Price Trends and Volatility-Driven Movements in TCS Ltd. Two Decades of Evidence from BSE

Christeena Thomas

Published By

Ambitious Books
Empowering, Simplifying, Supporting, Affordable

978-81-984787-7-1

PRICE TRENDS AND VOLATILITY-DRIVEN MOVEMENTS IN TCS LTD.: TWO - DECADES OF EVIDENCE FROM BSE

A Research Monograph

By

Christeena Thomas

Assistant Professor of Commerce,

Christ College, Puliyanmala, Kattappana, Idukki

This work is published as a Research Monograph
under the PG Department of Commerce,
Christ College.

Price Trends and Volatility-Driven Movements in TCS Ltd.: Two-Decades of Evidence from BSE

Author:

Christeena Thomas

Price: 100

ISBN: 978-93-47890-09-3 (E Book)

ISBN: 978-81-984787-7-1 (Print)

https://dx.doi.org/10.37298/abpl978-81.23

Download similar works from:

https://abplpublications.co.in/CCP

First Published on:

19-12-2025

Published by:
Ambitious Books, Kerala
https://abplpublications.co.in

TABLE OF CONTENT

FOREWORD

I am pleased to present this book, which serves as a significant outcome of the workshop conducted by the PG Department of Commerce on *"Secondary Data and AI-Assisted Research Tools."* This publication reflects the department's commitment to strengthening the research culture of the institution by embracing modern analytical techniques and technological advancements.

The initiative taken by the Commerce Department is highly commendable. By integrating artificial intelligence into academic research practices, the department has set an excellent example for others to follow. This book stands as a model that can inspire all departments to adopt similar innovative strategies to enhance the quality and visibility of their academic output.

This publication forms an important part of the department's ongoing research initiatives, aimed at promoting a structured and progressive approach to academic inquiry. It also opens the possibility for annual publications of PG and UG research works, thereby creating a continuous and sustainable platform

for scholarly contributions from the department. In the future, the department hopes and aspires to bring out many more such publications, further strengthening its academic and research footprint.

I congratulate the PG Department of Commerce for its vision, dedication, and academic leadership. I am confident that this book will serve as a valuable reference for researchers, faculty members, and all those interested in quality-driven academic work.

Dr. M V Georgekutty
Principal, Christ College

PREFACE

This study is an analytical exploration of the stock price behaviour of Tata Consultancy Services (TCS) over a twenty-year period from January 2005 to May 2025. Grounded in empirical evidence and supported by modern analytical tools, the work examines long-term market trends, volatility movements, trading dynamics, and the interrelationship among key price variables. Using monthly secondary data, the study employs descriptive statistics, time-series visualisation, correlation analysis, normality testing, the Sign Test, and rank-based correlation techniques to interpret the behaviour of one of India's leading IT companies within the evolving financial landscape.

The relevance of this work lies in its systematic, data-driven approach and the integration of AI-assisted research tools that enhance accuracy, depth, and clarity in financial analysis. By analysing a major Indian stock comprehensively, this study provides a replicable framework for conducting secondary-data-based stock market research using modern statistical and econometric methods. It is intended to serve as a useful reference for researchers, academicians, students, and

market analysts seeking insights into long-term stock behaviour and methodological approaches in financial studies.

I express my sincere gratitude to Dr. Boby Thomas of Pavanatma College, Murickassery, Idukki, for his consistent guidance, motivation, and academic support throughout the preparation of this work. His valuable suggestions and scholarly insights have significantly contributed to the quality and rigour of this study. I also acknowledge that this publication is an outcome of the workshop on "Secondary Data and AI-Assisted Research Tools" organized by the PG Department of Commerce, which provided the conceptual foundation and inspiration for undertaking this research.

It is my hope that this work encourages evidence-based financial research and inspires further studies using analytical and AI-powered approaches in the field of commerce and finance.

Christeena Thomas

ABSTRACT

This study examines the monthly stock price behavior of Tata Consultancy Services (TCS) over a 20-year period using descriptive statistics, correlation analysis, the Sign Test, and time series visualization. The analysis provides a comprehensive assessment of the stock's central tendency, dispersion, price movements, and inter-variable relationships. Results indicate substantial long-term growth in stock prices with moderate volatility and strong positive correlations among Open, High, Low, and Close prices, reflecting consistent intraday market behavior. The Sign Test confirms that High Prices are consistently greater than Close Prices, revealing a stable directional pattern. Normality tests show that stock prices do not follow a normal distribution, a typical characteristic of financial time series. Additionally, Spearman's Rank Correlation establishes a significant positive relationship between Low Price and Total Turnover, suggesting increased trading activity at higher price levels. Overall, the study offers meaningful insights into the historical performance of TCS stock, supporting informed investment decisions and providing a solid basis for future forecasting and financial modeling.

Chapter I

INTRODUCTION AND FRAMEWORK

1.1 Introduction

The BSE Sensex is a free-float market capitalization-weighted index comprising 30 of the largest and most actively traded companies listed on the Bombay Stock Exchange (BSE). The selection of these companies is based on well-defined criteria set by the BSE Index Committee, which considers factors such as free-float market capitalization, trading liquidity, frequency of trading, sector representation, and the company's operational and financial track record. The Sensex aims to represent a diverse cross-section of the Indian economy by including companies from key sectors like information technology, banking, automobiles, FMCG, energy, and healthcare. The composition of the index is reviewed semi-annually, typically in June and December, and changes are made to ensure the index remains a true barometer of market trends by including

companies that consistently meet the selection criteria while removing those that no longer qualify.

1.2 Company profile

Tata Consultancy Services (TCS), established in 1968, is a leading global provider of information technology services, consulting, and business solutions. Headquartered in Mumbai, India, TCS is a flagship company of the Tata Group and has been a consistent constituent of the BSE Sensex 30 index. Recognized for its strong financial performance, extensive global presence, and diversified service portfolio, TCS ranks among the largest IT services firms globally by market capitalization. Its inclusion in the Sensex reflects its significant market value, high liquidity, and critical role in representing the Indian IT sector within the index. As of 2025, TCS continues to be one of the most actively traded and influential stocks on the Bombay Stock Exchange (BSE), contributing notably to the movement and stability of the Sensex.

1.3 Need for the study

Analyzing the stock behavior of Tata Consultancy Services (TCS) over time is essential due to its significant role as a market leader in the Indian IT sector and as a major constituent of the BSE Sensex. Given its substantial market capitalization, strong trading volume, and influence on overall market movements, fluctuations in TCS's stock price have broader implications for investors and market trends. Studying its long-term price trends, volatility patterns, and trading activity offers valuable insights into market dynamics, investor behavior, and sectoral performance. Such an analysis not only aids in investment decision-making but also contributes to a deeper understanding of how a key stock influences the Indian capital market over extended periods.

1.4 Objectives of the study

1. To describe the central tendency and dispersion characteristics of TCS stock prices over the study period.

2. To analyze the monthly price movements of TCS stock over a 20-year period from 2005 to 2025.
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. To identify any long-term trends in the performance of TCS stock during the study period.

1.5 Research Questions

1. What do the descriptive statistics indicate about the average level, variability, and distribution of monthly stock prices during the 10-year period?
2. What patterns and fluctuations can be observed in the monthly stock price movements throughout the study period?
3. Is there a directional difference between the monthly high prices and closing prices of the stock over the study period?

4. Is there a statistically significant relationship between monthly stock prices and trading turnover during the study period?

1.6 Research Hypothesis

$H_{0\ 1}$ There is no directional difference between the monthly high prices and closing prices of the stock.

$H_{0\ 2}$ There is no linear correlation between stock price and turnover"

$H_{0\ 3}$ There is no significant trend in the monthly stock prices of TCS over the study period.

$H_{0\ 4}$ There is no significant difference in the variability of monthly stock prices across different years within the study period.

$H_{0\ 5}$ The distribution of monthly stock prices does not significantly deviate from normality over the study period.

1.7 Scope of the Study

This study focuses on analyzing the stock price behavior of Tata Consultancy Services (TCS), a

key constituent of the BSE Sensex, over a 20-year period from January 2005 to May 2025. It examines the central tendency, dispersion, long-term trends, and the relationship between stock prices and trading turnover**,** based on monthly data from the Bombay Stock Exchange (BSE)**.** The research also assesses the directional difference between monthly high and closing prices and tests for the normality of stock price distribution. The scope is limited to secondary data from BSE, with all statistical analyses conducted using Gretl software**.**

1.8 Research Methodology

1.8.1 Research Design

The study adopts a quantitative, descriptive, and analytical research design, focusing on the analysis of historical stock price behavior of Tata Consultancy Services (TCS). It involves examining trends, variability, and relationships in stock price data over a long-term period using statistical and econometric tools.

1.8.2 Sources of Data

The study is based on secondary data collected from reliable financial sources, primarily the Bombay Stock Exchange (BSE)**.** Monthly data on stock prices and trading turnover of TCS were obtained for the purpose of analysis.

1.8.3 Period of the Study

The research covers a 20-year period from January 2005 to May 2025, using monthly observations of stock price data and trading turnover.

1.8.4 Variables Considered

The following variables were considered for the study:

- Monthly High Price
- Monthly Closing Price
- Monthly Trading Turnover

1.8.5 Software Used

All statistical and econometric analyses for the study were performed using Gretl software**.**

1.8.6 Tools of Analysis

The study employed the following analytical tools:

- Descriptive Statistics (Mean, Median, Standard Deviation etc)
- Time series Plots
- Sign Test (for comparing high and closing prices)
- Correlation Analysis (between stock prices and turnover)

1.9 Limitations of the Study

1. The study is confined to the analysis of a single company, Tata Consultancy Services (TCS), and the findings may not be generalizable to other companies, sectors, or indices in the Indian stock market.
2. The research is based solely on secondary data obtained from the Bombay Stock Exchange (BSE) and does not incorporate data from other exchanges like the National Stock Exchange (NSE).

3. The analysis considers monthly data only, and daily or intraday price movements, which could offer deeper insights into short-term volatility, are not included.
4. The study period is limited to January 2005 to May 2025, and events or market developments occurring outside this timeframe are not considered.
5. The research does not account for macroeconomic factors, global market trends, or company-specific events such as dividend declarations, mergers, or management changes, which may have influenced stock prices.
6. All statistical and econometric analyses are conducted using Gretl software, and findings may vary if different software or analytical models are employed.

1.10 Chapter Scheme

Chapter 1: Introduction and Framework

This chapter outlines the background of the study, research problem, objectives, research questions, hypotheses, scope, limitations, and methodology adopted for the analysis.

Chapter 2: Review of Literature

This chapter presents a review of past studies related to stock price behavior, turnover analysis, trend analysis, and statistical techniques used in stock market research. It also identifies research gaps and establishes the theoretical foundation for the study.

Chapter 3: Data Analysis

This chapter includes descriptive statistics, time series plots, Sign Test results, and correlation analysis to answer the research questions.

Chapter 4: Findings and Suggestions

This chapter discusses the major findings derived from the analysis, interprets the results in light of

the research objectives, and provides suggestions for investors, researchers, and policy-makers.

Chapter II

LITERATURE REVIEW

2.1 Introduction

The stock market, being inherently dynamic and sensitive to economic, political, and corporate developments, has long attracted the attention of researchers, investors, and policymakers. Forecasting stock price movements remains a challenging task due to the volatile and complex nature of financial markets. Over the years, numerous studies have been conducted globally and within India to analyze stock price behavior, market efficiency, and the effectiveness of various forecasting models. This chapter presents a review of relevant literature that examines stock market efficiency, time series forecasting techniques, artificial intelligence applications in stock price prediction, and stock market volatility modeling, with a specific focus on the Indian stock market and Tata Consultancy Services (TCS). The insights gained from these studies provide a theoretical

foundation and methodological direction for the present research.

2.2 Stock Price Behavior, Trading Volume, and Market Efficiency

An equilibrium model of stock price behavior was proposed to explain the volatility and predictability of U.S. stock returns from 1871 to 1986 by incorporating interactions between exogenous noise traders and smart-money investors with constant absolute risk aversion. The model demonstrated that market behavior could be explained either through a low discount rate paired with a constant risk premium or a higher discount rate alongside noise trading correlated with market fundamentals. However, empirical data were inconclusive in distinguishing between these competing explanations (Campbell & Kyle, 1993).

A study examining the relationship between dividend policy and stock price behavior in the Indian corporate sector analyzed a sample of 500 BSE-listed companies across six industries from 1996 to 2006. Using a panel data approach with a

fixed-effect model, the research assessed the impact of the dividend-retention ratio, firm size, and long-term debt-equity ratio on stock returns. The findings indicated that these variables significantly influenced stock price behavior, with evidence of firm-level effects and possible clientele effects in certain industries. Although the results were less robust compared to developed markets, the study contributed valuable insights into the dynamics of dividend policy and stock returns in India (Pani, 2008).

Researchers studied sharp rise in trading activity and its impact on market efficiency in recent years. The study found that increased turnover has been driven by a higher frequency of smaller trades, largely influenced by declining trading costs and greater institutional participation. Variance ratio tests indicated that institutional trading boosted information-based trading, contributing to improved price efficiency. Additionally, intraday volatility declined, and prices aligned more closely with a random walk behavior (Chordia, Roll, and Subrahmanyam 2011).

This study analyzed the behavior of various Bombay Stock Exchange (BSE) sectoral indices over an eight-year period using daily returns to identify sectoral patterns and correlations. The findings revealed significant cross-correlations among sectors, with some autocorrelations persisting over time. The study concluded that the Random Walk Hypothesis does not hold for the Indian market, especially during periods of large fluctuations, suggesting the need for advanced predictive models (Sharma and Banerjee 2015).

In this study the researchers tested the weak form of market efficiency in the Indian stock market during 2007–2008 using daily closing prices and returns from three indices. The study investigated anomalies such as the Monday Effect and Friday Effect but found no evidence of their existence. Serial correlation and run tests supported the Random Walk Theory, indicating that the Indian market was informationally efficient in the weak form during the study period (Mittal and Jain 2009).

Study provided a foundational explanation of the Random Walk Theory and its implications for stock market analysis. He emphasized that if markets are semi-strong efficient, stock price changes are largely independent and unpredictable, rendering past data ineffective for forecasting future movements. Empirical findings supported the view that a buy-and-hold strategy often outperforms mechanical trading rules (Fama 1995).

In this the researchers studied stock price dynamics using a large dataset of daily closed-end fund prices and mixed-effects regression models. Their findings revealed significant influences of recent trends, valuation changes, money supply growth, and proximity to recent high prices on relative price changes, providing evidence for both underreaction and overreaction behaviors in financial markets (Caginalp and Desantis 2009).

A study conducted by Thomas.B on daily stock price dynamics of IRCTC and RVNL show contrasting behaviours, with IRCTC trading at

higher and more stable prices, while RVNL remains lower-priced and more volatile. Unit root tests confirm both stocks are I(1), supporting further long-run linkage analysis. However, Engle–Granger results indicate no cointegration, suggesting an absence of long-term equilibrium between the firms despite their sectoral connection. VAR findings reveal significant short-run influence of IRCTC on RVNL, indicating short-term shock transmission. Overall, IRCTC emerges as a leading indicator in India's railway-linked stock movements (Thomas, 2025).

2.3 Statistical and Econometric Techniques in Stock Price Analysis

Researchers evaluated the effectiveness of a nonparametric sign test for detecting abnormal security price movements in event studies using daily stock return data. The study compared the performance of the sign test with a parametric t-test and a nonparametric rank test, concluding that while the sign test was often more powerful than the t-test under certain conditions, the rank test

remained superior for nonparametric inferences (Corrado and Zivney 1992).

The study emphasized the importance of time series analysis and forecasting in predicting stock market behavior due to the market's complex and dynamic nature. Their study focused on analyzing time series data from the Indian stock market and developing a statistical prediction model capable of efficiently forecasting stock market volatility (Idrees, Alam, and Agarwal (2019).

In this study they examined the limitations of traditional time series forecasting models in capturing extreme stock price movements and proposed an improved modeling framework capable of forecasting both extreme market events and high-volatility conditions. Their framework demonstrated better performance over existing risk models, especially in evaluating market risk exposure during distressed periods (Kim et al. 2011).

The study explored the application of time series forecasting models integrated with artificial neural

networks (ANN) for predicting stock market indices in India. The study highlighted the effectiveness of neural network models in improving forecasting accuracy for the Bombay Stock Exchange (BSE) and NIFTY MIDCAP50 indices, with hybrid models outperforming standalone models (Kumar and Yu 2013).

The researchers conducted a comparative study of Multilayer Perceptron (MLP) neural networks with dynamic backpropagation for forecasting stock prices on the Bombay Stock Exchange (BSE). Results indicated that neural network-based models effectively captured price patterns and could reasonably forecast stock prices despite market volatility (Devadoss and Ligori 2013).

2.4 AI and Machine Learning Models for Stock Price Prediction

The study conducted a comparative analysis of deep neural network models for short-term stock price prediction of Tata Consultancy Services (TCS) and Madras Rubber Factory (MRF). The study trained various deep learning models,

including Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM), and a hybrid Conv1D-LSTM model, finding the Conv1D-LSTM model to outperform others in prediction accuracy (Jain, Gupta, and Moghe 2018).

The study applied Artificial Neural Networks (ANN) to forecast the non-linear price movements of the three most volatile, high market capitalization stocks listed on the Bombay Stock Exchange (BSE) — Reliance Industries Limited (RIL), Tata Consultancy Services (TCS), and HDFC Bank Limited. The study demonstrated the effectiveness of ANN-based models in forecasting stock price movements, offering valuable insights for data-driven investment decisions (Sigo et al. 2018).

Researcher proposed a multi-indicator feature selection framework for stock price prediction combining the Pearson Correlation Coefficient (PCC) with a Broad Learning System (BLS). The model screened potential input features and trained a BLS for forecasting, outperforming ten

established machine learning algorithms in prediction accuracy.

Kumar and Yu (2013) also contributed to this category by investigating hybrid models combining statistical techniques with ANN. Their findings emphasized the advantages of hybrid models in forecasting accuracy and identified optimal parameters for neural network models, adding valuable insights to financial market forecasting methodologies in the Indian context (Li et al. 2022).

2.5 Research Gap

While extensive research exists on stock price behavior, trading activity, and market efficiency, much of it has either focused on broad market indices or short-term stock price forecasting using AI models. Limited studies have systematically analyzed the long-term price movements, turnover relationships, and trend patterns of individual high-cap stocks like Tata Consultancy Services (TCS) using conventional econometric tools over an extended period. Moreover, there's a noticeable

gap in integrating descriptive, correlation, and time series analyses exclusively on TCS stock data within a two-decade framework using statistical software like Gretl. This study aims to address this gap by offering an empirical, long-term examination of TCS's stock price behavior from 2005 to 2025, contributing fresh insights to the limited body of firm-specific stock market research in India.

REFERENCES

Caginalp, G., & Desantis, M. (2009). Stock price dynamics: nonlinear trend, volume, volatility, resistance and money supply. *Quantitative Finance*, *11*(6), 849–861. https://doi.org/10.1080/14697680903220356

Campbell, J. Y. and Kyle, A. S. (1993). Smart Money, Noise Trading and Stock Price Behaviour. *The Review of Economic Studies, 60*(1). https://doi.org/10.2307/2297810

Chordia, T., Roll, R. & Subrahmanyam, A. (2011). Recent trends in trading activity and market quality. *Journal of Financial Economics, 101*(2). https://doi.org/10.1016/j.jfineco.2011.03.008

Corrado, C., & Zivney, T. L. (1992). The specification and power of the sign test in event study hypothesis tests using daily stock returns. *Journal of Financial and Quantitative Analysis, 27*(3), 465–478. https://doi.org/10.2307/2331331

Devadoss, A., & Ligori, T. (2013). Forecasting of stock prices using multi-layer perceptron. *International Journal of Web Technology, 2*(2), 73–78. https://doi.org/10.20894/ijwt.104.002.002.006

Fama, E. F. (1995). Random walks in stock market prices. *Financial Analysts Journal, 51*(1), 75–80. https://doi.org/10.2469/faj.v51.n1.1861

Idrees, S., Alam, M. A., & Agarwal, P. (2019). A prediction approach for stock market volatility based on time series data. *IEEE Access, 7*, 17287–17298. https://doi.org/10.1109/access.2019.2895252

Jain, S., Gupta, R. K., & Moghe, A. A. (2018). Stock price prediction on daily stock data using deep neural networks. In *2018 International Conference on Advanced Computation and Telecommunication (ICACAT)* (pp. 1–7). IEEE. https://doi.org/10.1109/ICACAT.2018.8933791

Kim, Y. S., Rachev, S. T., Bianchi, M. L., Mitov, I., & Fabozzi, F. J. (2011). Time series analysis for financial market meltdowns. *Journal of Banking & Finance, 35*(8), 1879–1891. https://doi.org/10.1016/j.jbankfin.2010.12.007

Kumar, D. A., & Yu, T. (2013). Performance analysis of Indian stock market index using neural network time series model. In *2013 International Conference on Pattern Recognition, Informatics and Mobile Engineering (ICPRIME)* (pp. 25–30).

IEEE. https://doi.org/10.1109/icprime.2013.6496450

Li, G., Zhang, A., Zhang, Q., Wu, D., & Zhan, C. (2022). Pearson correlation coefficient-based performance enhancement of broad learning system for stock price prediction. *IEEE Transactions on Circuits and Systems II: Express Briefs, 69*(6), 2429–2433. https://doi.org/10.1109/TCSII.2022.3160266

Mittal, S., & Jain, S. (2009). Stock market behaviour: Evidences from Indian market. *Global Business Review, 10*(1), 1–17. https://doi.org/10.1177/097226290901300302

Pani, U. (2008). Dividend Policy and Stock Price Behaviour in Indian Corporate Sector: A Panel Data Approach. *Social Science Research Network*. http://www.igidr.ac.in/conf/oldmoney/mfc-12/Coporate_Dividendpolicy_and_stock_price_behaviour_upananda%20pani.pdf

Sigo, M. O., Selvam, M., Maniam, B., Kannaiah, D., Kathiravan, C., & Vadivel, T. (2018). Big data analytics—Application of artificial neural network in forecasting stock price trends in India. *Academy of Accounting and Financial Studies Journal,*

22(3), 1–11. https://www.abacademies.org/articles/big-data-analytics-application-of-artificial-neural-network-in-forecasting-stock-price-trends-in-india-1528-2635-22-3-225.pdf

Sharma, C. and Banerjee, K. (2015). A study of correlations in the stock market. *Physica A-statistical Mechanics and Its Applications, 432*. https://doi.org/10.1016/j.physa.2015.03.061

Thomas, B. (2025). Tracking the rails: Short-run interdependence and price dynamics in India's railway firms. Conference proceedings.

Chapter III

ANALYSIS AND INTERPRETATION

3.1 Introduction

This chapter presents the analysis of TCS stock price data collected over the period 2005 to 2025. Using descriptive statistics, correlation analysis, and time series techniques, the study examines stock price behavior, trends, and relationships between variables. The results are interpreted in accordance with the research objectives and hypotheses to draw meaningful insights into the stock's performance over time.

The analysis employs tools such as Excel, Gretl software for statistical computations and tests. Descriptive statistics, correlation analysis, Sign Test, and time series methods are used to evaluate stock price behavior, variability, and patterns. The objectives of the study include describing the central tendency and dispersion of stock prices, analyzing monthly price movements, testing the

directional difference between monthly high and closing prices and identifying long-term trends.

1. To describe the central tendency and dispersion characteristics of TCS stock prices over the study period.
2. To analyze the monthly price movements of TCS stock over a 20-year period from 2005 to 2025**.**
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. To identify any long-term trends in the performance of TCS stock during the study period.

3.2 Data Description

The study is based on secondary data comprising the monthly stock prices of Tata Consultancy Services (TCS) for the period from January 2005 to May 2025. The dataset includes monthly values of Opening Price, High Price, Low Price, Closing Price, and Turnover**.** These data points were

sourced from reliable stock market databases and official financial records.

The data is organized as monthly time series observations, providing a continuous record of stock price behavior over a 20-year period. This extensive time frame enables the study to capture both short-term fluctuations and long-term trends in stock price movements, making it suitable for descriptive, correlation, and time series analyses. The data is processed and analyzed using Gretl software, which supports the application of both basic statistical tools and econometric tests required for the study.

Table 3.1 Descriptive Statistics: Measures of Central Tendency and Range

This section presents the measures of central tendency and range for the monthly stock prices of TCS Ltd., providing a foundational understanding of the stock's price behaviour over the 10-year study period. The variables analysed include Open, High, Low, and Close prices. Table 3.1 show the measures of central tendency and range of the data.

Table 3.1

Descriptive Statistics: Measures of Central Tendency and Range

	Mean	Median	Minimum	Maximum
Open Price	2094.3	2099.5	380.00	4584.9
High Price	2217.5	2259.9	526.80	4585.9
Low Price	1971.2	1983.8	355.25	4226.6
Close Price	2100.4	2108.3	389.70	4551.9
No of Shares	3792178	3035676	794965	27518584

Source: Secondary Data Gretl Output

Interpretation:

The descriptive statistics reveal that TCS stock prices showed considerable variation during the study period. The average opening price was ₹2094.3, with prices ranging from ₹380.00 to ₹4584.9. The average high and low prices were ₹2217.5 and ₹1971.2 respectively, indicating notable daily fluctuations. The mean closing price

stood at ₹2100.4. Trading volumes also varied widely, with the number of shares traded ranging from 7.95 lakh to 275.18 lakh, and an average of 37.92 lakh shares. This reflects active trading in TCS stock with significant price and volume movements over time.

Table 3.2

Descriptive Statistics: Measures of Dispersion and Shape

	Std. Dev.	C.V.	Skewness	Ex. Kurtosis
Open Price	1010.8	0.48265	0.29612	-0.87933
High Price	1054.4	0.47550	0.29630	-0.91208
Low Price	972.19	0.49320	0.29023	-0.89991
Close Price	1009.8	0.48078	0.27988	-0.89674
No of Shares	2923045	0.77081	3.5077	20.473

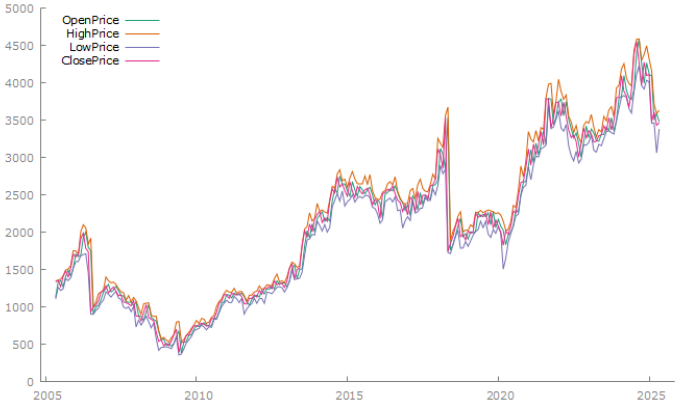
Source: Secondary Data Gretl Output

The standard deviation values indicate high variability in TCS stock prices, with figures around ₹1000 for all price variables, reflecting significant price fluctuations during the period. The Coefficient of Variation (C.V.) values, ranging between 0.47 and 0.49, suggest moderate relative volatility in stock prices, while the number of shares traded shows a much higher C.V. of 0.77, indicating greater inconsistency in trading volumes. The skewness values for price variables are slightly positive, suggesting a mild tendency for prices to record higher values, while excess kurtosis values are negative (around -0.88 to -0.91), indicating a flatter distribution than normal. However, the number of shares traded shows high positive skewness (3.51) and very high kurtosis (20.47), reflecting occasional extreme spikes in trading activity.

3.4 Price Movement Analysis

This section analyses the monthly price movement of TCS. In the context of stock market analysis, it

helps visualize the movement and trend patterns of stock prices over time. By plotting variables such as Open, High, Low, and Close prices against time, this tool enables the identification of trends, seasonal patterns, fluctuations, and anomalies, offering valuable insights into the stock's historical behavior and potential future movements.



Source: Secondary Data Gretl Output

Interpretation:

The plot reveals a strong upward trend over the two decades, with all four-price metrics— Open Price,

High Price, Low Price, and Close Price—closely following each other throughout the timeline. This indicates consistency and strong correlation between these prices. Despite occasional volatility and sharp spikes or drops (notably around 2018 and 2020), the overall pattern suggests steady growth in stock value. The narrow gap between High and Low prices during most periods reflects market stability, while brief wider gaps may indicate high trading activity or market shocks.

Overall, the plot reveal that while the stock has experienced short-term volatility, the long-term trend remains positive. This pattern is typical of fundamentally strong stocks in growing markets, making these insights valuable for investors and analysts aiming to forecast future price movements or assess historical market behavior.

Testing of Normality

Doornik-Hansen test for normality was applied to determine whether the data follows a normal distribution. The following hypothesis is formulated.

H0: The data for stock prices follows a normal distribution.

Table 3.3

Testing Normality

Particulars	Test Statistic Value	p-Value
Open Price	21.231	0.0000245
High Price	22.7524	0.0000115
Low Price	21.6839	0.0000196
Close Price	20.7259	0.0000316
No. of Shares Traded	402.691	3.60343e-088

Source: Secondary Data Gretl Output

Since the p-values for all the variables are much less than 0.05, I reject the null hypothesis at 5% significance level.

Hence, we move forward to non -parametric test.

3.6 Directional Analysis of High and Close Prices

This section evaluates whether the monthly High Prices of the stock are consistently greater than the Close Prices over the study period. The analysis applies the Sign Test, a non-parametric statistical method used to determine the direction of differences in paired data. By examining the frequency of months in which the High Price exceeds the Close Price, this test helps identify any consistent directional pattern in price behaviour, which may reflect market dynamics, investor sentiment, or trading strategies. The following null hypothesis is formulated:

$H_{0\,2}$ There is no directional difference between the monthly high prices and closing prices of the stock.

The Sign Test assesses whether the number of positive and negative differences between paired observations is significantly different from what would be expected by chance.

Sign Test

Test for difference between HighPrice and ClosePrice

n = 241

W+ = 29161, W- = 0

(zero differences: 0, non-zero ties: 4)

Expected value = 14580.5

Variance = 1.17373e+006

z = 13.4578

P(Z > 13.4578) = 0

Interpretation:

The Wilcoxon Signed-Rank Test result indicates a statistically significant difference between the paired observations, with a z-value of 13.4578 and a p-value effectively equal to 0. Since the sum of negative ranks (W−) is 0 and all differences are

positive, it suggests that the second set of values consistently exceeds the first. Therefore, we reject the null hypothesis and conclude that there is a significant and consistent positive change between the two paired samples.

3.7 Correlation Matrix Analysis

The table shows correlation matrix between variables. Correlation Coefficients, using the 241 observations 2005:05 - 2025:05.

Table 3.4

Correlation

Open Price	High Price	Low Price	Close Price	
1.0000	0.9951	0.9876	0.9809	Open Price
	1.0000	0.9883	0.9879	High Price
		1.0000	0.9949	Low Price
			1.0000	Close Price

Source: Secondary Data Gretl Output

The correlation matrix table displays the correlation coefficients between multiple variables like Open price, High price, Low price, Close price and total turnovers. The Correlation of each variable to other variables are discussed below.

Table 3.5

Correlation with Open Price

Variable	Correlation	Interpretation
Open Price	1.0000	Perfect correlation with itself.
High Price	0.9951	Strong positive correlation; as open price increases, high price also tends to rise.
Low Price	0.9876	Strong positive relationship with low price.

Close Price	0.9809	Strong positive association with close price.

Interpretation:

The Open Price shows a very strong positive correlation with all other price variables: High Price (0.9951), Low Price (0.9876), and Close Price (0.9809). This indicates that when the opening price increases or decreases, the other prices tend to move in the same direction with very little variation. Such high correlations suggest that market prices throughout the trading day are closely linked to the opening price, reflecting consistent market behavior and minimal intraday price divergence.

Table 3.6

Correlation with High Price

Variable	Correlation	Interpretation
Open Price	0.9951	Strong positive correlation with open price.
High Price	1.0000	Perfect correlation with itself.
Low Price	0.9883	Strong positive relationship; higher highs align with higher lows.
Close Price	0.9879	Strong correlation; high prices are aligned with higher closing prices.

Interpretation:

The High Price is highly correlated with Open Price (0.9951), Low Price (0.9883), and Close Price (0.9879). This means that changes in the High Price during a trading period closely mirror movements in other prices. The strong positive relationship indicates that when the High Price increases or decreases, the other prices tend to follow a similar pattern, highlighting the interconnectedness of intraday market prices.

Table 3.7

Correlation with Low Price

Variable	Correlation	Interpretation
Open Price	0.9876	Strong positive relationship with open price.
High Price	0.9883	Strong correlation; lows rise along with highs.

Low Price	1.0000	Perfect correlation with itself.
Close Price	0.9949	Very strong correlation with closing prices.

Interpretation:

The Low Price has a strong positive correlation with Open Price (0.9876), High Price (0.9883), and Close Price (0.9949). This shows that fluctuations in the Low Price are closely aligned with changes in other prices. The slightly higher correlation with Close Price suggests that the lowest point of the day often remains close to the closing levels, reflecting relatively stable market trends within the day.

Table 3.8

Correlation with Close Price

Variable	Correlation	Interpretation
Open Price	0.9809	Strong positive correlation with opening prices.
High Price	0.9879	Strong positive relationship with high prices.
Low Price	0.9949	Very strong correlation; closing prices closely follow low prices.
Close Price	1.0000	Perfect correlation with itself.

Interpretation:

The Close Price demonstrates strong positive correlations with Open Price (0.9809), High Price

(0.9879), and Low Price (0.9949). This pattern indicates that closing values are generally consistent with the day's price movements. The highest correlation with Low Price suggests that the market often closes near its daily low, which could imply periods of end-of-day selling pressure or stable price consolidation.

The correlation analysis shows a strong positive relationship among all stock price variables. The Open Price is highly correlated with High (0.9951), Low (0.9876), and Close (0.9809) prices, indicating consistent price movements during the trading day. Similarly, High, Low, and Close prices are also strongly interrelated, suggesting minimal intraday volatility and a stable price trend over time. The following null hypothesis is tested.

$H_{0\,3}$ There is no linear correlation between stock price and turnover

Spearman's rank correlation coefficient is used for testing the linearity between low price and total turnover.

Spearman's rank correlation

Spearman's rank correlation coefficient (rho) = 0.34290349 Under the null hypothesis of no correlation: t(239) = 5.64331, with two-tailed p-value 0.0000

Interpretation:

The Spearman's rank correlation coefficient between Low Price and Total Turnover (Rs) is 0.3429**,** indicating a moderate positive relationship—as the Low-Price increases, Total Turnover tends to increase as well. The test statistic t(239) =5.6433t(239) = 5.6433t(239) = 5.6433 with a two-tailed p-value < 0.0001 suggests this correlation is highly statistically significant, providing strong evidence against the null hypothesis of no correlation. This means the observed association is unlikely to have occurred by chance. Since the p-value is 0.0000 (less than 0.05), we reject the null hypothesis of no correlation between *Low Price* and *Total Turnover (Rs)*.

3.8 Conclusion

The analysis revealed substantial growth in stock prices with moderate volatility and strong internal correlation among Open, High, Low, and Close prices. Time series plots showed a steady upward trend, while correlation analysis confirmed uniform price movements. A significant positive relationship was found between Low Price and Total Turnover, indicating higher trading activity at higher price levels. Normality tests showed the data is non-normal, a common feature in financial series. These insights provide a clear view of the stock's behavior and a strong base for forecasting.

Chapter IV

FINDINGS AND SUGGESTIONS

4.1 Introduction

This chapter presents the key findings derived from the analysis of stock price data, highlighting major patterns, relationships, and trends observed in the study. Based on these findings, practical suggestions are provided to guide investors, researchers, and policymakers in making informed decisions and to support future research in stock market forecasting. The objectives of the study include describing the central tendency and dispersion of stock prices, analyzing monthly price movements, testing the directional difference between monthly high and closing prices and identifying long-term trends. The study was conducted with the following objectives:

1. To describe the central tendency and dispersion characteristics of TCS stock prices over the study period.

2. To analyze the monthly price movements of TCS stock over a 20-year period from 2005 to 2025.
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. To identify any long-term trends in the performance of TCS stock during the study period.

4.2 Summary of Findings

4.2.1 Summary of Data

The analysis of TCS stock price data from 2005 to 2025 provided valuable insights into the stock's behavior over the 20-year period. Descriptive statistics showed considerable variation in stock prices, with the average Open Price at ₹2094.3 and significant fluctuations observed in daily price movements and trading volumes. Time series analysis revealed a steady long-term upward trend in stock prices, despite occasional short-term volatility, especially around 2018 and 2020.

Correlation analysis demonstrated a very strong positive relationship among all stock price variables (Open, High, Low, Close), indicating that they move in close alignment over time, reflecting market stability and minimal intraday price divergence. The Doornik-Hansen test confirmed that the data does not follow a normal distribution, which is typical for financial time series.

The directional Sign Test showed that monthly High Prices were consistently greater than Closing Prices throughout the study period. Additionally, a significant moderate positive correlation (rho = 0.3429) was found between Low Price and Total Turnover, suggesting that higher trading activity occurs at higher price levels.

These findings provide a comprehensive understanding of TCS stock's historical performance, serving as a solid foundation for further forecasting and investment decision-making.

4.2.2 The central tendency and dispersion characteristics

1. The average monthly Open Price was ₹2094.3, High Price ₹2217.5, Low Price ₹1971.2, and Close Price ₹2100.4, showing considerable variation over time.
2. The standard deviations for price variables were around ₹1000, indicating significant volatility.
3. The number of shares traded ranged from 7.95 lakh to 27.52 lakh, reflecting active market participation.

4.2.3 The monthly price movements

1. Time series plots showed a consistent upward trend across Open, High, Low, and Close Prices.
2. Despite occasional sharp fluctuations, especially around 2018 and 2020, the long-term trend remained positive, indicating steady growth in stock value over time.

3. Narrow gaps between High and Low prices during most periods suggest market stability.

4.2.4 Comparison of Monthly High and Closing Prices

1. The Sign Test confirmed that High Prices were consistently greater than Close Prices throughout the study period ($z = 13.4578$, p-value = 0).
2. This significant result indicates a consistent directional relationship, reflecting typical market behavior.

4.2.5 Long-Term Trend Analysis

1. The overall time series analysis showed a strong and steady upward trend in stock prices from 2005 to 2025.
2. Correlation analysis revealed very strong positive correlations between Open, High, Low, and Close Prices (coefficients above 0.98), confirming uniform price movements and stability.

3. A significant positive relationship (Spearman's rho = 0.3429, $p < 0.0001$) was found between Low Price and Total Turnover, indicating that higher turnover is associated with higher stock prices.

4.3 Suggestions

4.3.1 Based on Price Behavior and Trend Analysis

1. Investors can consider TCS stock for long-term investment due to its stability and steady growth.
2. Analysts should monitor the daily price relationships for short-term trading opportunities, as High Prices consistently exceed Close Prices.

4.3.2 Based on Relationship Between Price and Turnover

1. Market analysts should use turnover data as an important indicator of price movements and investor sentiment.

2. Investors should track turnover trends to time their buy or sell decisions.

4.3.3 Based on Statistical Properties of Data

1. Future forecasting models should apply non-parametric or machine learning techniques that do not assume normality.
2. Researchers should focus on advanced methods that better handle non-normal, volatile financial time series data.

4.3.4 Based on Market Stability and Volatility

1. Regulators should ensure market transparency and monitor for external events causing sudden market fluctuations.
2. Investors should remain cautious and diversify their portfolio to manage risk during volatile periods.

4.4 Conclusion

The analysis of TCS stock price data from 2005 to 2025 provides valuable insights into the stock's behavior, trends, and market dynamics. The study

revealed a significant long-term upward trend in stock prices, accompanied by moderate volatility and strong positive correlations among Open, High, Low, and Close prices. A statistically significant positive relationship was found between Low Price and Total Turnover, indicating that higher trading volumes are associated with higher stock prices. The normality tests confirmed that the data does not follow a normal distribution, emphasizing the need for advanced non-parametric or machine learning approaches in future forecasting. These findings suggest that TCS stock remains a stable option for long-term investment, while turnover data can serve as a useful indicator for short-term price movements. The study offers a solid foundation for investors, analysts, and researchers to make informed decisions and develop robust forecasting models in a volatile financial market.