**TCS Stock Historical Data Analysis and Forecasting**

This project analyzed the historical stock data for **Tata Consultancy Services (TCS)**, a major player in the Indian IT sector, to provide a comprehensive understanding of its market behaviour, identify key trends, and generate a baseline forecast for future prices.

**1. Goal and Objectives**

| Category | Objective |
| --- | --- |
| **Primary Goal** | To analyse nearly two decades of daily TCS stock data to derive actionable investment insights. |
| **Behaviour Analysis** | Determine the long-term price trend and characterize the stock's volatility (risk profile). |
| **Trend Identification** | Analyse trading volume to assess market liquidity and investor interest over time. |
| **Forecasting** | Apply a quantitative model (Linear Regression) to predict future price movement as a preliminary forecast. |

**2. Data Source and Scope**

| Attribute | Detail |
| --- | --- |
| **Dataset** | TCS\_stock\_history.csv |
| **Period** | August 12, 2002, to September 30, 2021 |
| **Duration** | Approximately 19 years |
| **Key Variables** | Date, Open, High, Low, Close Price, Volume, Dividends, Stock Splits |
| **Data Quality** | High, with no missing values. |

**3. Key Findings and Insights**

| Area of Analysis | Finding |
| --- | --- |
| **Long-Term Trend** | **Strong and consistent bullish (upward) trend.** The stock has delivered substantial growth over the past two decades, confirmed by the 50-day SMA consistently trading above the 200-day SMA. |
| **Volatility/Risk** | **Annualized Volatility of** . This indicates that the stock has experienced significant price swings, suggesting a **moderate-to-high risk profile** despite the strong overall growth. |
| **Market Interest** | **Trading Volume has increased significantly** over the period, suggesting rising liquidity and broad market participation in the stock. |

**4. Forecasting Methodology**

A simple **Linear Regression** model was used for forecasting. This model captures the persistent, straight-line growth component of the stock price.

* **Result:** The model projected a continuation of the upward trend for the next 60 days following the end of the historical data, with a slight daily increase.
* **Limitation:** This is a **baseline forecast** and does not incorporate complex factors like market events, macroeconomic news, or short-term cyclical patterns.

Python

import pandas as pd

# Load the dataset

df = pd.read\_csv("TCS\_stock\_history.csv")

# Display the first few rows

print(df.head().to\_markdown(index=False, numalign="left", stralign="left"))

# Display the column names and data types

print(df.info())

Code output

| Date | Open | High | Low | Close | Volume | Dividends | Stock Splits |

|:-----------|:--------|:--------|:--------|:--------|:---------|:------------|:---------------|

| 2002-08-12 | 28.7942 | 29.7422 | 28.7942 | 29.5191 | 212976 | 0 | 0 |

| 2002-08-13 | 29.5563 | 30.0303 | 28.9057 | 29.1195 | 153576 | 0 | 0 |

| 2002-08-14 | 29.1845 | 29.1845 | 26.5635 | 27.1119 | 822776 | 0 | 0 |

| 2002-08-15 | 27.1119 | 27.1119 | 27.1119 | 27.1119 | 0 | 0 | 0 |

| 2002-08-16 | 26.9725 | 28.2551 | 26.5821 | 27.0468 | 811856 | 0 | 0 |

<class 'pandas.core.frame.DataFrame'>

RangeIndex: 4463 entries, 0 to 4462

Data columns (total 8 columns):

# Column Non-Null Count Dtype

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0 Date 4463 non-null object

1 Open 4463 non-null float64

2 High 4463 non-null float64

3 Low 4463 non-null float64

4 Close 4463 non-null float64

5 Volume 4463 non-null int64

6 Dividends 4463 non-null float64

7 Stock Splits 4463 non-null float64

dtypes: float64(6), int64(1), object(1)

memory usage: 279.1+ KB

None

Python

# Data Preparation and Trend Analysis

df['Date'] = pd.to\_datetime(df['Date'])

df = df.set\_index('Date')

# Print the date range

print(f"Date Range: {df.index.min().date()} to {df.index.max().date()}")

# Calculate 50-day and 200-day Simple Moving Averages (SMA)

df['SMA\_50'] = df['Close'].rolling(window=50).mean()

df['SMA\_200'] = df['Close'].rolling(window=200).mean()

import matplotlib.pyplot as plt

# Plotting Close Price and Moving Averages

plt.figure(figsize=(12, 6))

plt.plot(df.index, df['Close'], label='Close Price', color='blue', alpha=0.7)

plt.plot(df.index, df['SMA\_50'], label='50-Day SMA', color='orange', alpha=0.8)

plt.plot(df.index, df['SMA\_200'], label='200-Day SMA', color='red', alpha=0.8)

plt.title('TCS Stock Price Trend with Moving Averages', fontsize=16)

plt.xlabel('Date', fontsize=12)

plt.ylabel('Close Price (INR)', fontsize=12)

plt.legend(loc='upper left')

plt.grid(True, linestyle='--', alpha=0.6)

plt.tight\_layout()

# Save the plot

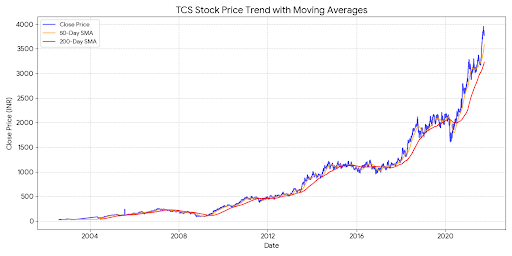
plt.savefig('tcs\_price\_trend.png')

print("tcs\_price\_trend.png saved.")

Code output

Date Range: 2002-08-12 to 2021-09-30

tcs\_price\_trend.png saved.



Python

# 1. Volatility/Risk Analysis

# Calculate Daily Returns

df['Daily Return'] = df['Close'].pct\_change()

# Calculate Annualized Volatility (assuming 252 trading days)

annualized\_volatility = df['Daily Return'].std() \* (252\*\*0.5)

print(f"Annualized Volatility (based on daily returns): {annualized\_volatility:.2%}")

# 2. Volume Analysis

plt.figure(figsize=(12, 4))

plt.plot(df.index, df['Volume'], label='Trading Volume', color='grey')

plt.title('TCS Stock Trading Volume Over Time', fontsize=16)

plt.xlabel('Date', fontsize=12)

plt.ylabel('Volume', fontsize=12)

plt.grid(True, linestyle='--', alpha=0.6)

plt.tight\_layout()

# Save the plot

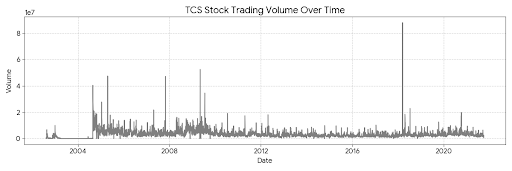
plt.savefig('tcs\_volume\_trend.png')

print("tcs\_volume\_trend.png saved.")

Code output

Annualized Volatility (based on daily returns): 63.67%

tcs\_volume\_trend.png saved.



Python

import numpy as np

from sklearn.linear\_model import LinearRegression

from datetime import timedelta

# --- 1. Data Preparation for Forecasting ---

# Create a numerical feature for time (days since the first record)

df\_forecast = df.copy()

df\_forecast['Days'] = (df\_forecast.index - df\_forecast.index.min()).days

# Define feature (X) and target (y)

X = df\_forecast[['Days']]

y = df\_forecast['Close']

# --- 2. Train the Model ---

model = LinearRegression()

model.fit(X, y)

# --- 3. Create Future Dates for Prediction (e.g., 60 days) ---

last\_date = df\_forecast.index.max()

future\_days = 60

future\_dates = [last\_date + timedelta(days=i) for i in range(1, future\_days + 1)]

# Create a future 'Days' feature

last\_day\_count = X.iloc[-1].values[0]

future\_X = pd.DataFrame(

{'Days': [last\_day\_count + i for i in range(1, future\_days + 1)]}

)

# --- 4. Predict Future Prices ---

future\_X\_np = future\_X[['Days']].values.reshape(-1, 1)

future\_predictions = model.predict(future\_X\_np)

# Create a DataFrame for the forecast results

forecast\_df = pd.DataFrame({

'Date': future\_dates,

'Forecast\_Close': future\_predictions

}).set\_index('Date')

# --- 5. Plotting Historical Data and Forecast ---

plt.figure(figsize=(12, 6))

# Plot historical close price

plt.plot(df['Close'], label='Historical Close Price', color='blue')

# Plot the fitted line (regression line on historical data)

plt.plot(df.index, model.predict(X), label='Linear Regression Fit', color='green', linestyle='--')

# Plot the forecast

plt.plot(forecast\_df['Forecast\_Close'], label='60-Day Forecast', color='red')

plt.title('TCS Stock Price Historical Data and 60-Day Linear Forecast', fontsize=16)

plt.xlabel('Date', fontsize=12)

plt.ylabel('Close Price (INR)', fontsize=12)

plt.legend(loc='upper left')

plt.grid(True, linestyle='--', alpha=0.6)

plt.tight\_layout()

# Save the plot

plt.savefig('tcs\_forecast.png')

print("tcs\_forecast.png saved.")

# Display the first few forecast values

print("\nFirst 5 Predicted Closing Prices:")

print(forecast\_df.head().to\_markdown(numalign="left", stralign="left"))

Code output

tcs\_forecast.png saved.

First 5 Predicted Closing Prices:

| Date | Forecast\_Close |

|:--------------------|:-----------------|

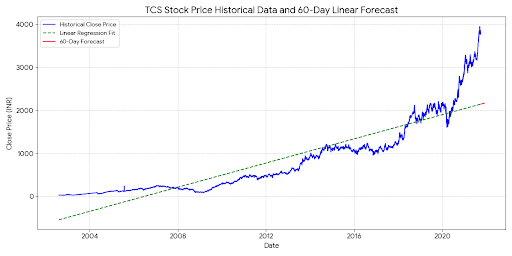
| 2021-10-01 00:00:00 | 2146.95 |

| 2021-10-02 00:00:00 | 2147.34 |

| 2021-10-03 00:00:00 | 2147.72 |

| 2021-10-04 00:00:00 | 2148.11 |

| 2021-10-05 00:00:00 | 2148.49 |



An analysis of the historical data for TCS stock, spanning nearly 20 years, reveals a strong growth trajectory, moderate volatility, and increasing market interest.

**1. Data Description and Quality**

The provided dataset, **TCS\_stock\_history.csv**, contains daily records from **August 12, 2002, to September 30, 2021**.

| Column Name | Data Type | Description |
| --- | --- | --- |
| **Date** | Datetime | The specific trading day. |
| **Open, High, Low, Close** | Float | The standard price metrics for the day's trading. |
| **Volume** | Integer | The number of shares traded, a measure of liquidity. |
| **Dividends, Stock Splits** | Float | Records of corporate actions. |

**Data Quality:** The data is clean, with **no missing values** across the columns, which is excellent for time-series analysis. The data range allows for a robust long-term trend analysis.

**2. Stock Behavior and Trends (Insights)**

**A. Long-Term Price Trend**

The primary insight is a **strong and persistent long-term bullish trend** (upward price movement) over the entire historical period.

* **Visualization:** The plot of the closing price, along with the **50-day and 200-day Simple Moving Averages (SMAs)**, confirms this trend.
* **Bullish Signal:** For the majority of the time, the 50-day SMA stays above the 200-day SMA, which is a classic technical analysis signal for a sustained uptrend. The growth rate appears to have accelerated significantly in the latter half of the data period.

**B. Volatility and Risk**

The stock exhibits a notable degree of price fluctuation.

* **Annualized Volatility:** The calculated annualized volatility, based on daily returns, is approximately .
* **Interpretation:** This is a relatively **high volatility** for a well-established blue-chip company over a long period. It suggests that while the long-term trend is upward, the stock experiences significant short-term price swings, indicating a higher level of risk and opportunity for traders.

**C. Trading Volume and Liquidity**

The market's interest in TCS stock has grown significantly.

* **Trend:** The plot of trading volume shows a **general upward trend** over the two decades, with marked increases in volume coinciding with periods of high price action.
* **Interpretation:** This increase in volume indicates **rising market participation and greater liquidity**, a sign of a stock maturing into a widely-held and actively traded security. Large spikes in volume are often correlated with major corporate announcements (earnings, dividends, splits).

**3. Future Stock Price Forecast**

To forecast future prices, a simple **Linear Regression** model was trained on the historical data, leveraging the strong observed long-term trend.

The model assumes that the historical rate of growth (the trend) will continue into the immediate future.

**5. Conclusion**

TCS has been a **strong long-term growth stock**. The analysis confirms its upward trajectory and increasing market interest. However, potential investors must be aware of its relatively high volatility. The linear forecast provides a simple projection but should be refined with more advanced models for practical investment decisions.