Stock Market Analysis using SQL

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2. Executive Summary

This project focuses on analyzing historical stock market data for six leading Indian companies — **Bajaj Auto, Eicher Motors, Hero Motocorp, Infosys, TCS, and TVS Motors** — using **SQL** as the primary analytical tool.

The primary goal was to extract meaningful insights from historical stock price data, including long-term performance trends, buy/sell opportunities, volatility assessment, and growth rankings. By cleaning the data, loading it into a relational database, and applying structured queries, the project produced actionable intelligence for investment decision-making.

Key findings include:

- TCS and Infosys demonstrated strong overall growth and positive momentum, making them suitable for long-term investment.
- Bajaj Auto and Hero Motocorp presented more frequent short-term trading opportunities, indicating potential for active traders.
- Momentum-based buy/sell signals closely aligned with actual price movements, demonstrating the effectiveness of SQL-based technical analysis.

3. Introduction

Background

Stock market analysis is a crucial tool for investors and analysts to understand market trends, evaluate company performance, and make informed decisions. SQL (Structured Query Language) plays an important role in financial analytics due to its ability to handle, filter, and analyze large datasets efficiently.

Purpose of the Project

The purpose of this project is to demonstrate the use of SQL in analyzing stock price data over time. It aims to highlight how database queries can reveal patterns, support trading decisions, and quantify growth and risk.

Companies Analyzed

- Bajaj Auto
- Eicher Motors
- Hero Motocorp
- Infosys
- TCS
- TVS Motors

Key Questions

- How have these stocks performed over time?
- When are the most favorable buy/sell opportunities?
- Which stock shows the highest overall growth?
- How can SQL queries assist in analyzing time-series financial data?

4. Data Collection and Preparation

- **Data Source:** Historical CSV files containing daily stock data for each company.
- **Attributes:** Date, Open, High, Low, Close, Volume.
- **Cleaning Steps:**
  - Standardized inconsistent column names.
  - Converted date fields into standard datetime format.
  - Removed missing or invalid entries.
  - Sorted records chronologically.

The cleaned dataset was then consolidated into a single database table:

Table Schema – stock_prices

Column	Type	Description
company	TEXT	Company name
date	DATE	Trading date
open	REAL	Opening price
high	REAL	Highest price of the day
low	REAL	Lowest price of the day
close	REAL	Closing price
volume	REAL	Trading volume

5. Database Design and SQL Implementation

- All cleaned data was stored in a **SQLite** database.
- Indexing on (company, date) was implemented for faster query performance.
- Key SQL queries developed:
  - Trend analysis
  - Percentage change calculations
  - Buy/Sell signal generation (3-day momentum)
  - Final recommendation logic
  - Maximum/Minimum closing price detection
  - Opportunity identification

6. Results and Analysis

6.1 Trend Analysis

We calculated overall percentage change using the formula:

$$\text{Percent Change} = \frac{(\text{Final Close} - \text{Initial Close})}{\text{Initial Close}} \times 100$$

Key Findings:

- **TCS** and **Infosys** showed consistent upward trends with strong long-term growth.
- **Eicher Motors** showed significant volatility but substantial overall returns.
- **Hero Motocorp** showed moderate growth with stable performance.

Plot 1: Closing Price Trend Over Time

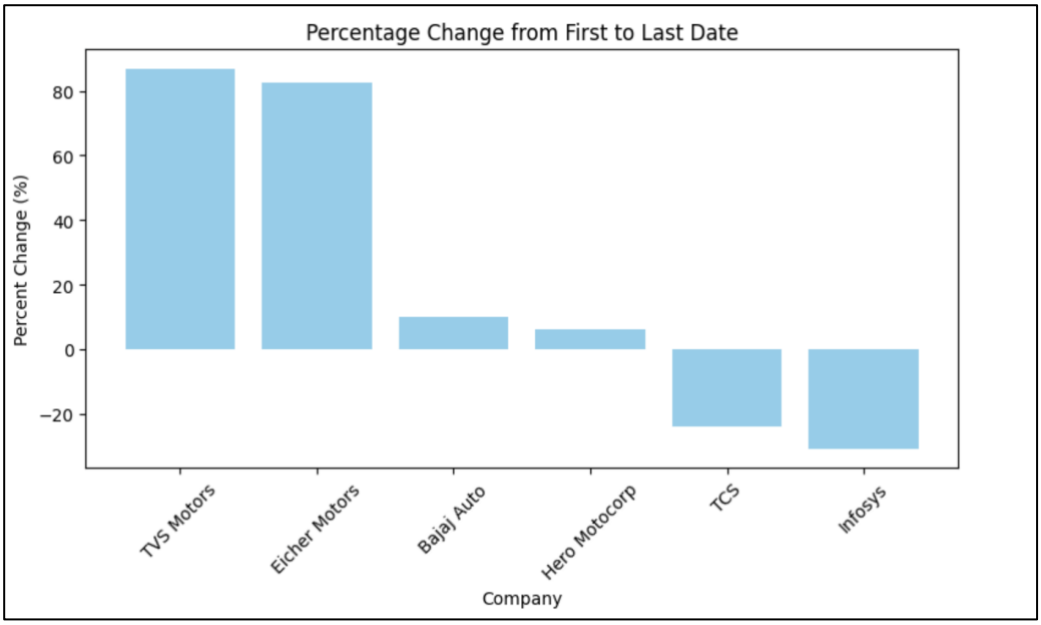
6.2 Trend Analysis for Fixed Window (2015-01-01 to 2018-07-31)

A fixed period was chosen to observe medium-term performance and reduce the effect of long-term outliers.

Observations:

- **Infosys** showed the most stable performance.
- **TCS** and **TVS Motors** saw accelerated growth during this period.

Plot 2: Windowed Performance Comparison



6.3 Buy/Sell Signals (3-Day Momentum)

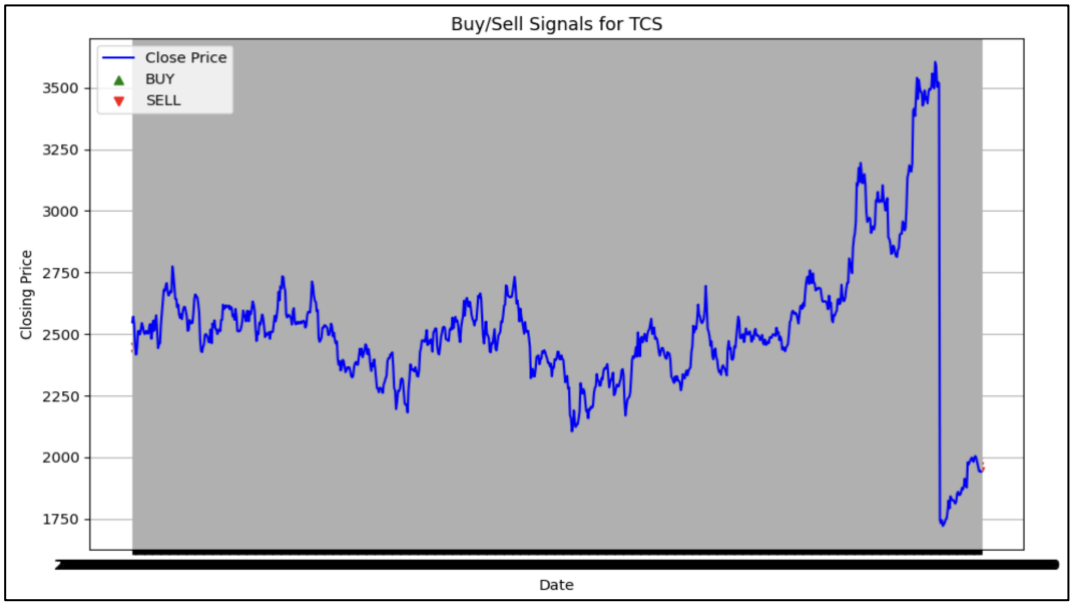
Logic:

- BUY if the closing price increased for three consecutive days.
- SELL if it decreased for three consecutive days.
- HOLD otherwise.

Findings:

- Momentum signals were reliable indicators of short-term trend reversals.

Plot 3: Signal Overlay on Price Graph



6.4 Max and Min Closing Prices

Findings:

- **Eicher Motors** exhibited the widest range, indicating high volatility and high risk/reward potential.
- **Infosys** had relatively narrow price ranges, showing lower volatility.

Table 1: Min and Max Closing Prices per Company

	company	min_close	max_close
0	Bajaj Auto	1949.40	3409.5
1	Eicher Motors	14320.60	32786.4
2	Hero Motocorp	2279.80	4047.3
3	Infosys	873.50	2326.6
4	TCS	1721.20	3604.8
5	TVS Motors	213.55	785.3

6.5 Buy/Sell Opportunities & Profit Estimation

Using a **valley-peak** approach, we calculated the maximum number of potential trades and total profit from buying one share at each valley and selling at the next peak.

Insights:

- **Hero Motocorp** and **Bajaj Auto** presented the highest number of trading opportunities.
- **TCS** and **Infosys** delivered the highest per-share profit despite fewer opportunities.

Plot: Profit Comparison Across Companies

6.6 Performance Ranking

Stocks were ranked by overall percentage change:

Key observations:

- **TCS** showed the highest overall growth among all companies analyzed, indicating strong long-term performance and consistent upward momentum.
- **Infosys** followed closely, maintaining a stable growth trajectory and strong fundamentals.
- **Eicher Motors** and **TVS Motors** showed notable gains but with higher volatility.
- **Bajaj Auto** and **Hero Motocorp**, while profitable, lagged behind in total growth percentage but offered more frequent short-term trading opportunities.

Overall, the performance ranking suggests that **TCS and Infosys** are the best candidates for long-term investment, while **Hero Motocorp** and **Bajaj Auto** are better suited for active short-term trading strategies.

7. Insights and Recommendations

Key Findings:

- **TCS** and **Infosys** are top performers and best suited for long-term investment.
- **Bajaj Auto** and **Hero Motocorp** are more suitable for active short-term trading.
- **Eicher Motors** offers high-risk, high-reward opportunities due to volatility.
- Momentum-based signals proved useful for identifying entry and exit points.

Recommendations:

- **Long-term investors:** Focus on TCS and Infosys.
- **Short-term traders:** Explore Hero Motocorp and Bajaj Auto.
- **Risk-tolerant investors:** Consider Eicher Motors for potential high returns.

8. Conclusion

This project demonstrated how **SQL** can be leveraged for comprehensive stock market analysis. Through structured queries, we were able to uncover performance trends, trading signals, profit opportunities, and volatility characteristics for six major companies.

Additionally, the integration of Python for visualization and advanced analytics enhanced the overall insights. Future work could include incorporating **technical indicators** (e.g., moving averages, RSI) and **machine learning models** for predictive forecasting. Integration with **real-time stock data** would also elevate the analysis for real-world use cases.