FRA Project - Coded B

Finance and Risk Analytics

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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.

1. Overview of the Dataset

Shape of the dataset - 418 rows and 6 columns

```
(418, 6)
```

Shape of the dataset

```
<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
```

Info of the dataset

	count	mean	std	min	25%	50%	75%	max
ITC Limited	418.0	278.964115	75.114405	156.0	224.25	265.5	304.00	493.0
Bharti Airtel	418.0	528.260766	226.507879	261.0	334.00	478.0	706.75	1236.0
Tata Motors	418.0	368.617225	182.024419	65.0	186.00	399.5	466.00	1035.0
DLF Limited	418.0	276.827751	156.280781	110.0	166.25	213.0	360.50	928.0
Yes Bank	418.0	124.442584	130.090884	11.0	16.00	30.0	249.75	397.0

statistical summary of the data

```
Date             0
ITC Limited      0
Bharti Airtel    0
Tata Motors      0
DLF Limited      0
Yes Bank         0
dtype: int64
```
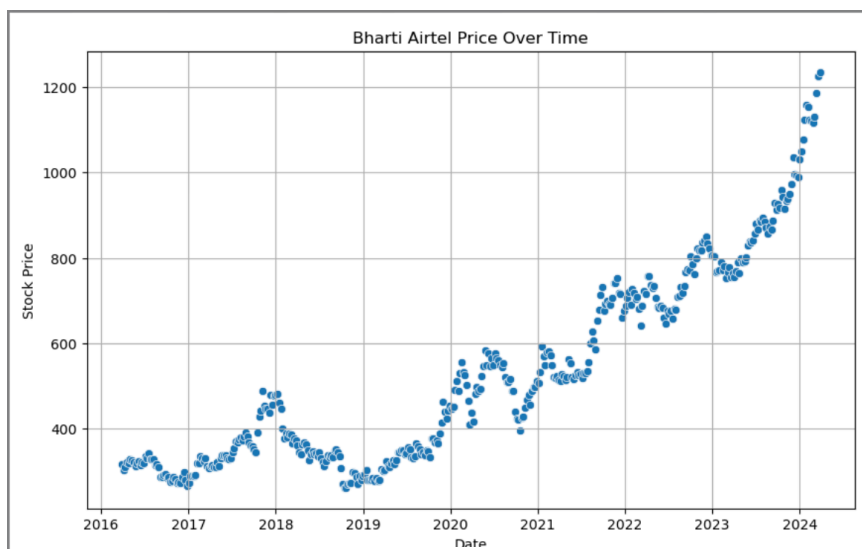
There is no missing value

Convert Object to DateTime

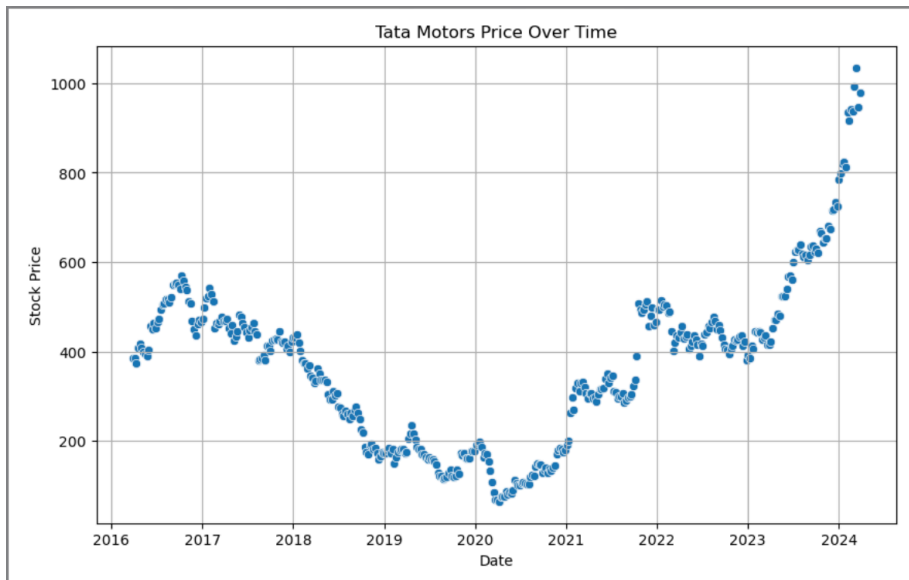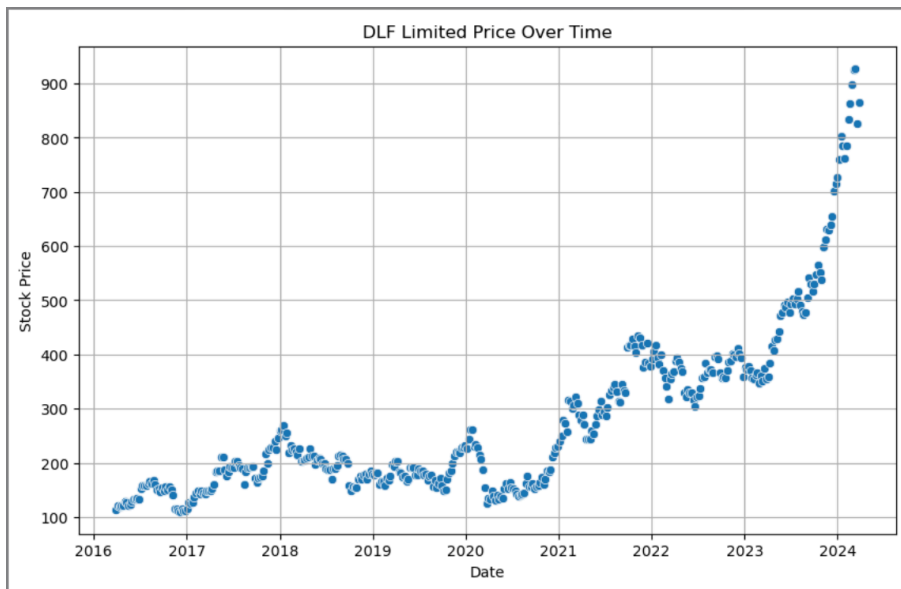|	Date	ITC Limited	Bharti Airtel	Tata Motors	DLF Limited	Yes Bank
0	2016-03-28	217	316	386	114	173
1	2016-04-04	218	302	386	121	171
2	2016-04-11	215	308	374	120	171
3	2016-04-18	223	320	408	122	172
4	2016-04-25	214	319	418	122	175

2. Stock Price Analysis
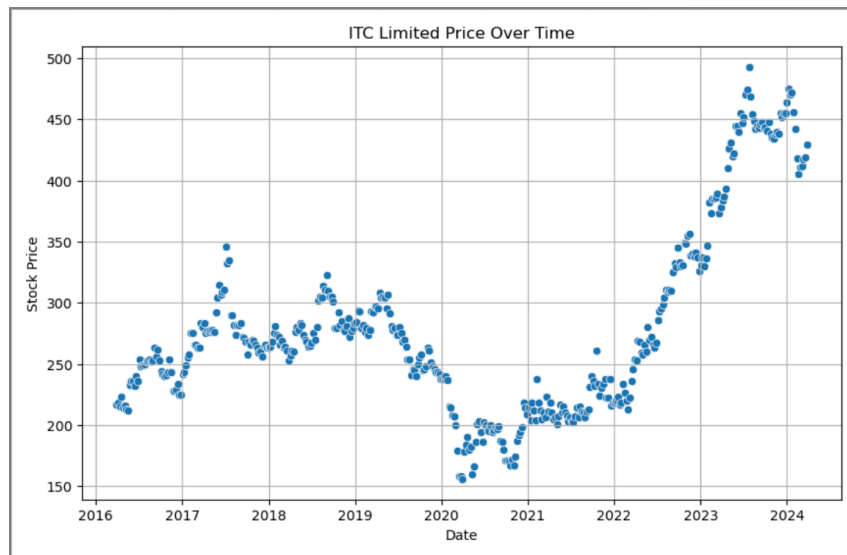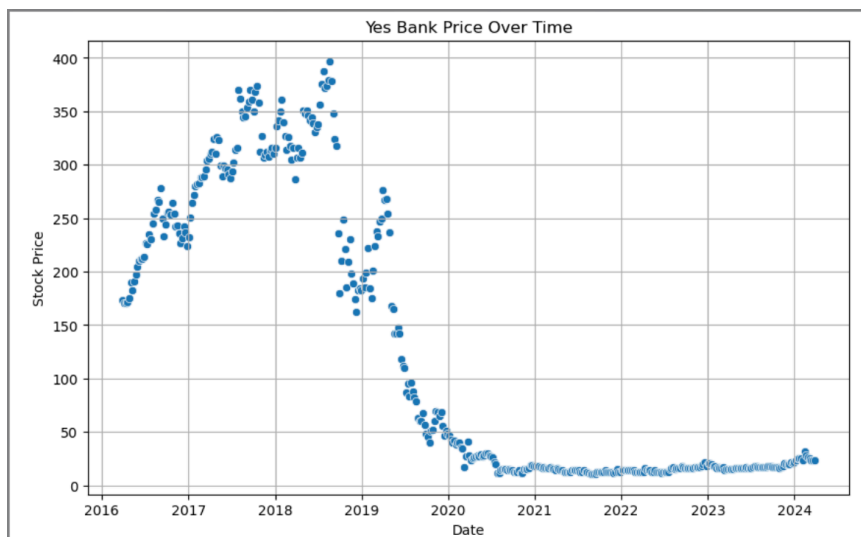

ITC Limited Price Over Time

Bharti Airtel Price Over Time

Tata Motors Price Over Time

DLF Limited Price Over Time

Yes Bank Price Over Time

Observations:

1. ITC Limited:

- The stock price was relatively stable between 2016 and 2020, fluctuating between 200 and 350.
- After 2021, there was a significant upward trend, reaching nearly 500 by 2024.

2. Bharti Airtel:

- The stock price showed a gradual increase from 2016, with some fluctuations around 2020.
- A strong upward trend is observed from 2021 onwards, reaching above 1200 by 2024.

3. Tata Motors:

- The stock price experienced a decline from 2018 to 2020.
- There was a sharp increase starting in 2021, reaching over 1000 by 2024.

4. DLF Limited:

- The stock price was relatively stable between 2016 and 2020, with minor fluctuations.
- A notable increase is observed from 2021 onwards, with the price exceeding 900 by 2024.

5. Yes Bank:

- The stock price showed a peak around 2018, followed by a steep decline.
- After 2020, the price remained relatively low and stable, hovering below 50.

3. Stock Returns Calculation and Analysis

Return Calculation
Steps to Calculate Stock Returns

1. **Drop the Date Column**:
   - Since the calculation of returns does not require the date column, we exclude it from the DataFrame.

2. **Apply the Natural Logarithm**:
   - Taking the natural logarithm of stock prices helps in stabilizing the variance and transforming the multiplicative relationships into additive ones, which makes the data more suitable for certain statistical analyses.

3. **Compute the Difference**:
   - The difference between the logarithms of consecutive stock prices approximates the continuously compounded return, which is useful in finance for modeling returns.

4. **Set Display Options**:
   - By setting the display options to show all rows and columns, we ensure that the full DataFrame is displayed for inspection.

5. **Display the Calculated Returns**:
   - The resulting Return_of_Stocks DataFrame contains the logarithmic returns for each stock over the given time periods.

	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
5	0.009302	0.024769	-0.024214	0.055791	0.082238
6	-0.013986	-0.006135	-0.019803	-0.015625	-0.037538
7	-0.004706	-0.015504	-0.015114	-0.040166	0.042787
8	0.094452	-0.025318	-0.012772	0.016261	0.030930
9	0.012793	0.019048	0.040308	0.039531	0.039806
10	0.000000	0.012500	0.122982	0.030537	0.024098
11	-0.017094	-0.025159	-0.015402	-0.007547	0.009479
12	0.033902	0.022048	0.030570	0.015038	0.000000
13	-0.016807	-0.006250	-0.028355	-0.007491	0.009390
14	0.073502	0.045950	0.032647	0.133531	0.058974
15	-0.023906	-0.012048	0.010650	0.038715	-0.004415
16	0.004024	0.035718	0.047579	0.000000	0.039051
17	0.004008	-0.041797	0.021979	0.000000	-0.021506
18	0.007968	0.000000	0.001974	0.031155	0.063179
19	0.003960	-0.003053	0.021464	0.012195	0.036076
20	0.003945	-0.043757	-0.001932	-0.012195	0.015625

Stock Returns

Average Returns

```
Yes Bank        -0.004737
ITC Limited      0.001634
Tata Motors      0.002234
Bharti Airtel    0.003271
DLF Limited      0.004863
dtype: float64
```

Average Returns for all stocks

Volatility

```
ITC Limited      0.035904
Bharti Airtel    0.038728
DLF Limited      0.057785
Tata Motors      0.060484
Yes Bank         0.093879
dtype: float64
```

The std. deviation for the returns for all stocks

Observations:

1. **Average Returns:**
   - **Yes Bank:** -0.004737 (negative average return)
   - **ITC Limited:** 0.001634 (positive average return)
   - **Tata Motors:** 0.002234 (positive average return)
   - **Bharti Airtel:** 0.003271 (positive average return)
   - **DLF Limited:** 0.004863 (positive average return)
2. **Standard Deviation (Volatility):**
   - **ITC Limited:** 0.035904 (lowest volatility)
   - **Bharti Airtel:** 0.038728
   - **DLF Limited:** 0.057785
   - **Tata Motors:** 0.060484
   - **Yes Bank:** 0.093879 (highest volatility)

Analysis:

1. **Risk and Return Relationship:**
   - Generally, higher volatility indicates higher risk, and potentially higher returns, though this is not always the case.
2. **Negative Average Returns:**
   - Yes Bank has a negative average return (-0.004737), indicating a loss over the observed period. It also has the highest volatility (0.093879), making it the riskiest investment among the listed stocks.
3. **Positive Average Returns:**
   - All other stocks (ITC Limited, Tata Motors, Bharti Airtel, and DLF Limited) show positive average returns, indicating profitability over the observed period.
   - DLF Limited has the highest average return (0.004863) with moderate volatility (0.057785), suggesting a favorable risk-reward ratio.
   - Bharti Airtel and Tata Motors also exhibit positive returns with moderate volatility, making them attractive investment options.
4. **Low Risk, Positive Returns:**
   - ITC Limited has the lowest volatility (0.035904) with a positive average return (0.001634), making it the least risky investment option among the listed stocks.

Conclusion:

- **High Risk, Negative Returns:** Yes Bank shows the highest risk and negative returns, making it an unattractive investment.
- **Moderate Risk, Positive Returns:** DLF Limited, Bharti Airtel, and Tata Motors show moderate risk with positive returns, indicating a balance between risk and reward.
- **Low Risk, Positive Returns:** ITC Limited is the least risky option with positive returns, making it a stable and attractive investment.

Visualising Returns and Volatility

	Mean	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

Dataframe for mean and std. deviation for the returns of all stocks

Among the five stocks, DLF Limited has the highest positive average return (0.004863) with moderate volatility (0.057785), making it an attractive investment option. Bharti Airtel and Tata Motors also exhibit positive returns (0.003271 and 0.002234, respectively) with moderate volatility (0.038728 and 0.060484, respectively), indicating a balanced risk-reward profile. ITC Limited has the lowest volatility (0.035904) with a positive return (0.001634), making it the least risky and a stable investment choice. In contrast, Yes Bank shows a negative average return (-0.004737) coupled with the highest volatility (0.093879), signaling a high-risk, low-reward investment.
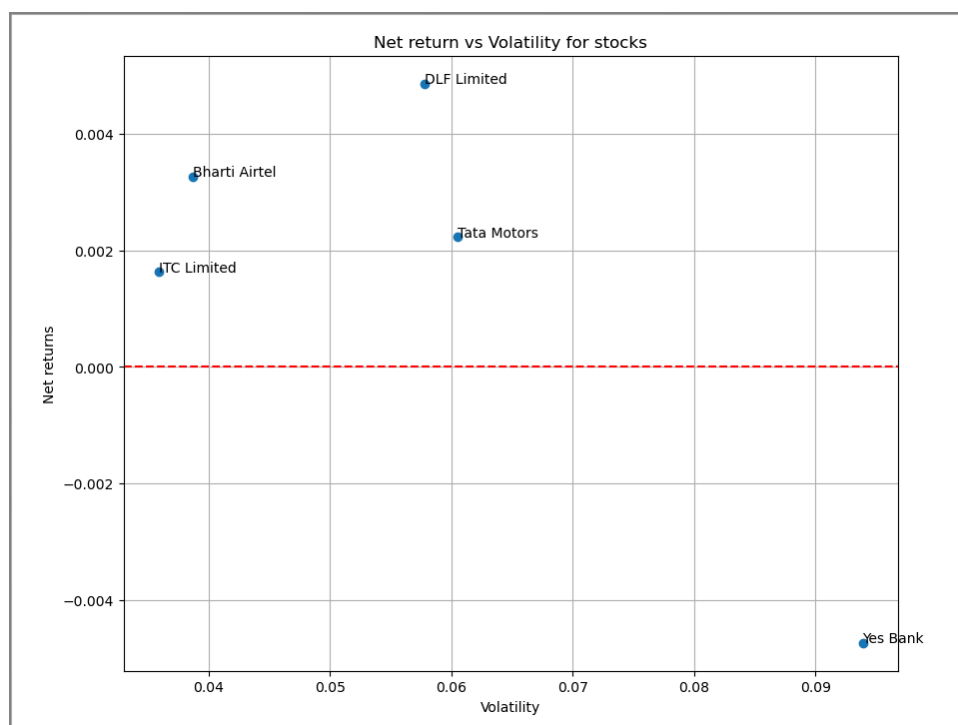
Net return vs Volatility for stock

The scatter plot titled "Net Return vs. Volatility for Stocks" illustrates the relationship between the volatility of various stocks and their net returns. The x-axis, labeled 'Volatility,' ranges from 0 to 0.10, while the y-axis, labeled 'Net Return,' spans from -0.004 to 0.002. The graph includes data points for companies such as ITC Limited, Bharti Airtel, Tata Motors, DLF Limited, and Yes Bank. A horizontal dashed red line crosses the y-axis slightly above the -0.001 mark, possibly indicating an average or specific value of interest in net return. The plot reveals that DLF Limited shows the highest net returns, followed by Bharti Airtel and Tata Motors, while Yes Bank has a negative return and the highest volatility, indicating the most significant loss in net return. This visual representation is valuable for investors or financial analysts as it helps assess the risk versus reward of these stocks.

4. Actionable Insights and Recommendations:

1. **Yes Bank:**
   - **Insight:** Exhibits significant loss and high volatility.
   - **Recommendation:** Implement rigorous financial restructuring, improve asset quality, and enhance risk management to stabilize returns and reduce volatility.

2. **ITC Limited:**
   - **Insight:** Low volatility with positive returns.
   - **Recommendation:** Continue current strategies, explore new market opportunities, and focus on sustainable growth initiatives to maintain stability and drive further returns.

3. **Tata Motors:**
   - **Insight:** Moderate volatility with positive returns.
   - **Recommendation:** Invest in innovation and technology, expand global market reach, and enhance operational efficiencies to sustain and potentially increase returns.

4. **Bharti Airtel:**
   - **Insight:** Moderate volatility with positive returns.
   - **Recommendation:** Continue to expand network infrastructure, invest in 5G technology, and improve customer services to maintain and grow market share.

5. **DLF Limited:**
   - **Insight:** Highest positive returns with moderate volatility.
   - **Recommendation:** Focus on strategic property developments, diversify portfolio, and strengthen financial health to sustain high returns and manage risk.

General Recommendations:

- **Portfolio Diversification:**
Encourage investors to diversify their portfolio by including a mix of stocks with varying levels of risk and return, balancing high-performing stocks like DLF Limited and Bharti Airtel with potentially high-reward stocks like Tata Motors.

- **Regular Monitoring:**
Regularly monitor the performance and volatility of these stocks to make timely adjustments to investment strategies based on market conditions and company performance.

- **Risk Management:**

Implement robust risk management strategies, including stop-loss orders and hedging, to protect investments from unexpected market downturns.

- **Market Analysis:**

Continuously analyze market trends, regulatory changes, and competitive landscape to identify opportunities and threats, allowing for proactive decision-making.

By following these insights and recommendations, companies can improve their financial performance and stability, while investors can make more informed decisions to maximize their returns and manage risk effectively.