MA 374: FE - Assignment #05

Due on Friday, February 19, 2016

Silvi Pandey(130123045)

PROBLEM - 1

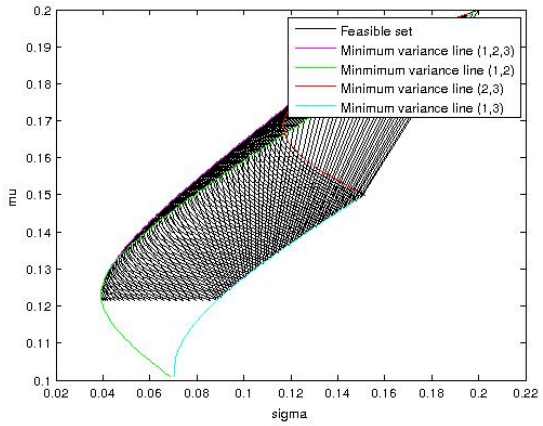
Consider the same data given in Lab 04 (Problem 1) to construct the efficient frontier. Now, construct the minimum variance curve (and efficient frontier) and the feasible region (in the risk-return plot) assuming that short sales are not allowed. In the same plot, also indicate the minimum variance curves (there are three of those) if you consider any two out of three securities at a time. Also, in another graph, plot the weights corresponding to the minimum variance curve (and write the equation that these weights satisfy).

SOLUTION

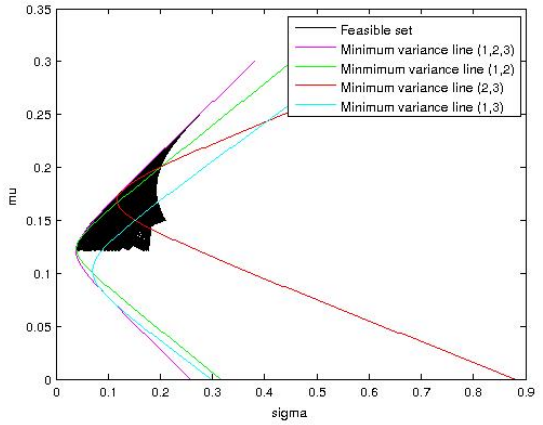
The weights corresponding to the minimum variance portfolio can be obtained by minimising the variance subject to the constraint that the sum of the respective weights is equal to 1 . The following is the expression for the weights corresponding to the minimum variance portfolio. :

$$w = \frac{\begin{vmatrix} 1 & uC^{-1}m^T \\ \mu_V & mC^{-1}m^T \end{vmatrix} uC^{-1} + \begin{vmatrix} uC^{-1}u^T & 1 \\ mC^{-1}u^T & \mu_V \end{vmatrix} mC^{-1}}{\begin{vmatrix} uC^{-1}u^T & uC^{-1}m^T \\ mC^{-1}u^T & mC^{-1}m^T \end{vmatrix}},$$

Without short sell

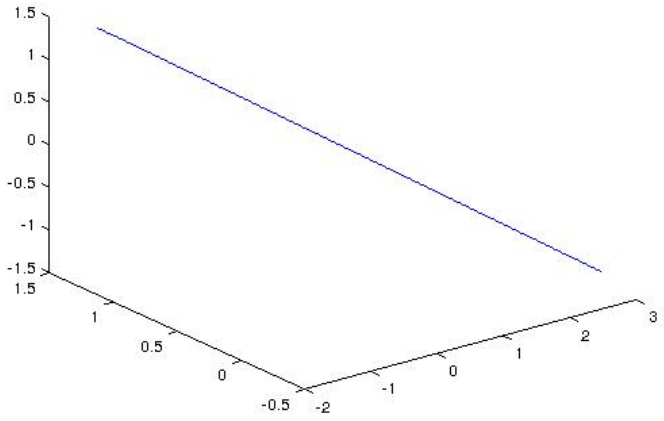


With short sell



In the plot corresponding to 'Without short sell' the weights are forced to be positive while this restriction is not there in the plot corresponding to 'With short sell'. As observed from the plot,when short sell is not allowed, the efficient frontier is just the part above the minimum variance portfolio while the efficient frontier covers the entire minimum variance line in the case where short sell is allowed

Weights corresponding to the minimum variance line



.

The above is a line plot in three dimensions satisfying the equation $w_1 + w_2 + w_3 = 1$ and belonging to the minimum variance line.As expected the plot is a plane in 3D.

PROBLEM - 2

Recall the Lab 04 assignment with the data part (Problem 2). In a similar way, do the following: Collect the data of basic BSE and NSE index values (from their respective official websites) for the period from January 1, 2007 to December 31, 2015. Now, for the same period, collect the stock price data for 10 stocks that are included in the index and 10 stocks that are not included in the index, for each of the index. Repeat what you have done in Lab 04, with the index as market portfolio (for both the indices). From the CAPM formula (SML), draw inference about each of the stocks. Try to compare the betas of securities (by taking the actual data and computing from your data for each index). Keep the data in two separate Excel files and name them as bsedata1 and nsedata1. Obtain data on stocks yourself and do not copy from others. We will use these data in future assignments too.

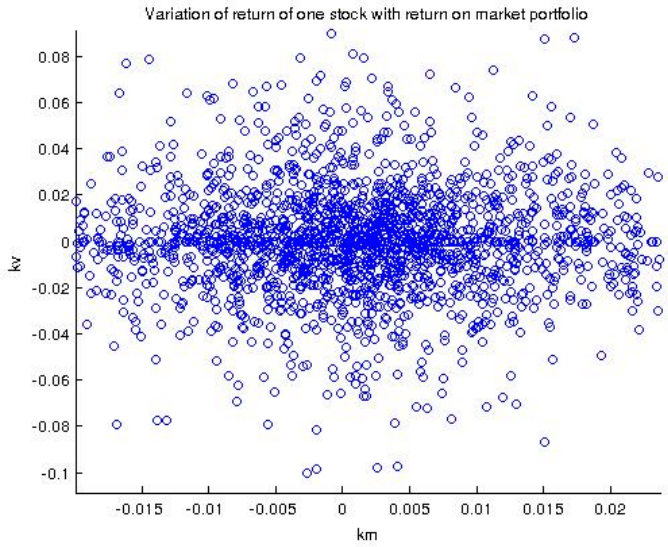
SOLUTION

From BSE (SP-BSE100):
The index chosen was SP-BSE 100 and it included around 80-100 stocks.Out of which 10 stocks were chosen and 10 stocks which were not a part of the index was also chosen.
The following 10 stocks were taken from BSE index : ABB-India ltd , ACC ltd, Adani Ports and Special Economic Zone, Ambuja Cements ltd, Ashok Leyland ltd , Asian Paints ltd, Aurobindo Pharma ltd , Axis Bank ltd, Bank Of Baroda , Bank Of India.
The following 10 stocks were taken which aren't part of BSE index : Aditya Birla Nuvo ltd, Alphabet ltd, Amazon ltd, Dadone ltd, Dollar General Corporation, Facebook ltd , Hess Corporation , Liberty Lilac Group ,MTNL , Taj Hotels.

In part 1 of the problem, the beta values for every stock was calculated using the index as the market portfolio. Firstly, the return of one of the stock was plotted against the market portfolio.In order to calculate the beta values the returns (K_v, K_m) were fit in a line using regression.The following is the expression for beta :

$$\beta = \frac{Cov(K_v, K_m)}{\sigma_m^2}$$

The following scatter plot was obtained between the return of 'Aditya Birla Nova Ltd' and the market portfolio formed from the BSE index.



The β values for the stocks not included in the index are (in the order as mentioned above) :

```
>> Lab05Q2BetaFromBSE
>> beta

beta =

    0.0094   -0.0211    0.0007   -0.0133    0.0156    0.0119   -0.0011    0.0024    0.0134    0.0225

fx >>
```

The β values of the stocks included in the index are (in the order as mentioned above) :

```
>> Lab05Q2BetaFromBSE
>> beta

beta =

   -0.0008   -0.0196    0.0032   -0.0170   -0.0006    0.0012    0.0056   -0.0017   -0.0148   -0.0083

fx >>
```

Now, the stocks included in the index was used to simulate the index (market portfolio) by taking the weighted average of the prices of the stocks and doing a similar exercise.
The β values of the stocks not included in the index obtained by simulating the index from the ten stocks already in the BSE index are (in the order as mentioned above):

```
>> Lab05Q2BetaFromActualData
>> beta

beta =

    0.1405   -0.0159    0.0180    0.0186   -0.0017    0.0825   -0.0062   -0.0030    0.2229    0.0527

fx >>
```

From NSE (NIFTY 100):
The following 10 stocks were taken from NSE index : ACC ltd, Adani Ports and Special Economic Zone, Ambuja Cements ltd, Apollo Hospital , Asian Paints, Aurobindo Pharma ltd, Axis Bank ltd, Bank Of Baroda, Bank Of India, Bosch ltd
The following 10 stocks were taken which aren't part of BSE index : Aditya Birla Nuvo ltd, Alphabet ltd, Amazon ltd, Dadone ltd, Dollar General Corporation, Facebook ltd , Hess Corporation , Liberty Lilac Group ,MTNL , Taj Hotels.

The β values for the stocks not included in the index are (in the order as mentioned above) :

```
>> Lab05Q2BetaFromNSE
>> beta

beta =

   -0.0045   -0.0009   -0.0211    0.0162    0.0148    0.0116    0.0092    0.0143   -0.0033    0.0207

fx >>
```

The β values of the stocks included in the index are (in the order as mentioned above) :

```
>> Lab05Q2BetaFromNSE
>> beta

beta =

   -0.0133    0.0016   -0.0014    0.0055    0.0008   -0.0044    0.0012    0.0022    0.0051   -0.0448

fx >>
```

Now, the stocks included in the index was used to simulate the index (market portfolio) by taking the weighted average of the prices of the stocks and doing a similar exercise.
The β values of the stocks not included in the index obtained by simulating the index from the ten stocks already in the BSE index are (in the order as mentioned above):

```
>> Lab05Q2BetaFromActualDataNSE
>> beta

beta =

    0.1529    0.0012    0.0192    0.0116   -0.0203    0.1439    0.0054   -0.0161    0.1448    0.0903

fx >>
```