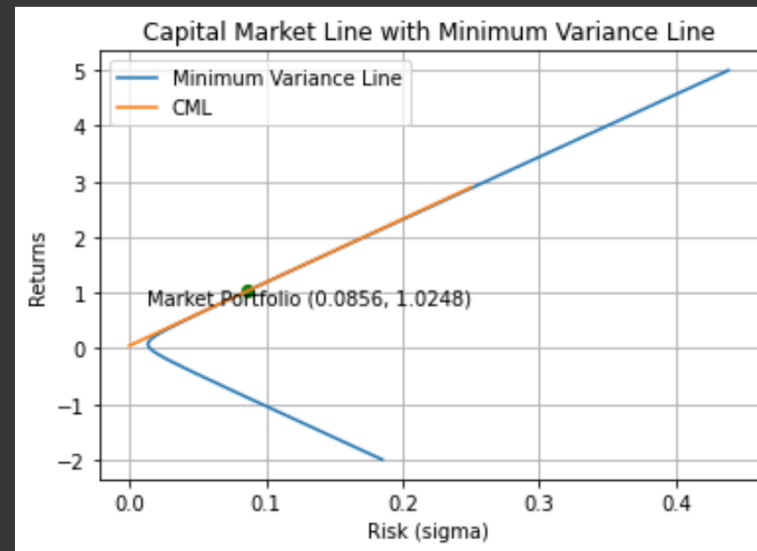


***** 10 stocks from the NSE Index *****

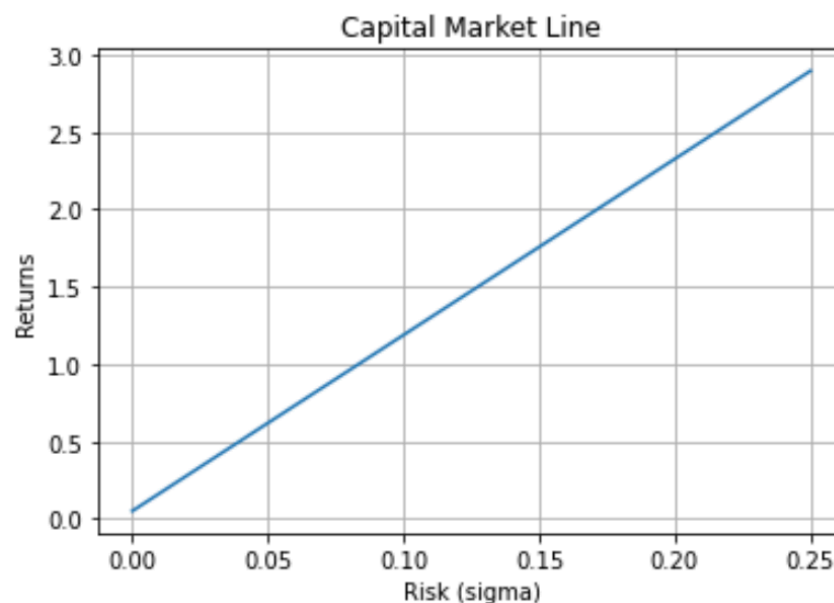
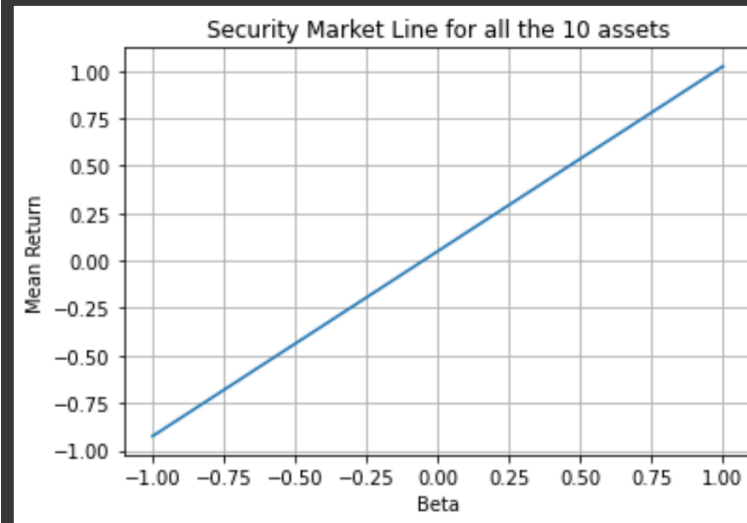


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Market Portfolio Weights      = [-0.13578158  0.03292941  0.15339818 -0.48609186  0.25141976  0.45845427
0.60139794 -0.28036715  0.42195312 -0.0173121 ]
Return                       = 0.41208616987508273
Risk                         = 1.8455963327783234 %
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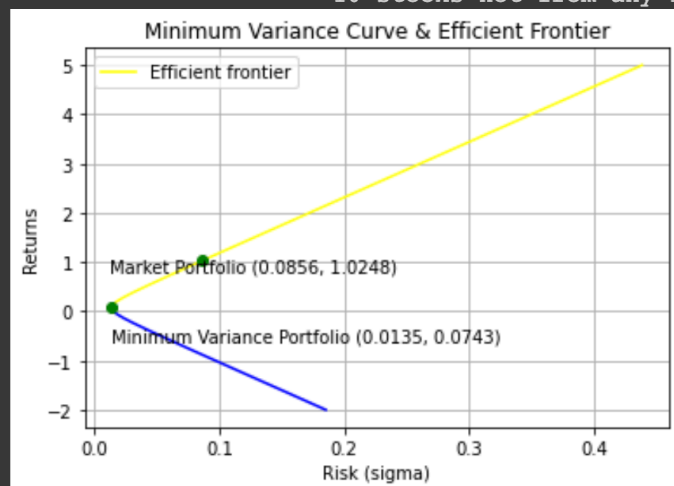
Equation of CML is:
 $y = 11.3849 x + 0.0500$



Eqn of Security Market Line is:
 $\mu = 0.97 \text{ beta} + 0.05$



***** 10 stocks not from any Index *****



Market Portfolio Weights = [1.33745784 -0.02814459 -0.34046223 -1.75049733 1.694612 -1.0670991
 0.97811283 -2.83885276 1.83141123 1.18346232]
 Return = 1.0247702927424194
 Risk = 8.561925477329027 %

***** Inference about stocks not taken from any index with index taken from BSE values*****

| Stocks Name | Actual Return | Expected Return |
|--------------|-----------------------|---------------------|
| ACC.NS | 0.11605967774155172 | 0.18041187794116192 |
| HINDZINC.NS | 0.07864009623765908 | 0.13642357888323298 |
| IDEA.NS | -0.021600118970564745 | 0.26885757954598266 |
| GODREJIND.NS | -0.004632973090229623 | 0.1444798362941803 |
| IGL.NS | 0.10678405208864272 | 0.1762164602079337 |
| LUPIN.NS | 0.02078363161245805 | 0.12299521968822105 |
| MAHABANK.NS | 0.20732344246569498 | 0.16707893340025665 |
| MGL.NS | 0.00483767281289127 | 0.17545572512930713 |
| PAGEIND.NS | 0.17033200879993451 | 0.15235475830125864 |
| TATACHEM.NS | 0.16605096469586234 | 0.1849753516970613 |

***** Inference about stocks taken from NSE *****

| Stocks Name | Actual Return | Expected Return |
|---------------|----------------------|---------------------|
| WIPRO.NS | 0.14561282593090663 | 0.16760880081547355 |
| BAJAJ-AUTO.NS | 0.053251531277694775 | 0.21833838226642505 |
| HDFCBANK.NS | 0.15205114058348362 | 0.27837820311444206 |
| HEROMOTOCO.NS | -0.01668257790040928 | 0.2501677007994812 |
| TCS.NS | 0.21206234017379993 | 0.17763581303880494 |
| INFY.NS | 0.25756730115328247 | 0.1906331502709137 |
| NESTLEIND.NS | 0.2143027279051978 | 0.16639222976623202 |
| MARUTI.NS | 0.02489493229545939 | 0.2818535840020543 |
| RELIANCE.NS | 0.25362217824131594 | 0.28615178733065827 |
| TATAMOTORS.NS | 0.0951430626835397 | 0.31426584796478074 |

***** Inference about stocks taken from BSE *****

| Stocks Name | Actual Return | Expected Return |
|---------------|-----------------------|---------------------|
| WIPRO.BO | 0.14690917165334177 | 0.14174041427614487 |
| BAJAJ-AUTO.BO | 0.05640396954621738 | 0.16859764927315574 |
| HDFCBANK.BO | 0.15163208082492788 | 0.1982431486872513 |
| HEROMOTOCO.BO | -0.014028398008634854 | 0.18237001769852712 |
| TCS.BO | 0.21145427987740212 | 0.13490920818243773 |
| INFY.BO | 0.255941030134476 | 0.14689738782949563 |
| NESTLEIND.BO | 0.2152940582388096 | 0.12670859435723175 |
| MARUTI.BO | 0.025070595465348906 | 0.2067014494847189 |
| RELIANCE.BO | 0.2528174168277474 | 0.20578765361176182 |
| TATAMOTORS.BO | 0.09788723783323228 | 0.23038589407743348 |

***** Inference about stocks not taken from any index with index taken from NSE values*****

| Stocks Name | Actual Return | Expected Return |
|--------------|-----------------------|---------------------|
| ACC.NS | 0.11605967774155172 | 0.256662040580102 |
| HINDZINC.NS | 0.07864009623765908 | 0.1869543437929977 |
| IDEA.NS | -0.021600118970564745 | 0.3968208164734891 |
| GODREJIND.NS | -0.004632973090229623 | 0.1997209922169711 |
| IGL.NS | 0.10678405208864272 | 0.2500136155783083 |
| LUPIN.NS | 0.02078363161245805 | 0.16567459415136 |
| MAHABANK.NS | 0.20732344246569498 | 0.23553349332455237 |
| MGL.NS | 0.00483767281289127 | 0.24880808839649166 |
| PAGEIND.NS | 0.17033200879993451 | 0.21220028073796166 |
| TATACHEM.NS | 0.16605096469586234 | 0.26389371926931937 |

IMPORTANT POINTS:-

1. The market portfolio return is taken as the corresponding value calculated using the index values.
2. The dependence between actual return and expected return depends on the value of beta. (which is discussed in detail in the next question)
3. If the value of beta is close to 1, the expected return is very close to the market portfolio return, otherwise if it is close to 0, then the expected return is around the risk-free return.

4. Also, since the market portfolio mean is calculated from the index values, and not from the combined asset of 10 chosen stocks, there can be some deviations in the observed values.
5. For the non-index stocks, the comparison was made twice, first by considering the market portfolio constructed using BSE index and then using NSE index

| ***** Beta for securities in non-index using BSE Index ***** | | | |
|--|---|---|---------------------|
| ACC.NS | = | | 0.9430645258319666 |
| HINDZINC.NS | = | = | 0.624966166632379 |
| IDEA.NS | = | | 1.5826535338474643 |
| GODREJIND.NS | = | = | 0.6832244380044323 |
| IGL.NS | = | | 0.912725651047578 |
| LUPIN.NS | = | = | 0.5278599106925728 |
| MAHABANK.NS | = | = | 0.8466482544008807 |
| MGL.NS | = | | 0.9072244476485105 |
| PAGEIND.NS | = | = | 0.7401713948753372 |
| TATACHEM.NS | = | = | 0.9760649724300564 |
| ***** Beta for securities in non-index using NSE Index ***** | | | |
| ACC.NS | = | | 0.8619340446378595 |
| HINDZINC.NS | = | = | 0.5401511994921713 |
| IDEA.NS | = | | 1.3949038440991302 |
| GODREJIND.NS | = | = | 0.6236729587737769 |
| IGL.NS | = | | 0.818300564724484 |
| LUPIN.NS | = | = | 0.45616346437756916 |
| MAHABANK.NS | = | = | 0.7786896026463915 |
| MGL.NS | = | | 0.8258255117923045 |
| PAGEIND.NS | = | = | 0.6904098775826951 |
| TATACHEM.NS | = | = | 0.8972617338341531 |

| ***** Beta for securities in BSE ***** | | | |
|--|---|--|--------------------|
| WIPRO.BO | = | | 0.6634144960936363 |
| BAJAJ-AUTO.BO | = | | 0.8576307437811442 |
| HDFCBANK.BO | = | | 1.0720101338288788 |
| HEROMOTOCO.BO | = | | 0.9572246788099453 |
| TCS.BO | = | | 0.6140150990653309 |
| INFY.BO | = | | 0.7007067956571235 |
| NESTLEIND.BO | = | | 0.5547129242121465 |
| MARUTI.BO | = | | 1.1331757542987166 |
| RELIANCE.BO | = | | 1.1265677022927 |
| TATAMOTORS.BO | = | | 1.3044481863964985 |
| ***** Beta for securities in NSE ***** | | | |
| WIPRO.NS | = | | 0.5366863099937365 |
| BAJAJ-AUTO.NS | = | | 0.7681815015751459 |
| HDFCBANK.NS | = | | 1.042162272403376 |
| HEROMOTOCO.NS | = | | 0.9134287908483619 |
| TCS.NS | = | | 0.5824427512896995 |
| INFY.NS | = | | 0.6417537289587013 |
| NESTLEIND.NS | = | | 0.5311347099201411 |
| MARUTI.NS | = | | 1.0580215391543553 |
| RELIANCE.NS | = | | 1.0776356060272128 |
| TATAMOTORS.NS | = | | 1.2059289935632431 |

IMPORTANT POINTS:-

1. The beta of a security is a measure of its systematic risk, which cannot be eliminated by diversification.
2. A beta value of one is considered as the overall market average. A beta value which is greater than one represents a risk level greater than the market average, and a beta value of less than one represents a risk level that is less than the market average.
3. From the above tables, it is clear that for the stocks from MARUTI, RELIANCE, HDFCBANK and, TATAMOTORS, the value of beta is greater than 1 for both the indices, while for the stocks of the rest of the companies, the value of beta is less than 1.
4. Beta less than 1 can also occur when the asset price goes opposite to the market.

