# Finance and Retail Analytics

# (Part 2)

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**Executive Summary:**

This report presents a market risk analysis of 6 years of weekly stock price data for 10 different Indian stocks. The analysis focuses on calculating the mean and standard deviation of stock returns to assess market volatility. Key insights derived from the analysis provide valuable information for investors and stakeholders to understand the risk associated with investing in these stocks.

**Data Ingestion:**

We began by importing essential libraries, including pandas for data manipulation, matplotlib and seaborn for visualization, and sklearn for metrics calculation. Additionally, warnings were suppressed to ensure a clean output.
Next, we loaded the dataset "Market+Risk+Dataset.csv" into a pandas DataFrame named market_risk_data. This dataset contains 6 years of weekly stock information for 10 different Indian stocks.
The initial few rows of the dataset were displayed to understand its structure and the information it contains.

```
First few rows of the dataset:
```

| | Date | Infosys | Indian Hotel | Mahindra & Mahindra | Axis Bank | SAIL | Shree Cement | Sun Pharma | Jindal Steel | Idea Vodafone | Jet Airways |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 31-03-2014 | 264 | 69 | 455 | 263 | 68 | 5543 | 555 | 298 | 83 | 278 |
| 1 | 07-04-2014 | 257 | 68 | 458 | 276 | 70 | 5728 | 610 | 279 | 84 | 303 |
| 2 | 14-04-2014 | 254 | 68 | 454 | 270 | 68 | 5649 | 607 | 279 | 83 | 280 |
| 3 | 21-04-2014 | 253 | 68 | 488 | 283 | 68 | 5692 | 604 | 274 | 83 | 282 |
| 4 | 28-04-2014 | 256 | 65 | 482 | 282 | 63 | 5582 | 611 | 238 | 79 | 243 |

Fig 1: Sample of the datset

## Data Overview and Types

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 314 entries, 0 to 313
Data columns (total 11 columns):
 #   Column              Non-Null Count  Dtype
---  ------              --------------  -----
 0   Date                314 non-null    object
 1   Infosys             314 non-null    int64
 2   Indian_Hotel        314 non-null    int64
 3   Mahindra_&_Mahindra 314 non-null    int64
 4   Axis_Bank           314 non-null    int64
 5   SAIL                314 non-null    int64
 6   Shree_Cement        314 non-null    int64
 7   Sun_Pharma          314 non-null    int64
 8   Jindal_Steel        314 non-null    int64
 9   Idea_Vodafone       314 non-null    int64
 10  Jet_Airways         314 non-null    int64
dtypes: int64(10), object(1)
memory usage: 27.1+ KB
```

Fig 2 : Info of the dataset

## Descriptive Statistics

| | Infosys | Indian_Hotel | Mahindra_&_Mahindra | Axis_Bank | SAIL | Shree_Cement | Sun_Pharma | Jindal_Steel | Idea_Vodafone | Jet_Airways |
|---|---|---|---|---|---|---|---|---|---|---|
| count | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 | 314.000000 |
| mean | 511.340764 | 114.560510 | 636.678344 | 540.742038 | 59.095541 | 14806.410828 | 633.468153 | 147.627389 | 53.713376 | 372.659236 |
| std | 135.952051 | 22.509732 | 102.879975 | 115.835569 | 15.810493 | 4288.275085 | 171.855893 | 65.879195 | 31.248985 | 202.262668 |
| min | 234.000000 | 64.000000 | 284.000000 | 263.000000 | 21.000000 | 5543.000000 | 338.000000 | 53.000000 | 3.000000 | 14.000000 |
| 25% | 424.000000 | 96.000000 | 572.000000 | 470.500000 | 47.000000 | 10952.250000 | 478.500000 | 88.250000 | 25.250000 | 243.250000 |
| 50% | 466.500000 | 115.000000 | 625.000000 | 528.000000 | 57.000000 | 16018.500000 | 614.000000 | 142.500000 | 53.000000 | 376.000000 |
| 75% | 630.750000 | 134.000000 | 678.000000 | 605.250000 | 71.750000 | 17773.250000 | 785.000000 | 182.750000 | 82.000000 | 534.000000 |
| max | 810.000000 | 157.000000 | 956.000000 | 808.000000 | 104.000000 | 24806.000000 | 1089.000000 | 338.000000 | 117.000000 | 871.000000 |

Fig 3: Descriptive statistics

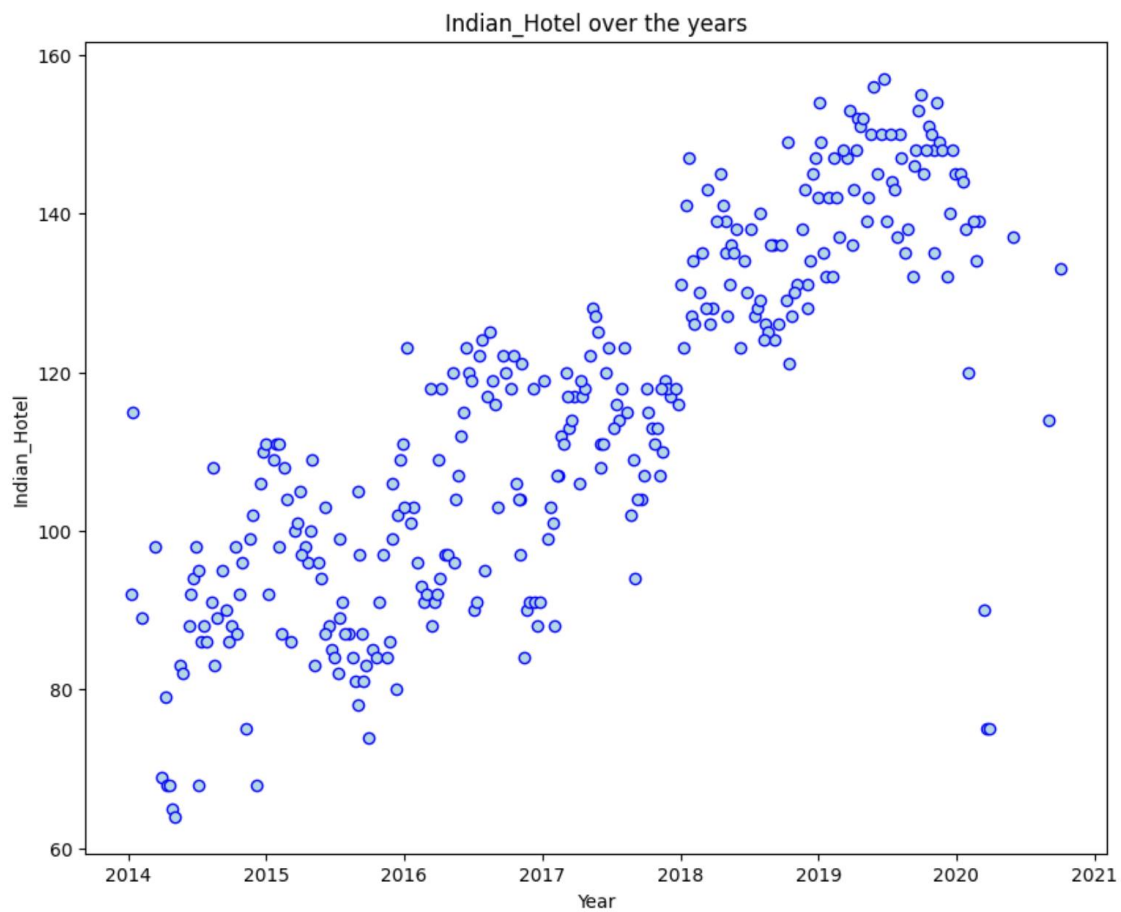**Stock Price Trend of Indian Hotel and Axis Bank over Time**



Fig 4 : Stock Price Trend of Indian Hotel over Time

From the scatter plot we can see that the stock prices od India_hotel shows an inclining trend over the years 2014 to 2020
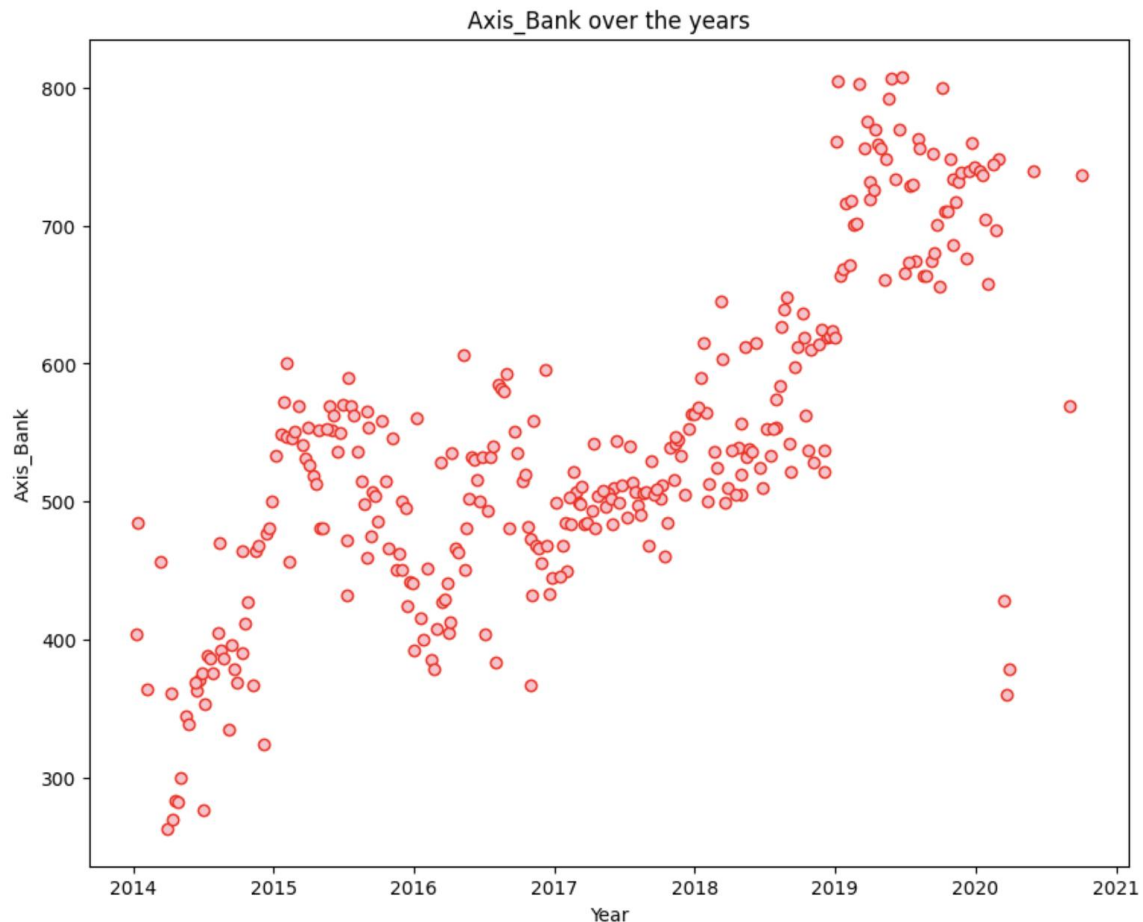
Fig 5: Stock Price Trend of Indian Hotel over Time

From the Fig we can see that the Axis bank shares shows an increase in its stock prices from 2014 to 2021.

**Stock Returns Analysis for Indian Stocks**

We calculated the returns for all stocks by taking the logarithmic difference of the stock prices using NumPy's **log** and Pandas **diff** functions. This process helps us to compute the percentage change in stock prices over consecutive time periods. The resulting DataFrame **stock_returns** has dimensions (314, 10), indicating 314 observations and 10 features (stocks).
Finally, we displayed the first few rows of the **stock_returns** DataFrame to examine the calculated returns for each stock. This process allows us to analyze the historical returns of the stocks in the dataset.

| | Infosys | Indian_Hotel | Mahindra_&_Mahindra | Axis_Bank | SAIL | Shree_Cement | Sun_Pharma | Jindal_Steel | Idea_Vodafone | Jet_Airways |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| 1 | -0.026873 | -0.014599 | 0.006572 | 0.048247 | 0.028988 | 0.032831 | 0.094491 | -0.065882 | 0.011976 | 0.086112 |
| 2 | -0.011742 | 0.000000 | -0.008772 | -0.021979 | -0.028988 | -0.013888 | -0.004930 | 0.000000 | -0.011976 | -0.078943 |
| 3 | -0.003945 | 0.000000 | 0.072218 | 0.047025 | 0.000000 | 0.007583 | -0.004955 | -0.018084 | 0.000000 | 0.007117 |
| 4 | 0.011788 | -0.045120 | -0.012371 | -0.003540 | -0.076373 | -0.019515 | 0.011523 | -0.140857 | -0.049393 | -0.148846 |

Fig 6: Sample dataframe of the stock return

**Calculating Stock Means and Stock Standard deviations:**

**Stock Means:**

| Stock | Mean Return |
|---|---|
| Infosys | 0.002794 |
| Indian_Hotel | 0.000266 |
| Mahindra_&_Mahindra | -0.001506 |
| Axis_Bank | 0.001167 |
| SAIL | -0.003463 |
| Shree_Cement | 0.003681 |
| Sun_Pharma | -0.001455 |
| Jindal_Steel | -0.004123 |
| Idea_Vodafone | -0.010608 |
| Jet_Airways | -0.009548 |

Table 1: Stock means

**Stock Standard Deviations:**

| Stock | Standard Deviation |
|---|---|
| Infosys | 0.035070 |
| Indian_Hotel | 0.047131 |
| Mahindra_&_Mahindra | 0.040169 |
| Axis_Bank | 0.045828 |
| SAIL | 0.062188 |
| Shree_Cement | 0.039917 |
| Sun_Pharma | 0.045033 |
| Jindal_Steel | 0.075108 |
| Idea_Vodafone | 0.104315 |
| Jet_Airways | 0.097972 |

Table 2 : Stock Standard Deviations

We calculated the mean and standard deviation of stock returns across all stocks in the dataset. The resulting means and standard deviations provide insights into the average returns and volatility of each stock over the given time period.

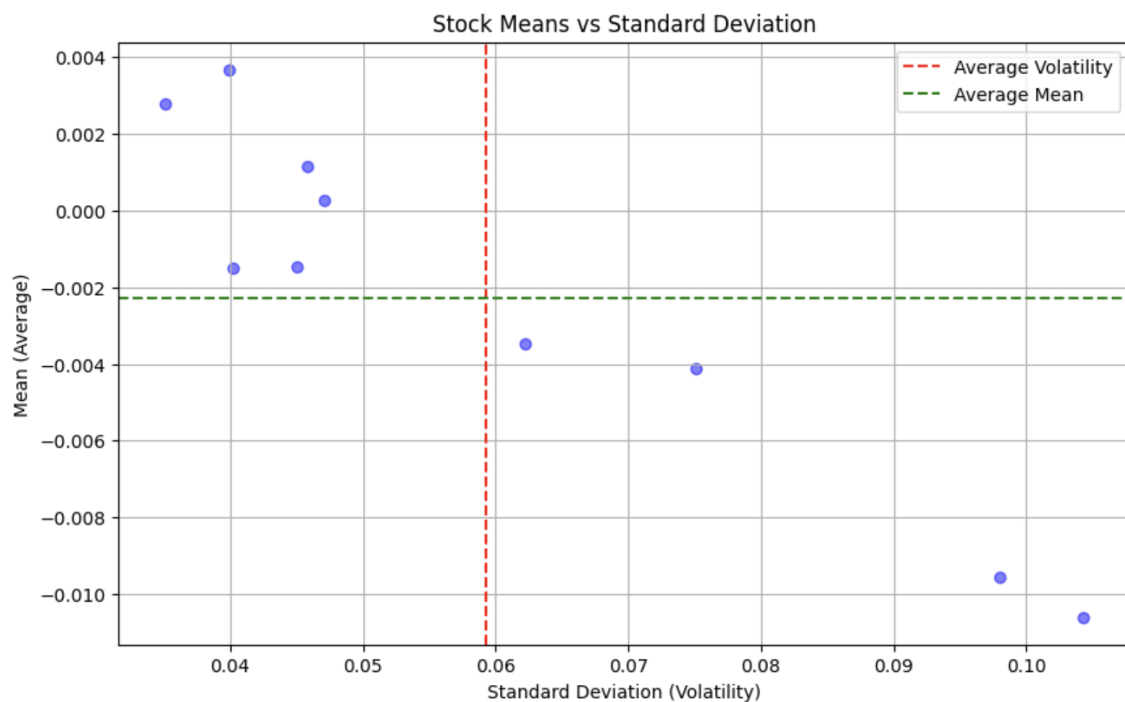**Relationship Between Stock Means and Standard Deviation**



Fig 6: Plot between stocks and standard deviations

The plot of Stock Means vs Standard Deviation allows us to visualize the relationship between the average returns (means) and the volatility (standard deviation) of the stocks. Inferences can be drawn based on the distribution of points and the positioning of the average volatility and mean lines.
This plot helps in identifying:
1. Risk-Return Trade-off: Stocks with higher average returns tend to have higher volatility, indicating a positive relationship between risk and return.
2. Outliers: Any stocks deviating significantly from the average volatility and mean lines can be considered as outliers, potentially indicating unique risk-return profiles.
3. Diversification: Investors can assess the diversification benefits by considering stocks that offer higher returns relative to their volatility, aiming to optimize their portfolio's risk-return profile.

Overall, this plot provides insights into the risk and return characteristics of individual stocks, aiding investors in making informed investment decisions.

**Summary:**

In summary, our analysis of market risk involved studying the stock prices and returns of various Indian stocks over time. Key observations included:
1. **Stock Price Trends**: We examined the fluctuation patterns and trends in the stock prices of Indian Hotel and Axis Bank through visualizations.
2. **Returns Analysis**: Logarithmic returns were calculated for all stocks to assess their performance over the analyzed period.
3. **Mean and Volatility**: The mean and standard deviation of stock returns were computed to gauge their average performance and volatility.
4. **Relationship Exploration**: Through scatter plotting, we explored the correlation between mean returns and volatility across different stocks.

**Recommendations:**

1. **Diversification**: To minimize risk, investors should diversify their portfolios across stocks with varying levels of volatility and performance.
2. **Monitoring**: It's crucial to regularly monitor stock performance and market trends to make informed investment decisions.
3. **Risk Management**: Employing risk management strategies like stop-loss orders and hedging techniques can safeguard investments from adverse market movements.
4. **Professional Guidance**: Seeking advice from financial experts or advisors can help in crafting a tailored investment strategy aligned with individual risk tolerance and financial objectives.

END OF REPORT