भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

# MA 374: Financial Engineering Lab

# Lab 05

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***Note:*** ✍

1. *For **question 1** please wait for a little time (~5 s) for each efficient frontier.*
2. ***Please run python programs using python3**, i.e.* `python3 <filename>.py`

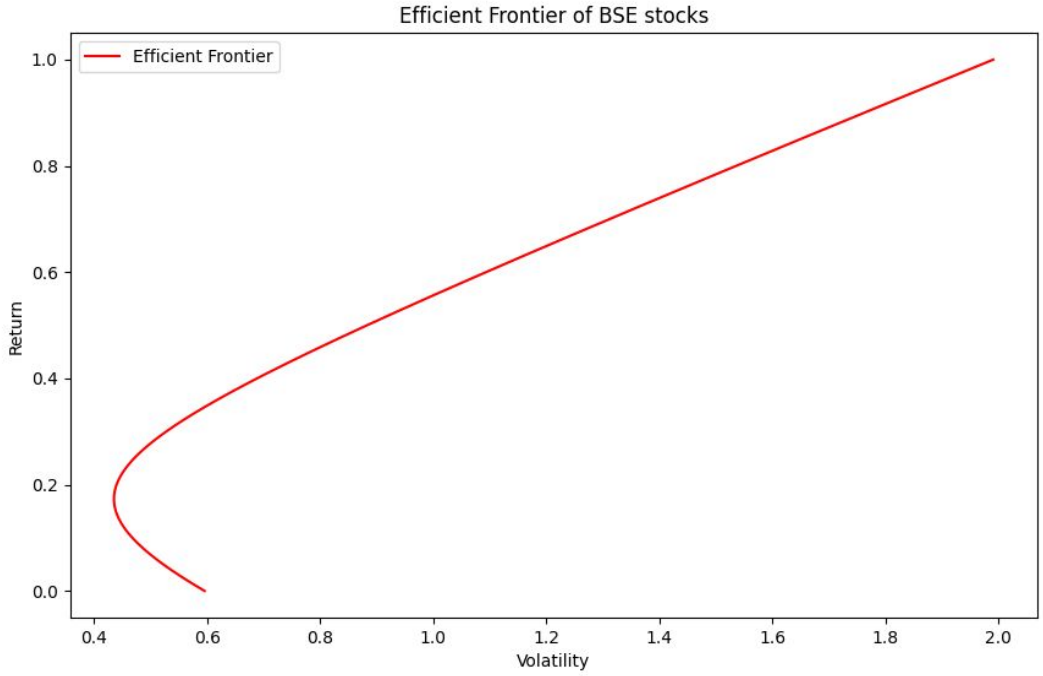
# Question 1.

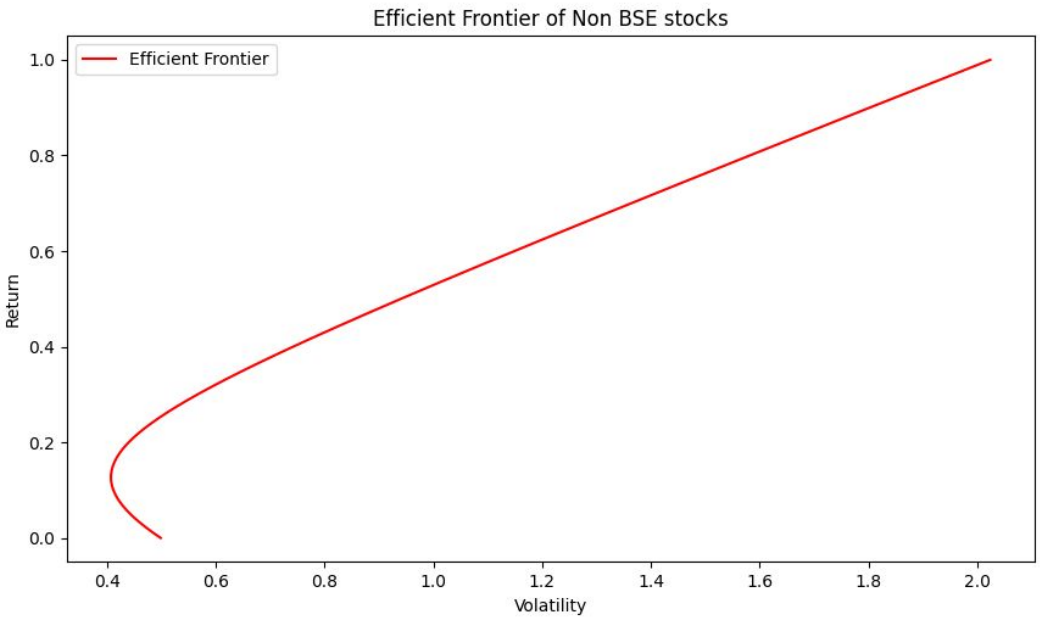
*First, we collect the monthly data for basic BSE and NSE (or SENSEX and NIFTY respectively), from the duration Jan 01, 2014, to Dec 31, 2018 (5 years). For this same period, we also obtain stock price data for 10 stocks that are included and not included in each index (effectively 40 stocks).*

a. Using **BSE (SENSEX)** as the index we first obtain the market portfolio as `(0.1243, 0.4659)`.
   - **Stocks included in SENSEX**:
     - IndusInd Bank Ltd(L)
     - HCL Technologies Ltd(L)
     - State Bank Of India(L)
     - ITC Ltd(L)
     - Infosys Ltd(L)
     - Bajaj Finserv Ltd(L)
     - Maruti Suzuki India Ltd(L)
     - Axis Bank Ltd(L)
     - Tata Steel Ltd(L)
     - Tata Consultancy Services Ltd(L)
   - **Stocks not included in SENSEX**:
     - IndusInd Bank Ltd(L)
     - HCL Technologies Ltd(L)
     - State Bank Of India(L)

- ITC Ltd(L)
- Infosys Ltd(L)
- Bajaj Finserv Ltd(L)
- Maruti Suzuki India Ltd(L)
- Axis Bank Ltd(L)
- Tata Steel Ltd(L)
- Tata Consultancy Services Ltd(L)

The efficient frontiers in each case are shown in the plots below.

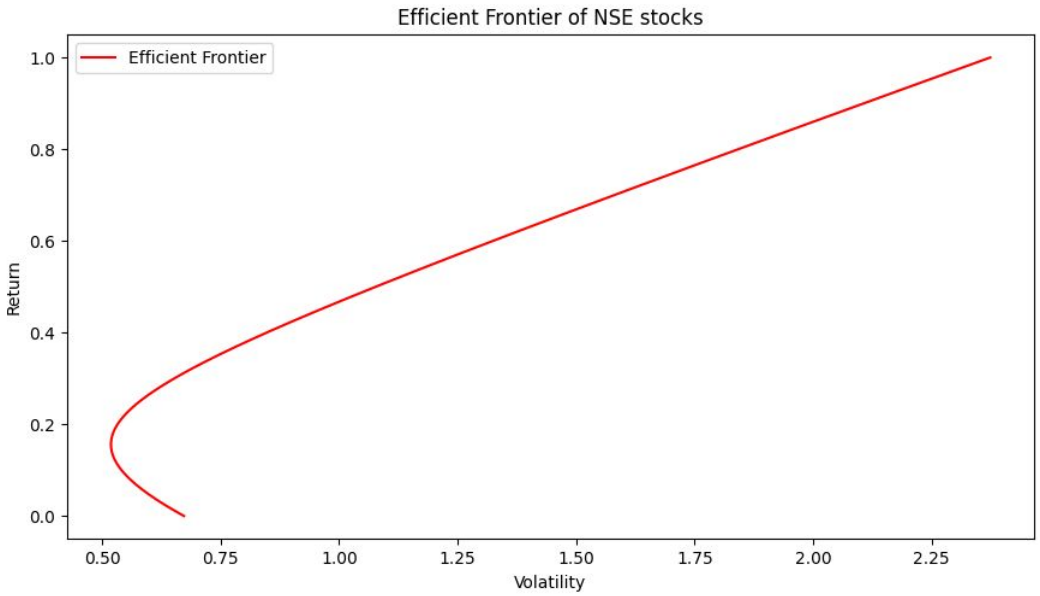


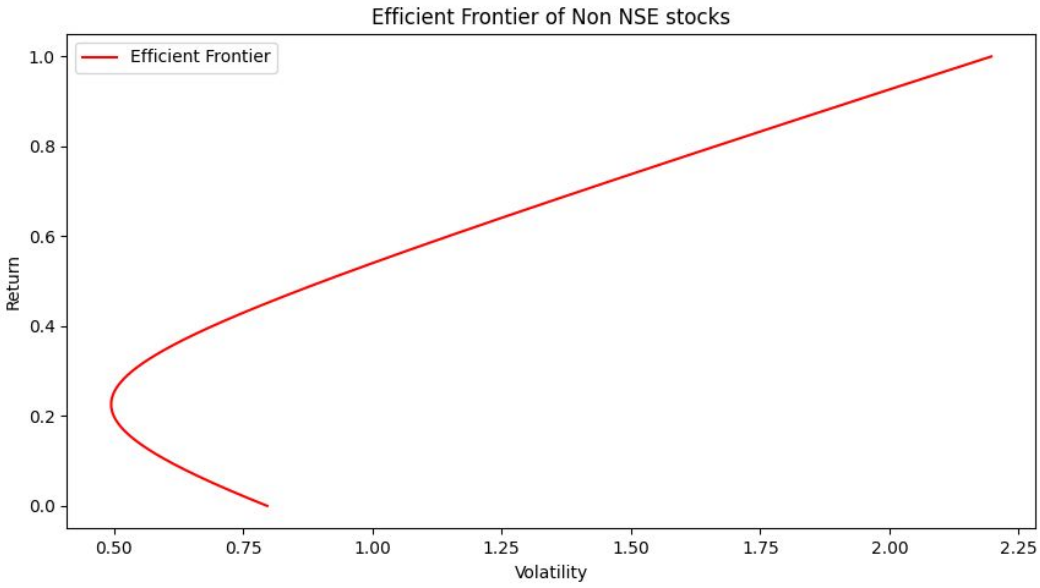



b. Using **NSE (NIFTY)** as the index we first obtain the market portfolio as `(0.1274, 0.4691)`.
   - **Stocks included in NIFTY:**
     - Oil & Natural Gas Corporation Ltd(L)
     - GAIL (India) Ltd(L)
     - Bharat Petroleum Corporation Ltd(L)
     - Indian Oil Corporation Ltd(L)
     - NTPC Ltd(L)
     - Coal India Ltd(L)
     - Asian Paints Ltd(L)
     - Power Grid Corporation Of India Ltd(L)
     - Tech Mahindra Ltd(L)
     - Tata Motors Ltd(L)
   - **Stocks not included in NIFTY:**
     - BHEL
     - Colgate

- Dabur
- Godrej
- Havells
- MRF
- Bank of Baroda
- Punjab National Bank
- Abbott India Ltd(L)
- Bosch Ltd(L)

The efficient frontiers in each case are shown in the plots below.



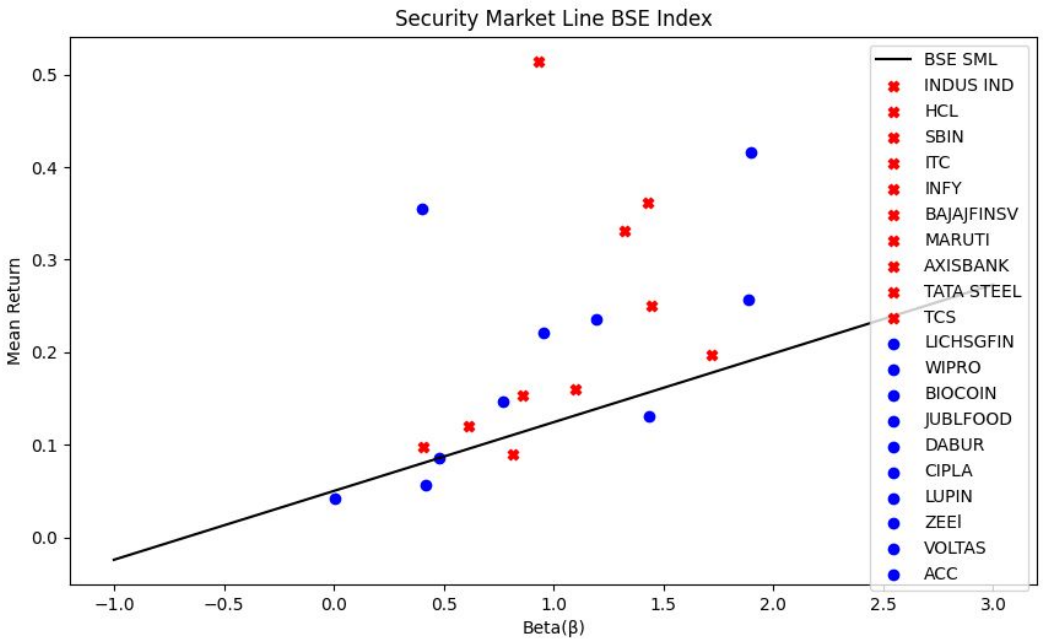



# Question 2.

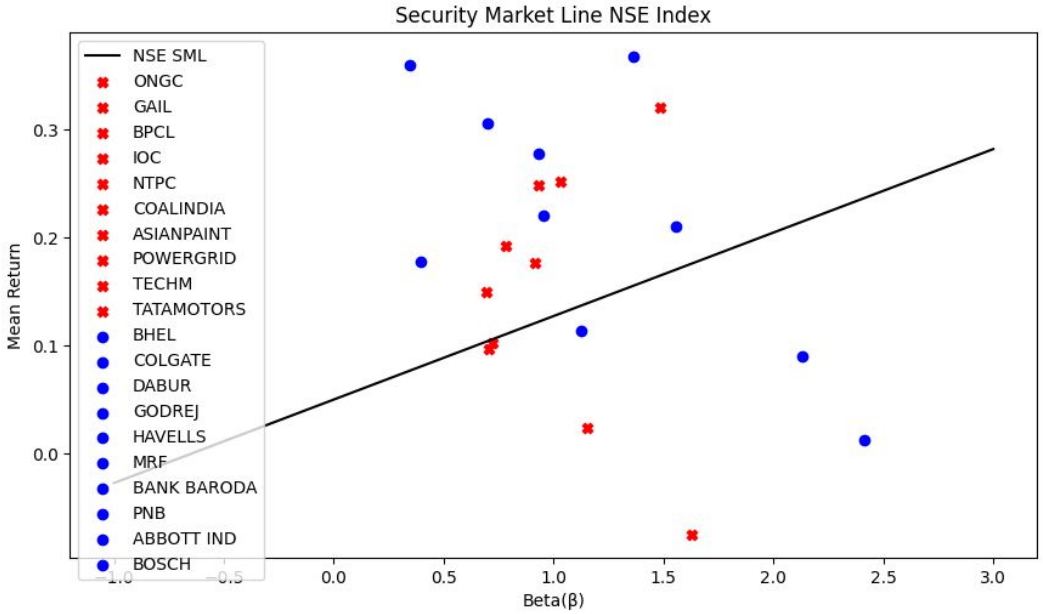
For each stock that we listed in question 1, $\beta$ was calculated taking the corresponding index as the market portfolio. On 2 graphs (1 for SENSEX and 1 for NIFTY), the SML and the pair of points $(\beta_i, E(R_i))$ were plotted where ***i***, corresponded to one of the 20 stocks in that category.

This setup will help provide crucial information about the stocks.

- In the graph below we see 2 types of points - red **X** which represents the stocks included in the BSE index, and blue **O** which represents the stocks not included.
- SENSEX consists of 30 stocks, and some of the ones we have chosen show a higher return than average (above the SML) at their value given $\beta$, which are said to be **undervalued**.
- Similarly, stocks with lower than average returns are said to be **overvalued.**
- **The SML thus divides stocks into over and undervalued stocks.**




A similar analysis can be carried out in the case of NSE (NIFTY). The plot for the same is below:



The values of $\beta$ for each stock are shown below:

```
BSE Stock
         Stock  Beta-value
0    INDUS IND    1.321904
1          HCL    0.406606
2         SBIN    1.719913
3          ITC    0.812860
4         INFY    0.612208
5   BAJAJFINSV    0.931604
6      MARUTI    1.428151
7    AXISBANK    1.443215
8   TATA STEEL    1.098324
9          TCS    0.861623


Non BSE Stock
         Stock  Beta-value
0   LICHSGFIN    1.193410
1      WIPRO    0.420365
2    BIOCOIN    0.402319
3   JUBLFOOD    1.884137
4      DABUR    0.954570
5      CIPLA    0.477522
6      LUPIN    0.005858
7       ZEEl    0.767660
8     VOLTAS    1.895221
9        ACC    1.437033
```

```
NSE Stock
         Stock  Beta-value
0         ONGC    1.151656
1         GAIL    0.916720
2         BPCL    1.484882
3          IOC    0.932760
4         NTPC    0.702718
5    COALINDIA    0.719322
6   ASIANPAINT    1.030016
7    POWERGRID    0.782690
8         TECHM    0.696110
9   TATAMOTORS    1.630289


Non NSE Stock
         Stock  Beta-value
0         BHEL    2.410736
1      COLGATE    0.395385
2        DABUR    0.953446
3       GODREJ    0.933398
4      HAVELLS    1.362092
5          MRF    0.699291
6   BANK BARODA    1.122762
7          PNB    2.129400
8    ABBOTT IND    0.344474
9        BOSCH    1.555713
```

- We find that we have obtained a mix of $\beta$ values for our stocks. For positive and less than 1 value of $\beta$, we can conclude that the stocks increase in value lower than the market and with a lower risk factor too.
- Value of $\beta$ greater than 1 indicates that the stocks grow

```
    faster than the market, however, they have a higher risk
    factor.
```

# Question 3.

For this question, we will tabulate the $\beta$ values for some of our stocks, and compare them with **long-term beta-values** obtained easily from https://www.topstockresearch.com. Also, we won't write any code for this question.

| Stock | Computed Beta Value | Actual Beta Value |
|---|---|---|
| IndusInd Bank Ltd(L) | 1.321904 | **1.23** |
| HCL Technologies Ltd(L) | 0.406606 | **0.505** |
| State Bank Of India(L) | 1.719913 | **1.75** |
| ITC Ltd(L) | 0.812860 | **1.01** |
| Infosys Ltd(L) | 0.612208 | **0.255** |
| Bajaj Finserv Ltd(L) | 0.931604 | **1.62** |
| Maruti Suzuki India Ltd(L) | 1.428151 | **1.35** |
| Axis Bank Ltd(L) | 1.443215 | **1.42** |
| Tata Steel Ltd(L) | 1.098324 | **1.38** |
| Tata Consultancy Services Ltd(L) | 0.861623 | **0.898** |
| LIC Housing Finance Ltd(L) | 1.193410 | **1.16** |
| Wipro Ltd(L) | 0.420365 | **0.480** |
| Biocon Ltd(L) | 0.402319 | **0.52** |

```
Similarly, we can also analyze for other stocks and observe
that the  we have obtained in parts 1 and 2, is indeed a
good approximation of the actual data, thus ensuring that
our analysis is correct!
```

In particular, note that long-term beta, computed by taking monthly data over a period of 5 years (as on Yahoo Finance) - a thing, we did in this assignment!

# Extras...

For this lab, we will need to make use of the following packages. The installation instructions are given alongside.

*Kindly use pip3 since the code must be run in python 3 as mentioned previously.*

```
Numpy - pip3 install numpy
Matplotlib - pip3 install matplotlib
Scipy - pip3 install scipy
Pandas - pip3 install pandas
```

Note that the Excel files named “bsedata1” and “nsedata1 are inside BSE and NSE folder respectively, where we also have CSV files for stock prices for all the different cases discussed above!