

Data Analysis Project Report

Decoding the Optimal Trading Day: A Data-Driven Journey into Nifty50's Market Secrets

Prepared by:

Sushant Sunil Kale

Abstract:

The goal of this project was to identify the optimal day for trading in the Nifty50 index and recommend a trading strategy based on the analysis. The data preprocessing included handling date and volume columns, segmentation, and outlier removal. Key analysis points include the average weekly returns, trading volume, volatility, correlation analysis, risk-return analysis, RSI overbought/oversold, SMA50/SMA200 analysis, EMA50/EMA200 analysis and the identification of golden and death crossovers.

1. Introduction:

1.1 Background

The Nifty50 index, representing the India's top 50 listed companies on the National Stock Exchange, holds crucial significance for traders and investors seeking insights into market trends. In this dynamic financial landscape, understanding historical patterns in Nifty50 data is key to crafting effective trading strategies.

This project aims to leverage data-driven insights for identifying the optimal trading day. Analysing parameters like average weekly returns, trading volume, volatility, and key technical indicators (RSI, SMA50, SMA200, EMA50, EMA200) will uncover actionable patterns, enhancing decision-making for traders navigating the evolving stock market.

1.2 Objectives

1. Optimal Trading Day Identification:

- Utilize advanced data analytics to identify specific days within the Nifty50 index that historically exhibit optimal conditions for trading.

2. Risk Assessment:

- Evaluate the inherent risks associated with the identified optimal trading days.

3. Technical Indicator Effectiveness Assessment:

- Evaluate the effectiveness of key technical indicators, including RSI, SMA50, SMA200, EMA50, and EMA200, in identifying optimal trading days within the Nifty50 index.
- Examine historical data to understand how these indicators contribute to the identification of favorable trading conditions.

4. Decision-Making Support:

- Provide actionable insights and data-driven recommendations to enhance decision-making processes for traders and investors operating in the Nifty50 index.

1.3 Scope

This data analytics project focuses on analysing historical data of the Nifty50 index, specifically within the time frame from 2015/01/01 to 2023/12/29, to identify optimal trading days. The project aims to assess the effectiveness of key technical indicators, including RSI, SMA50, SMA200, EMA50, and EMA200, in identifying optimal trading days.

2. Data Preprocessing:

1. Importing Libraries:

- Leveraged essential Python libraries, including Pandas for data manipulation, NumPy for numerical operations, stats for statistical analysis and Seaborn, Matplotlib for visualization.

2. Loading Data:

- Imported the Nifty50 index daily data.

3. Initial Data Inspection:

- Conducted a thorough examination of the dataset's head, info, and null values to gain insights into its structure and cleanliness.

4. Handling Date and Volume Columns:

- Processed the Date column to extract meaningful temporal information, facilitating time-based analysis.
- Investigated and addressed any considerations related to the Volume column.

5. Feature Correlation:

- Explored the correlation between various features and the Closing Price to identify potential relationships.

6. Renaming Columns:

- Renamed columns for clarity and consistency, enhancing readability and interpretability.

7. Segmentation of Data:

- Divided the dataset into three distinct segments:
 - **2015 to 2019:** Examining pre-pandemic market trends.
 - **2020:** Analysing the market during the pandemic.
 - **2021 to 2023:** Post-pandemic market trends.

8. Line Chart Visualization:

- Visualized market trends by creating line charts for each segment, offering insights into the evolving market landscape.

9. Day Column Creation:

- Introduced a 'Day' column, assigning the day-of-week number to each data point within the respective segments.

10. Percentage Change Calculation:

- Calculated the percentage change between consecutive days for weekdays, enabling a nuanced analysis of market fluctuations.

11. Outlier Detection and Removal:

- Employed outlier detection techniques to identify and subsequently remove outliers within each data segment.
- The exclusion of outliers is essential for maintaining a focus on normal market behaviour and ensuring data accuracy. Extreme values, like a weekly change of -20% or -17%, can distort statistics and compromise dataset integrity. The deliberate removal of these outliers aims to achieve a more accurate representation of typical market conditions, enhancing the reliability of insights in subsequent analyses.
- Integrated the three segments into a consolidated dataframe, conducting a final check for outliers to ensure data coherence

12. Additional Technical Indicators:

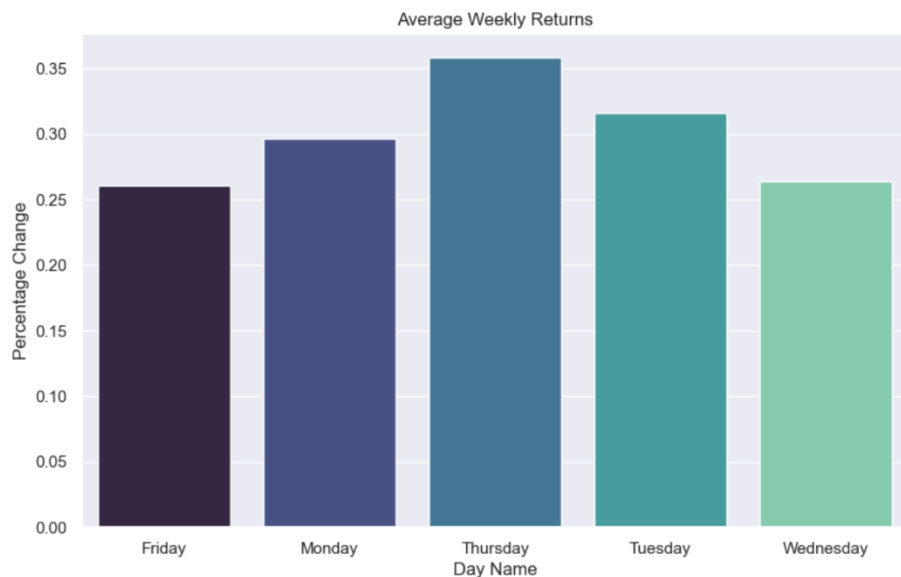
- Enhanced the dataset by incorporating key technical indicators, including RSI, SMA50, SMA200, EMA50, and EMA200, laying the foundation for subsequent analyses.

3. Data Analysis:

3.1 Average Weekly Returns

- Evaluating average weekly returns assists in pinpointing the day with the highest returns, offering valuable insights for traders seeking the optimal day to capitalize on potential profit opportunities.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Avg. Return	0.29%	0.31%	0.26%	0.35%	0.26%

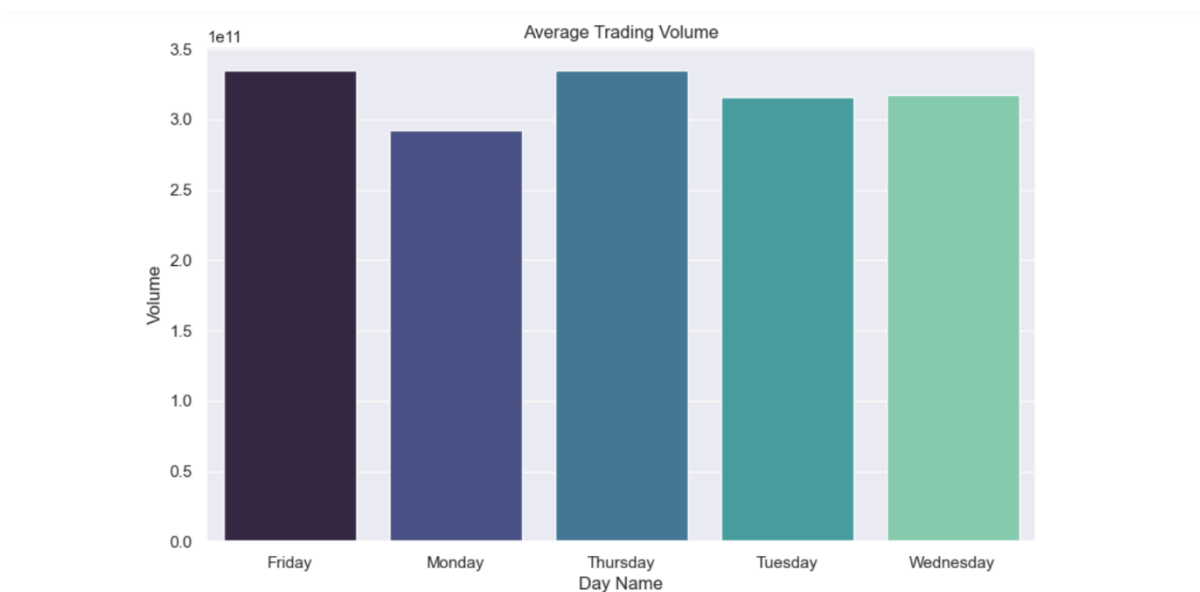


- Thursday stands out with the highest average return of 0.35%. This day, being the day of option expiry, demonstrates the highest average return among weekdays.
- Tuesdays also show a positive average return of 0.31%. While slightly lower than Thursdays.

3.2 Average Trading Volume

- Understanding average trading volumes aids in identifying days with substantial liquidity, contributing to optimal trading conditions for executing transactions seamlessly and efficiently.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Avg. Volume	2.93×10^{11}	3.15×10^{11}	3.17×10^{11}	3.35×10^{11}	3.35×10^{11}

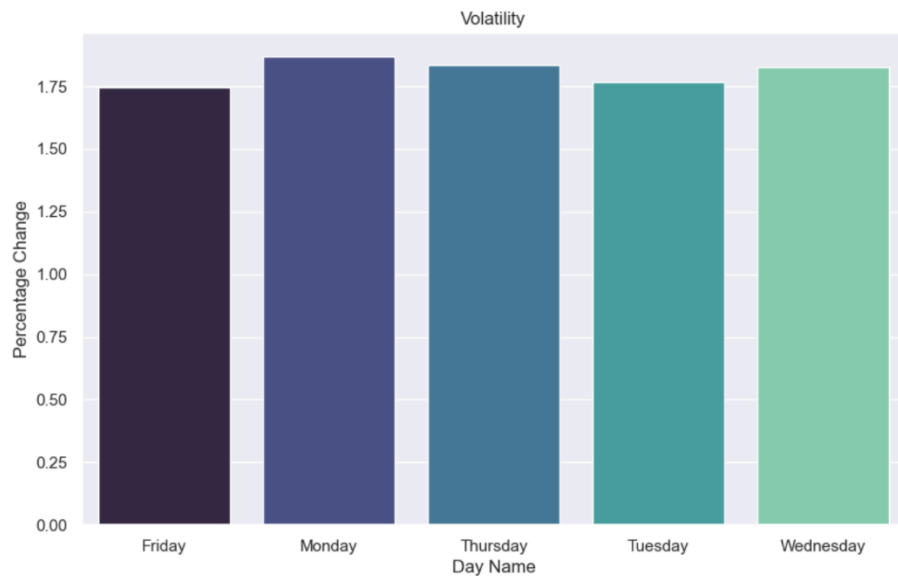


- Tuesdays and Fridays exhibit the most notable average trading volumes, both recorded at 3.35×10^{11} .

3.3 Volatility

- Volatility analysis provides a crucial perspective on market variability, enabling traders to assess risk levels.

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Volatility	1.86	1.76	1.82	1.83	1.74



- Thursdays display significant market variability with a volatility of 1.83. This heightened volatility on Thursdays is particularly noteworthy as it corresponds to the day before the weekly option expiry. Traders and investors may find the observed volatility on Thursdays essential for decision-making, especially in the context of options trading and the dynamics leading up to the weekend.
- Mondays, with a volatility of 1.86, showcase the highest market variability. Considering that the market is closed during the weekends (Saturday and Sunday), Monday's volatility may reflect adjustments and reactions following the weekend break. This highlights the potential impact of the weekend hiatus on market dynamics and the observed volatility on Mondays.

3.4 Risk-Return Analysis

As the analyst, I acknowledge the importance of not solely pursuing returns but also thoroughly evaluating associated risks. This section aims to provide a condensed yet insightful overview, setting the stage for a deeper dive into the intricacies of potential gains and associated risks.

Thursdays - Favourable Risk-Return Trade-off:

Average Return: 0.358060%

Volatility: 1.835917

Analysis: Historically, Thursdays have shown the highest average return among weekdays with a moderate level of volatility, suggesting attractiveness relative to risk. The presence of weekly option expiry on Thursdays adds to the market dynamics.

Fridays - Increased Market Activity:

Average Trading Volume: 3.35×10^{11}

Analysis: The highest average trading volume on Fridays suggests increased market activity, making it an attractive day for traders and investors seeking ample liquidity. Additionally, new contracts opening on Fridays contribute to heightened interest.

Tuesdays - Balanced Stability:

Tuesdays demonstrate stability with a balanced risk-return profile:

Average Return: 0.316009%

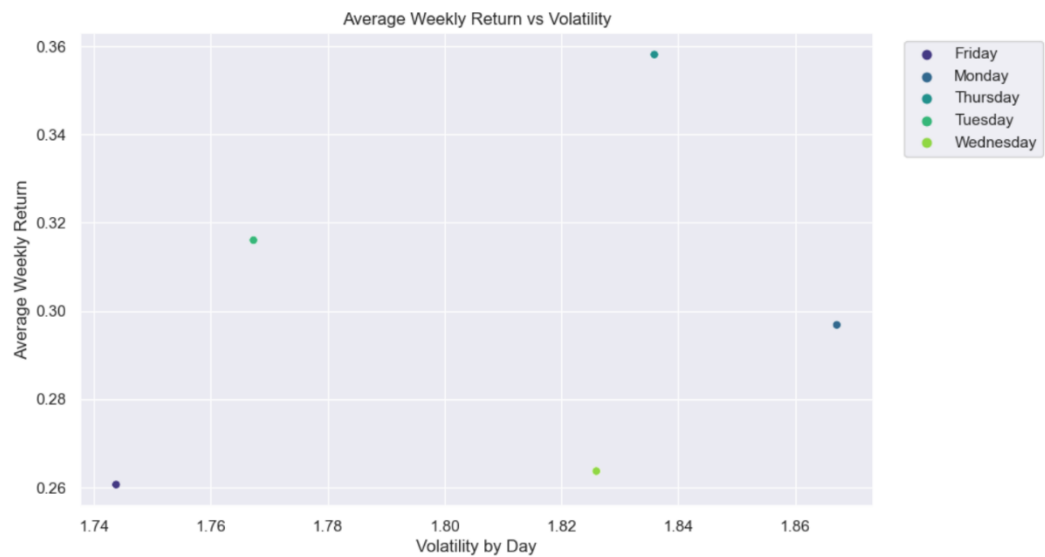
Volatility: 1.767301

Analysis: Tuesdays present a moderate level of volatility coupled with a positive average return, indicating a stable market environment suitable for investors seeking lower risk.

Mondays and Wednesdays:

Mondays: Exhibit a moderate average return and volatility, making them suitable for investors seeking a balanced start to the week.

Wednesdays: Show a moderate average return and volatility, serving as a middle-ground day for market participants. Being the day before option expiry, Wednesdays may witness increased activity as market participants position themselves for the upcoming expiry.



3.5 Correlation Analysis

- Average Weekly Return and Average Volume:

- Correlation Coefficient: 0.133112
- Interpretation: A weak positive correlation suggests a slight positive relationship between average weekly returns and average volume.

- Average Weekly Return and Volatility:

- Correlation Coefficient: 0.323207
- Interpretation: A moderate positive correlation indicates a moderate positive relationship between average weekly returns and volatility.

- Average Volume and Volatility:

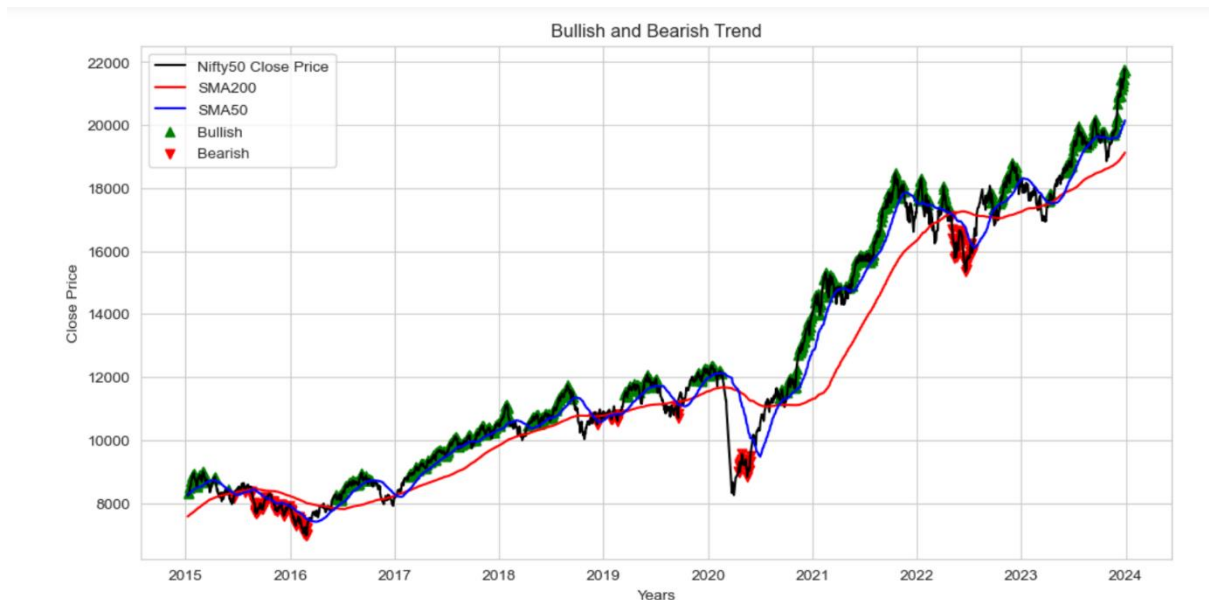
- Correlation Coefficient: -0.573000
- Interpretation: A moderate negative correlation suggests a moderate negative relationship between average volume and volatility.

- Overall Insights:

- The moderate positive correlation between average weekly returns and volatility suggests these two variables tend to move together, potentially influencing each other.
- The negative correlation between average volume and volatility implies that periods of high trading volume may be associated with lower volatility, or vice versa.

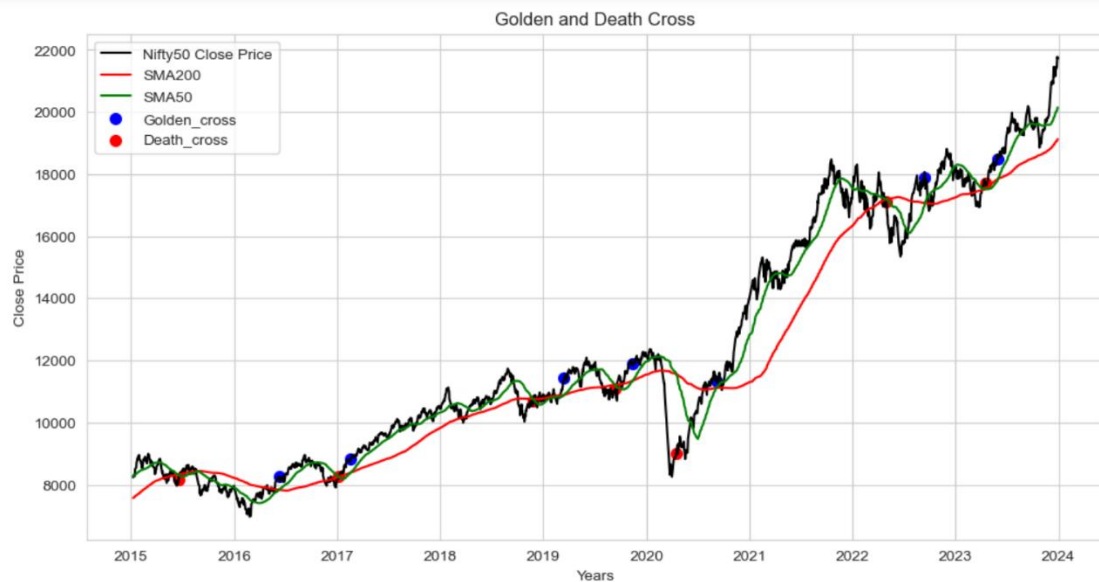
3.6 SMA50 and SMA200 Trend Analysis

- SMAs help identify trends, with SMA50 capturing short-term movements and SMA200 reflecting longer-term trends. This aids in understanding the overall market direction.



3.7 Crossover Analysis

Crossovers between SMAs offer crucial signals for traders. A Golden Crossover, where SMA50 crosses above SMA200, indicates a potential bullish trend. Conversely, a Death Crossover, with SMA50 crossing below SMA200, signals a potential bearish trend.



3.8 Frequency Analysis

Golden Cross:

- The Golden Crossovers were most frequent on Thursdays, with three occurrences, suggesting a notable trend.
- June and September appear to be months with a higher likelihood of Golden Crossovers, each having two occurrences.
- The years 2016, 2017, 2019, 2020, 2022, and 2023 each experienced at least one Golden Crossover event.

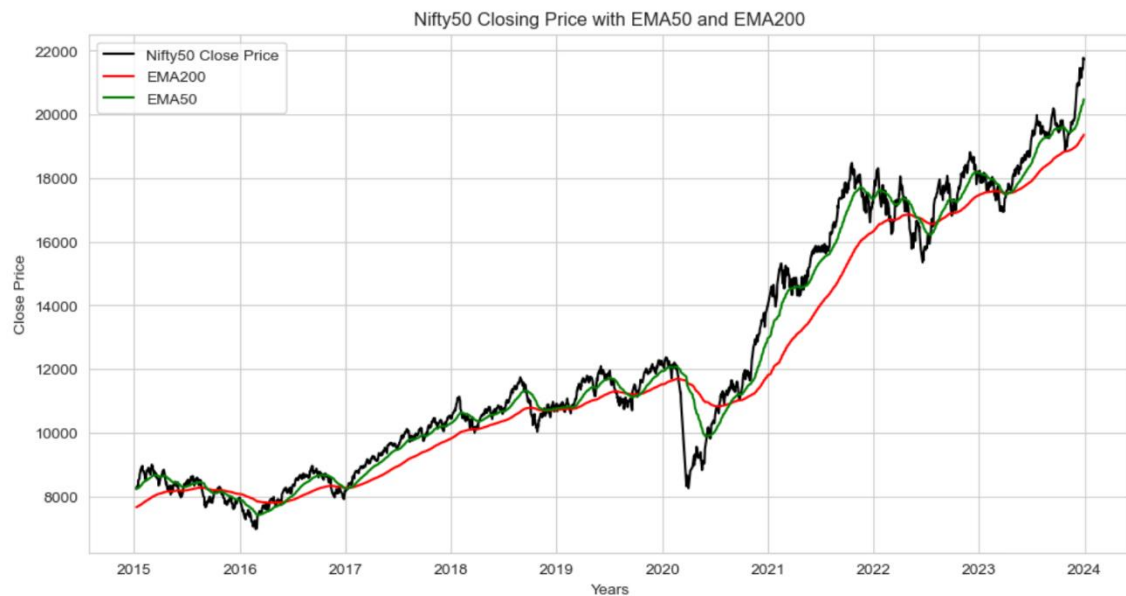
Death Cross:

- Death Crossovers occurred on specific dates across the years, contributing to a total of 7 occurrences.
- Thursdays witnessed the highest frequency, with 3 Death Crossovers.
- The year 2015, 2017, 2018, 2019, 2020, 2022, and 2023 each had one Death Crossover event.

It is essential to acknowledge that the removal of outliers does have implications for the calculation of SMA/EMA values and, consequently, the identification of crossover dates. Outliers, by their nature, can introduce noise and distort the underlying trends captured by moving averages. By excluding these extreme values, my analysis seeks to provide a more accurate representation of the genuine market trends, allowing for a more informed interpretation of EMA crossover dates for optimal trading strategies.

3.9 EMA50 and EMA200 Analysis

Exponential Moving Averages (EMAs), specifically EMA50 and EMA200, play a crucial role in technical analysis by providing a weighted average of an asset's price over different time periods. This analysis aims to uncover trends, potential crossovers, and market signals.



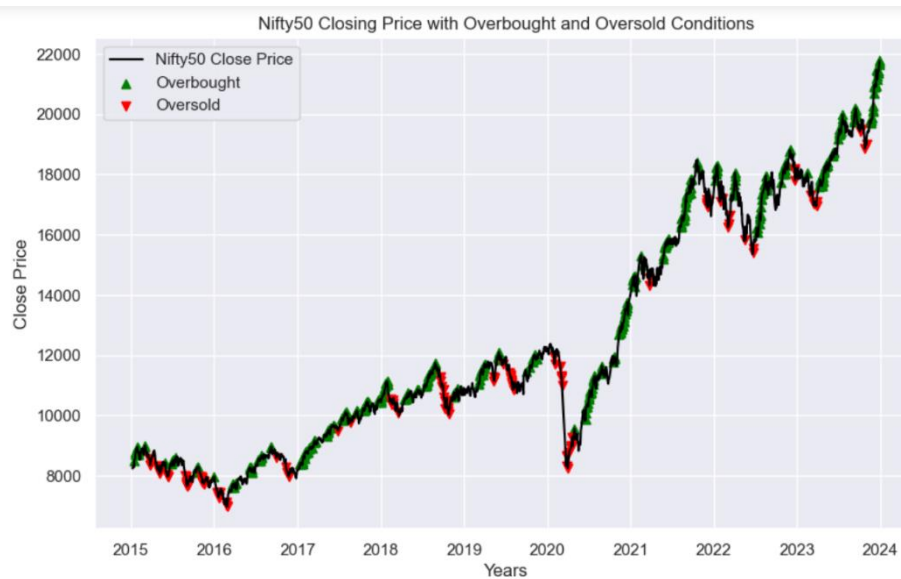
Over the analyzed historical data from 2015, the Exponential Moving Average (EMA) has demonstrated results similar to the Simple Moving Average (SMA). Despite EMA's focus on recent prices and responsiveness to short-term fluctuations, both EMA and SMA have revealed comparable insights into historical market movements and trends. In this specific context, the choice between EMA and SMA appears to have less impact on the overall trend analysis, indicating that either indicator can effectively provide valuable insights from the historical market data since 2015.

3.10 RSI Overbought and Oversold Analysis

In our market analysis, we leveraged the Simple Moving Averages (SMA50 and SMA200) as primary indicators for identifying potential uptrends and downtrends. These SMAs provided valuable signals, confirming uptrends upon SMA50 crossing above SMA200 and downtrends upon SMA50 crossing below SMA200. To further enhance the robustness of these trend identifications, we incorporated the Relative Strength Index (RSI) for validation.

- **Overbought and Oversold Conditions:**

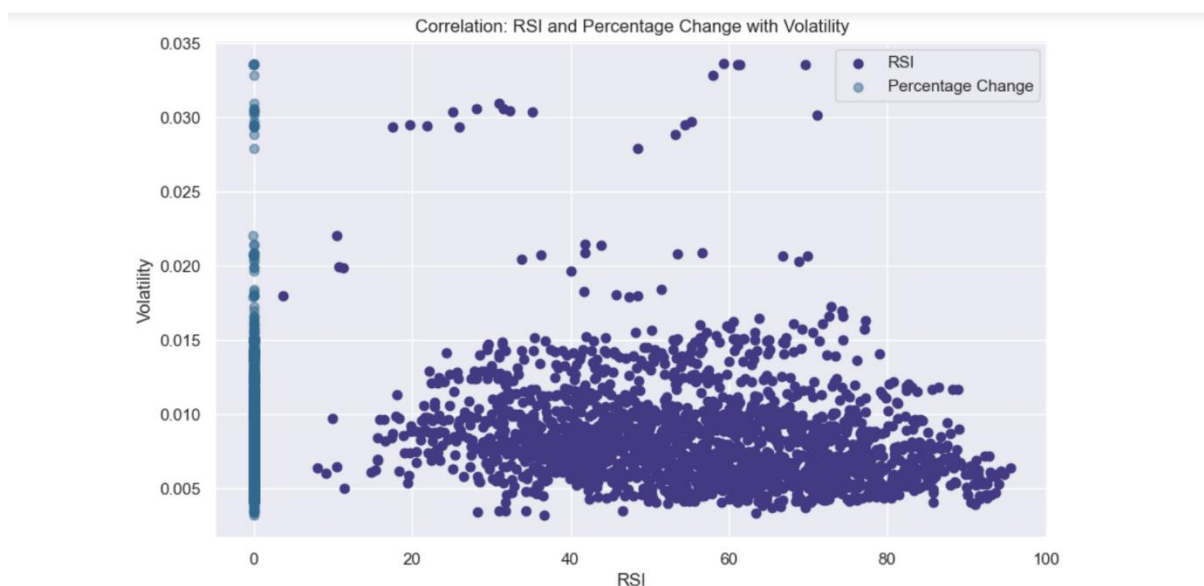
Overbought conditions ($RSI > 70$) and oversold conditions ($RSI < 30$) have been identified using the Relative Strength Index (RSI).



3.11 RSI and Volatility Correlation

The analysis extends to the correlation between RSI (Relative Strength Index) and volatility, offering nuanced insights into market dynamics:

- Correlation between RSI and Volatility: -0.23
- **Analysis:** A mild negative correlation of -0.23 unveils an interesting relationship between RSI and volatility. When the market exhibits high RSI (indicating overbought conditions), there tends to be lower volatility. Conversely, lower RSI (indicating oversold conditions) aligns with higher volatility. This pattern reflects the market's tendency to correct after overbought levels and rebound after oversold conditions.
- Correlation between Percentage Change and Volatility: 0.04
- **Analysis:** A mild positive correlation of 0.04 is observed between percentage change and volatility. Notably, substantial percentage changes in the Nifty 50 index are associated with slightly higher volatility. This correlation stems from the fact that significant price movements often trigger increased trading activity, fostering an environment conducive to elevated volatility.



- **Overall Insights:** The scatter plot analysis suggests a subtle inverse relationship between RSI and volatility and a mild direct relationship between percentage change and volatility.

4. Conclusion:

In conclusion, the comprehensive analysis of Nifty50 historical data spanning from 2015 to 2023 has unveiled valuable insights for traders and investors. Optimal trading days, risk-return dynamics, and the efficacy of key technical indicators were systematically explored. Thursdays emerged as strategically significant with consistently high average returns, while Fridays offered increased market activity and liquidity. The risk-return profiles of each weekday were assessed, guiding tailored strategies. The evaluation of technical indicators highlighted their role in identifying optimal trading conditions. The recommendations emphasize continuous monitoring, adaptive strategies, and leveraging technical insights for informed decision-making. This project equips market participants with actionable information, enhancing their ability to navigate the dynamic landscape of the Nifty50 index for successful trading and investment.

5. Recommendations:

1. **Strategic Focus on Thursdays:** Given Thursdays' consistent record of optimal returns and a favorable risk-return trade-off, traders may strategically focus on this day for key market activities, including portfolio adjustments and strategic trades.
2. **Dynamic Approach on Fridays:** With heightened market activity and increased trading volume on Fridays, traders and investors seeking liquidity may find this day opportune for executing trades. Additionally, considering the opening of new contracts, Fridays can be strategically utilized for exploring new market positions.
3. **Stability-Oriented Approach on Tuesdays:** Tuesdays, offering a balanced stability with positive average returns, can be appealing to investors seeking a more stable market environment. A cautious and stability-oriented approach on Tuesdays may align with risk-averse investment strategies.
4. **Technical Indicator Integration:** The identified optimal trading days can serve as a foundation for integrating key technical indicators. Traders may explore incorporating RSI, SMA50, SMA200, EMA50, and EMA200 into their strategies on the identified optimal days to enhance decision-making.
5. **Risk Management Strategies:** Recognizing the varying risk-return profiles across different weekdays, traders are advised to tailor risk management strategies accordingly. Implementing risk mitigation measures on days with higher volatility can be essential for safeguarding portfolios.
6. **Continuous Monitoring and Adaptation:** The financial landscape is dynamic, and market conditions can evolve. Traders and investors are recommended to continuously monitor market trends, adapt strategies, and stay informed about external factors influencing the Nifty50 index.
7. **Exploration of Intraday Opportunities:** Based on the findings, traders may explore intraday opportunities aligned with the identified optimal trading days. Short-term strategies and intraday trades on Thursdays, for example, may capitalize on the day's historical patterns.
8. **Golden and Death Crossovers:** Incorporating insights from the analysis of Golden and Death Crossovers, traders can use these signals as additional indicators for market entry and exit points. The frequency of these crossovers provides valuable information for crafting effective trading strategies.

6. Future Work:

Opportunities for future work include:

- Deepening the analysis of technical indicators for more nuanced insights.
- Exploring the impact of external factors on optimal trading days.
- Integrating machine learning models for predictive analytics.

Thank you for taking the time to explore this data analysis project with me.

Your interest and consideration are greatly appreciated.

Thank You!