

FRA Project - Guided B

Finance and Risk Analytics

Isha Shukla

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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   Dish TV               418 non-null   int64  
2   Infosys               418 non-null   int64  
3   Hindustan Unilever    418 non-null   int64  
4   Vodafone Idea         418 non-null   int64  
5   Cipla                 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
Dish TV	418.0	38.648325	31.944620	4.0	14.00	19.5	73.0	108.0
Infosys	418.0	1007.210526	455.089501	445.0	591.25	777.5	1454.0	1939.0
Hindustan Unilever	418.0	1906.344498	597.800173	788.0	1368.50	2083.0	2419.0	2798.0
Vodafone Idea	418.0	23.234450	20.264854	3.0	9.00	12.0	43.0	71.0
Cipla	418.0	756.614833	252.969619	370.0	556.00	637.0	946.0	1493.0

statistical summary of the data

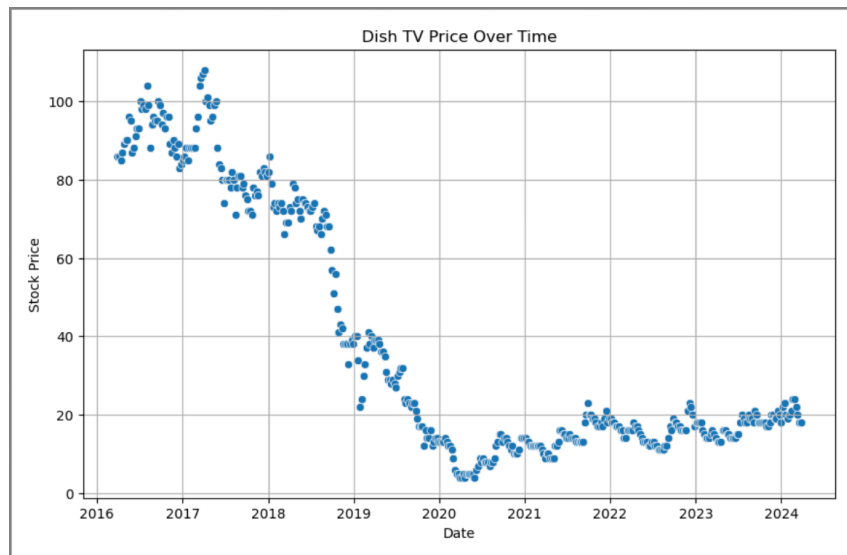
```
Date                0
Dish TV             0
Infosys             0
Hindustan Unilever  0
Vodafone Idea       0
Cipla               0
dtype: int64
```

There is no missing value

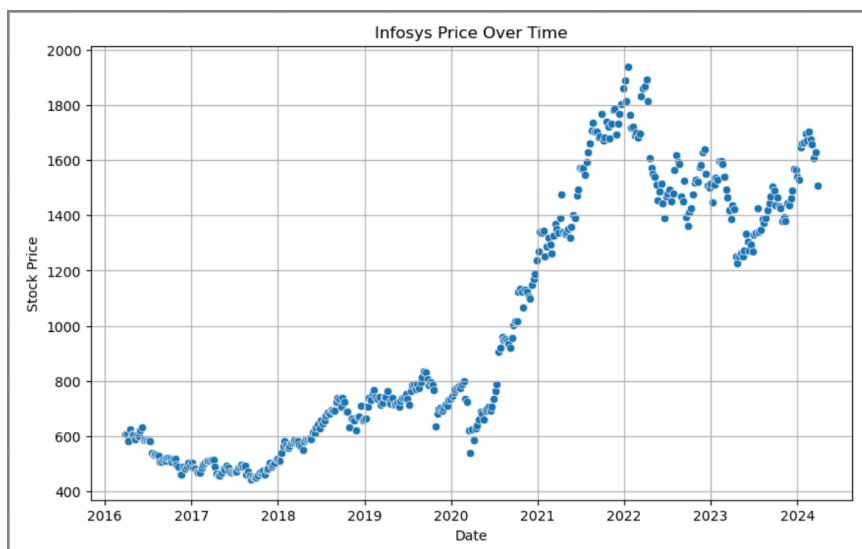
Convert Object to DateTime

	Date	Dish TV	Infosys	Hindustan Unilever	Vodafone Idea	Cipla
0	2016-03-28	86	608		867	67
1	2016-04-04	86	607		863	65
2	2016-04-11	85	583		853	66
3	2016-04-18	87	625		900	69
4	2016-04-25	89	606		880	71

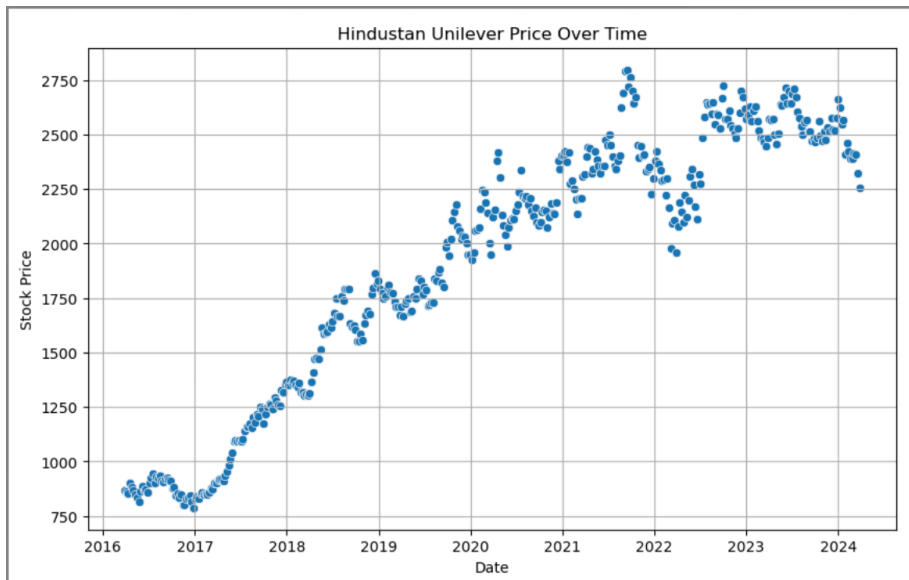
2. Stock Price Analysis



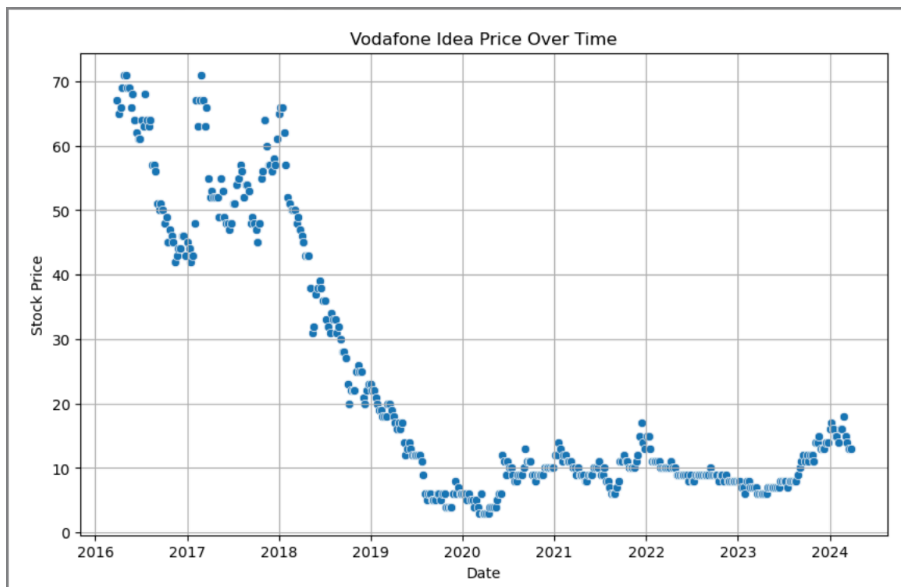
Dish TV Price Over Time



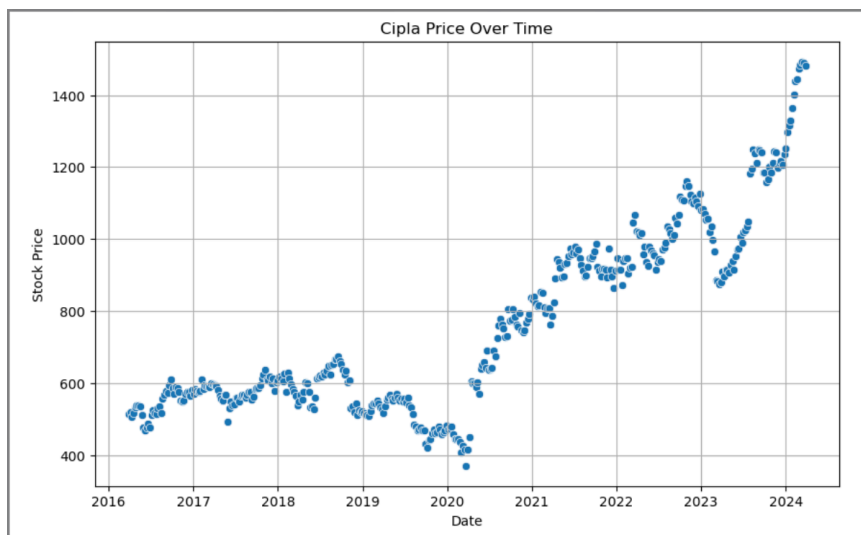
Infosys Price Over Time



Hindustan Unilever Price Over Time



Vodafone Idea Price Over Time



Cipla Price Over Time

Observations:

1. Dish TV:

- From 2016 to early 2018, Dish TV's stock price fluctuated between 80 to 100.
- There was a sharp decline starting in mid-2018, with the price falling below 20 by the end of 2019.
- Since 2020, the stock price has been relatively stable, fluctuating between 5 and 20, with no significant upward movement observed through 2024.

2. Infosys:

- Infosys's stock price showed a steady upward trend from 2016, starting around 500 and reaching 800 by early 2020.
- There was a significant increase in the stock price from 2020, peaking around 1800+ in early 2022.
- Post-2022, there were fluctuations, but the stock price remained relatively high, stabilizing around 1300 to 1700 until 2024.

3. Hindustan Unilever:

- Hindustan Unilever's stock price steadily increased from 2016, starting around 950 and reaching approximately 2500 by mid-2021.
- There were minor fluctuations between 2021 and 2024, but the stock price generally remained above 2000, indicating strong performance.

4. Vodafone Idea:

- Vodafone Idea's stock price showed a continuous decline from 2016 to 2019, dropping from around 70 to below 10.
- Since 2020, the stock price remained low, fluctuating between 5 and 15, with no significant recovery observed through 2024.

5. Cipla:

- In 2016 the stock price starts with around 500.
- The graph indicates a general upward trend in Cipla's stock price over the years, with some fluctuations. Notably, there is a higher concentration of data points between 2021 and 2023, suggesting increased variability or frequency of data during this period.

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.

	Dish TV	Infosys	Hindustan Unilever	Vodafone Idea	Cipla
0	NaN	NaN	NaN	NaN	NaN
1	0.000000	-0.001646	-0.004624	-0.030305	0.009681
2	-0.011696	-0.040342	-0.011655	0.015267	-0.025367
3	0.023257	0.069564	0.053635	0.044452	0.017630
4	0.022728	-0.030872	-0.022473	0.028573	0.032477
5	0.011173	-0.001652	-0.014883	0.000000	0.009355
6	0.000000	-0.023412	-0.018627	-0.028573	0.001860
7	0.064539	0.023412	-0.021378	0.000000	-0.007463
8	-0.010471	-0.004971	-0.019395	-0.044452	-0.045985
9	-0.087969	0.031074	0.055934	0.029853	-0.066894
10	0.011429	0.017558	0.027399	-0.060625	-0.016914
11	0.033523	-0.072162	-0.023933	-0.031749	0.012712
12	0.021740	0.003396	0.009185	-0.016261	0.024949
13	0.000000	-0.006803	-0.019620	0.000000	-0.024949
14	0.072571	0.003407	0.047791	0.048009	0.073055
15	-0.020203	-0.006826	0.029559	-0.015748	0.027029
16	0.010152	-0.080185	0.018173	0.076373	-0.015355
17	-0.010152	-0.013072	-0.047731	-0.060625	-0.005820
18	0.059423	0.007491	0.032790	-0.015748	0.028765
19	-0.049271	-0.003738	-0.003231	0.015748	0.009407
20	-0.117783	-0.005634	0.008593	-0.115832	-0.034289
21	0.065958	-0.042314	-0.024907	0.000000	0.076458
22	0.021053	0.000000	-0.006601	-0.017700	0.019556
23	-0.010471	0.013659	0.016421	-0.093526	0.017452
24	0.000000	-0.005831	0.004334	-0.019803	-0.010435
25	0.051293	0.019306	-0.010870	0.019803	0.039422

Average Returns

```
Vodafone Idea      -0.003932
Dish TV            -0.003751
Infosys            0.002180
Hindustan Unilever 0.002294
Cipla              0.002538
dtype: float64
```

Average Returns for all stocks

Volatility

```
Hindustan Unilever 0.028845
Infosys            0.036102
Cipla              0.036759
Dish TV            0.091333
Vodafone Idea      0.113747
dtype: float64
```

The std. deviation for the returns for all stocks

Observations:

1. Average Returns:

- **Vodafone Idea:** -0.003932 (negative average return)
- **Dish TV:** -0.003751 (negative average return)
- **Infosys:** 0.002180 (positive average return)
- **Hindustan Unilever:** 0.002294 (positive average return)
- **Cipla:** 0.002538 (positive average return)

2. Standard Deviation (Risk):

- **Hindustan Unilever:** 0.028845 (lowest risk)
- **Infosys:** 0.036102
- **Cipla:** 0.036759
- **Dish TV:** 0.091333
- **Vodafone Idea:** 0.113747 (highest risk)

Analysis:

1. Risk and Return Relationship:

- Generally, a higher standard deviation indicates higher risk and potential for higher returns. However, this is not a strict rule and must be observed in conjunction with average returns.

2. Negative Average Returns:

- Vodafone Idea and Dish TV both have negative average returns, suggesting that, on average, these stocks are losing value over the observed period. They also have the highest standard deviations (0.113747 for Vodafone Idea and 0.091333 for Dish TV), indicating that these stocks are highly volatile and risky.

3. Positive Average Returns:

- Infosys, Hindustan Unilever, and Cipla have positive average returns, suggesting that, on average, these stocks are gaining value.
- Among these, Cipla has the highest average return (0.002538), followed by Hindustan Unilever (0.002294) and Infosys (0.002180).

4. Risk-Adjusted Returns:

- To evaluate stocks, it's important to consider both returns and risk. A stock with a high average return and low standard deviation is generally more desirable.
- Hindustan Unilever has the lowest standard deviation (0.028845) with a positive average return (0.002294), indicating a lower risk compared to its return, making it an attractive option.
- Infosys and Cipla have similar standard deviations (0.036102 and 0.036759, respectively) and positive returns, suggesting they are also relatively stable and profitable investments.

Conclusion:

- **High Risk, Negative Returns:** Vodafone Idea and Dish TV are the riskiest investments with negative returns.
- **Moderate Risk, Positive Returns:** Infosys, Hindustan Unilever, and Cipla show moderate risk with positive returns, with Hindustan Unilever being the most stable among them.

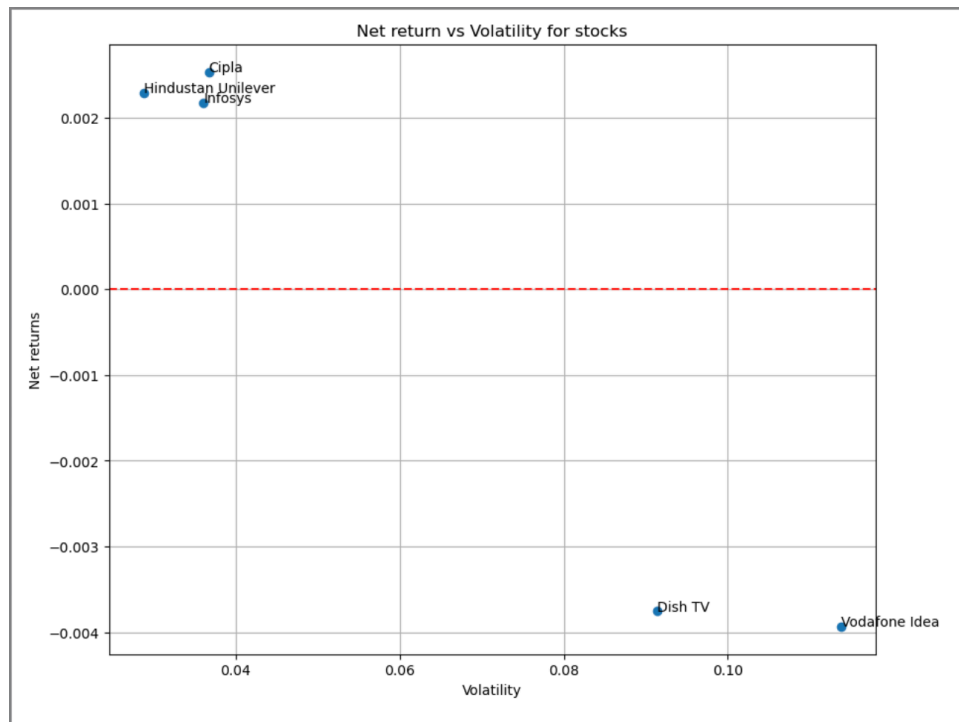
- **Investment Preference:** For a risk-averse investor, Hindustan Unilever appears to be the best choice, whereas an investor seeking higher returns might consider Cipla or Infosys while accepting moderate risk.

Visualizing Returns and Volatility

	Mean	Volatility
Dish TV	-0.003751	0.091333
Infosys	0.002180	0.036102
Hindustan Unilever	0.002294	0.028845
Vodafone Idea	-0.003932	0.113747
Cipla	0.002538	0.036759

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

Among the five stocks, Vodafone Idea and Dish TV have negative average returns, indicating a loss over the observed period, with Vodafone Idea being the most volatile (0.113747) and Dish TV also highly volatile (0.091333). In contrast, Infosys, Hindustan Unilever, and Cipla show positive average returns, suggesting profitability. Hindustan Unilever is the least volatile (0.028845), making it the most stable investment option, while Infosys (0.036102) and Cipla (0.036759) offer moderate risk with positive returns. Overall, Vodafone Idea and Dish TV present high risk with negative returns, whereas Hindustan Unilever, Infosys, and Cipla are more appealing for their balance of moderate risk and positive returns.



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 Cipla, Hindustan Unilever, Infosys, Dish TV, and Vodafone Idea. 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 Cipla shows the highest net returns, followed by Hindustan Unilever and Infosys, while Dish TV has a negative return, and Vodafone Idea shows 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. Vodafone Idea:

- **Insight:** Vodafone Idea exhibits the most significant loss with the highest volatility.
- **Recommendation:** Implement cost-cutting measures, diversify services, and improve customer retention strategies to stabilize returns and reduce volatility.

2. **Dish TV:**

- **Insight:** Dish TV has negative returns and high volatility, though not as extreme as Vodafone Idea.
- **Recommendation:** Enhance content offerings and customer experience, explore strategic partnerships, and optimize operational efficiencies to boost returns and manage risk.

3. **Infosys:**

- **Insight:** Infosys shows positive returns with moderate volatility.
- **Recommendation:** Continue investing in innovation and technology, expand into new markets, and maintain strong customer relationships to sustain and potentially increase returns while managing risk.

4. **Hindustan Unilever:**

- **Insight:** Hindustan Unilever has stable positive returns with the lowest volatility, indicating a strong, stable performance.
- **Recommendation:** Maintain current strategies, focus on sustainable practices, and explore new product lines or markets to leverage stability and drive further growth.

5. **Cipla:**

- **Insight:** Cipla has the highest net returns among the stocks with moderate volatility.
- **Recommendation:** Invest in research and development to introduce new pharmaceutical products, expand market reach, and continue to focus on cost management to sustain high returns and moderate 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 Cipla and Hindustan Unilever with potentially high-reward stocks like Infosys.

• **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.