

FRA PROJECT

PART-B

FASNA

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PGDSBA-23-24

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PROBLEM STATEMENT

Context

Investors face market risk, arising from asset price fluctuations due to economic events, geopolitical developments, and investor sentiment changes. Understanding and analyzing this risk is crucial for informed decision-making and optimizing investment strategies.

Objective

The objective of this analysis is to conduct Market Risk Analysis on a portfolio of Indian stocks using Python. It uses historical stock price data to understand market volatility and riskiness. Using statistical measures like mean and standard deviation, investors gain a deeper understanding of individual stocks' performance and portfolio variability.

Through this analysis, investors can aim to achieve the following objectives:

- **Risk Assessment:** Analyze the historical volatility of individual stocks and the overall portfolio.
- **Portfolio Optimization:** Use Market Risk Analysis insights to enhance risk-adjusted returns.
- **Performance Evaluation:** Assess portfolio management strategies' effectiveness in mitigating market risk.
- **Portfolio Performance Monitoring:** Monitor portfolio performance over time and adjust as market conditions and risk preferences change.

DATA DICTIONARY

The dataset contains weekly stock price data for 5 Indian stocks over an 8-year period. The dataset enables us to analyze the historical performance of individual stocks and the overall market dynamics.

FEW ROWS OF DATA SET

	Date	ITC Limited	Bharti Airtel	Tata Motors	DLF Limited	Yes Bank
0	28-03-2016	217	316	386	114	173
1	04-04-2016	218	302	386	121	171
2	11-04-2016	215	308	374	120	171
3	18-04-2016	223	320	408	122	172
4	25-04-2016	214	319	418	122	175

Table-1-first 5 rows of the data set

No .of rows=(418)

No.of columns=6

DATA SET INFORMATION

<class 'pandas.core.frame.DataFrame'>

RangeIndex: 418 entries, 0 to 417

Data columns (total 6 columns):

Column Non-Null Count Dtype

```

---
0 Date 418 non-null object
1 ITC Limited 418 non-null int64
2 Bharti Airtel 418 non-null int64
3 Tata Motors 418 non-null int64
4 DLF Limited 418 non-null int64
5 Yes Bank 418 non-null int64

```

dtypes: int64(5), object(1)

memory usage: 19.7+ KB

Change the data type of "Date" column

STATISTICAL SUMMARY

	ITC Limited	Bharti Airtel	Tata Motors	DLF Limited	Yes Bank
count	418.000000	418.000000	418.000000	418.000000	418.000000
mean	278.964115	528.260766	368.617225	276.827751	124.442584
std	75.114405	226.507879	182.024419	156.280781	130.090884
min	156.000000	261.000000	65.000000	110.000000	11.000000
25%	224.250000	334.000000	186.000000	166.250000	16.000000
50%	265.500000	478.000000	399.500000	213.000000	30.000000
75%	304.000000	706.750000	466.000000	360.500000	249.750000
max	493.000000	1236.000000	1035.000000	928.000000	397.000000

Table-2-STATISTICAL SUMMARY

1: Stock Price Graph Analysis

Stock Price Graph (Stock Price vs Time) for the given stocks

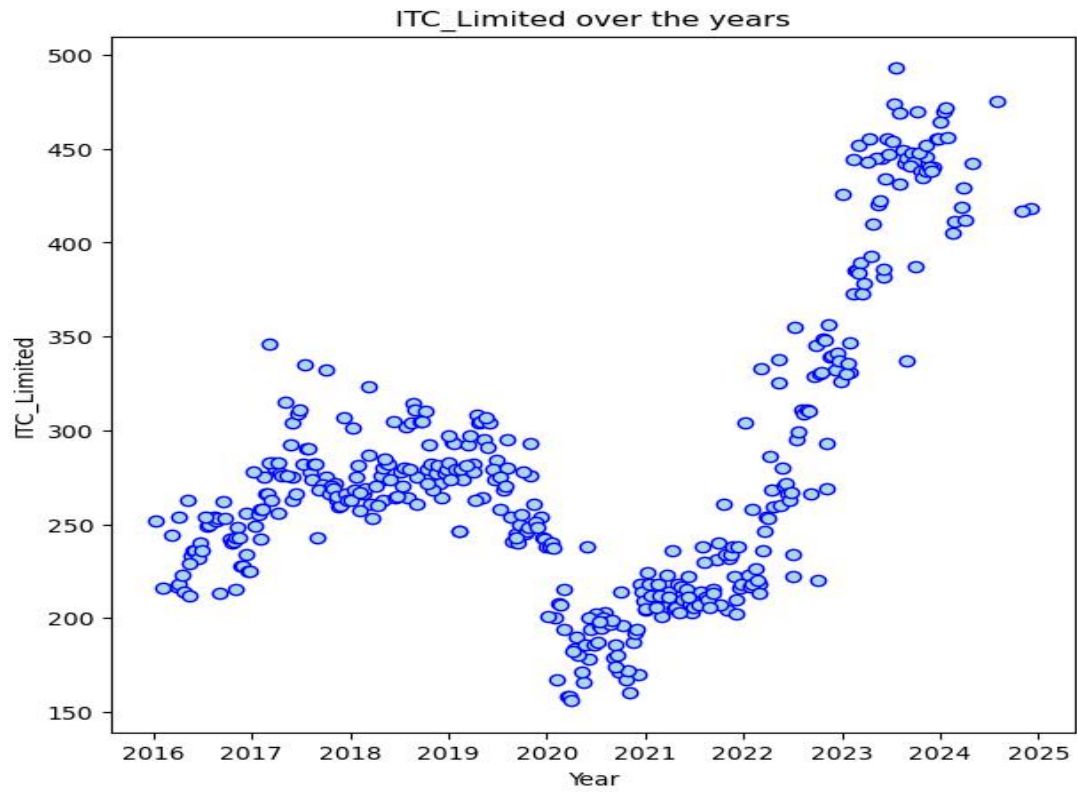


Figure-1-ITC_Limited over the years

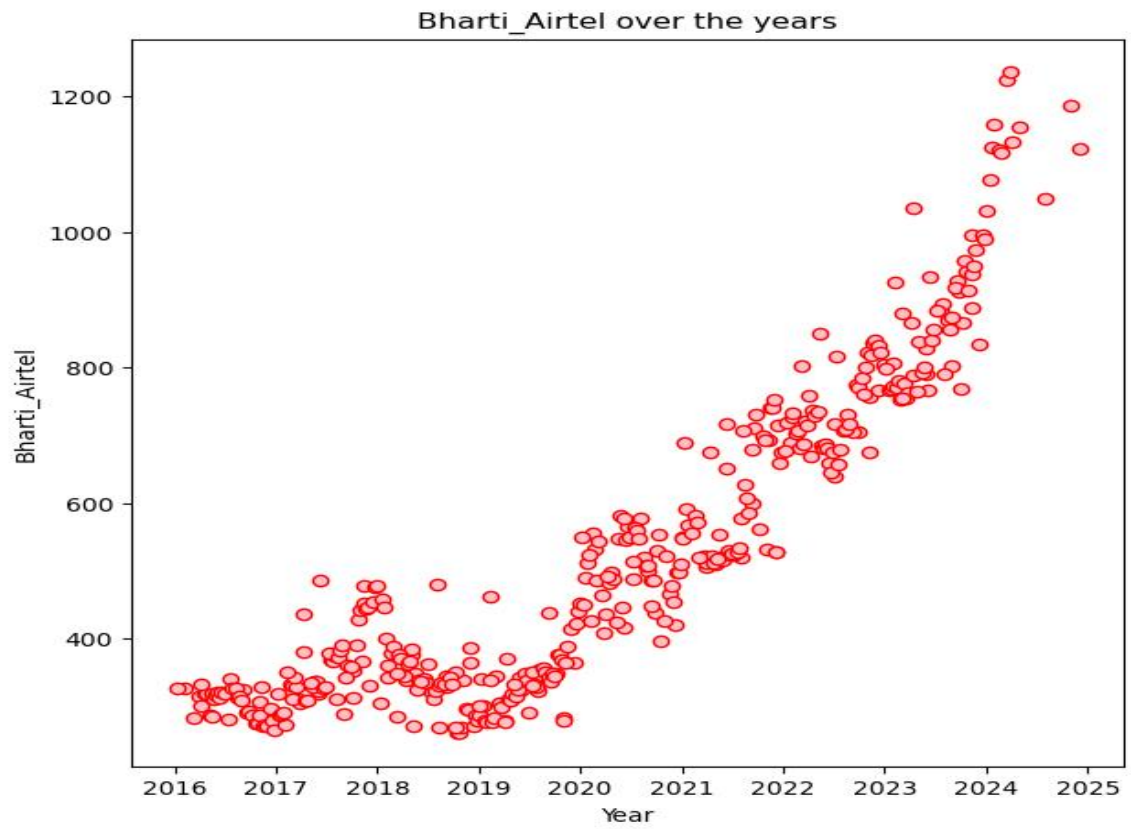


Figure-2-Bharti_Airtel over the years

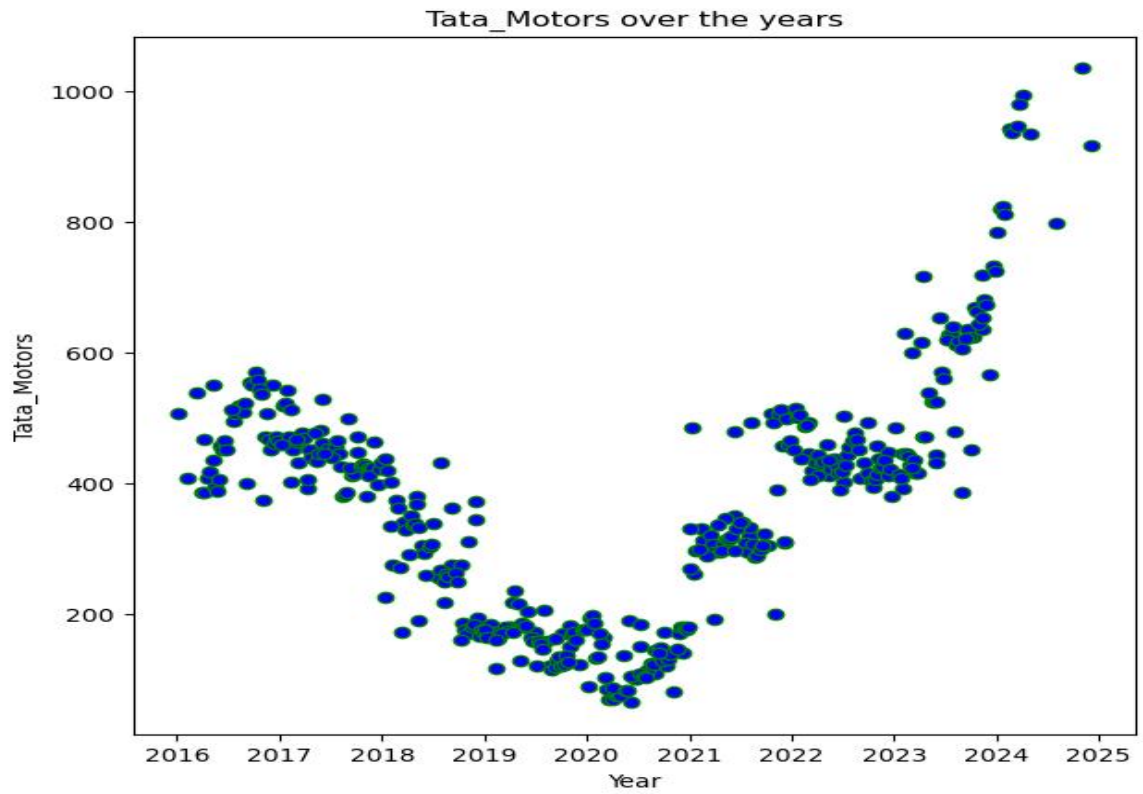


Figure-3-Tata_Motors over the years

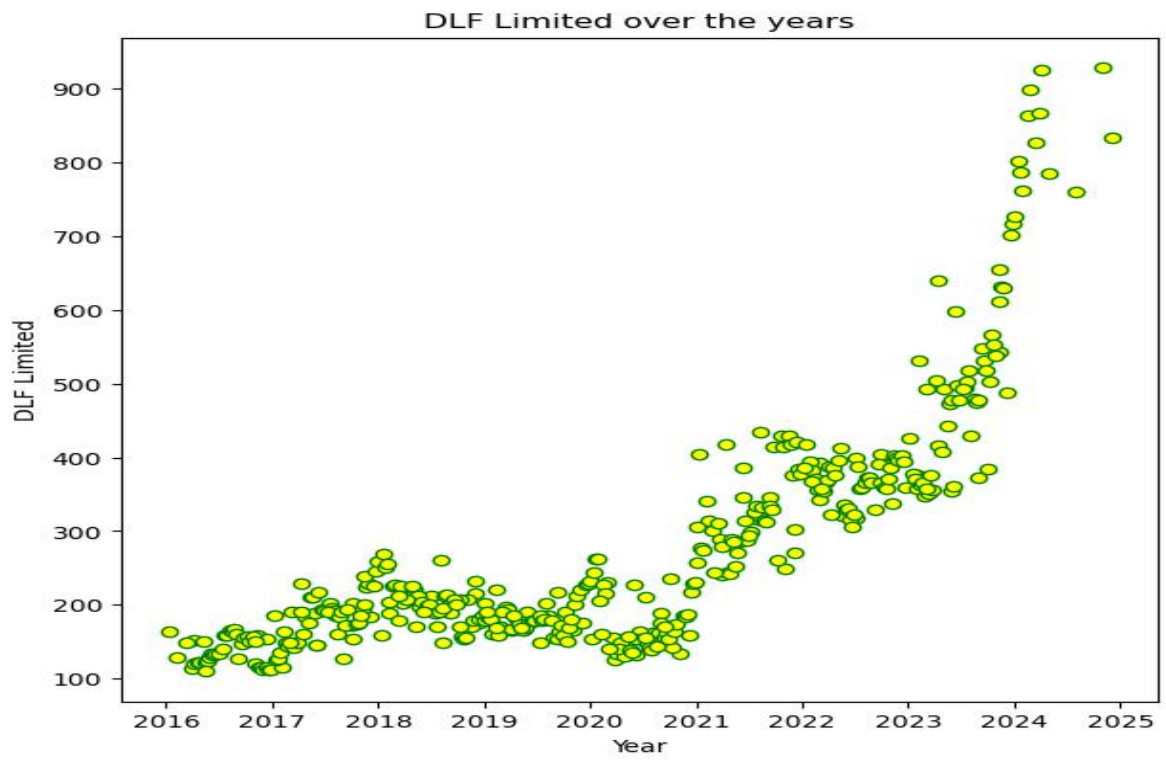


Figure-4-DLF Limited over the years

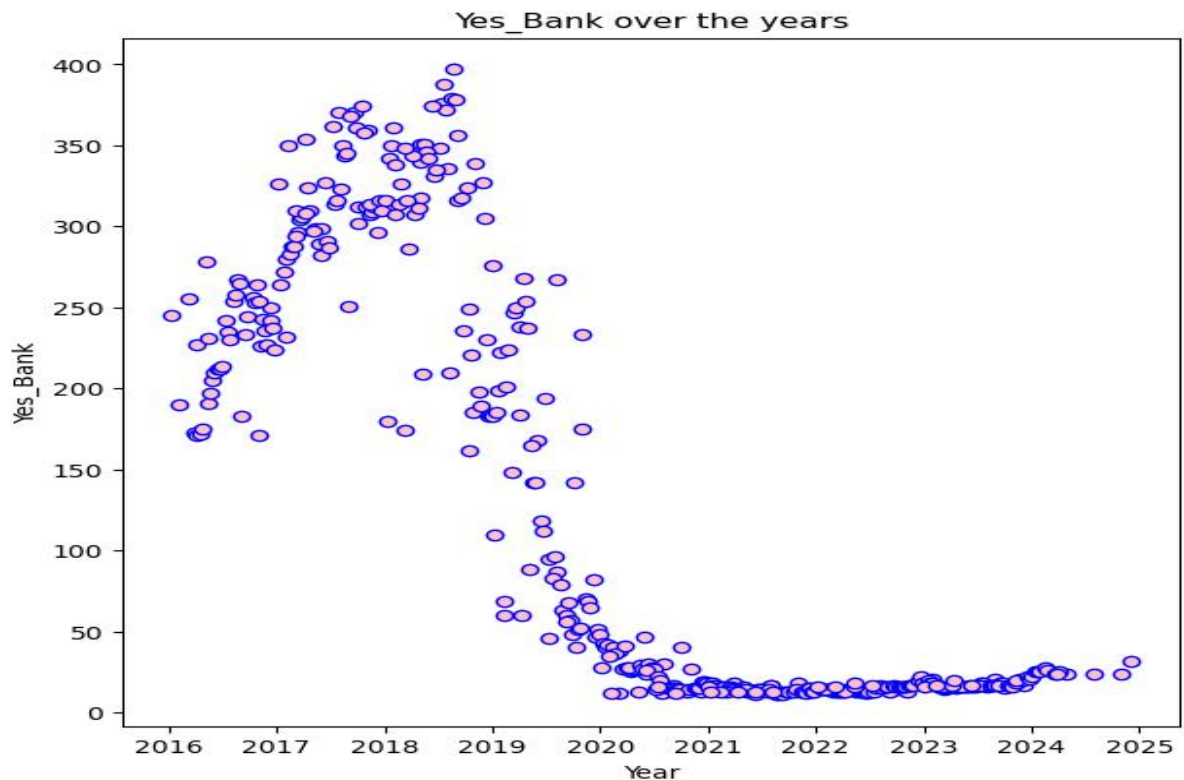


Figure-5-Yes_Bank over the years

OBSERVATIONS:

ITC Limited's stock price:

- **Overall Upward Trend:** The stock price shows an upward trajectory from 2016 to around 2021.
- **Significant Increase:** There is a notable rise in stock price starting at the end of 2020, continuing into 2021.
- **Sharp Decline:** After peaking in 2021, there's a marked drop followed by volatility.
- **Subsequent Recovery:** Post-2022, the stock price appears to recover, indicating growth.

Bharti Airtel's stock price

- **Overall Upward Trend:** The stock price shows a general increase over the years, indicating positive growth for Bharti Airtel. This could be due to successful business strategies, expansion, or favorable market conditions.

- **Volatility:** There are periods of fluctuations visible in the graph. These could be due to market dynamics, such as economic events, geopolitical developments, or changes in investor sentiment.

Significant Growth Post-2020: After 2020, there is a notable rise in the stock price. This could be attributed to specific company milestones or broader industry trends that positively impacted Bharti Airtel's valuation.

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Investment Implications: The upward trend suggests that long-term investors might have seen appreciable returns. However, the volatility indicates that there is a risk of short-term price swings which investors need to be mindful of.

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Tata Motors' stock price:

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Mid-2018 Peak and Sharp Decline: After reaching a peak in mid-2018, the stock price experienced a significant drop, indicating a period of high volatility.

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Fluctuations Post-Decline: Following the sharp decline, there were numerous fluctuations, with the stock price showing both upward and downward movements in a short span of time.

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Early 2021 Recovery: Starting in early 2021, the stock price began to rise sharply again, suggesting a strong recovery phase and reduced volatility.

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Long-Term Growth Trend: Despite short-term volatility, the overall long-term trend from 2016 to beyond 2025 shows growth.

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DLF Limited over the years

- **Steady Growth:** The data points show a general upward trend from 2016 to 2025, indicating steady growth over the years.
- **Significant Increase Post-2022:** There's a sharp increase in the metric measured after 2022, suggesting a period of accelerated growth or positive performance.
- **Yearly Variability:** Each year shows a spread of data points, which could reflect annual volatility or fluctuations in performance.
- **Long-term Positive Outlook:** The overall trajectory suggests a positive long-term outlook for DLF Limited, assuming the metric is related to financial performance.

Yes Bank:

- **High Activity Period:** Between 2016 and mid-2018, there was a high frequency of data points, indicating active performance or higher values.
- **Sharp Decline:** Starting around mid-2018, there is a noticeable decline in both the frequency of data points and their values.

- **Reduced Figures Post-2019:** After 2019, data points are fewer and scattered at lower values, suggesting a downturn in performance.
- **Low Values Towards 2025:** The clustering of points near the bottom of the graph towards 2025 indicates persistently low values or performance.
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2: Stock Returns Calculation and Analysis

- - Calculate the Mean and Standard Deviation for the returns of all stocks - Draw a plot of Mean vs Standard Deviation for all stock returns - Write observations and inferences

Calculate Returns for all stocks

Steps for calculating returns from prices:

Take logarithms Take differences

	ITC_Limited	Bharti_Airtel	Tata_Motors	DLF_Limited	Yes_Bank
0	NaN	NaN	NaN	NaN	NaN
1	0.004598	-0.045315	0.000000	0.059592	-0.011628
2	-0.013857	0.019673	-0.031582	-0.008299	0.000000
3	0.036534	0.038221	0.087011	0.016529	0.005831
4	-0.041196	-0.003130	0.024214	0.000000	0.017291

Table-3- FIRST 5 ROWS OF STOCK RETURNS

Calculate the Mean and Standard Deviation for the returns of all stocks

Calculating stock mean

```
ITC_Limited    0.001634
Bharti_Airtel  0.003271
Tata_Motors    0.002234
DLF_Limited    0.004863
Yes_Bank       -0.004737
dtype: float64
```

Calculating stock standard deviation

```
ITC_Limited    0.035904
Bharti_Airtel  0.038728
Tata_Motors    0.060484
DLF_Limited    0.057785
Yes_Bank       0.093879
```

dtype: float64

	Average	Volatility
ITC_Limited	0.001634	0.035904
Bharti_Airtel	0.003271	0.038728
Tata_Motors	0.002234	0.060484
DLF_Limited	0.004863	0.057785
Yes_Bank	-0.004737	0.093879

Table-4-Table-Average vs volatility for each stocks

plot of Mean vs Standard Deviation for all stock returns

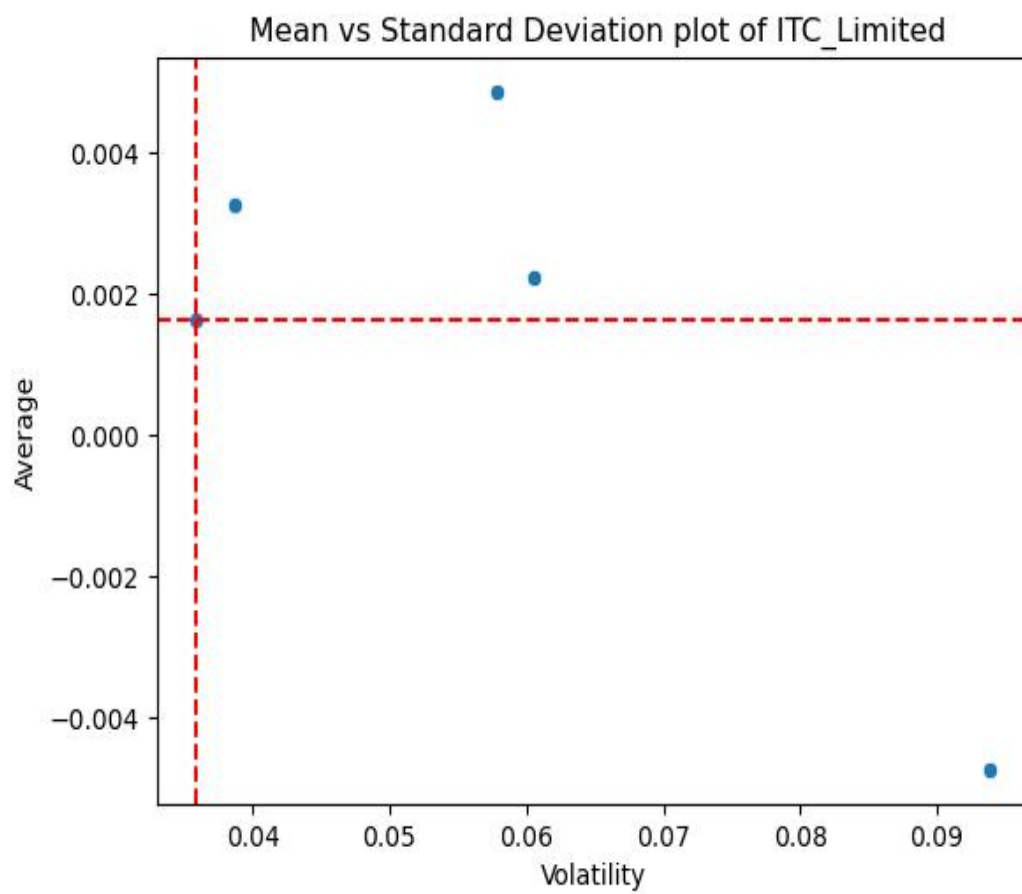


Figure-6-Mean vs Standard Deviation plot of ITC_LIMITED

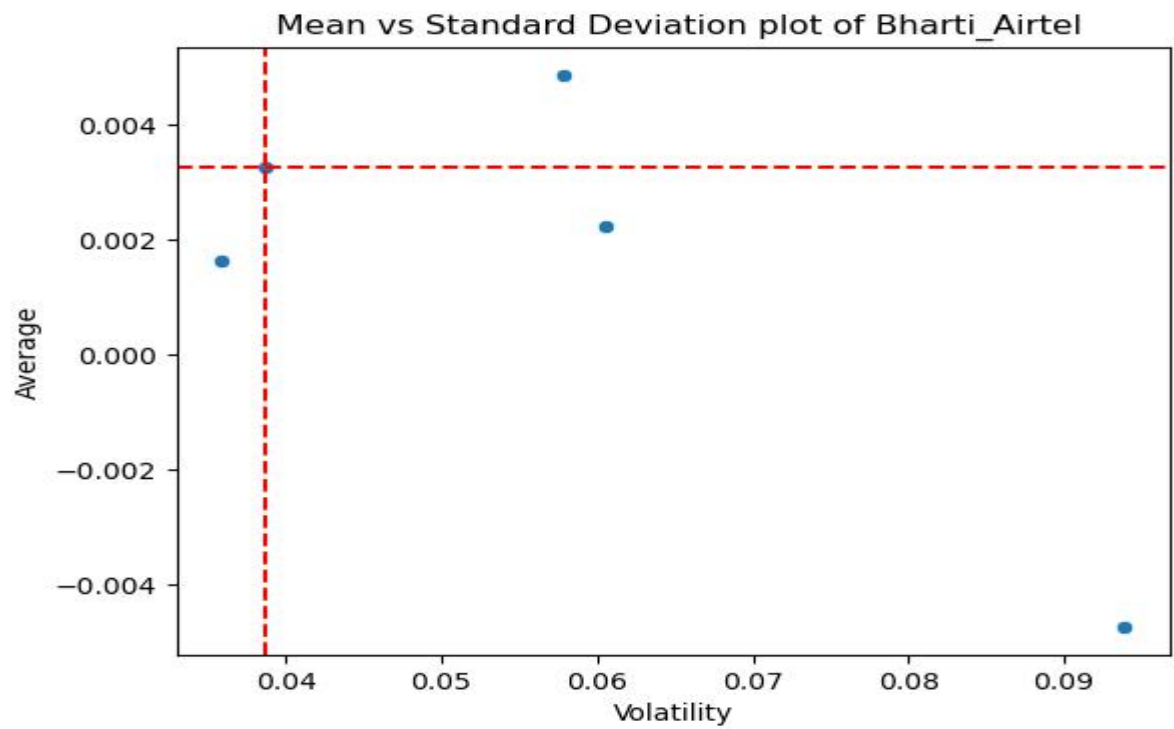


Figure-7-Mean vs Standard Deviation plot of Bharti_Airtel

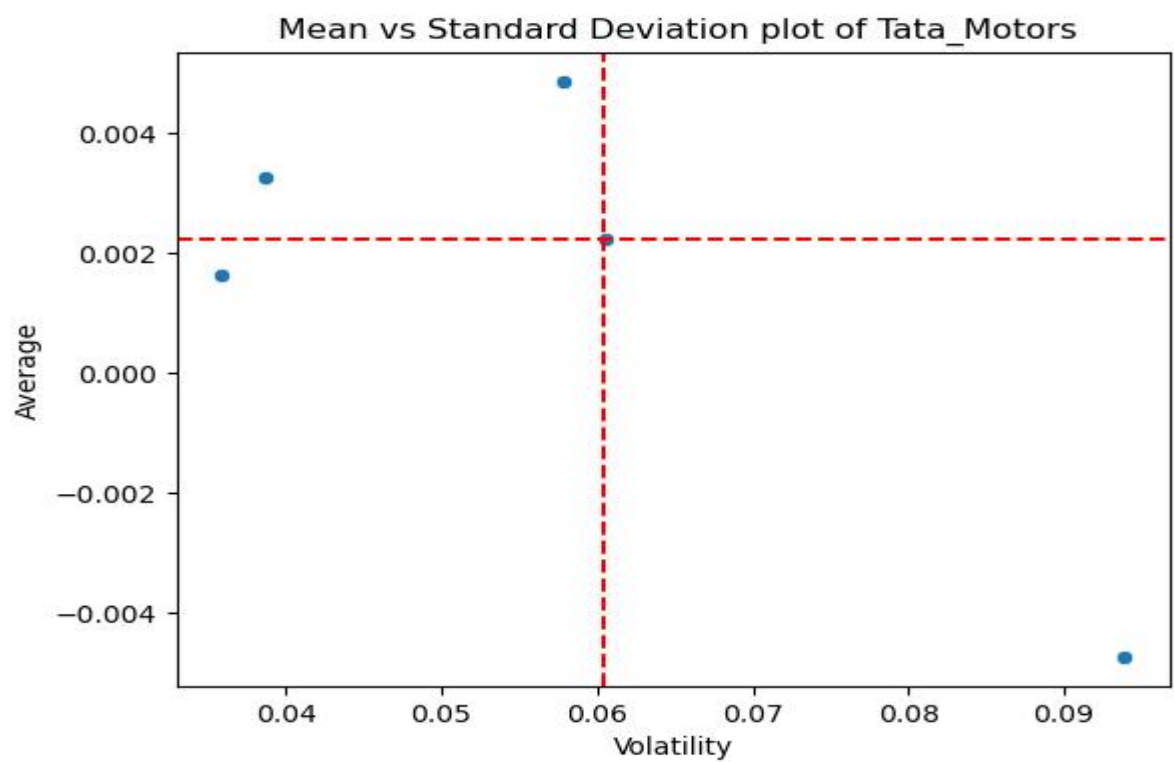


Figure-8-Mean vs Standard Deviation plot of Tata motors

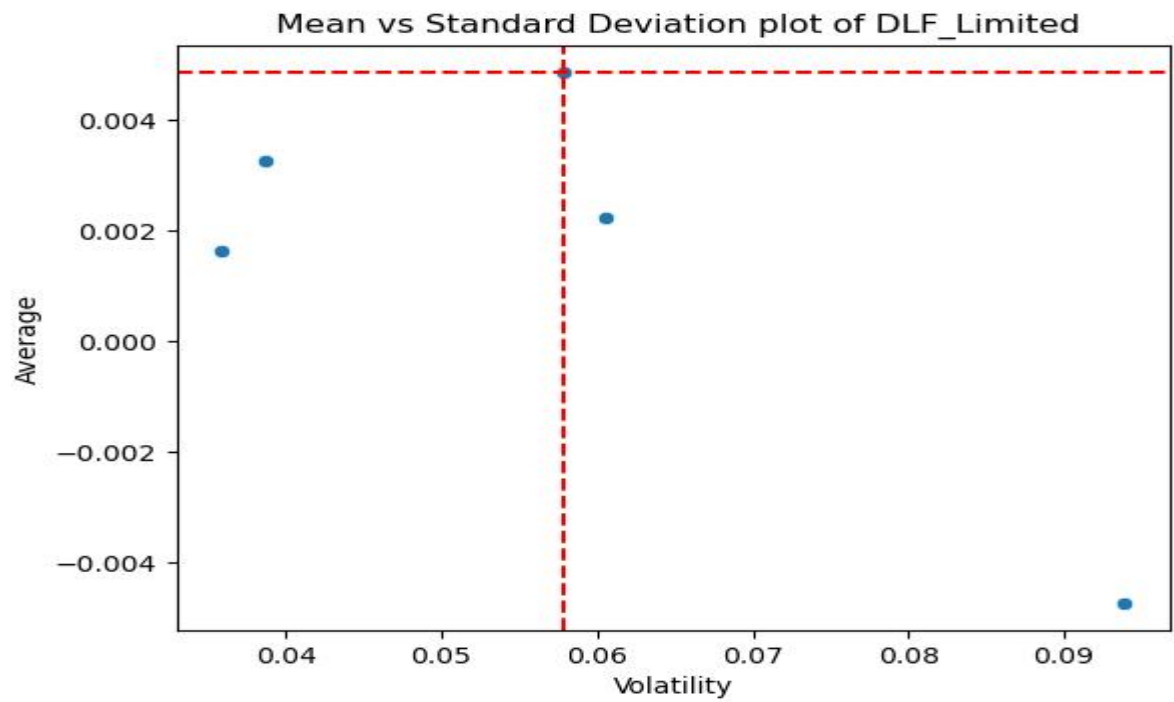


Figure-9-Mean vs Standard Deviation plot of DLF_Limited

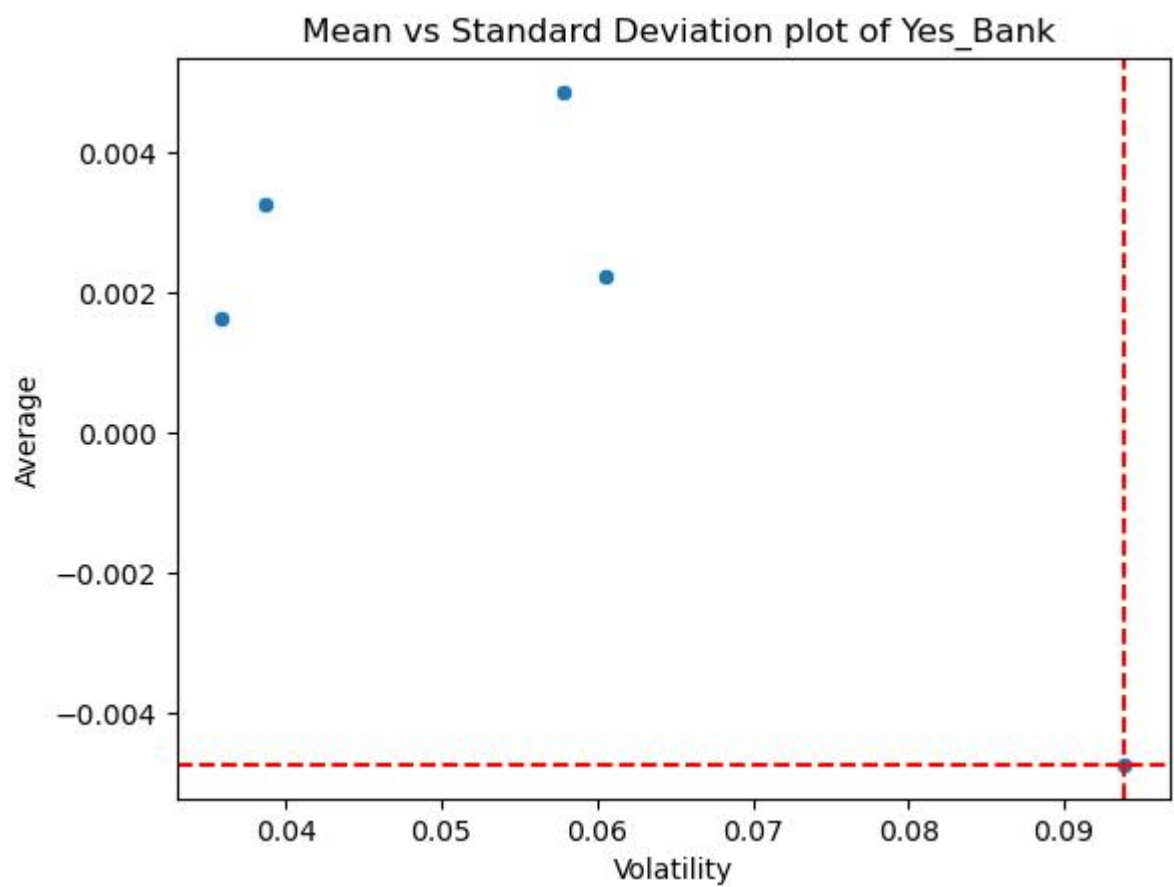


Figure-10-Mean vs Standard Deviation plot of yes_Bank

Write observations and inferences

ITC_LIMITED

Observations:

The points are mainly concentrated in the first quadrant, indicating positive returns. Most points lie close to the intersection of the mean average return and mean volatility lines, suggesting a common range for both.

Inferences:

ITC Limited generally has a positive return since most points are above the horizontal line representing the mean average return. The concentration of points near the intersection could indicate that there's a typical range of returns and volatility that ITC Limited experiences.

Bharti Airtel

Observations:

The data points are primarily in the first quadrant, indicating positive average returns. There is a spread of points along the volatility axis, showing different levels of risk.

Inferences:

Bharti Airtel tends to yield positive returns on average, as most points are above the zero line on the y-axis. The variability in performance, indicated by the spread along the volatility axis, suggests that while returns are generally positive, they come with varying degrees of risk.

TATA MOTORS

Observations:

Data points are clustered towards the lower end of volatility, indicating lower risk. Average returns are symmetrically spread around the mean, suggesting consistent performance.

Inferences:

The stock may have periods of underperformance or just meeting market expectations, as indicated by points near or below zero on the Average axis. The lower volatility concentration suggests that Tata Motors' stock price experiences less extreme fluctuations.

DFL_LIMITED

Observations:

Data points are clustered towards the lower end of volatility, indicating lower risk. Average returns are symmetrically spread around the mean, suggesting consistent performance.

Inferences:

The stock may have periods of underperformance or just meeting market expectations, as indicated by points near or below zero on the Average axis. The lower volatility concentration suggests that Tata Motors' stock price experiences less extreme fluctuations.

YES_BANK

- **Observations:**

- - If the data points are clustered together, it suggests that Yes Bank's returns are consistent with their level of volatility.
 - If the data points are spread out, it indicates variability in returns for a given level of volatility.

- **Inferences:**

- - A higher concentration of points in the area of low volatility and high average return would suggest a favorable risk-reward ratio.
 - Conversely, if many points are in areas of high volatility but low average return, it might suggest a less favorable risk-reward scenario.

3-Actionable Insights & Recommendations

ITC Limited**Observations:**

- Consistent positive returns with moderate volatility.
- Points are mainly concentrated in the first quadrant, indicating positive returns.

Insights:

- ITC Limited shows a general trend of providing positive returns, making it a potentially stable investment for risk-averse investors.
- The moderate level of volatility suggests that the stock does not experience extreme price fluctuations, which is favorable for long-term investors.

Recommendations:

- **Long-Term Holding:** Consider holding ITC Limited in the portfolio for the long term due to its consistent positive returns and moderate volatility.

- **Risk Mitigation:** Use ITC Limited as a stabilizing component in a diversified portfolio to mitigate risk from more volatile stocks.
- **Periodic Review:** Regularly review the performance, especially around significant market events, to ensure it aligns with the overall investment strategy.

Bharti Airtel

Observations:

- Positive average returns with a spread along the volatility axis.
- Periods of fluctuations indicating varying levels of risk.

Insights:

- Bharti Airtel generally yields positive returns, but with varying degrees of risk, indicating potential for both high returns and high volatility.
- The stock's performance can be significantly influenced by market dynamics and specific company milestones.

Recommendations:

- **Tactical Allocation:** Include Bharti Airtel in the portfolio for potential high returns, but limit its proportion to manage overall portfolio risk.
- **Risk Management:** Implement risk management strategies like stop-loss orders to protect against significant short-term price swings.
- **Sector Analysis:** Keep abreast of telecom sector developments and Bharti Airtel's strategic moves, adjusting the investment based on market conditions.

Tata Motors

Observations:

- Data points are clustered towards the lower end of volatility, indicating lower risk.
- Returns are symmetrically spread around the mean, suggesting consistent performance.

Insights:

- Tata Motors shows a pattern of lower risk with consistent returns, making it a safer bet within the automotive sector.
- Periods of underperformance suggest that it might not always outperform the market but provides steady returns.

Recommendations:

- **Stable Investment:** Consider Tata Motors as a core holding for a balanced portfolio due to its lower risk and consistent returns.
- **Growth Opportunities:** Monitor for recovery phases and potential growth periods to capitalize on upward trends.
- **Diversification:** Use Tata Motors to diversify within the automotive sector, balancing it with other stocks that have higher growth potential.

DLF Limited

Observations:

- Data points are clustered towards the lower end of volatility, indicating lower risk.
- Average returns are symmetrically spread around the mean, suggesting consistent performance.

Insights:

- DLF Limited demonstrates a pattern of steady growth with low volatility, making it a reliable investment in the real estate sector.
- The consistent performance indicates that the stock can be a dependable component of a diversified portfolio.

Recommendations:

- **Core Holding:** Include DLF Limited as a core part of the portfolio for steady growth and low volatility.
- **Market Monitoring:** Keep an eye on real estate market trends and DLF's strategic developments to anticipate and respond to market changes.
- **Balanced Portfolio:** Use DLF Limited to balance more volatile investments, ensuring a more stable overall portfolio performance.

Yes Bank

Observations:

- High activity period followed by a sharp decline and reduced figures post-2019.
- Clustering of points near the bottom indicates persistently low values towards 2025.

Insights:

- Yes Bank has experienced significant volatility and a notable downturn in performance, making it a high-risk investment.
- The clustering of points at low values suggests a less favorable risk-reward scenario.

Recommendations:

- **Caution Advised:** Exercise caution with Yes Bank due to its history of high volatility and recent poor performance.
- **Small Allocation:** If considering investment, limit the allocation to a small portion of the portfolio to manage risk.
- **Performance Monitoring:** Continuously monitor Yes Bank's performance and market developments closely, being prepared to exit the investment if the risk outweighs the potential returns.
- **Alternative Investments:** Explore alternative banking stocks or financial sector investments with more stable performance and better risk-reward ratios.

Overall Portfolio Strategy

- **Diversification:** Ensure a well-diversified portfolio across different sectors and stocks with varying risk profiles to optimize risk-adjusted returns.
 - **Regular Review:** Regularly review the portfolio performance and market conditions, making adjustments as necessary to align with investment goals and risk tolerance.
 - **Risk Management:** Implement risk management strategies such as stop-loss orders, hedging, and tactical asset allocation to protect against market volatility and adverse price movements.
 - **Long-Term Focus:** Maintain a long-term investment perspective, especially for stocks with consistent performance and growth potential, while being agile in responding to market changes.
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