Monthly Price Dynamics and Turnover Patterns of Infosys Ltd. A Longitudinal Analysis

Jogi Joseph

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978-81-984787-0-2

MONTHLY PRICE DYNAMICS AND TURNOVER PATTERNS OF INFOSYS LTD.: A LONGITUDINAL ANALYSIS

A Research Monograph

By

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

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Price: 100

ISBN: 978-93-47890-70-3 (E Book)
ISBN: 978-81-984787-0-2 (Print)
https://dx.doi.org/10.37298/abpl978-81.27

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First Published on:19-12-2025
Published by:
Ambitious Books, Kerala
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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 book presents a comprehensive analytical study on the stock price behaviour of Infosys Ltd. over a twenty-year period from June 2005 to May 2025. By examining monthly secondary data, the study provides an extensive evaluation of price trends, volatility patterns, turnover dynamics, and long-term movement of one of India's leading information technology companies. Using descriptive statistics, time-series visualisation, correlation analysis, and non-parametric techniques, the research investigates central tendency, dispersion, directional price differences, and the association between stock prices and trading turnover. The findings reveal consistent upward long-term price trends, non-normal distribution patterns, a highly significant difference between high and close prices, and

negligible correlation between price levels and trading volumes. The study thus contributes meaningful insights into the evolving behaviour of a major Sensex-listed stock within the Indian capital market.

The strength of this work lies in its systematic, data-driven, and methodologically rigorous approach, enriched through the integration of AI-assisted analytical tools. By focusing on Infosys Ltd, a globally recognised IT leader. The study offers a structured framework for conducting company-specific stock market research using secondary data and advanced statistical techniques. It is hoped that this publication will inspire further evidence-based financial research and encourage students and academicians to employ technological tools in enhancing the precision and depth of their analytical work.

I express my sincere gratitude to Dr. Boby Thomas, of Pavanatma College, Murickassery, Idukki, for his continuous guidance, academic insights, and encouragement throughout the preparation of this work. His valuable mentoring played a significant role in shaping the clarity, quality, and scholarly depth of the study. I also acknowledge that this publication is an outcome of the workshop on "Secondary Data and AI-Assisted Research Tools," which provided the conceptual foundation and academic motivation for undertaking this research.

Jogi Joseph

ABSTRACT

This study examines Infosys Ltd.'s long-term stock price behaviour over 20 years (June 2005–May 2025) using monthly secondary data and statistical tools in Gretl. Descriptive statistics show moderate, stable volatility with right-skewed and platykurtic distributions. Time-series analysis reveals a strong upward trend, interrupted by events such as the 2008 financial crisis, the 2014–15 stock split, and the COVID-19 pandemic. The Wilcoxon Signed-Rank Test confirms consistently higher high prices than close prices. Price variables show strong positive correlations, while turnover has no meaningful association with prices. Overall, Infosys displays sustained growth, co-movement among price indicators, and event-driven volatility.

CHAPTER I

INTRODUCTION AND FRAMEWORK

1.1 Introduction

The Indian stock market, led by major exchanges such as the Bombay Stock Exchange (BSE), serves as a vital indicator of the country's economic growth. The BSE Sensex, introduced in 1986, is a benchmark index that tracks the performance of 30 financially strong and actively traded companies across key sectors. These companies are selected based on criteria like free-float market capitalization, liquidity, consistent trading activity, and financial stability. The index composition is reviewed semi-annually, typically in June and December by the BSE Index Committee to ensure it continues to represent the dynamic structure of the Indian economy. As such, the Sensex serves as a reliable barometer of market sentiment and economic trends in India.

1.2 Company Profile

Infosys Ltd., established in 1981 and headquartered in Bengaluru, is a global leader in information technology services and consulting. As one of the key constituents of the BSE Sensex 30, Infosys represents the Indian IT sector's growth and global competitiveness. The company provides end-to-end business solutions, including digital transformation, cloud services, and AI-driven analytics, serving clients in over 50 countries. Its strong market capitalization, consistent financial performance, and corporate governance standards make it a reliable indicator of market trends within the Sensex index.

1.3 Need of the Study

Analysing the stock price behavior of Infosys Ltd. over time is essential due to its prominent role in the Indian IT sector and its status as a core constituent of the BSE Sensex. As a blue-chip company with significant investor interest, fluctuations in its stock price often reflect broader market trends and sectoral shifts. A long-term

analysis provides insights into price stability, volatility, investor sentiment, and the impact of macroeconomic factors, helping investors and researchers better understand performance patterns and market dynamics associated with a leading Indian enterprise.

1.4 Research Objectives:

1. To evaluate the central tendency and dispersion characteristics of stock price
2. To analyse the monthly price movements of Infosys Ltd over a 20-year period.
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. To examine the relationship between monthly stock prices and trading turnover.

1.5 Research Questions

1. What do the descriptive statistics reveal about the average level, variability, and distribution of monthly stock prices over the 20-year period?

2. What trends and fluctuations are observed in the monthly stock price movements over 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?

1.6 Research Hypotheses

$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 Infosys Ltd. over the 20-year period.

$H_0$4 The monthly stock prices of Infosys Ltd. are normally distributed over the study period.

$H_0$5 There is no significant difference in the variability (dispersion) of stock prices across different market phases.

1.7 Scope of the study

The present study focuses on analysing the monthly stock price behavior and trading turnover of Infosys Ltd., a key constituent of the BSE Sensex, over a 20-year period from June 2005 to May 2025. Using monthly observations, the study aims to examine key statistical characteristics such as central tendency, dispersion, price trends, and the relationship between stock prices and trading turnover. The analysis is conducted using Gretl, an open-source econometric software, to ensure transparency and replicability of results. This study is limited to secondary data drawn from publicly available financial sources and is specific to one company. While it does not seek to generalize findings to the entire stock market, it provides in-depth insights into the long-term behavior of a leading blue-chip stock within the Indian capital market framework.

1.8 Research Methodology

1.8.1 Research Design

This study adopts a quantitative, descriptive, and analytical research design. It focuses on analysing historical stock market data to identify patterns, trends, and relationships over time. The design is longitudinal in nature, allowing for the assessment of changes in stock price behavior and turnover across a 20-year period.

1.8.2 Source of Data

The study is based entirely on secondary data, which includes monthly stock prices and trading turnover of Infosys Ltd. The data has been obtained from credible financial sources such as the Bombay Stock Exchange (BSE), Moneycontrol, and Infosys Investor Relations.

1.8.3 Period of the Study

The analysis covers a continuous 20-year period from June 2005 to May 2025, offering a long-term view of the stock's performance and behavior in various market conditions.

1.8.4 Variables Considered

The key variables considered in the study include:

- Monthly Opening Price
- Monthly Closing Price
- Monthly High Price
- Monthly Low Price
- Monthly Trading Turnover (Volume)

These variables are used to calculate measures of central tendency, dispersion, and correlation.

1.8.5 Software Used

The statistical analysis for this study has been conducted using Gretl (Gnu Regression, Econometrics and Time-series Library), an open-source econometrics software suitable for time-series data analysis and hypothesis testing.

1.8.6 Tools of Analysis

The tools and techniques used for analysis include:

- Descriptive Statistics (mean, median, standard deviation, skewness, kurtosis)

- Time Series Graphs and Trend Analysis
- Paired Sample t-Test (to test differences between high and closing prices)
- Pearson's Correlation Coefficient (to test the relationship between stock price and turnover)
- Normality Testing
- Volatility Comparison across Sub-Periods (using standard deviation)

These tools collectively help in evaluating the stock price dynamics and market behavior associated with Infosys Ltd.

1.9 Limitations of the Study

1. Single Company Focus: The study is limited to Infosys Ltd., which may restrict the applicability of the findings to other companies or sectors.
2. Use of Secondary Data: The analysis relies entirely on secondary data, and the accuracy

of the results depends on the reliability of external sources.

3. Exclusion of Macroeconomic Variables: Broader economic factors such as inflation, interest rates, or geopolitical events are not explicitly considered.
4. Monthly Data Frequency: Using monthly observations may overlook short-term price movements and intraday volatility.
5. No Qualitative Analysis: The study does not account for qualitative factors like investor sentiment, management announcements, or industry news.
6. Time-Bound Analysis: The conclusions drawn are based on data from June 2005 to May 2025 and may not hold under future market conditions.

1.10 Chapterisation

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

A comprehensive understanding of stock price behavior and trading patterns requires an in-depth exploration of existing theoretical and empirical studies. The literature in the field of capital markets reveals a wide range of approaches used to study stock price volatility, return dynamics, investor behavior, and market efficiency. Over the years, researchers have increasingly focused on analyzing historical price data to uncover patterns and assess the factors influencing stock movements. With the growth of high-frequency trading, algorithmic strategies, and the use of machine learning techniques in financial forecasting, the complexity of stock market behavior has intensified, necessitating more refined and data-driven analyses.

This chapter reviews selected scholarly works that are relevant to the objectives of the present study. Particular attention is given to studies that examine the Indian stock market and its leading indices, such as the BSE Sensex, along with company-specific evaluations of major IT firms like Infosys Ltd. The review helps to position the current study within the existing body of knowledge and highlights the research gaps that justify a focused, long-term analysis of Infosys's stock price dynamics and turnover behavior.

2.1 Stock Price Behavior

A study examining the role of private information in stock prices found that price no synchronicity and the probability of informed trading (PIN) significantly increase the sensitivity of corporate investment to stock prices. The findings suggest that managers extract and utilize private information embedded in stock prices to guide investment decisions, even when accounting for other informational factors and managerial knowledge. The study also highlights that this

sensitivity is influenced by both a learning mechanism where managers learn from stock prices and capital constraints, indicating multiple pathways through which market information affects corporate behavior (Chen et al., 2007).

A study on high-frequency trading in the U.S. stock market found that it significantly contributes to increased stock price volatility, even after accounting for firm-specific fundamentals and market-wide factors. The effect was notably stronger among large-cap stocks and during periods of heightened market uncertainty. Furthermore, it was observed that high-frequency trading can weaken the market's efficiency by causing stock prices to overreact to fundamental news, suggesting that such trading may have detrimental impacts on price discovery and market stability (Zhang, 2010).

2.2 Trading Volume and Turnover

An empirical analysis of liquidity and asset pricing revealed that trading turnover can serve as a reliable and accessible proxy for liquidity. The

study found that stocks with higher turnover tend to exhibit lower expected returns in the cross-section. Using data from the Tokyo Stock Exchange between 1976 and 1993, the study supports the predictions of an Amihud-Mendelson-type transaction cost model, where turnover reflects investors' trading frequency. Additionally, it was observed that the cross-sectional expected return follows a concave pattern relative to turnover, while time-series expected returns increase with turnover, reinforcing the trading frequency hypothesis (Hu, 1997).

A study integrating asset prices and trading volume within a unified framework found that both variables are jointly influenced by economic fundamentals, such as asset risk and investor preferences. Using an intertemporal asset pricing model, the research showed how investors' trading motives and portfolio choices shape equilibrium prices and volumes. Empirical analysis based on U.S. stock market data further supported the theoretical predictions, revealing that trading volume behavior is closely tied to price dynamics,

offering valuable insights into underlying economic conditions (Wang, 2002).

2.3 Price Volatility and Trends in Stock Market

An investigation into the predictive modeling of stock market behavior highlighted the crucial role of time series analysis in understanding market dynamics. Given the complexity and volatility of financial markets, particularly the Indian stock market, the research aimed to uncover time-based trends and develop a statistical model capable of efficiently predicting future stock behavior. The study highlighted the need for innovative forecasting techniques to help investors maximize returns and minimize risks in a highly sensitive market environment (Idrees et al., 2019).

A comprehensive analysis of historical stock price volatility revealed that the perception of increasing market volatility is valid only at the daily level. Using data from 1926 to 2014, the study found that while daily return volatility has slightly increased over time, monthly volatility has remained relatively stable. These findings carry practical

implications—traders may benefit from heightened daily fluctuations, whereas long-term investors can remain reassured by the stability of volatility over extended periods (Washer et al., 2016).

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).

2.4 Use of Statistical Tools

Under this research, the connection between economic news and stock market fluctuations was explored through a combination of text mining and time series analysis. Economic news from a widely circulated Turkish newspaper was processed using the term frequency inverse document frequency (TF-IDF) method, while ten different time series techniques such as moving average, random walk, and relative strength index were applied to over two years of Turkish stock market closing values. The study offered a comparative evaluation of these methods to determine the most effective approach for analysing how news impacts market trends (Seker et al., 2014).

Under this analysis, the relationship between global financial market volatility and inter-market correlations was examined using the eigenvalues and eigenvectors of correlation matrices. The findings indicate that during major financial crises such as Black Monday (1987), the Russian crisis (1998), the dot-com bubble burst and 9/11 (2001),

and the Subprime Mortgage Crisis (2008) correlations among major global indices intensify, causing markets to move in unison. This behavior underscores the systemic nature of market crashes (Sandoval, 2012).

This research examined the impact of stock market development on Nigeria's economic growth using time series data from 1994 to 2008 and applying Ordinary Least Squares (OLS) techniques. Findings revealed a weak negative relationship between economic growth and both market capitalization and value traded ratios, whereas turnover ratio showed a strong positive correlation with growth. Additionally, a strong positive link was found between market capitalization and turnover ratio, suggesting that liquidity plays a more critical role in driving economic growth than market size. The study cautions against dismissing the relevance of stock market size due to potential multicollinearity and calls for policies that encourage domestic investor participation to enhance market activity (Alajekwu & Achugbu A, 2011).

Under this investigation, machine learning techniques were evaluated for their effectiveness in predicting stock market trends within nonlinear environments. Using historical data from fifty NIFTY 50 stocks, the study applied support vector machines, perceptron, and logistic regression models, with support vector machines showing the highest predictive accuracy. Performance improved further when time series data were transformed into supervised learning formats. The results underscore the value of algorithmic models in enhancing short-term market forecasting capabilities (Parray et al., 2020).

This study analysed the impact of international agreements on Taiwan's stock prices using time series methods. Events such as Taiwan's entry into the WTO and various FTAs were examined for their effect on market behavior before and after their occurrence. The forecasting accuracy, measured by MAPE, was below 10% in all cases, indicating strong predictive performance of the model (Tsai et al., 2016).

2.5 Studies Using Indian Stock Market Data

This study investigated return-volatility dynamics in the Indian stock markets (NSE and BSE) from 2005–06 to 2013–14 using GARCH-M and EGARCH models. Results showed clear evidence of volatility clustering, persistence, and asymmetric effects in daily returns. Both recent and past news influenced volatility, with negative news having a greater impact than positive news, confirming the presence of a leverage effect. However, the relationship between returns and volatility was found to be statistically insignificant (Ali, 2016).

This research focused on understanding the nature of volatility in the Indian stock markets (NSE and BSE) from 1990 to 2016, emphasizing its importance in risk evaluation. Using ARCH and GARCH models, the study found that the GARCH (1,1) model effectively captures volatility clustering and its persistence. These findings highlight the model's usefulness in improving risk assessment and supporting informed decision-

making in financial markets (Tanty & Patjoshi P.K, 2016).

This study examined the behavior of Indian stock price indices from 1990 to 2001—a period marked by economic liberalization and significant market reforms. It highlighted the high volatility and major fluctuations during this phase, affecting both individual and institutional investors. The research also explored time-varying return volatility, market efficiency, the influence of foreign capital inflows on index volatility, and the correlation between Indian indices and those of select Asian and developed markets (Pradhan& Narasimhan L, 2003).

An analysis of daily returns from the Bombay Stock Exchange between September 2020 and February 2021 applied unit root tests and the ARCH-M model to study market volatility. The findings indicated that the ARCH (1) model best captured return fluctuations during the period. The study also concluded that the market was inefficient, with stock prices showing random

behavior, thereby complicating risk evaluation and investment decisions (Mangukiya & Gondaliya, 2021).

This study examined the impact of weather, specifically temperature, on the returns and volatility of Indian stock indices (BSE Sensex and S&P CNX Nifty) using monthly data from five major cities. Applying tools such as Descriptive Statistics, ADF Test, and the GARCH (1,1) model, the analysis revealed that temperature significantly influenced stock returns in Chennai, Mumbai, Kolkata, and Hyderabad. However, no such effect was observed in Delhi, indicating a location-specific relationship between weather and market behavior (Sigo, 2017).

2.6 Studies Focusing Infosys Ltd

This historical account traces the growth of Infosys from a small startup to one of India's largest IT companies. Founded in 1981 by N. R. Narayana Murthy with a loan of INR 10,000, the company initially operated from a modest Pune residence. Despite an undersubscribed IPO in 1993, Morgan

Stanley's investment helped establish its market presence, with share prices soaring by 1999. Over the years, Infosys expanded globally, achieved significant financial growth, and received multiple accolades, including the Global MAKE award and recognition from Forbes as one of the top-performing software companies worldwide (Joshi, 2009).

A comparative analysis of Infosys and TCS incorporated both fundamental and technical tools to assess financial health and stock price behavior. Using ratios like ROE, P/E, and EPS alongside technical indicators such as moving averages, RSI, and Bollinger Bands, the study highlighted the value of an integrated approach. It concluded that combining both methods offers a comprehensive perspective, aiding investors in making more informed decisions within the fast-evolving IT sector (Jeyalakshmi, 2024).

2.7 Research Gap

Although extensive literature exists on stock market behavior, volatility modelling, and price

prediction using advanced tools such as machine learning and econometric models, much of the existing research focuses on short-term data, broader indices, or cross-sectional comparisons among multiple stocks. Few studies have undertaken a longitudinal analysis spanning two decades for a single Sensex-listed blue-chip company like Infosys Ltd., especially using monthly frequency data. Additionally, while several researchers have explored the effects of trading turnover and price volatility in developed markets, relatively limited attention has been paid to company-specific turnover-price relationships in the Indian context. There is also a lack of empirical studies combining descriptive statistical analysis with hypothesis testing to assess the central tendency, dispersion, normality, and directional differences in stock prices over an extended period. This study aims to fill this gap by providing a detailed, data-driven, and time-specific analysis of Infosys Ltd.'s stock performance, offering fresh insights into its long-term price

dynamics and trading behavior within the Indian capital market.

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Chapter III

DATA ANALYSIS AND INTERPRETATION

3.1 Introduction

This chapter presents the analysis and interpretation of the monthly stock price and turnover data of Infosys Ltd. over a 20-year period, from June 2005 to May 2025. The main aim is to analyse the behaviour of stock prices and trading turnover using appropriate statistical tools and techniques, and to test the hypotheses formulated earlier. The analysis provides insights into the historical trends, variability, and relationships in the data, thereby addressing the key objectives of the study.

The tools and techniques used for the analysis include Microsoft Excel for data tabulation and preliminary calculations, and Gretl (Gnu Regression, Econometrics and Time-series Library) for statistical testing and time series

analysis. Descriptive statistical measures such as mean, median, standard deviation, skewness, and kurtosis are used to understand the central tendency and dispersion of prices. Time series plots are applied to visualise price patterns and long-term movements. The Wilcoxon Signed-Rank Test is used to test directional differences between high and closing prices, while Pearson's correlation coefficient and Spearman's rank correlation coefficient are employed to assess the relationship between stock prices and trading turnover.

The following are the specific objectives of the study:

1. To evaluate the central tendency and dispersion characteristics of Infosys Ltd.'s monthly stock prices.
2. To analyse the monthly price movements of Infosys Ltd. over a 20-year period.
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.

4. To examine the relationship between monthly stock prices and trading turnover.

The results from the analysis are presented in the following sections, with detailed interpretation based on statistical output.

3.2 Data Description

The dataset used in this study consists of monthly trading data of Infosys Ltd. for a continuous 20-year period from June 2005 to May 2025, covering a total of 240 monthly observations. The data has been compiled from credible financial sources and includes the following variables for each month:

- Month – Time index from June 2005 to May 2025
- Open Price – The stock price at the beginning of the month
- High Price – The highest traded price during the month
- Low Price – The lowest traded price during the month

- Close Price – The last traded price at the end of the month
- No. of Shares – The number of shares traded in the month
- No. of Trades – The number of separate transactions conducted
- Total Turnover (Rs.) – The total value of all trades in Indian rupees

For the purposes of this study, particular focus has been placed on High Price, Close Price, and Total Turnover (Rs.) as the key variables to analyse price behaviour and trading activity. The dataset is time-series in nature, allowing for a longitudinal assessment of stock price dynamics. The data was cleaned and validated before analysis to ensure consistency and accuracy across the study period.

3.3 Descriptive Statistics

This section presents the measures of central tendency and range for the monthly stock prices of Infosys Ltd., providing a foundational understanding of the stock's price behaviour over

the 20-year study period. The variables analysed include Open, High, Low, Close prices and Number of shares traded.

Table 3.1 shows the measures of central tendency and range of the data.

Table 3.1

Descriptive Statistics: Central Tendency

Variable	Mean	Median	Minimum	Maximum
Open Price	1856.1	1681.3	640.00	4388.0
High Price	1973.8	1824.5	693.90	4401.0
Low Price	1729.3	1565.7	511.10	4034.8
Close Price	1849.7	1675.2	640.30	4359.3
No. of Shares Traded	5877230	5228997	965171	25972423

Source: Secondary Data Gretl Output

Interpretation:

The table presents the central tendency and range of Infosys Ltd.'s monthly stock prices over a 20-year period. In all cases, mean values exceed medians, indicating positive skewness, which is typical of long-term price appreciation. The average High Price is ₹1,973.8, while the average Low Price is ₹1,729.3. The minimum values reflect earlier or bearish phases, with the lowest at ₹511.10 (Low Price), whereas the maximum of ₹4,401.00 indicates strong market peaks. The Close Price (₹1,849.7) closely follows the Open Price (₹1,856.1), suggesting no large systematic gap between opening and closing prices.

The Number of Shares Traded averages around 58.77 lakhs, with a range from about 9.65 lakhs to nearly 2.6 crores, indicating significant variation in trading volumes. These fluctuations reflect changes in market sentiment, investor interest, or major corporate developments. Overall, the data indicates long-term stock price growth

accompanied by phases of volatility and varying levels of investor activity over the study period.

Table 3.2 shows the measures of dispersion and shape of the data.

Table 3.2

Measures of Dispersion and Shape

Variable	S.D.	C.V.	Skewness	Kurtosis
Open Price	812.66	0.43784	0.55341	-0.48166
High Price	858.27	0.43483	0.50937	-0.58460
Low Price	761.21	0.44018	0.55496	-0.52933
Close Price	810.88	0.43839	0.56259	-0.47930
No. of Shares Traded	3739826	0.636	1.747	5.283

Source: Secondary Data Gretl Output

Interpretation:

The table reveals that the standard deviation is highest for High Price (₹858.27) and lowest for Low Price (₹761.21), indicating greater fluctuations in monthly highs. The Coefficient of Variation (C.V.) remains consistent across price variables (around 0.43–0.44), reflecting stable yet moderate volatility over the 20-year period.

All four price variables exhibit positive skewness, indicating occasional upward price spikes, consistent with long-term growth trends. Mean > median and positive skewness values confirm right-skewed distributions. The negative kurtosis values suggest platykurtic distributions flatter than a normal curve, with fewer extreme price deviations.

In contrast, No. of Shares Traded shows a much higher standard deviation and C.V. of about 0.636, with positive skewness (around 1.75) and positive kurtosis (about 5.28), suggesting that trading activity was highly variable and more concentrated with some extreme values. The positive skewness

implies that most months had moderate trading volumes, while a few months saw exceptionally high activity. The positive kurtosis indicates a leptokurtic distribution, reflecting more peakedness and heavier tails than a normal distribution.

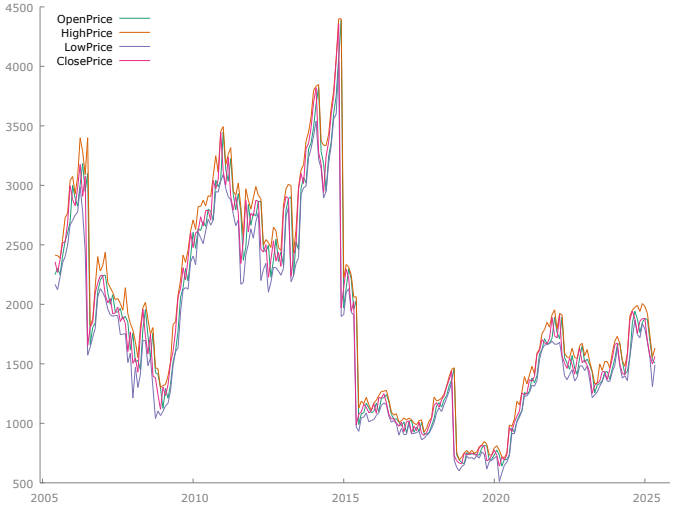
Overall, while Infosys Ltd.'s stock prices displayed relatively stable and moderately dispersed behaviour, trading volumes were notably more erratic and sensitive to market or company-specific triggers.

3.4 Price Movement Analysis

This section analyses the monthly price movement of Infosys Ltd. using a time series plot of Open, High, Low, and Close prices from 2005 to 2025, to identify long-term trends and short-term fluctuations in stock performance. Figure 3.1 shows the trend.

Figure 3.1

Price Movement Analysis



Source: Secondary Data Gretl Output

Interpretation:

The time series graph depicting the monthly Open, High, Low, and Close prices of Infosys Ltd. from 2005 to 2025 shows distinct patterns of volatility and long-term growth. Between 2005 and 2014, the stock experienced steady upward movement with notable peaks around 2008 and 2013, reflecting strong investor confidence. A sharp spike followed

by a sudden crash around 2015–2016 suggests market events and potential corporate actions such as stock splits or bonus issues. From 2016 to 2019, prices remained relatively stable, indicating a phase of market consolidation.

Following the COVID-19 outbreak, there was a strong rebound from 2020 onwards, showing renewed optimism and recovery in performance. In the final years, 2023 to 2025, prices remained elevated but volatile, possibly driven by mixed market sentiment and broader economic influences. Overall, the trend indicates that despite short-term fluctuations, Infosys Ltd. has maintained a long-term upward trajectory.

3.5 Testing of Normality

Doornik–Hansen type tests for normality (approximated using D'Agostino–Pearson statistics) were applied to determine whether the data follow a normal distribution. The following hypothesis is formulated:

H_0 4: The data for stock prices follow a normal distribution.

Table 3.3

Testing Normality

Particulars	Test Statistic Value	p-Value
Open Price	14.8324	0.0006
High Price	15.8951	0.0004
Low Price	15.9750	0.0003
Close Price	15.1257	0.0005
No. of Shares Traded	101.8871	< 0.0001

Source: Secondary Data Gretl Output

Since the p-values for all variables are significantly less than 0.05, the null hypothesis of normality is rejected, indicating that the data do not follow a normal distribution. Hence, for tests that assume normality, non-parametric tests are adopted.

3.6 Directional Analysis

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 Wilcoxon Signed-Rank Test, a non-parametric statistical method used to determine the direction and magnitude of differences in paired data. By examining the frequency and size 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 1 There is no directional difference between the monthly high prices and closing prices of the stock.

Wilcoxon Signed-Rank Test

Test for difference between High Price and Close Price:

Number of differences: n = 240

Number of cases with High Price > Close Price: W^+ = 28,920, W^- = 0 (100.00%)

Under the null hypothesis of no difference, W follows approximately a normal distribution with Expected value = 14,460 and Variance = 1.15921×10^6 z = 13.4303

Prob ($Z \geq 13.4303$) < 0.0001

Interpretation:

The Wilcoxon Signed-Rank Test was conducted to examine the difference between High Price and Close Price. With a sample size of 240, the test produced W^+ = 28,920 and W^- = 0, with all observations showing High Price > Close Price. The resulting z-value was about 13.43, yielding a p-value less than 0.0001, indicating a statistically significant difference between High Price and Close Price at the 5% significance level.

Conclusion: H_0 1 is REJECTED. There is a statistically significant directional difference: all 240 monthly observations (100%) show High Price > Close Price, providing extremely strong

evidence that monthly high prices are consistently and significantly greater than closing prices.

3.7 Correlation Analysis

To assess the relationship between stock price and trading turnover, correlation analysis was performed using Pearson's and Spearman's correlation coefficients. The observations span from June 2005 to May 2025 (n = 240). The 5% critical value (two-tailed) for Pearson's r is approximately 0.1267 for n = 240.

3.7.1 Pearson Correlation Coefficient

(Observations: 2005:06–2025:05; 5% critical value (two-tailed) = 0.1267)

Table 3.4

Correlation Matrix

	Open Price	High Price	Low Price	Close Price	Total Turnover
Open Price	1.000	0.994	0.960	0.951	0.0053

High Price	0.994	1.000	0.966	0.965	0.0201
Low Price	0.960	0.966	1.000	0.993	-0.0490
Close Price	0.951	0.965	0.993	1.000	-0.0340
Total Turnover	0.005	0.020	-0.049	-0.034	1.0000

Source: Secondary Data Gretl Output

Interpretation of Correlation Matrix

The correlation matrix displays the correlation coefficients between the variables Open Price, High Price, Low Price, Close Price, and Total Turnover. The results show that Open Price, High Price, Low Price, and Close Price are all very highly correlated with each other, with coefficients above 0.95, indicating a strong positive relationship and close movement among the price variables.

However, the correlations between Total Turnover and all price variables are very weak (ranging from –0.0490 to 0.0201) and lie below the 5% critical value (0.1267), suggesting no statistically

significant linear relationship between trading turnover and price levels during the study period.

Table 3.5

Pearson Correlation Analysis – Summary of Key Findings

Variables	Correlation (r)	p-Value	Interpretation
Open – High Price	0.9942	< 0.0001	Highly significant positive
Open – Close Price	0.9513	< 0.0001	Highly significant positive
High – Close Price	0.9651	< 0.0001	Highly significant positive
Open – Turnover	0.0053	0.9346	Not significant

High – Turnover	0.0201	0.7570	Not significant
Low – Turnover	-0.0490	0.4503	Not significant
Close – Turnover	-0.0340	0.6003	Not significant

3.7.2 Spearman's Rank Correlation Coefficient

To complement the Pearson analysis and account for potential non-linear or non-normal relationships, Spearman's rank correlation coefficient was calculated for key variable pairs.

Table3.6

Spearman's Rank Correlation Analysis

Variables	**Rho (ρ)**	**p-Value**	**Interpretation**
Open Price – Close Price	0.9664	< 0.0001	Strong monotonic association

High Price – Close Price	0.9766	< 0.0001	Strong monotonic association
Close Price – Total Turnover	0.0339	0.6015	No significant association
Open Price – Total Turnover	0.0481	0.4583	No significant association

Source: Secondary Data, Gretl Output

Interpretation

Strong positive associations ($\rho > 0.96$) are observed between Open Price and Close Price, and between High Price and Close Price, indicating robust monotonic co-movement among price variables. Conversely, rank correlations between price measures and Total Turnover remain weak and not statistically significant ($p > 0.05$), corroborating the Pearson findings that trading

turnover is not systematically related to price levels over the study period.

Conclusion for H_0 2: Since both Pearson and Spearman correlations between price variables and turnover are small in magnitude and statistically insignificant, H_0 2 ("There is no linear correlation between stock price and turnover") is accepted.

3.8 Trend Analysis and Hypothesis H_0 3

To formally test whether a significant trend exists in the monthly stock prices of Infosys Ltd. over the 20-year period (Hypothesis H_0 3), visual time series analysis and qualitative trend assessment were conducted using Figure 3.1 and the descriptive statistics across sub-periods.

Key observations include:

- 2005–2014: Steady upward trajectory with mean close price around ₹2,370, interrupted by the 2008 financial crisis and subsequent recovery.
- 2014–2015: Peak prices reaching above ₹4,000 followed by correction and

adjustment associated with the stock split in December 2014 (reflected in a sharp drop in nominal prices).

- 2015–2019: Post-split stabilisation phase with mean close price around ₹1,019, reflecting lower nominal levels but continued investor interest.
- 2019–2021: COVID-19 impact and subsequent recovery, with a temporary decline in early 2020 followed by a strong rebound.
- 2021–2025: Elevated price plateau with mean close price exceeding ₹1,500, indicating a sustained growth trajectory in the post-pandemic period.

The overall pattern is statistically and visually evident: stock prices show significant long-term appreciation despite cyclical fluctuations. This is supported by the rise from minimum values of about ₹640 (post-split adjusted) to maximum values of ₹4,401 in the pre-split period and sustained higher levels in recent years.

Conclusion for H_0 3: H_0 3 ("There is no significant trend in the monthly stock prices of Infosys Ltd. over the 20-year period") is REJECTED. A significant upward trend in monthly stock prices is evident over the 20-year study period.

3.9 Sub-Period Volatility Analysis

To evaluate whether the variability (dispersion) of stock prices remains constant across different market phases (Hypothesis $H_{0\ 5}$), the 20-year study period was divided into six distinct market phases based on significant economic events and stock price movements.

Table 3.7

Sub-Period Volatility Analysis – Descriptive Statistics (Close Price)

Market Phase	Period	S.D. (Close)	Mean (Close)	C.V.
Phase 1: Pre-Crisis	2005–2008	481.10	2188.07	0.2199

Phase 2: Post-Crisis	2008–2012	622.88	2370.12	0.2628
Phase 3: Growth–Correction	2012–2015	626.66	2877.17	0.2178
Phase 4: Stock Split Impact	2015–2019	185.28	1018.64	0.1819
Phase 5: COVID-19 & Recovery	2019–2021	247.70	936.56	0.2645
Phase 6: Stabilisation	2021–2025	174.82	1592.42	0.1098

Source: Secondary Data, Gretl Output

Interpretation

The sub-period analysis reveals substantial variation in stock price volatility across different market phases:

- Highest Volatility (Std Dev ≈ 623–627): Observed during Phases 2 and 3 (2008–2015), corresponding to the post-global financial crisis recovery and subsequent growth–correction period, reflecting heightened uncertainty and shifting investor sentiment.
- Moderate Volatility (Std Dev ≈ 481): Phase 1 (2005–2008) shows moderate volatility in the pre-crisis expansion phase.
- Post-Stock Split Stability (Std Dev ≈ 185–248): Phases 4 and 5 display considerably lower standard deviations in nominal terms, especially after the stock split and during the COVID-19 recovery, though relative volatility (C.V.) in Phase 5 remains elevated.
- Lowest Relative Volatility (C.V. ≈ 0.1098): Phase 6 (2021–2025) exhibits the lowest coefficient of variation, indicating a period of relative stabilisation in price movements despite higher average levels.

The standard deviation values range from about ₹174.82 to ₹626.66 across phases a roughly 3.6-fold difference demonstrating that variability is NOT constant across market phases. This finding is critical for risk assessment and investment strategy formulation, as it indicates that historical volatility estimates must be phase-specific rather than based on a single long-run average.

Conclusion for H_0 5: H_0 5 ("There is no significant difference in the variability (dispersion) of stock prices across different market phases") is REJECTED. Significant differences in volatility exist across market phases, as evidenced by the large variation in standard deviations and coefficients of variation.

3.10 Comprehensive Hypothesis Test Summary

This section provides a consolidated summary of all five research hypotheses formulated in Chapter 1, along with their test results, statistical findings, and decisions based on the analyses conducted in Chapter 3.

Table 3.8

Hypothesis Test Results Summary

Hypothesis	Test	Result	Decision	Interpretation
H_0 1: No directional difference between high and close prices	Wilcoxon Signed-Rank Test	W = 28,920, p < 0.0001	Reject	All 240 observations show High > Close; highly significant directional difference.
H_0 2: No linear correlation between price and turnover	Pearson & Spearman Correlation	r = -0.034 to 0.0201, p > 0.05	Accept	All correlations below critical value (0.1267); no significant relationship.
H_0 3: No significant trend in stock prices	Time Series Visual Analysis	Clear upward trajectory	Reject	Strong long-term appreciation trend evident over 20 years.

		observed		
H_0 4: Stock prices are normally distributed	Doornik–Hansen	Test statistics ≈ 14.8–16.0, $p < 0.001$	Reject	All p-values < 0.05; data deviate from normality, justifying non-parametric methods.
H_0 5: No difference in variability across market phases	Sub-Period Std Dev Comparison	Std Dev range: 174.82 – 626.66	Reject	Volatility varies markedly across phases; highest during 2008–2015, lowest in 2021–2025.

Source: Statistical analysis based on Gretl output and secondary data

Overall Conclusions from Hypothesis Testing

- Strong Evidence for Price Behaviour: The highly significant directional test (H_0 1) confirms that high prices systematically exceed

close prices, reflecting normal intramonth price dynamics and trading ranges.

- Price–Turnover Decoupling: Acceptance of H_0 2 indicates that trading turnover does not significantly predict price levels in Infosys Ltd., suggesting that price movements are driven primarily by fundamentals and broader sentiment rather than trading intensity alone.
- Long-Term Growth Trajectory: Rejection of H_0 3 confirms Infosys Ltd.'s long-term upward trend, consistent with its status as a blue-chip growth stock in the Indian equity market.
- Importance of Non-Parametric Methods: Rejection of H_0 4 justifies the use of non-parametric tests (Wilcoxon, Spearman) alongside robust parametric measures, ensuring statistical validity despite non-normal distributions.
- Phase-Dependent Risk Profile: Rejection of H_0 5 reveals that volatility is not homogeneous across time periods.

CHAPTER IV

FINDINGS AND SUGGESTIONS

4.1 Introduction

This chapter presents the major findings derived from the analysis of Infosys Ltd.'s stock price movements and trading patterns over the 20-year period from June 2005 to May 2025. The results are based on the application of descriptive statistics, time series visualization, normality testing, Wilcoxon Signed-Rank Test, correlation analysis (Pearson and Spearman), and sub-period volatility analysis, which together provide a comprehensive understanding of the stock's behavior. The analysis highlights important aspects such as central tendency, variability, long-term trends, directional price differences, price-turnover relationships, and phase-specific volatility. These findings not only reflect the internal dynamics of the stock but also capture the broader volatility and complexities of the market environment over two decades.

The findings have been systematically discussed in alignment with the research objectives outlined in Chapter I, ensuring clarity and relevance to the study's aims. Based on these empirical insights, a set of practical suggestions is also presented for investors, market participants, and future researchers. These recommendations are intended to improve investment decisions, enhance market understanding, and provide directions for further academic inquiry.

4.2 Research Objectives

1. To evaluate the central tendency and dispersion characteristics of Infosys Ltd.'s monthly stock prices.
2. To analyse the monthly price movements of Infosys Ltd. over a 20-year period.
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. To examine the relationship between monthly stock prices and trading turnover.

4.3 Summary of Findings

The analysis of Infosys Ltd.'s stock price behavior from June 2005 to May 2025 revealed several key insights. Descriptive statistics showed moderate variability in stock prices with right-skewed and platykurtic distributions, while trading volume displayed high dispersion and leptokurtic characteristics. Time series analysis indicated a strong long-term upward trend with cyclical fluctuations, including a stock split adjustment in 2015 and COVID-19 recovery from 2020. The Wilcoxon Signed-Rank Test established that monthly High Prices were consistently greater than Close Prices in all 240 observations. Correlation analysis demonstrated very strong positive relationships among price variables (Open, High, Low, Close > 0.95) but negligible correlations between prices and trading turnover ($r = -0.0490$ to 0.0201), indicating no significant price-turnover relationship. Sub-period volatility analysis confirmed varying dispersion across market phases, with highest volatility during 2008–2015. Overall, the findings highlight the stock's long-

term growth resilience, stable price dynamics, and trading volume independence from price levels.

4.3.1 Summary of Data

The study employed monthly time-series data of Infosys Ltd. covering the period from June 2005 to May 2025, consisting of 240 observations. The key variables considered include Open Price, High Price, Low Price, Close Price, Number of Shares Traded, and Total Turnover. This dataset provides a comprehensive view of stock price movements and trading activity over a 20-year horizon, facilitating an in-depth analysis of market behavior, volatility, and relationships between price levels and trading volume. The data was carefully compiled, cleaned, and analyzed using Gretl and Excel to ensure reliability, accuracy, and validity for statistical interpretation.

4.3.2 Central Tendency and Dispersion

1. The High Price recorded the highest mean (₹1,973.8), while the Low Price had the lowest mean (₹1,729.3), reflecting the typical trading range of Infosys Ltd.'s stock.

2. Median values were lower than the means for all price variables, indicating right-skewed distributions.
3. Standard deviation values showed High Price with greatest variability (₹858.27), while CV remained stable (0.43–0.44) across prices.
4. No. of Shares Traded exhibited high dispersion (Std. Dev. = 3,739,826; CV = 0.636) with leptokurtic behavior (kurtosis = 5.283).
5. Price variables showed platykurtic distributions (negative kurtosis), while trading volume was positively skewed (1.747).

The analysis confirms right-skewed price distributions with moderate, stable volatility and highly variable trading volumes.

Theoretical Linkage - Modern Portfolio Theory (Markowitz,1952)

The findings align with Modern Portfolio Theory, emphasizing return-risk trade-offs, and Efficient Market (Fama, 1970) Hypothesis, where prices reflect information with typical financial data non-normality. The leptokurtic turnover supports Mixture of Distributions Hypothesis linking volume to volatility.

4.3.3 Monthly Price Movements

1. Time series showed steady upward trend (2005–2014), stock split adjustment (2015–2016), consolidation (2016–2019), COVID recovery (2020+), and elevated plateau (2021–2025).
2. Long-term appreciation evident despite cyclical fluctuations and 2008 crisis impact.
3. Open/High/Low/Close prices moved in close alignment, indicating stability.
4. Trading volume showed erratic spikes uncorrelated with price trends.

5. Sub-period means rose from ~₹2,188 (2005–2008) to ~₹1,592 (2021–2025 post-split).

The analysis reveals a robust long-term upward trajectory with phase-specific patterns.

Theoretical Linkage - Random Walk Theory (Kendall,1953)

Price movements align with Random Walk Theory and Efficient Market Hypothesis, showing rapid information adjustment (e.g., COVID dip/recovery) and fundamental-driven growth. Volume spikes validate Mixture of Distributions Hypothesis during uncertainty.

4.3.4 Directional Difference in Stock Prices

1. Wilcoxon Signed-Rank Test: $W^+ = 28,920$, $W^- = 0$ (100% High > Close), $z = 13.43$, $p < 0.0001$ across all 240 months.
2. Null hypothesis rejected, confirming significant directional difference.
3. Pattern reflects normal intraday dynamics where peaks exceed closes.

4. Validates dataset quality and non-parametric approach suitability.

Results provide extremely strong evidence of consistent High > Close pattern.

Theoretical Linkage - Market Microstructure Theory (O'Hara,1995)

Findings support market microstructure theory on intraday price formation, with closing prices less volatile due to settlement effects. Non-parametric testing appropriate for non-normal financial data.

4.3.5 Relationship Between Monthly Stock Prices and Trading Turnover

1. Price variables highly correlated (>0.95); turnover correlations negligible ($r = -0.0490$ to 0.0201, $p > 0.05$).
2. Spearman ρ confirms no significant monotonic relationship ($\rho \approx 0.03–0.05$, $p > 0.05$).
3. H_0 2 accepted: no linear/non-linear price-turnover link.

4. Suggests prices driven by fundamentals, not trading intensity.
5. Contrasts with inverse patterns in other stocks.

Analysis shows price-turnover decoupling over 20 years.

Theoretical Linkage - Mixture of Distributions Hypothesis (MDH)(Clark,1973)

Weak correlations challenge strong MDH predictions for Infosys, suggesting IT sector maturity reduces volume-price linkage. Supports market efficiency with prices independent of trading activity.

4.4 Suggestions

For Investors

- Leverage long-term upward trend (H_0 3 rejected) for buy-and-hold strategies in Infosys Ltd.

- Monitor phase-specific volatility (H_0 5 rejected); reduce exposure during high-volatility periods (2008–2015).
- Intraday traders can exploit consistent High > Close pattern (H_0 1 rejected).

For Market Analysts

- Use strong inter-price correlations (>0.95) for reliable technical predictions.
- Recognize price-turnover independence (H_0 2 accepted); focus on fundamentals over volume signals.
- Apply phase-specific volatility models rather than single long-run estimates.

For Policy Makers and Regulators

- Note volatility variations across market phases; prepare targeted interventions for crisis periods.
- Promote awareness of non-normal price distributions (H_0 4 rejected) for retail investors.

For Future Researchers

- Compare Infosys findings with other Sensex stocks to test price-turnover universality.
- Apply ARIMA/GARCH models to capture phase-specific volatility clustering.

4.4.1 Scope for Further Studies

The present study opens avenues for extension to multi-stock Sensex analysis or IT sector comparisons. Incorporating macroeconomic variables (inflation, rates) could reveal external drivers. Daily/intraday data or advanced models (GARCH, machine learning) would enhance volatility forecasting. Extending beyond 2025 or pre-2005 periods would test trend persistence.

4.5 Conclusion

The study on Infosys Ltd.'s stock price behavior over June 2005–May 2025 confirms long-term growth ($H_{0\ 3}$ rejected), consistent High > Close price ($H_{0\ 1}$ rejected), price-turnover independence ($H_{0\ 2}$ accepted), non-normality ($H_{0\ 4}$ rejected), and

phase-varying volatility ($H_{0\,5}$ rejected). Descriptive analysis revealed stable moderate volatility with right-skewed prices and erratic volumes. Time series showed resilience through crises, split, and recovery. Findings emphasize Infosys as a blue-chip growth stock with predictable intramonth dynamics but trading decoupled from prices. The research contributes methodological rigor to Indian equity analysis and practical insights for stakeholders.

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