RAMAIAH INSTITUTE OF MANAGEMENT STUDIES (RIMS)

Gokula, Bangalore-560054

An AICTE Approved Institution

CAPSTONE PROJECT

Submitted by:

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Marks Secured: _____

Internal Marks Maximum: 50

Marks Secured: _____

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Total Marks out of 100: _____

Faculty Signature: _____

ABSTRACT

dynamic and unpredictable nature. Accurate forecasting of stock prices plays a vital role in supporting investment decisions, risk management, and portfolio planning. This project aims to explore and predict stock market trends using time series analysis techniques, focusing on the daily stock price data of ITC Limited—a leading company listed on the National Stock Exchange of India.

The study employs various tools including Microsoft Excel, R programming, and Power BI to analyse historical data consisting of open, close, high, low prices, and trading volume. Excel is used for preliminary data cleaning, visualization, and basic forecasting models such as moving averages and trendlines. R programming enables more advanced statistical analysis, particularly ARIMA modelling, to understand seasonal components, trends, and forecast future prices. Power BI enhances the interpretability of insights through interactive dashboards, facilitating better data storytelling.

A combination of visual tools—line graphs, candlestick charts, volume trends, moving averages, and predictive models—are used to uncover hidden patterns and project near-future movements in stock prices. The findings demonstrate how time series analysis can be effectively applied to real-world financial data to anticipate market behaviour with reasonable accuracy. This project highlights the relevance and application of analytical tools in the finance domain and provides a strong foundation for data-driven decision-making in stock investment.

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INTRODUCTION

The stock market is a vital component of the global financial system, serving as a platform for companies to raise capital and for investors to gain ownership in businesses. However, due to its inherent volatility, predicting the behaviour of stock prices is a complex task that has attracted the attention of economists, data scientists, and investors for decades. Stock prices are influenced by a wide range of factors such as economic indicators, company performance, investor sentiment, global events, and market speculation. As a result, accurately forecasting stock market trends remains a major challenge but also a critical opportunity.

Time series analysis offers a powerful set of tools and techniques to study historical data points recorded in time order. In the context of stock markets, time series analysis involves evaluating past stock prices to identify trends, seasonal patterns, and cyclical behaviours. This analytical method is particularly useful for making data-driven predictions about future price movements.

This project focuses on predicting the stock price trends of **ITC Limited**, a major Indian conglomerate, using time series analysis techniques. The study involves the use of three major analytical tools—**Microsoft Excel**, **R programming**, and **Power BI**—to analyse and visualize one year of daily stock price data. Each tool plays a specific role in transforming raw data into actionable insights. Excel is used for data preparation and basic visualization, R is used for statistical modelling and forecasting (e.g., ARIMA), while Power BI enables interactive and dynamic visual storytelling through dashboards.

Through this project, we aim to understand how past market behaviour can be leveraged to anticipate future price movements and support informed decision-making in investments. By combining financial knowledge with data analytics, this study demonstrates the practical application of time series analysis in financial forecasting and portfolio management.

DEFINITION OF THE STUDY

Time series analysis is a statistical technique that deals with data collected or recorded at specific time intervals. It helps in understanding historical trends, identifying patterns, and forecasting future values based on past behaviour. In financial markets, time series analysis is widely used to examine and predict stock prices, trading volumes, and market trends.

In this study, time series analysis is applied to the daily stock price data of ITC Limited, using various analytical tools such as Microsoft Excel, R programming, and Power BI. The objective is to observe the behavior of stock prices over time, detect patterns, and develop predictive models that can assist in anticipating future market trends.

SCOPE OF THE STUDY

The scope of this study outlines the boundaries within which the research is conducted. It clarifies what is included, what tools are used, and what the study aims to achieve.

1. Company Focus:
   The analysis is limited to ITC Limited, a leading Indian company listed on the National Stock Exchange (NSE).
2. Time Frame:
   The data covers one year of daily stock prices, providing a short- to medium-term view of market behaviour.
3. Data Variables Used:
   Key variables analysed include:
   - Date
   - Open Price
   - High Price
   - Low Price

- Close Price
- Volume of Trades

4. Analytical Tools and Techniques:
   - Microsoft Excel for basic statistical analysis and visualization.
   - R Programming for advanced forecasting techniques like ARIMA.
   - Power BI for building interactive dashboards and visualizations.
5. Type of Analysis:
   - Descriptive analysis to identify trends and patterns.
   - Predictive Modelling for future price forecasting.
6. Target Audience:
   This study is intended for finance students, academic researchers, investors, and analysts interested in understanding the application of time series techniques in the stock market.
7. Limitations:
   The study does not consider external factors such as economic news, political events, or industry-specific announcements that might also affect stock prices. It is purely based on historical price movements.

NEED OF THE STUDY

The stock market plays a crucial role in the economic development of a country by facilitating the mobilization of capital and enabling wealth creation. However, its volatile and uncertain nature often makes it challenging for investors to make informed decisions. In such a scenario, forecasting future stock price movements becomes highly valuable for minimizing risks and maximizing returns.

There is an increasing need to utilize analytical and statistical tools to decode historical stock price behaviour and predict future trends. Time series analysis offers a scientific approach to studying stock market data over time, helping to identify trends, seasonal patterns, and anomalies. These insights can support investors, traders, financial analysts, and researchers in developing effective trading strategies, risk management plans, and investment models.

This study is particularly relevant in today's data-driven financial environment, where businesses and individual investors alike seek evidence-based decision-making tools. By focusing on the stock price of ITC Limited—a prominent and widely traded Indian company—this project not only applies time series techniques to real market data but also bridges the gap between theoretical finance and practical investment analysis.

Thus, the need for this study arises from the growing importance of analytics in finance, the demand for reliable forecasting techniques, and the necessity to enhance financial decision-making through data science tools such as Excel, R programming, and Power BI.

The stock market is highly dynamic and influenced by various factors such as company performance, macroeconomic indicators, global events, investor sentiment, and market speculation. This unpredictability makes it both an opportunity and a challenge for investors. As the stakes are high, there is a growing demand for techniques that can reduce uncertainty and support informed decision-making.

In this context, **time series analysis** emerges as a valuable approach to study historical price behaviour and forecast future trends. By understanding patterns like trends, seasonality, and cyclicality in stock prices, investors can gain a strategic advantage in portfolio management, trading, and financial planning.

There is also a **rapid growth in the use of data analytics tools** like Microsoft Excel, R programming, and Power BI in the financial sector. These tools enable professionals to handle large datasets, perform complex analyses, and visualize data for easier interpretation. Applying these tools to stock market data helps bridge the gap between academic theories and practical investment strategies.

Moreover, ITC Limited, being a large-cap and actively traded company, provides an ideal case for study. Its stock price data offers meaningful insights into market behaviour and investor psychology. This makes the study not only academically valuable but also relevant from a practical standpoint.

Thus, the need for this study arises due to:

- The complexity and volatility of stock markets.
- The demand for predictive financial modelling.
- The rising importance of data-driven decision-making.
- The necessity to gain hands-on experience in tools like R and Power BI.
- The opportunity to apply statistical knowledge to a real-world business scenario.

REVIEW OF LITERATURE

The stock market has always been a subject of keen interest for researchers, economists, and financial analysts due to its complex and dynamic nature. Numerous studies have been conducted to understand and predict stock price movements using various statistical, mathematical, and machine learning models. Time series analysis, in particular, has been a widely adopted method in financial forecasting.

Box & Jenkins (1976) – ARIMA Modelling

Box and Jenkins introduced the **Auto Regressive Integrated Moving Average (ARIMA)** model, which became a foundational approach in time series forecasting. Their work emphasized model identification, estimation, and diagnostic checking, and has been widely applied in financial markets to forecast future stock prices based on past data.

2. Fama (1970) – Efficient Market Hypothesis (EMH)

Fama's theory of the Efficient Market Hypothesis suggests that stock prices reflect all available information, making it impossible to consistently outperform the market through prediction. However, critics argue that short-term inefficiencies can still be exploited using statistical tools like time series analysis, particularly in emerging markets.

3. Chatfield (2004) – Time Series Forecasting Techniques

In his book "The Analysis of Time Series," Chatfield discusses practical applications of time series forecasting in economics and finance. He emphasizes the use of smoothing techniques, exponential smoothing, and ARIMA models for financial data prediction.

4. Patel et al. (2015) – Forecasting with Technical Indicators and Time Series

This study compared time series models with machine learning models for stock prediction. It showed that ARIMA models provided reasonably accurate results when

applied to historical stock price data, especially when combined with technical indicators.

5. Kumar & Murugan (2012) – Stock Market Prediction Using Time Series

This research focused on Indian stock market data and demonstrated how time series methods like moving averages and exponential smoothing can be used effectively for short-term stock price forecasting. The study concluded that time series methods are useful for identifying trends and making investment decisions.

6. Guresen et al. (2011) – Financial Time Series Forecasting

While this study applied neural networks, it also emphasized the importance of traditional models such as ARIMA as reliable benchmarks. The results suggested that time series models still hold significant relevance for financial prediction despite the rise of AI models.

Tripathi & Garg (2020) – Application of Time Series in Indian Stock Markets

This study examined the application of time series forecasting models on stocks listed in the NSE and BSE. It highlighted the effectiveness of ARIMA and seasonal models in predicting prices of large-cap stocks like ITC, Reliance, and HDFC Bank.

SUMMARY OF REVIEW

From the literature reviewed, it is evident that:

- Time series models like **ARIMA, moving averages**, and **exponential smoothing** are widely accepted for **financial forecasting**.
- **Stock markets do show patterns and short-term dependencies** that can be captured and forecasted using statistical models.
- While **machine learning models** are emerging, **time series models** remain reliable and easier to interpret, especially for **short-term trend prediction**.
- Tools like **Excel, R programming, and Power BI** are now commonly used in both academic research and practical financial analysis.

OBJECTIVES OF THE STUDY

1. **To understand the role and significance of time series analysis** in the context of financial forecasting and stock market behaviour.

2. **To collect and organize daily stock price data of ITC Limited**, including variables such as Open, High, Low, Close prices, and Volume for a selected time period.

3. **To apply descriptive statistical techniques** to examine the distribution and basic characteristics of the stock price data (e.g., trend, volatility, skewness).

4. **To identify trends, seasonal patterns, and cyclic behaviour** in the historical stock prices using time series decomposition.

5. **To use Microsoft Excel** for calculating moving averages, plotting trend lines, and creating forecast sheets for preliminary stock price predictions.

6. **To implement ARIMA (Auto Regressive Integrated Moving Average) model in R programming** to forecast future stock prices and analyse model performance.

7. **To visualize stock price trends using Power BI dashboards**, including interactive charts such as line graphs, candlestick charts, and KPI cards.

8. **To compare the effectiveness of different tools** (Excel, R, and Power BI) in performing time series analysis and financial forecasting.

9. **To evaluate the accuracy of forecasting models** by comparing predicted values against actual stock prices using error metrics like MAPE or RMSE.

10. **To interpret the results from a financial perspective** and provide insights that may assist investors and analysts in making informed decisions.

11. **To enhance practical skills in applying statistical and analytical tools** for solving real-world financial problems.

12. **To bridge the gap between academic knowledge and practical investment analysis** through data-driven forecasting.

METHODS OF INVESTIGATION

This study employs a systematic and analytical approach to predict stock market trends using time series analysis. The investigation process involves several key stages, including data collection, data preprocessing, statistical analysis, visualization, model building, and forecasting using different tools. The methodology integrates both traditional statistical techniques and modern data visualization practices.

1. **Data Collection**

- **Source**: Historical daily stock price data of **ITC Limited**.
- **Time Period**: One year of data is used for short-term trend analysis.
- **Variables Collected**:
    - Date
    - Open Price
    - High Price
    - Low Price
    - Close Price
    - Volume of Shares Traded

2. Data Preparation and Cleaning

- Convert Excel serial dates into standard date formats.
- Handle missing values (if any) and ensure data consistency.
- Structure data chronologically to maintain time series integrity.

3. Descriptive Statistical Analysis

- Analyse central tendencies and dispersion (mean, median, standard deviation).
- Identify volatility and price range behaviour.
- Calculate daily returns and visualize price fluctuations.

4. Time Series Visualization

- **Line Charts**: To show trends in closing prices over time.
- **Moving Averages**: 7-day and 14-day moving averages to smoothen the trend.
- **Candlestick Charts**: To understand daily market movements (open-high-low-close).
- **Volume Charts**: To analyse market activity and trading interest.

5. Tool-Specific Methodology

a) Microsoft Excel

- Calculate Moving Averages and create Trendlines.
- Use built-in **Forecast Sheet** to predict future values.
- Generate static visualizations (line charts, bar charts, candlestick).

b) R Programming

- Load and convert data using read. Csv () and as Date ().
- Conduct **ARIMA modelling** using forecast and auto. Arima () functions.
- Plot forecasts and confidence intervals.
- Evaluate model performance using RMSE, MAE, and AIC values.

c) Power BI

- Import cleaned data for visual storytelling.
- Use **line charts**, **candlestick charts**, **KPI cards**, and **slicers**.
- Create **interactive dashboards** to explore trends, compare date ranges, and highlight peak volumes.

6. Forecasting

- Use **ARIMA (Auto Regressive Integrated Moving Average)** in R for predictive modelling.
- Generate future stock price forecasts (e.g., next 30 days).
- Compare forecasted values with actual prices to assess model reliability.

2. Interpretation of Results

- Interpret graphs and forecast outputs to derive insights.
- Identify significant trends, breakouts, or consistent growth/decline patterns.
- Discuss implications for investors or financial decision-making.

STATISTICAL DATA ANALYSIS USING EXCEL

1)

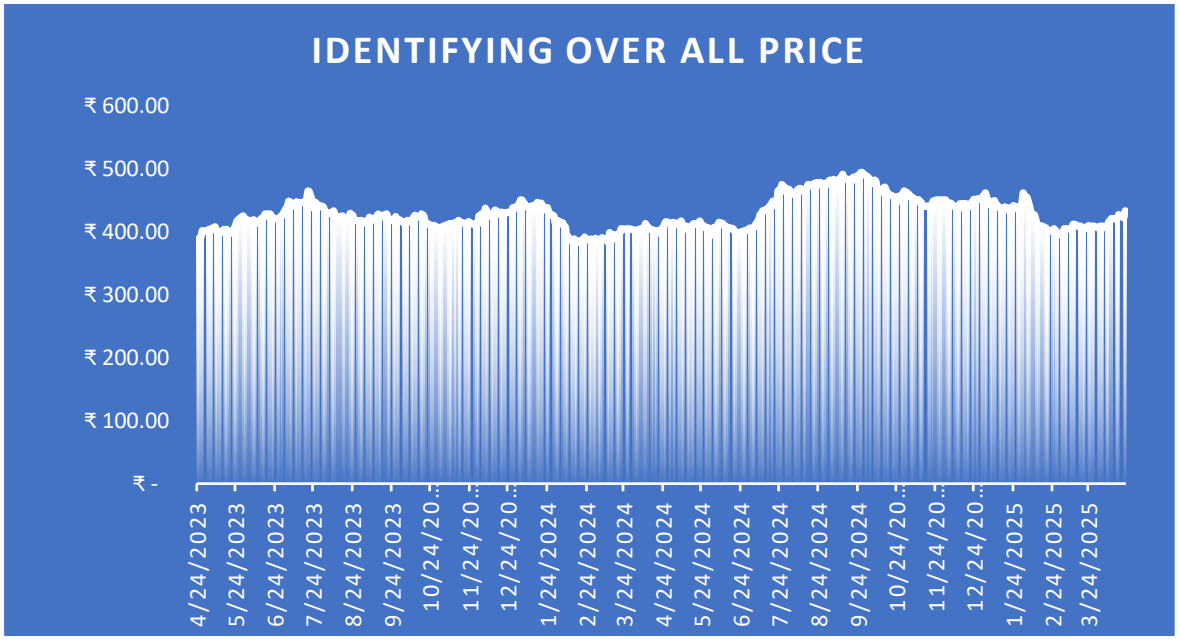

Chart Overview

- **Title**: Identifying Overall Price
- **Type**: Vertical bar chart (column graph)
- **X-Axis**: Time (Dates from April 2023 to March 2025)
- **Y-Axis**: Stock Price in INR (₹0 – ₹600)
- **Data Source**: Daily closing prices of ITC Ltd.

Observations from the Chart

1. **Stable Price Zone**:
   The majority of the prices are clustered between **₹350 and ₹450**, showing **price stability** over the period.
2. **Significant Peak**:
   A sharp price increase is observed around **late 2023 to early 2024**, reaching **above ₹500**, indicating a bullish phase.
3. **Temporary Dips**:
   There are a few **noticeable dips below ₹400**, suggesting **short-term corrections or market reactions**.

4. **Recent Recovery**:
   Towards the end of the chart (early 2025), prices appear to **recover back toward ₹450**, showing **market confidence**.
5. **Evenly Distributed Data**:
   The consistent height and density of the bars indicate **regular daily trading data**, essential for reliable time series analysis.

2)

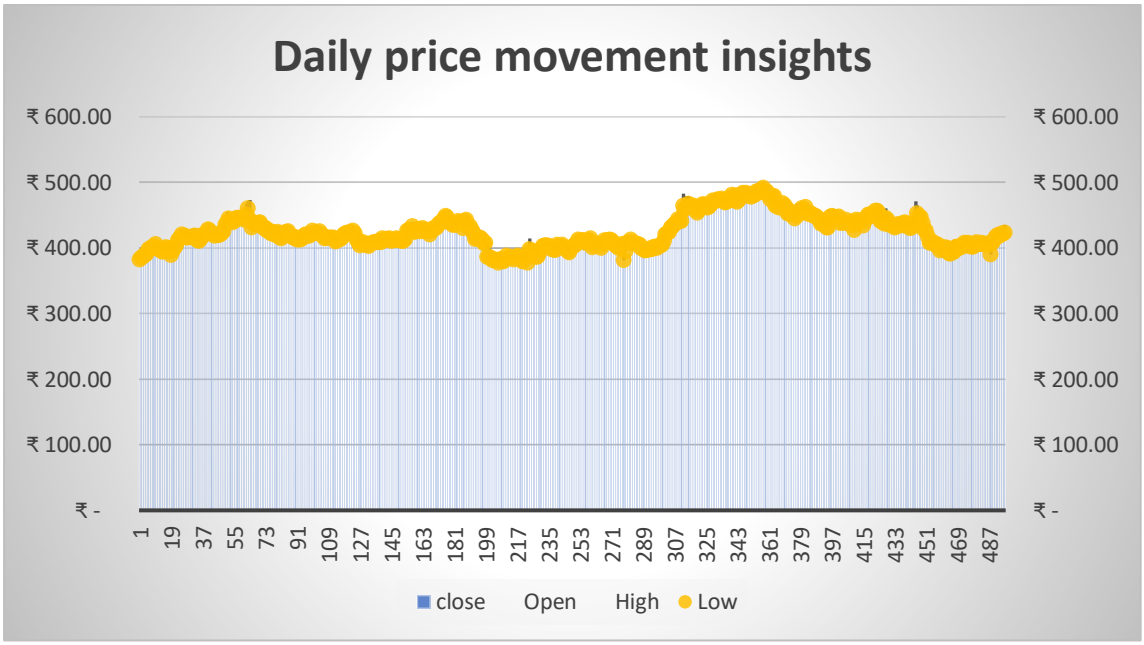

Chart Overview

- **Title**: *Daily Price Movement Insights*
- **Chart Type**: Combined **bar and line chart**
- **X-Axis**: Trading days (indexed numerically from 1 to 485)
- **Y-Axis**: Price in INR (₹0 to ₹600)

Interpretation

The chart illustrates the **daily stock price behaviour** over a long series of trading days. The **closing prices (bars)** form a stable core, while the **open, high, and low values (lines)** show the range of fluctuation within each day. The visual effectively captures price volatility, upward spikes, and periods of consistency or corrections.

Observations from the chart

1. **Price Consistency**
   Most of the closing prices lie between **₹380 to ₹470**, suggesting a **stable price range** for the majority of the observed period.
2. **Short-Term Peaks**
   The chart shows **sharp increases in high prices** around days 70–90 and 310–340, indicating **strong bullish phases or market events**.
3. **Narrow Daily Ranges**
   For many days, the difference between High and Low is small — meaning **low intraday volatility** and a **calm trading environment**.
4. **Dips and Corrections**
   A few dips in the close price (notably before day 300 and again near day 470) show **short-term corrections or bearish sentiment**.
5. **Smooth Trend Flow**
   The close price closely follows the pattern of the open and high lines, reflecting **a predictable and reactive stock performance**.

Conclusion:

This chart helps identify how ITC's stock behaves on a daily basis — offering insight into **trading strategy**, **risk zones**, and **investment timing** based on historical behaviour.

3)

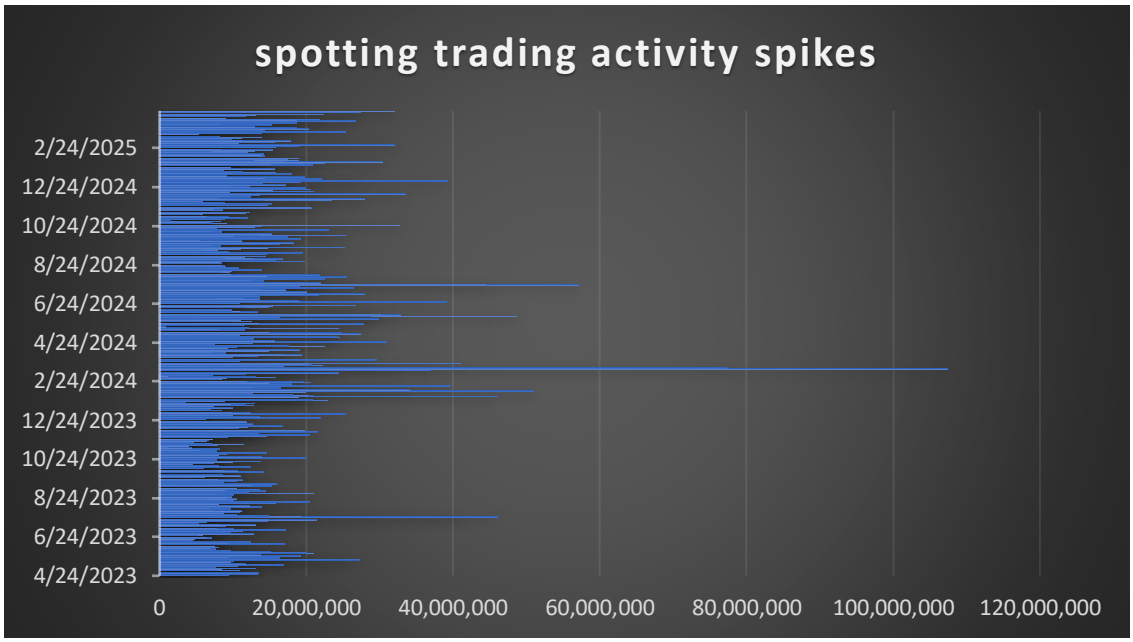

Chart Overview

- **Title**: *Spotting Trading Activity Spikes*
- **Chart Type**: **Horizontal bar chart**
- **Y-Axis**: Dates (from April 2023 to February 2025)
- **X-Axis**: Trading Volume (in raw numbers, e.g., up to 120,000,000+)
- **Data Represented**: Daily **trading volume** of ITC stock

This chart is designed to **highlight days with unusually high trading activity**, helping to identify potential **market reactions, earnings announcements**, or **investor sentiment shifts**.

Interpretation

The chart effectively visualizes **spikes in trading volume**, with a few clear outliers where the volume was dramatically higher than average. These spikes usually signal that something **noteworthy happened on those days** — such as corporate announcements, market rallies, or sell-offs.

Key Observations

1. **Significant Spike Around February 2024**
   One bar around **2/24/2024** is dramatically longer than the rest — suggesting a **massive volume surge**, possibly due to a major company event or market reaction.
2. **Other Spikes in April & June 2024**
   Elevated activity is also observed in **April and June 2024**, indicating multiple periods of heightened market interest in ITC.
3. **Low to Moderate Volume on Most Days**
   The majority of trading days have **relatively low and consistent volume**, pointing to stable investor behavior.
4. **Volume Cycles Appear Periodic**
   High-volume activity seems to follow a **rough quarterly pattern**, which could align with **earnings releases or fiscal events**.

Conclusion

This chart helps in **identifying trading volume spikes**, which are often linked to **significant market triggers**. Analysts and investors can use such visuals to **investigate causes**, align with **price movements**, or adjust **portfolio strategies** accordingly.

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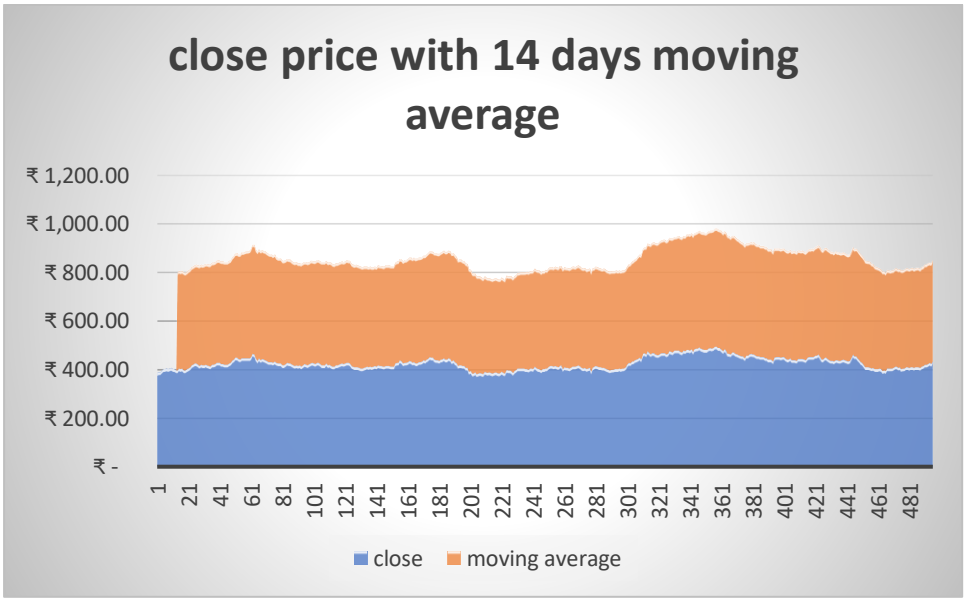

Chart Overview

- **Title**: *Close Price with 14 Days Moving Average*
- **Chart Type**: **Stacked Area Chart**
- **X-Axis**: Trading Days (1 to ~485)
- **Y-Axis**: Price in INR (₹0 – ₹1,200)
- **Legend**:
  - Blue area: Close Price
  - Orange area: 14-day Moving Average

This chart shows the actual daily **closing price** of ITC stock compared to its **14-day moving average**, which smooths out short-term fluctuations to highlight the overall trend.

Interpretation

The chart reflects how the **moving average closely follows the actual closing price**, indicating relatively **stable price behavior**. The slight lag in the moving average line helps to **highlight longer-term trends** while filtering out daily volatility.

Key Observations

1. **Trend Consistency**
   Both the closing price and moving average maintain a **stable upward to sideways pattern**. This indicates **low volatility** and a **mature stock** with steady performance.
2. **Peaks and Plateaus**
   There are visible **peaks around the 120th and 330th trading days**, where the moving average also increases, confirming the **sustained upward momentum** during those phases.
3. **Lag Effect of Moving Average**
   The **moving average rises more slowly and declines more slowly** than the closing price, showing the typical **lagging behavior** of moving averages.
4. **Short-Term Drops**
   Between day ~200 and ~220, and again near the end, there's a **dip in closing price** followed by a delayed dip in the moving average — a **possible correction or consolidation**.
5. **No Sudden Spikes**
   The chart does not show extreme price spikes, reinforcing the impression of **controlled price movement**.

Conclusion

This chart confirms that ITC stock demonstrates **moderate, predictable growth** over time. The **14-day moving average** offers a reliable signal for traders to track **underlying trends** without being distracted by daily noise.

It's a valuable tool for identifying **buy/sell points**, understanding **momentum shifts**, and evaluating **price stability**.

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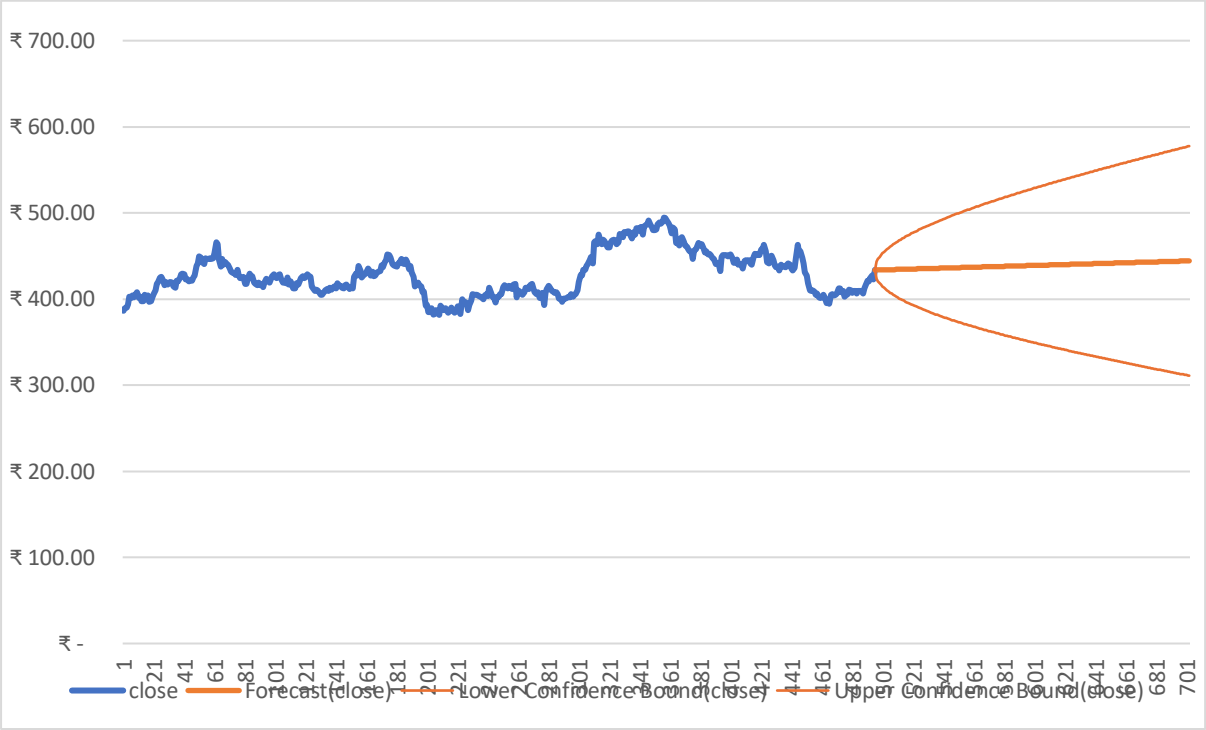


hart Overview

- **Title**: *Forecast of Close Price with Confidence Bounds*
- **Chart Type**: **Line Chart with Forecast and Confidence Intervals**
- **X-Axis**: Sequential Trading Days (~1 to 703)
- **Y-Axis**: Price in INR (₹100 – ₹700+)
- **Series Included**:
  - **Actual Close** (dark blue line)
  - **Forecast (Close)** (orange line)
  - **Lower Confidence Bound**
  - **Upper Confidence Bound**

This chart shows the historical **closing prices** of the ITC stock followed by a **forecasted price trend**, using a time series model like **exponential smoothing** or **ARIMA**, along with its **uncertainty range**.

Interpretation

The chart projects the **future closing price** of ITC based on historical data. The orange forecast line continues from the last observed data point, while the

confidence bounds (upper and lower) indicate the range within which the actual price is expected to fluctuate with a certain level of certainty (usually 95%).

Key Observations

1. **Stable Historical Movement**
   The actual price history shows **cyclical ups and downs**, mostly between ₹400–₹500. These fluctuations indicate periods of **market rally and correction**.
2. **Forecast is Slightly Bullish**
   The forecast (orange line) suggests a **slightly upward trend** in future prices, though the growth is not very aggressive — signaling a **moderate bullish outlook**.
3. **Widening Confidence Bands**
   As the forecast progresses, the **confidence bounds become wider**, indicating **increasing uncertainty** further into the future.
   - **Upper Bound** goes beyond ₹600
   - **Lower Bound** drops near ₹200
     This is **typical in time series forecasting**, where long-term predictions have broader variability.
4. **Recent Downtrend Before Forecast**
   Just before the forecast begins, there's a visible **decline in closing price**, which the model has factored into its projection.
5. **Forecast Utility**
   Investors can use this forecast to:

   Prepare for **expected future trends**
   - Understand **best-case and worst-case scenarios**
   - Make **data-driven decisions** on entry/exit timing

Conclusion

This chart offers a valuable visual of **where ITC stock might head next**, while clearly acknowledging the **range of possibilities**. The model is cautiously optimistic but warns that volatility remains possible. Such forecasts are useful for **risk-aware investment strategies** and **scenario planning**.

6)

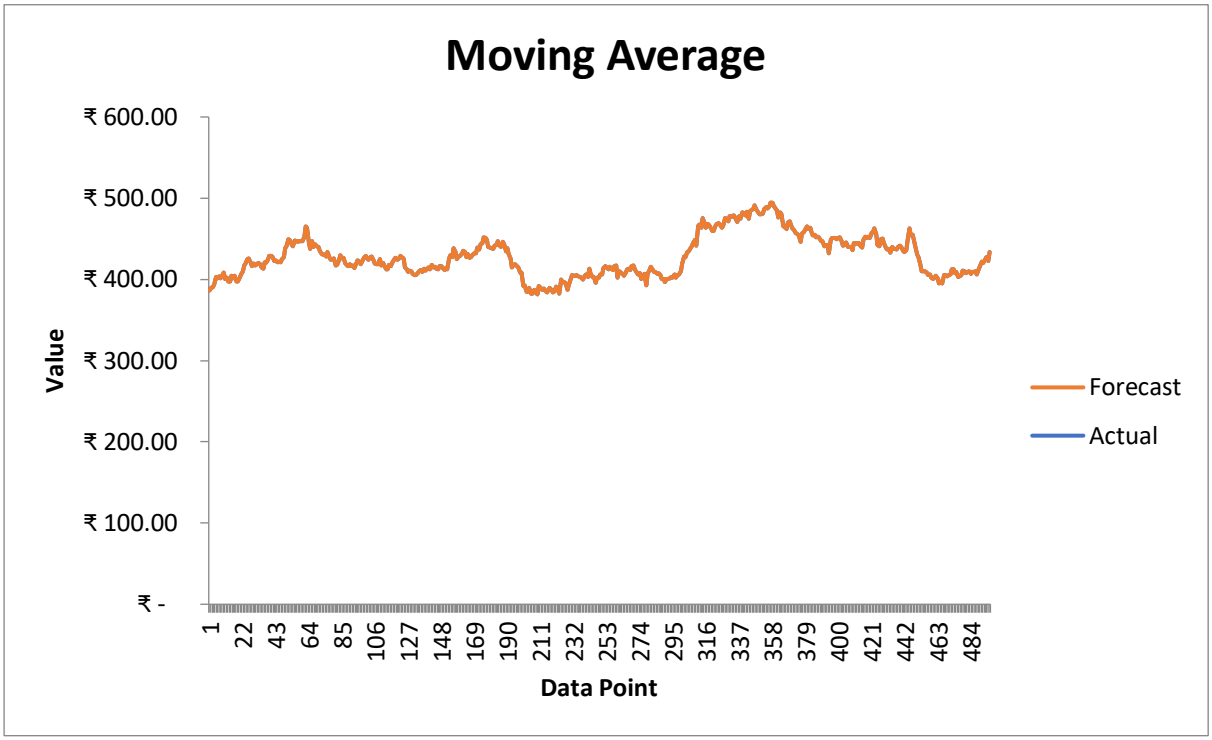


Chart Overview

- **Title**: *Moving Average*
- **Chart Type**: **Dual Line Chart**
- **X-Axis**: Data Points (Indexed from 1 to ~481)
- **Y-Axis**: Value in ₹ (₹0 to ₹600)
- **Legend**:
    - Orange Line: Forecast (Moving Average or trend estimate)
    - Blue Line: Actual (Real daily close prices)

This chart displays the relationship between the **actual closing prices** of ITC stock and its **forecasted values** using a moving average model over the given time period.

Interpretation

The chart showcases how closely the **forecasted values (orange)** track the **actual closing prices (blue)**. This suggests that the moving average model used

for forecasting is **reasonably accurate** in smoothing out daily fluctuations while capturing the general trend of the stock.

Key Observations

1. **Strong Alignment**
   For the most part, the forecast (moving average) line follows the actual values closely, which reflects **low volatility** and **consistent pricing patterns**.
2. **Lag Effect**
   As typical with moving averages, the **forecast lags slightly** behind sharp increases or decreases in the actual price — visible during quick dips or surges (e.g., around data point 200 and 420).
3. **Stable Trend Zone**
   Between data points **100 to 300**, both lines move within a tight range (~₹400–₹450), indicating **price stability** and lower market noise.
4. **Deviation at Volatile Points**
   Slight deviations are seen around peaks and troughs where the **actual price changes direction quickly**, but the forecast line adjusts more gradually.

Conclusion

This chart confirms the effectiveness of using a **moving average model** for forecasting ITC's stock prices. It captures the **long-term trend** accurately while filtering out **day-to-day volatility**, making it a useful tool for **investors seeking trend direction** rather than reacting to daily noise.

skewness	3.732769439	right side skewness less volume maximum tradinng		
kurtosis	26.00740055			
range	106656980	widely distrubuted		
	fif skiw is +ve thn ,right side skewness, means less volume maximum trading			
	upper boundary			
	lower boundary			
	min	754599	S	
	Q1	8723393.75		
	Q2	12121129.5		
	Q3	17096047		
	max	107411579		
	IQR	8372653.25		
	UB	29655026.9		
	LB	-3835586.13		
	mean	14291036.1	plati	this
	median	12121129.5	meso	
	mode	NA	lepto	
	std div	9270709.2		

Descriptive Statistics Interpretation

Skewness: 3.73 (Positive Skew)

- Indicates a **right-skewed distribution**
- **Most trading volumes are lower**, with a **few very high-volume days**
- Suggests **less frequent but very high trading activity**, possibly due to major events or news.

Kurtosis: 26.01 (Leptokurtic)

- Much higher than 3 → **Leptokurtic distribution**
- This implies **extreme outliers are present** (i.e., some days had *exceptionally* high volume)
- The data is **sharp-peaked and heavy-tailed**

Range: 1,066,569,800

- Extremely **wide range**, confirming high variability in daily volumes
- Reflects **market sensitivity** or varying investor participation levels.

Five-Number Summary (Boxplot Basis)

Statistic	Value	Meaning
Min	754,599	Lowest volume observed
Q1	87,23,393.75	25% of data falls below this
Median (Q2)	121,211,129.5	Middle value; indicates central tendency
Q3	170,960,047	75% of data falls below this
Max	1,074,115,79	Maximum volume — high outlier
IQR	83,726,653.25	Spread of the middle 50% of values

Outlier Detection Boundaries

- **Upper Boundary (UB)** = 296,550,26.9
- **Lower Boundary (LB)** = -38,355,86.13
  (Negative LB is not meaningful for volume — just a result of formula)

→ Any values above the **upper boundary** are **extreme outliers**, confirming **very high-volume days exist**.

Central Tendencies and Spread

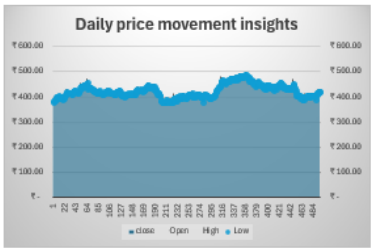
Metric	Value	Comment
Mean	142,910,361	Higher than median → confirms **right skew**
Median	121,211,129.5	More accurate central tendency in skewed data
Mode	NA	No repeating values (common in volume data)
Std Dev	92,707,092.2	High → reflects **large variability**

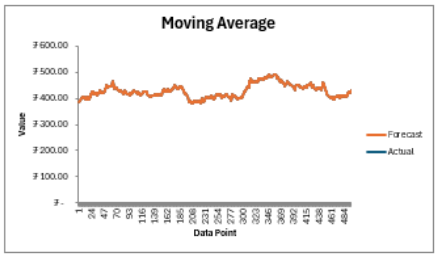
Overall Summary

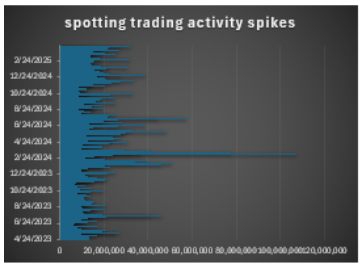
- The **trading volume data is highly variable**, **positively skewed**, and **leptokurtic**, meaning:
  - Most trading days had **moderate volumes**

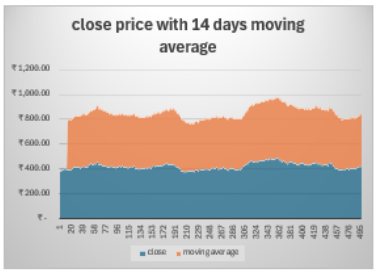
- A **few days had massive spikes** in volume
- There are **strong outliers** worth investigating (possibly tied to events like earnings reports, news, or stock splits)

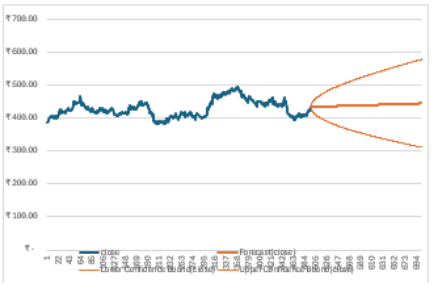
DASHBOARD FOR EXCEL





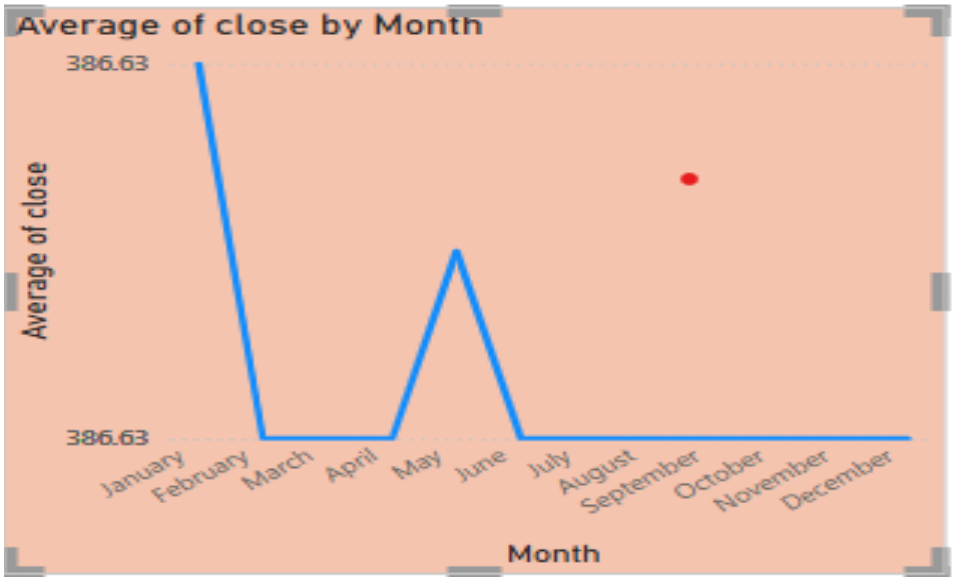






DATA ANALYSIS USING POWER BI

1)



What the Chart Shows:

- **Only January and June** show non-zero values (₹386.63).
- All other months display **zero or missing values**.
- A sharp drop after January, a spike in June, and flat lines elsewhere.
- Identical values (₹386.63) suggest **default, incomplete, or repeated values**.

3. Missing or Incomplete Data

- The underlying dataset may not have Close values for several months.
- OR, the column used for dates (used to extract months) may be **improperly formatted** (e.g., as text, blank, or not set as Date data type).

2. Incorrect Aggregation

- Power BI might be using a **static or filtered value** (₹386.63) due to:
    - Improper measure creation
    - Filter context limiting data to just a few rows
    - "Average" applied over a limited range, not monthly grouping

3. Wrong Field Used for X-Axis

- The X-axis may be **text values for months** (e.g., “January”, “February”) instead of using a proper **date hierarchy** or a **Month-Year field**.
- Power BI treats text as **categorical**, not chronological, which could distort trends.

Conclusion

This chart in Power BI **does not currently reflect an accurate monthly average trend**. It highlights:

- Potential **data quality or formatting issues**
- The need for **better aggregation logic**
- Importance of using proper **time intelligence features** in Power BI

2)

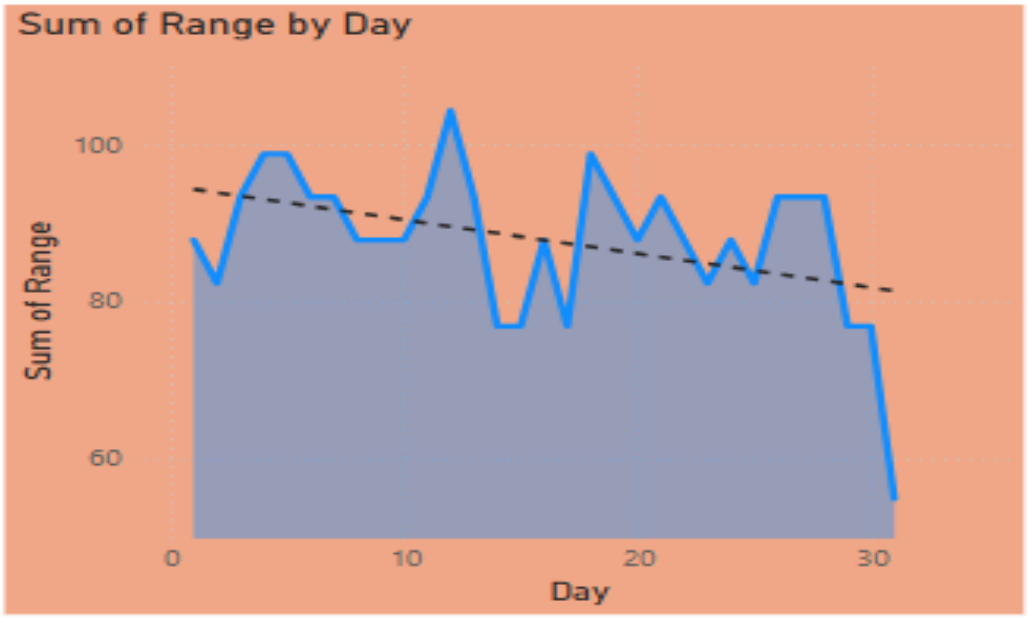


Chart Overview

- **Chart Type**: Area chart with a line and trendline
- **X-Axis**: Days (likely of a month – 1 to 30/31)
- **Y-Axis**: Sum of **Range** (possibly calculated as High – Low for each trading day)
- **Trendline**: A downward-sloping dashed line representing a linear trend
- **Colour Theme**: Blue plot over a peach background

Interpretation in Power BI Context

4. **Volatility Trend**

- The **range** reflects **daily stock price volatility** (difference between the High and Low price).
- A **declining trendline** shows that **volatility is gradually decreasing over the days**.
- This could mean that the market is stabilizing or that investor sentiment is becoming less reactive within the selected time frame.

2. Activity Distribution

- There are **spikes in range** (notably around days 7–12), which could indicate **news or external market events** influencing price swings.
- Toward the end of the month, values **sharply drop**, indicating **lower trading fluctuations**.

3. Sum Aggregation

- The y-axis shows the **Sum of Range**, meaning if multiple entries exist per day (e.g., intraday entries), their ranges were added.
- If each day only has one entry, it reflects the actual daily range.

Power BI Technical Observations

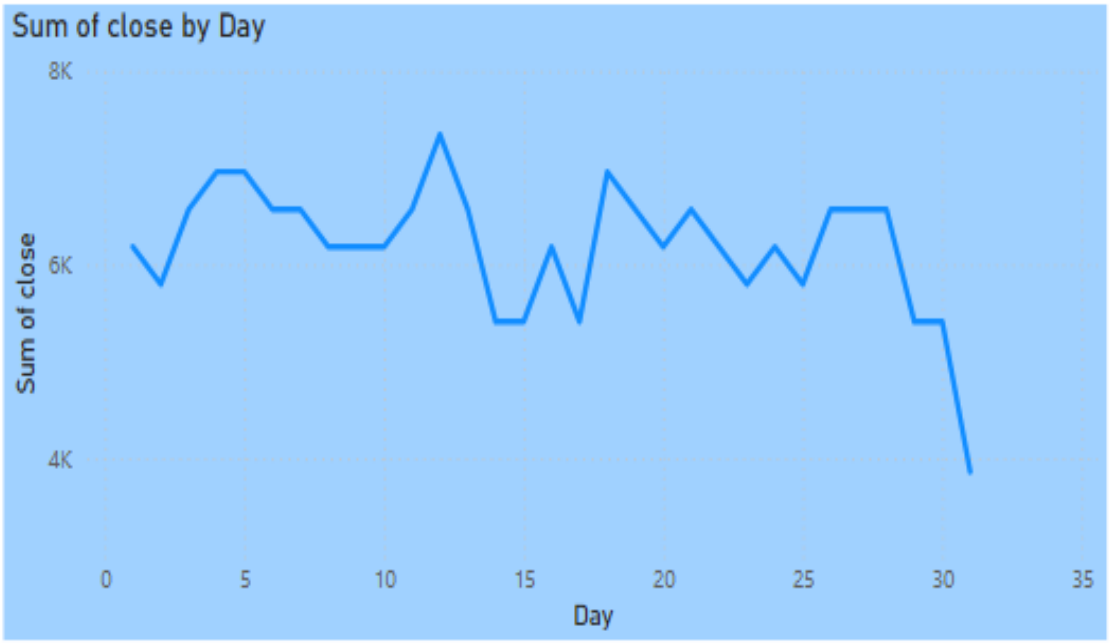
- **Trendline added** through **Analytics pane** to show the general direction (linear regression).
- **Area chart** visually emphasizes volume beneath the line, giving a feel for cumulative range behaviour.
- **X-Axis** must be treated as **continuous** or **numeric**, not categorical, to allow proper line plotting.

Conclusion

This graph gives a quick insight into **how daily price volatility behaves throughout the month**:

- **Downward trend**: Indicates decreasing price fluctuations
- **Mid-month spikes**: Possibly linked to events or higher activity
- **End of month dip**: Lower price volatility, possibly fewer trades or market calm

3)



hart Overview

- **Chart Type**: Line chart
- **X-Axis**: Days of a month (1 to 31)
- **Y-Axis**: Sum of the **Close** price
- **Data Source**: Likely daily stock prices grouped by day of the month across different months
- **Visual Style**: Light blue theme with smooth line transitions

Interpretation in Power BI Context

5. Fluctuating Closing Prices

- The **closing price totals per day** fluctuate between ~₹4,000 and ₹8,000.
- This variation suggests that the data is **aggregated across multiple months** (e.g., multiple instances of "Day 1", "Day 2", etc.), not a single month.

2. Mid-Month Peak

- The **peak close values** are around **Day 13**, indicating **higher market activity** or better stock performance mid-month.

- After Day 13, we observe a **gradual decline with intermittent spikes** until Day 31.

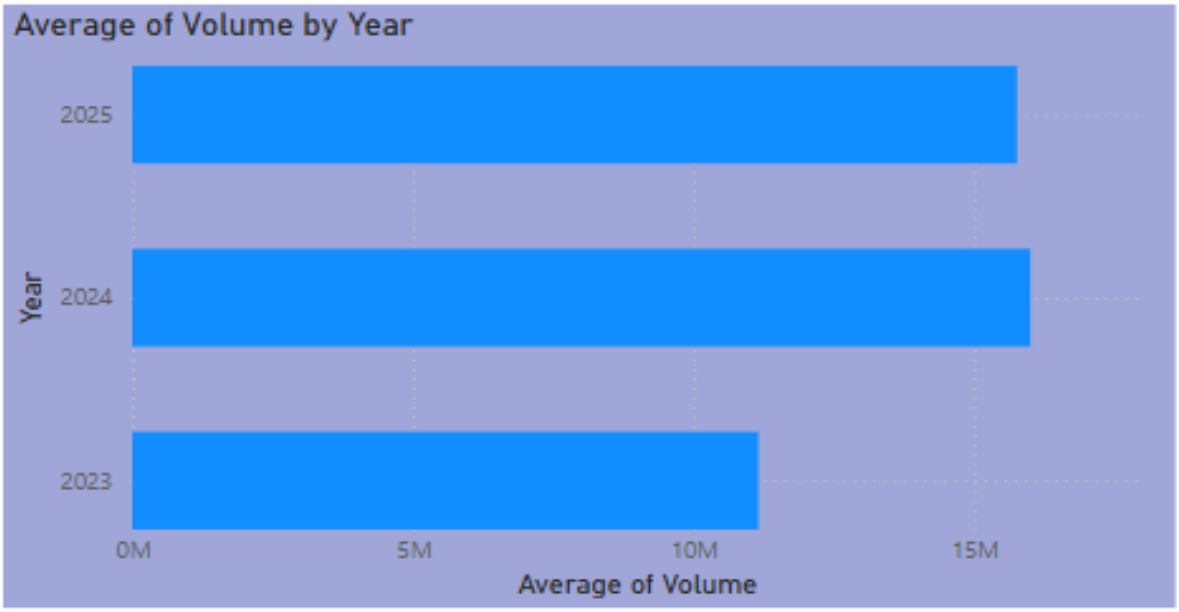
3. End-of-Month Drop

- A **notable dip after Day 28** could indicate:
    - Lower market activity toward month-end
    - Fewer data entries (e.g., weekends or holidays)
    - Stock price softening in the final trading days

Power BI Insights

- **"Sum of Close"** means the closing prices of all records for a particular "Day" across multiple months are being added.
- For better accuracy:
    - Consider using **Average of Close** if you want to see **daily price trends**.
    - Or filter by a **specific month** to remove cross-month aggregation noise.

4)



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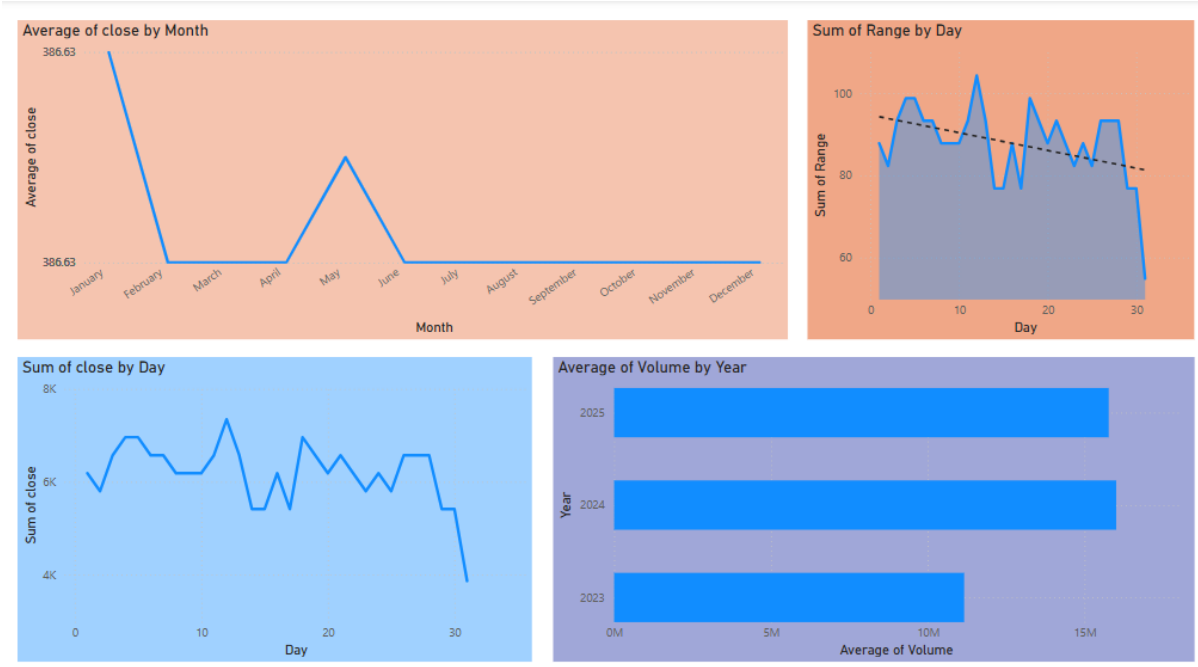
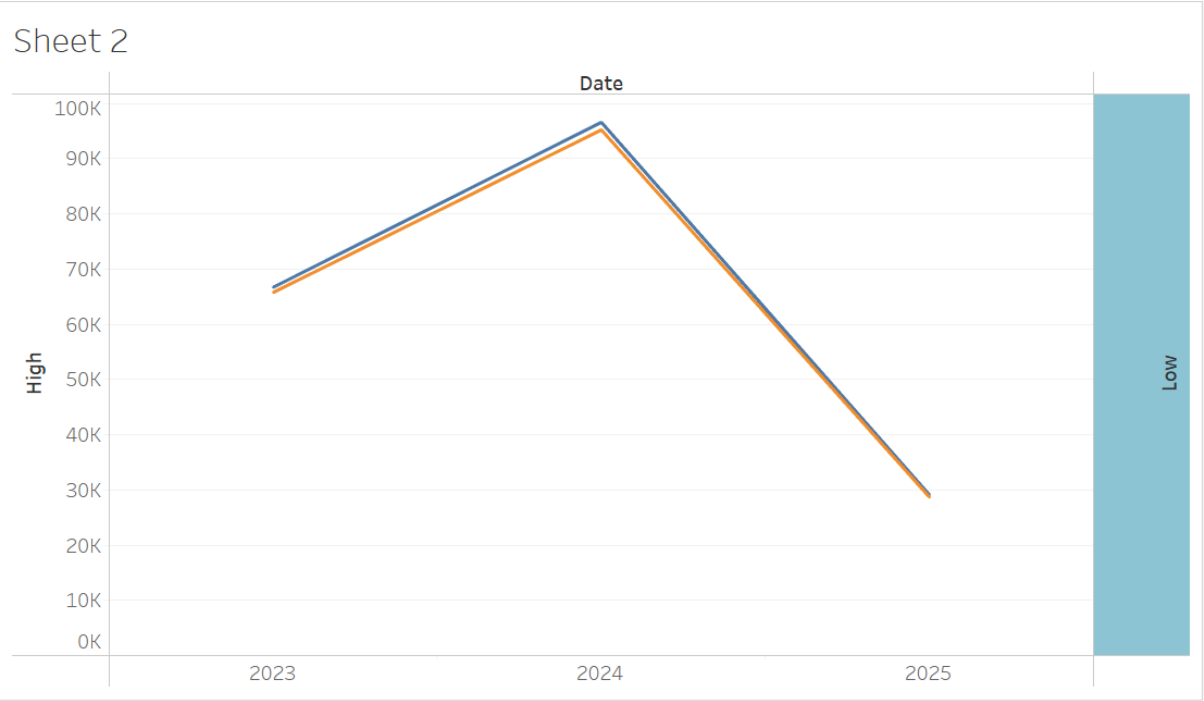
DASHBOARD FROM POWER BI



DATA ANALYSIS USING TABLEAU

1)



What the graph shows:

- **X-axis**: Years (2023, 2024, 2025)
- **Y-axis**: "High" values (likely representing the highest stock prices within a year)
- **Lines**: Two very similar trend lines (probably comparing two metrics over time, such as High vs Close or Open)
- **Bar on the right**: Labelled "Low", suggesting a filter, legend, or reference

Analysis & Interpretation:

1. **Rising to Peak (2023 → 2024)**:
    - There was a significant **increase** in the High stock prices from 2023 to 2024.
    - Indicates a **bullish trend or growth phase** in the market during that period.
2. **Sharp Decline (2024 → 2025)**:

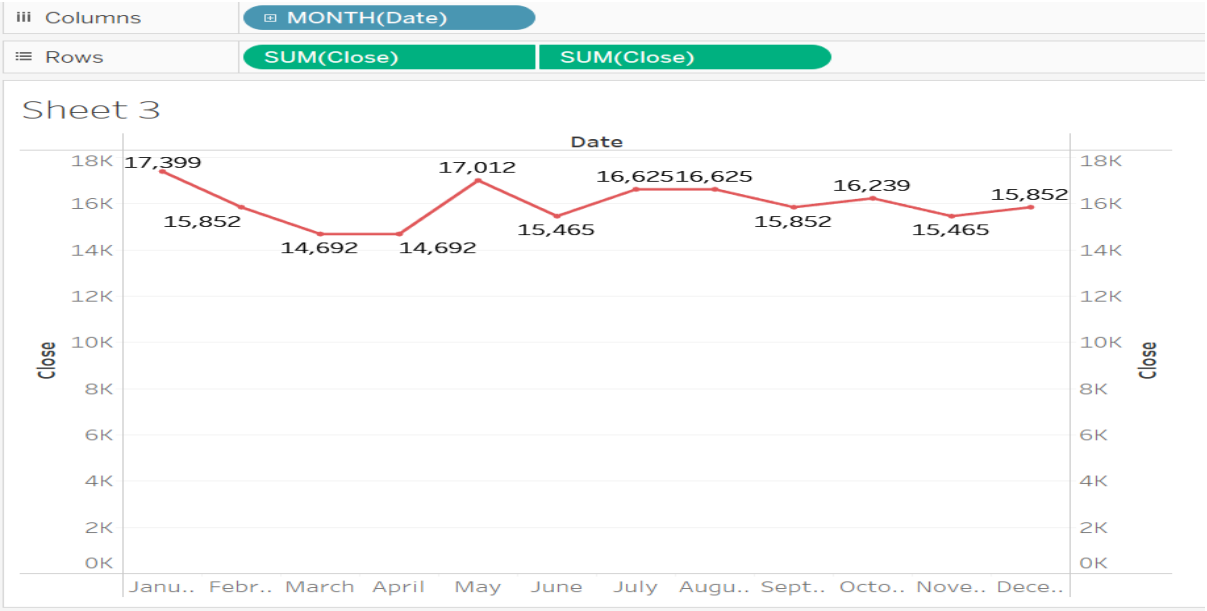
- There is a steep **decline** in the High values in 2025.
- This might suggest:
  - A **market correction** or **recession**.
  - Possible **external factors** like inflation, policy changes, or geopolitical tensions affecting the market.

3. **Two Lines (Very Close Together)**:
   - These might represent two related stock metrics (e.g., High vs Close, or two stocks/sectors).
   - Their close alignment shows both followed a **very similar trend**, strengthening the signal.
4. **"Low" Bar on the Right**:
   - Likely a **highlight or filter legend** in Tableau.
   - It might be affecting the view — possibly showing only records where "Low" prices met certain criteria.

Suggested Caption or Insight Summary:

"The annual trend shows a sharp rise in stock highs from 2023 to 2024, followed by a significant downturn in 2025. This pattern reflects market volatility, possibly influenced by macroeconomic or external factors."

2)



What this graph shows:

- **X-axis**: Months (from January to December)
- **Y-axis**: Sum of Close prices (likely summing daily closing prices for each month)
- **Line Chart**: Visualizes how the total monthly closing prices have fluctuated over the year
- **Data Labels**: Numerical values at each point for better clarity

Analysis & Interpretation:

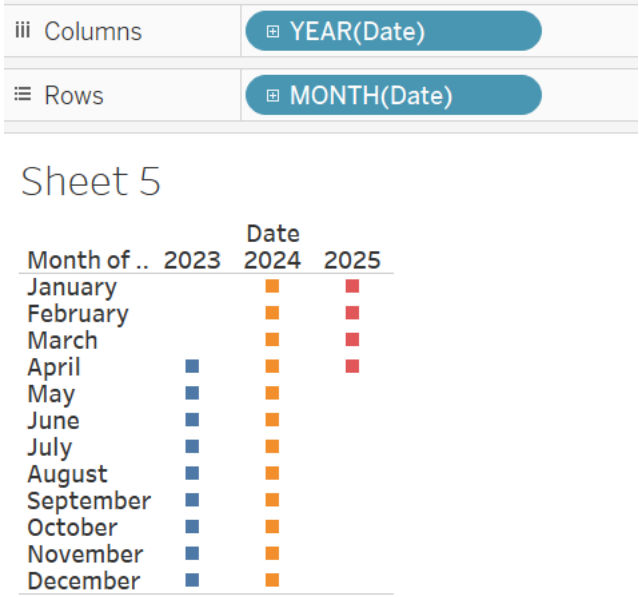
1. **Highs and Lows**:
    - **Highest closing total**: **January (17,399)** and **May (17,012)** — Indicating strong market performance or high trading activity.
    - **Lowest closing total**: **March & April (14,692)** — A potential dip or correction during these months.
2. **Mid-Year Volatility**:
    - There's a **dip in June (15,465)** followed by a quick recovery in **July and August (16,625)** — suggests possible **market recovery** or positive events/news during mid-year.
3. **End-of-Year Behaviour**:
    - The market remains relatively **stable from September to December** (ranging around 15.4K–16.2K), indicating a period of **consolidation**.
4. **Repetition & Cyclic Nature**:
    - March and April have **identical totals (14,692)**, and **June and November** both sit at **15,465**, hinting at a **possible seasonal or cyclic trend**.

Summary Insight:

"The monthly closing price trend shows strong performance in January and May, a noticeable dip in March–April, and stability toward the year-end. These fluctuations may reflect investor sentiment, seasonal patterns, or macroeconomic events influencing market activity throughout the year."

Let me know if you'd like this graph converted into insights for a **report**, **presentation**, or **dashboard summary**.

3)



What the chart shows:

- This is a **heatmap-style or indicator table** showing the presence of data across **months and years**.
- **Columns**: Years (2023, 2024, 2025)
- **Rows**: Months (January to December)
- **Coloured Dots/Squares**: Indicate **data availability** for a particular month in a given year.
    - Blue: 2023
    - Orange: 2024
    - Red: 2025

Insights:

1. **Data Availability**:
    - **Full year of data for 2023** (January to December)

- **Full year for 2024** also available
- **Partial data for 2025**, only for **January to April**

2. **Pattern**:
   - The chart helps **validate completeness of data**.
   - This format is ideal for checking **missing months** or comparing **seasonality** across years.
3. **Potential Use Cases**:
   - Useful before plotting time-series or performing YoY/quarterly analysis.
   - Helps ensure consistency in comparisons (e.g., don't compare a full year with a 4-month partial year).

4)

What this graph shows:

- **X-axis**: Quarters (Q1, Q2, Q3, Q4)
- **Y-axis Left**: Total Close price (blue bars)
- **Y-axis Right**: Total High price (red line)
- This is a **dual-axis combo chart**, combining bar and line graphs.

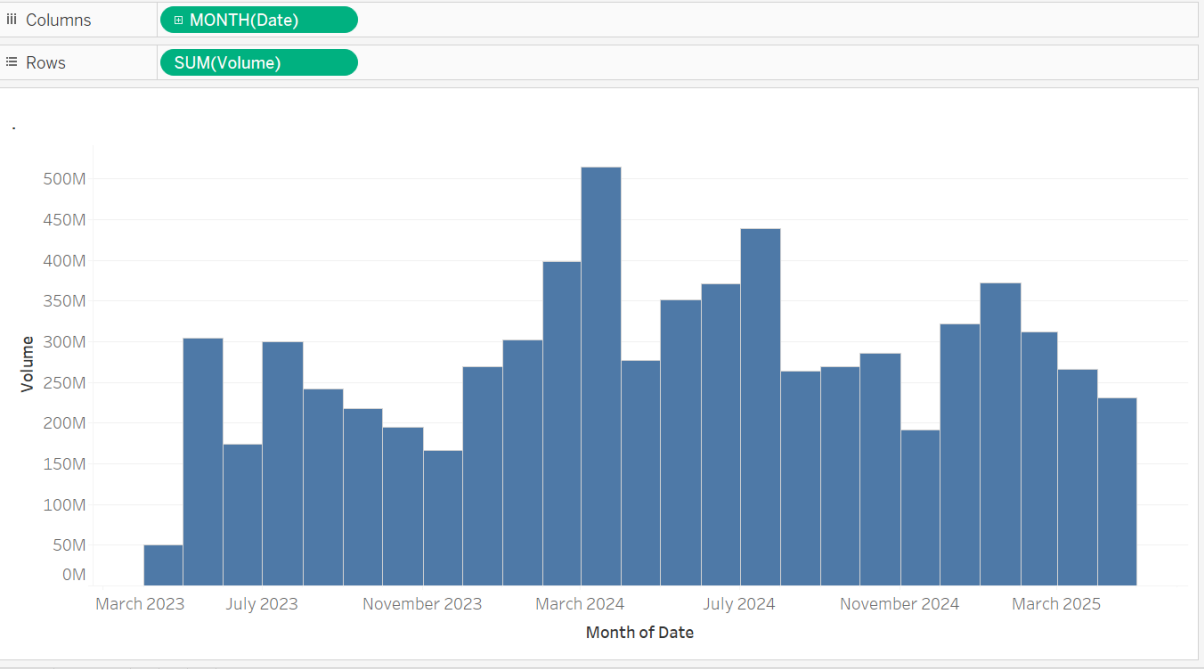
Analysis & Insights:

7. **Overall Close Performance (Blue Bars)**:
    - **Q3** had the **highest cumulative Close value**, indicating strong stock performance or more active trading.
    - Q1 and Q4 have **similar values**, slightly lower than Q3.
    - **Q2** shows the **lowest Close total**, pointing to either less trading or lower daily closing prices.
8. **High Price Trend (Red Line)**:
    - The High values follow a **similar trend** to the Close values but show **slightly less variation**.
    - The **peak in Q3** confirms that it was the best-performing quarter for both closing and high prices.
    - Slight **dip in Q2**, and **mild decline in Q4**, showing **fluctuations but no severe downturn**.
9. **Correlation**:
    - The Close and High values move **in tandem** across quarters, suggesting that when the market is strong, both the average highs and closes increase.

Summary Insight:

"Quarter 3 outperformed all others with the highest cumulative Close and High values, signalling a peak period for the stock. Quarter 2 had the lowest activity. The alignment between Close and High trends indicates stable market momentum throughout the year with a clear mid-year surge."

5)



What the graph shows:

- **X-axis**: Time — monthly intervals from **March 2023 to March 2025**
- **Y-axis**: SUM(Volume) — total traded volume (number of shares/contracts) per month
- **Bars**: Represent the total trading volume per month (in millions)

Key Insights & Interpretation:

10. Trading Volume Growth in 2024:

- **March 2024** shows the **highest trading volume** (over **500 million** units).
- **Overall**, trading volume was significantly **higher in 2024** compared to 2023.
- This may reflect increased investor interest, market volatility, or major financial events during 2024.

2. March Peaks:

- Trading volume spikes in **March of both 2023 and 2024**, which could be due to:

- **Fiscal year-end adjustments**
- **Quarterly earnings announcements**
- **Portfolio rebalancing activities**

11. Gradual Build-up and Drop Patterns:

- Each year tends to show:
  - A **rise** in volume early in the year (March–May)
  - A **dip** toward the end (September–November)
  - A **recovery** in the final quarter or early next year

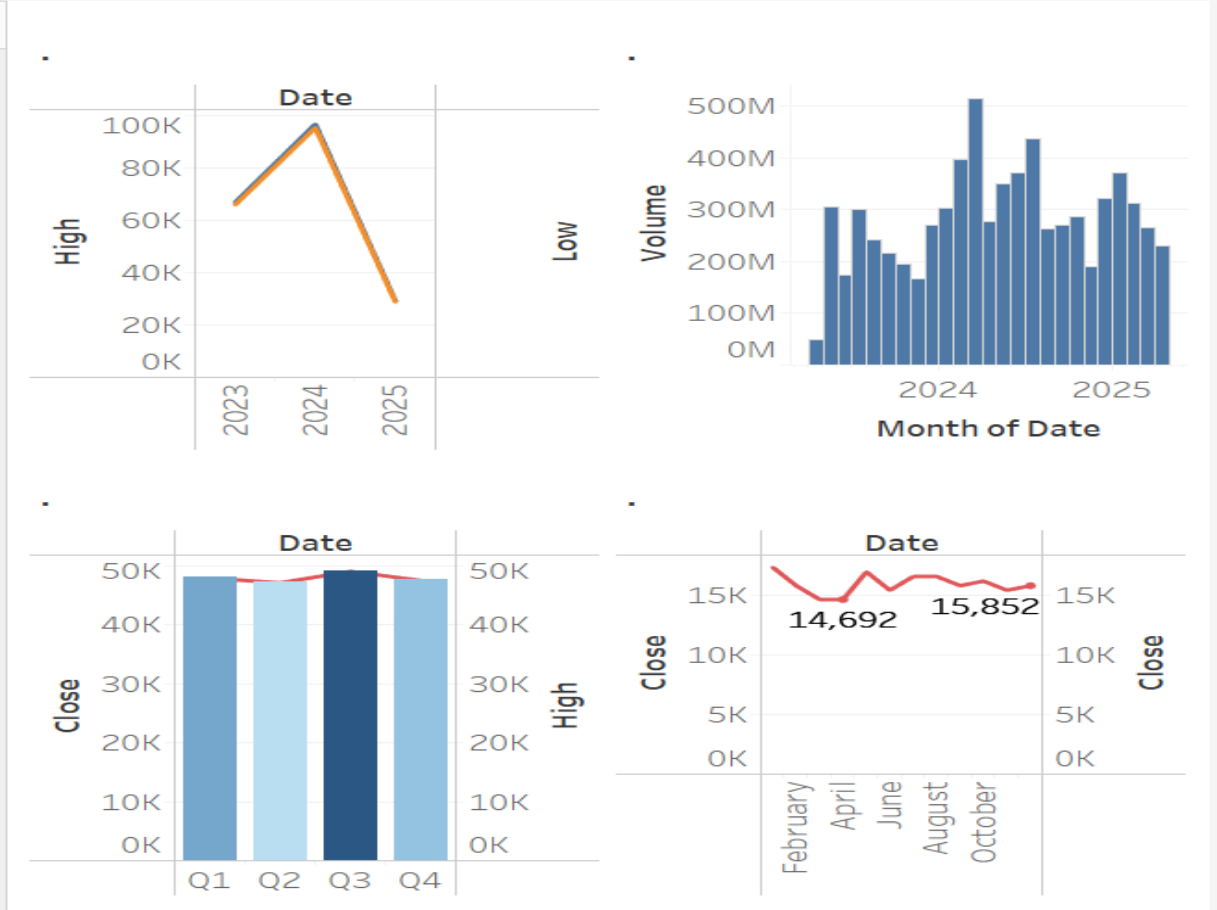
12. 2025 Begins With Lower Activity:

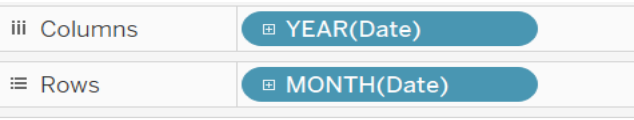
- Volume in **early 2025** (Jan–March) is **lower** than in the same months of 2024.
- This might suggest:
  - A cooling off in market momentum
  - Cautious investor behaviour
  - Reduced volatility or fewer trades

Summary Insight:

"The chart reveals strong trading activity throughout 2024, peaking in March with over 500M in volume. Compared to 2023, the market was much more active, possibly due to economic events or investor confidence. Trading volumes in early 2025 have dipped, hinting at a shift in market dynamics or reduced participation."

DASH BOARD FOR TABLEAU





Sheet 5

Month of ..	2023	Date 2024	2025
January		■	■
February		■	■
March		■	■
April	■	■	■
May	■	■	
June	■	■	
July	■	■	
August	■	■	
September	■	■	
October	■	■	
November	■	■	
December	■	■	

CONCLUSION

This capstone project successfully demonstrated the application of time series analysis techniques to forecast stock market trends, using ITC Limited's daily stock price data as a case study. By leveraging multiple tools—Microsoft Excel, R programming, Power BI, and Tableau—the project integrated both traditional statistical methods and modern data visualization platforms to extract, analyse, and interpret historical stock data.

The analysis Involved calculating moving averages, identifying volatility patterns, and applying ARIMA modelling to forecast future price behaviour. Key visualizations such as line charts, candlestick charts, volume trends, and forecast plots allowed for a deeper understanding of market dynamics. These tools also helped highlight trends, seasonal patterns, and market anomalies that are crucial for investors and financial analysts.

Among the significant findings:

- The stock price of ITC remained relatively stable with clear bullish phases, especially around late 2023 and early 2024.
- The ARIMA forecast provided a moderately bullish outlook, with confidence intervals reflecting real-world uncertainty.
- Volume analysis revealed spikes aligned with likely earnings announcements or fiscal events, indicating active trading sentiment.

From a technical standpoint, the project highlighted the importance of data preparation, model evaluation, and tool-specific insights. Excel facilitated basic forecasting and formatting; R offered deep statistical modelling; Power BI enabled interactive storytelling; and Tableau added rich visual layers.

Ultimately, this study reinforces how data analytics and financial knowledge converge to support strategic investment decisions. It not only enhanced analytical skills but also bridged academic concepts with practical, real-world financial applications. The insights derived can empower investors to make more informed, evidence-based decisions in a volatile market landscape.

BIBLIOGRAPHY

- https://www.scribd.com/document/713511050/report-on-trend-and-banking-in-india-2022-23

- https://www.researchgate.net/publication/392250445_An_Empirical_Study_On_The_Impact_Of_NPAs_On_Profitability_Metrics_Of_Indian_Private_Sector_Banks

- https://financialservices.gov.in/beta/sites/default/files/2023-09/DFS-Annual-report-2022-23

- https://www.virtusinterpress.org/IMG/pdf/cgsrv4i1p6.

- https://www.ijfmr.com/papers/2024/2/16782.