

A Decadal Analysis of Stock Price Dynamics and Trading Activity of Adani SEZ Ltd



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**A Decadal Analysis of Stock Price
Dynamics and Trading Activity of
Adani Ports & SEZ Ltd**

A Research Monograph

By

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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.

Principal

Dr. M V Georgekutty

PREFACE

This book is an outcome of the workshop on “Secondary Data and AI-Assisted Research Tools” conducted by the PG Department of Commerce under the initiative and coordination of Ms. Anitta Thomas, Head of the Commerce Department, Christ College, Puliyanmala, whose dedicated efforts in organising the programme provided the conceptual foundation and motivation for this study. I also extend my sincere gratitude to Dr Bobby Thomas, Assistant Professor, PG and Research Department of Commerce, Pavanatma College, Murickassery, Idukki, whose expert teaching, insightful feedback, and academic mentorship during the workshop significantly strengthened the analytical depth and overall quality of this research.

This book presents a detailed analytical examination of the stock price behaviour of Adani Ports and Special Economic Zone Ltd. (APSEZ) over a ten-year period, utilising monthly secondary data to capture shifts in market trends, volatility, and trading dynamics. Through descriptive statistics, correlation analysis, time-series visualisation, and non-parametric testing methods, the study explores the stock’s central

tendency, dispersion characteristics, long-term movements, and the association between price levels and trading turnover. The results highlight notable fluctuations, distinct volatility phases particularly around major market-triggering events and a clear long-term upward trajectory reflective of both corporate expansion and investor sentiment.

The relevance of this study lies in its structured, analytical approach supported by AI-assisted tools that enhance both precision and interpretive depth. By focusing on one of India's major port and logistics enterprises, this book provides a practical model for conducting financial research using secondary data and contemporary analytical methods. It is hoped that this work encourages students, scholars, and practitioners to adopt evidence-based methodologies and embrace technologically enriched research practices in the study of financial markets.

Dhanya Mohanan

ABSTRACT

This study provides a comprehensive analysis of the stock price behaviour of Adani Ports and Special Economic Zone Ltd. (APSEZ) over a ten-year period using monthly secondary data. The research examines key dimensions of market performance, including central tendency, dispersion, long-term price movements, volatility patterns, and the relationship between monthly stock prices and trading turnover. Descriptive statistics, time-series visualisation, correlation analysis, and non-parametric sign tests are employed to evaluate price dynamics and trading activity. The findings reveal notable variability in stock prices, a sustained long-term upward trend, and distinct phases of volatility, particularly around major market-triggering events. A moderate inverse association between price levels and trading turnover is also observed, indicating higher trading activity during periods of price decline or heightened uncertainty. By integrating traditional analytical methods with AI-assisted tools, this study contributes to the growing literature on stock market behaviour and offers a structured framework for conducting secondary data-based financial research in the Indian context.

Chapter 1

Introduction and Research Framework

1.1 Introduction

The Bombay Stock Exchange Sensitive Index, commonly known as the BSE SENSEX, is a benchmark stock market index that represents the Indian stock market. It comprises 30 of the largest and most actively traded stocks on the Bombay Stock Exchange (BSE), covering various sectors such as finance, energy, technology, and consumer goods. The SENSEX is a free-float market capitalization-weighted index, meaning that the companies with the largest market capitalization have a greater impact on the index's performance. The 30 companies that make up the SENSEX are selected based on their market capitalization, liquidity, and trading frequency, among other factors. The composition of the SENSEX is reviewed regularly, typically every six months, to ensure that it remains representative of the Indian

stock market. Companies that no longer meet the selection criteria are replaced by new companies that better reflect the market's dynamics. By tracking the performance of these 30 companies, the SENSEX provides a snapshot of the overall health of the Indian stock market and economy.

1.2 Company profile

Adani Ports & Special Economic Zone Ltd. (APSEZ) is a large-cap company with a market capitalization of ₹2,88,767 crores, operating in the shipping sector. The company is involved in port services and infrastructure leasing. The company's PE ratio stands at 26.06, while the PB ratio is 4.45, and the dividend yield is 0.52%. The EPS is ₹51.35, and the face value is ₹2.00.

The promoters hold a significant stake of 65.89% in the company, while Foreign Institutional Investors (FII) and Domestic Institutional Investors (DII) hold 13.43% and 14.73%, respectively. Mutual funds hold 5.02% of the company's shares, and the public holds 5.95%. In terms of financial performance, the company has

reported a revenue growth of 14.79% in FY 2025, with a net profit margin of 35.69%. The Return on Equity (ROE) stands at 17.76%, and the debt-to-equity ratio is 0.73.

The company's share price is ₹1,338.00, with a 52-week high and low of ₹1,604.95 and ₹995.65, respectively. The share has given a return of -8.94% in the last one year, 100.01% in the last three years, and 283.49% in the last five years. Analysts have a median target price of ₹1,627.38 for the company, with 9 strong buy and 8 buy recommendations. When compared to its peers, APSEZ Ltd. has a competitive price-to-earnings ratio and price-to-book ratio.

1.3 Need of the study

The need for a study on APSEZ Ltd. could be driven by several factors

Understanding Market Performance: Analyzing APSEZ's market performance, financials, and growth prospects can help investors make informed decisions.

Evaluating Investment Opportunities: The study can provide insights into APSEZ's strengths, weaknesses, opportunities, and threats, enabling investors to assess the potential for returns on investment.

Assessing Industry Trends: Examining APSEZ's position within the shipping and logistics industry can help identify trends, challenges, and opportunities that may impact the company's future performance.

Informing Strategic Decisions: The study can provide valuable information for stakeholders, including investors, policymakers, and industry professionals, to inform strategic decisions related to APSEZ or the broader industry.

Analysing Impact of Economic Factors: Understanding how economic factors, such as GDP growth, trade policies, and global market trends, impact APSEZ's performance can help stakeholders anticipate potential challenges and opportunities.

By conducting a study on APSEZ, researchers can gain a deeper understanding of the company's operations, financial performance, and growth prospects, ultimately contributing to more informed decision-making.

1.4 Research Objectives:

1. To describe the central tendency and dispersion characteristics of stock prices.
2. To analyse the monthly price movements of over a 10 year period.
3. To identify any long-term trends in the performance of the stock
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 10-year period?

2. What trends and fluctuations are observed in the monthly stock price movements over the study period?
3. To test whether the monthly high prices of the stock are consistently greater than the closing prices.
4. Is there a statistically significant relationship between monthly stock prices and trading turnover?

1.6 Research Hypothesis

- H_{0 1} There is no significant variability in the monthly stock prices over the 10-year period.
- H_{0 2} There is no significant trend in the monthly stock prices over the 10-year period.
- H_{0 3} There is no directional difference between the monthly high prices and closing prices of the stock.
- H_{0 4} There is no linear correlation between stock price and turnover.

1.7 Scope of the study

This study focuses on analysing the monthly stock price movements and trading turnover of a selected stock over a 10-year period. It aims to provide a comprehensive understanding of the central tendency, variability, and distribution of stock prices, while identifying long-term trends and patterns in market behaviour. The scope includes examining the directional relationship between high and closing prices and evaluating the correlation between stock prices and trading turnover.

1.8 Research Methodology

1.8.a. Research Design

The study adopts a quantitative, descriptive, and analytical research design. It involves the use of historical stock market data to analyze patterns, trends, and relationships among key financial variables over a defined period.

1.8.b. Source of Data

The study is based on secondary data collected

from authentic financial databases such as the Bombay Stock Exchange (BSE).

1.8.c. Period of the Study

The analysis covers a 10-year period, from May 2015 to June 2025, ensuring a sufficient time frame to observe meaningful trends and relationships.

1.8.d. Variables Considered

Dependent Variables: Monthly Stock Prices (Open, High, Low, Close)

Independent Variables: Trading Turnover (Volume of shares traded)

1.8.e. Software Used

The data analysis is carried out using Gretl

1.8.f. Tools of Analysis

Descriptive Statistics: Mean, Median, Standard Deviation, Skewness, Kurtosis

Time Series Analysis: Trend analysis using line graphs and moving averages

Paired Sample t-Test: To compare monthly high and closing prices

Correlation Analysis: Pearson's correlation to examine the relationship between stock prices and turnover

Regression Analysis: To evaluate the linear relationship between variables like opening stock and closing stock.

1.9 Limitation of the Study

While this study provides valuable insights into stock price behavior and related trends, it is subject to certain limitations. Firstly, the analysis is based solely on historical data from a selected company or set of stocks, which may not represent the entire market. Secondly, external factors such as macroeconomic conditions, political events, and global financial trends have not been extensively considered, though they can significantly influence stock prices and turnover. Thirdly, the study relies on secondary data, which may have inherent issues related to accuracy and consistency. Additionally, the use of limited statistical tools may not fully capture complex market dynamics. Finally, the findings are time-bound and may not hold true

under different market conditions or in future periods.

1.10 Chapterisation

Chapter 1: Introduction and Research Framework

This chapter introduces the study by providing its background, defining the research problem, and outlining the objectives, research questions, and hypotheses. It also details the scope, limitations, and the methodology employed for the analysis.

Chapter 2: Literature Review

This chapter reviews relevant literature on stock price behavior, turnover patterns, trend analysis, and statistical tools used in stock market research. It highlights existing research gaps and establishes the theoretical basis for the study.

Chapter 3: Data Analysis

This chapter presents the analytical part of the study, including descriptive statistics, time series visualizations, results of the Sign Test, and correlation analysis, all aimed at addressing the research questions.

Chapter 4: Findings and Recommendations

This chapter summarizes the key findings of the analysis, interprets the results in relation to the study's objectives, and offers practical suggestions for investors, researchers, and policy-makers.

Chapter 2

Literature Review

This chapter reviews key literature on stock price behaviour, trading turnover, volatility, correlation, and time series analysis, with a focus on both global and Indian stock markets. It highlights methodological approaches used to examine market efficiency, trend patterns, and the effects of external events such as the Hindenburg Research report. The review identifies significant gaps, including the lack of long-term monthly analyses, limited integration of trading volume with price trends, and insufficient event-focused studies in the Indian context. This foundation supports the current study's aim to analyse long-term stock price patterns and their relationship with trading turnover in India

2.1 Stock Price Behaviour

The study conducted by Pradhan and Narasimhan investigated the behaviour of Indian stock price

indices for the 12-year period 1990-2001. This period coincides with major changes in the Indian capital market and the opening up of the Indian economy. The stock market witnessed unprecedented swings and volatility during this period, which have had severe repercussions for investors, both individual and institutional. The study also explores other important issues facing the Indian stock market such as return volatility, including its time varying pattern, tests of market efficiency, impact of foreign capital inflows on the volatility of the indices and correlation of Indian indices with those of some Asian and developed country markets (Pradhan,2003).

In this study, Fuss in the year 2005 examined the random walk hypothesis and weak-form market efficiency in seven Asian emerging markets, focusing on the impact of financial market integration. It uses Lo and MacKinlay's single variance ratio test, Chow and Denning's multiple variance ratio test, and a nonparametric runs test to assess whether stock prices follow a random walk. Results indicate that in the pre-liberalization

period, weekly stock prices did not follow a random walk, suggesting market inefficiency. However, in the post-liberalization period, most markets showed weak-form efficiency at the 5% significance level, except Indonesia and Thailand. This suggests that financial integration improves market efficiency, limiting domestic investors' ability to earn abnormal returns through prediction-based strategies Füss, R. (2005).

Using a dynamic version of the present value model and a range of developed and Asian emerging markets, Chen and Fraser's article considers estimates of stock market prices given expectations on dividends and earnings and compares these fundamental stock prices with actual stock prices. The reported empirical results suggest that a dynamic present value model combined with differing definitions of cash flows can explain actual stock price movements for many of the sample markets. For markets where price deviations from fundamental value are statistically significant, the revealed deviations are investigated by considering types of investor behaviour which

might drive such departures (Chen and Fraser, 2010).

2.2 Trading Volume and Turnover

Tkac in this paper introduces a theoretical rebalancing benchmark linking individual stock trading volume to market-wide activity. Using data from large NYSE/AMEX firms, it shows that while 20% of firms align with the model's predictions, notable deviations highlight anomalous trading behaviour. Excess turnover is positively associated with option availability and institutional ownership, and negatively with firm size. The impact of S&P 500 inclusion is mixed—it boosts trading for firms previously under the benchmark but not for those already over it. The study confirms that the benchmark is effective for identifying and filtering abnormal trading through firm-level market model regressions (Tkac,1999)

This study examines the sharp rise in trading activity and its impact on market efficiency. Increased turnover is linked to more frequent, smaller trades and declining trading costs. Stocks

with high institutional ownership show the greatest turnover growth, indicating institutional investors drive the trend. Variance ratio tests suggest institutional trading enhances information-based trading. Intraday volatility has declined, and prices increasingly follow a random walk. Additionally, turnover has become more responsive to past returns, while cross-sectional return predictability has dropped, reflecting the broader adoption of quantitative trading strategies and more efficient price formation (Chordia et al.,2011).

2.2 Price Volatility and Trends

The study conducted by Zumbach in 2010, investigates how past price behaviour influences realized volatility, revealing that trending prices increase volatility, while driftless prices reduce it—a newly identified stylized fact called “volatility induced by trend.” This effect, distinct from traditional heteroskedasticity, is measured using the product of non-overlapping returns. Empirical analysis on USD/CHF exchange data across various time horizons confirms the trend

effect. ARCH-based models are modified to incorporate this factor, and their forecasting performance is evaluated. Results show that the shape of the memory kernel (particularly power-law) is the most critical for accurate forecasting, followed by the trend effect, with mean reversion playing a nuanced role (Zumbach, 2010).

China's stock market has experienced a big bull market in 2007 and a bear market in 2008. Since then, with the influence of the global economy, China's stock market exhibits ups and downs as usual. We examine the relationship between the stock market sector indices from the meso level, and divide the periods into two stages. One stage represents the drastic shock periods in 2007 and 2008, and the other represents the general ups and downs periods. In the first stage when the market experiences drastic ups and downs, the sector indices tend to rise or fall together, and exhibit very close correlations between each other. In the second stage, however, much smaller correlations appear, and the stock price indices reflect the

cyclical characteristics of the real sector economy (Cao, et al.,2013)

2.4 Correlation Analysis on Stock Market Price

Sharma and Banerjee studied various sectors of the Bombay Stock Exchange (BSE) for a period of 8 years from April 2006 to March 2014. Using the data of daily returns of a period of eight years we make a direct model free analysis of the pattern of the sectorial indices movement and the correlations among them. Our analysis shows significant auto correlation among the individual sectors and also strong cross-correlation among sectors. We also find that auto correlations in some of the sectors persist in time. This is a very significant result and has not been reported so far in Indian context. These findings will be very useful in model building for prediction of price movement of equities, derivatives and portfolio management. We show that the Random Walk Hypothesis is not applicable in modelling the Indian market and mean–variance–skewness–kurtosis based portfolio optimization might be required. We also find that

almost all sectors are highly correlated during large fluctuation periods and have only moderate correlation during normal periods (Sharma and Banerjee,2015).

The study by Chen and his colleagues analyses the connectivity of the Shanghai Stock Exchange (SSE) A-shares to assess market efficiency and risk contagion, comparing tranquil periods with the high-leverage 2015 subprime crisis period. Using dynamic correlation networks built via Pearson correlations and strongly connected subgraphs, the study finds that the SSE network exhibits stronger small-world and connective properties during crises. Finance, energy, and utilities sectors show higher intra-sector connectivity. HUB nodes play a key role in bull markets, while bear markets show a thin-tail degree distribution and distinct characteristics in market value and finance. Granger causality networks further support these findings, offering insights for portfolio optimization and risk management (Chen et al.,).

Godfrey, Granger, and Morgenstern argued that stock prices and trading volumes are unrelated, challenging the relevance of traditional supply and demand theory in explaining stock market behaviour. They claimed no connection exists between stock price series and transaction volumes, casting doubt on the usefulness of economic models widely used in textbooks. However, the current paper refutes their inference, showing it to be incorrect. It emphasizes that dismissing supply and demand theory based on their findings is misguided, as these tools remain vital for understanding stock market dynamics and price determination, despite the statistical observations made by the earlier authors (Crouch,1970).

2.5 Sign Test on Stock Market Price

This paper written by Corrado and Zivney evaluate a nonparametric sign test for abnormal security price performance in event studies. The sign test statistic examined here does not require a symmetrical distribution of security excess returns

for correct specification. Sign test performance is compared to a parametric t-test and a nonparametric rank test. Simulations with daily security return data show that the sign test is better specified under the null hypothesis and often more powerful under the alternative hypothesis than a t-test. The performance of the sign test is dominated by the performance of a rank test, however, indicating that the rank test is preferable to the sign test in obtaining nonparametric inferences concerning abnormal security price performance in event studies (Corrado and Zivney, 1992).

This study utilises recently developed tests based on ranks and signs, in addition to the traditional variance ratio test, to examine the behaviour of Euro exchange rates. We show that adjustments for multiple tests must be employed in order to avoid size distortions. Overall, such adjustments provide evidence consistent with random walk behaviour of Euro exchange rates (Belaire-Franch & Opong, 2005).

2.6 Time Series Analysis on Stock Market Price

This article published by Wright in 2000 proposes using variance-ratio tests based on the ranks and signs of a time series to test the null that the series is a martingale difference sequence. Unlike conventional variance-ratio tests, these tests can be exact. In Monte Carlo simulations, I find that they can also be more powerful than conventional variance-ratio tests. I apply the proposed tests to five exchange-rate series and find that they are capable of detecting violations of the martingale hypothesis for all five series, whereas conventional variance-ratio tests yield ambiguous results (Wright, 2000).

Predicting stock prices is crucial for investment decisions, but traditional single-stock time-series methods lack a comprehensive view. Stock prices are often influenced by related stocks, and existing relationship data from third-party platforms are limited and outdated. This paper introduces a Time Series Relational Model (TSRM) that combines stock transaction data with time and relationship

insights. It uses K-means for classification, LSTM for time-series features, and GCN for relational data. Tested on Shanghai and Shenzhen stock markets, TSRM improved cumulative returns by 44% and 41%, and reduced maximum drawdown by 4.9% and 6.6%, respectively, outperforming baseline models (Zhao et al.,2023)

2.7 Indian Stock Market Data Analysis

The study on stock market by Parray and others in 2020 says, its a platform for trading shares of public companies, reflects economic growth but is challenging to predict due to its nonlinear nature. This study explores the use of machine learning techniques—Support Vector Machine (SVM), Perceptron, and Logistic Regression—to predict next-day stock trends using historical data from 50 NIFTY 50 stocks (2013–2018). Initial accuracy rates were 87.35% (SVM), 75.88% (Perceptron), and 86.98% (Logistic Regression). By reorganizing the data into a supervised learning format, prediction accuracy improved to 89.93% (SVM), 76.68% (Perceptron), and 89.93%

(Logistic Regression), showing enhanced performance with structured data (Parray et al., 2020)

In the study by Paramati and Gupta in 2011 examines the relationship between stock market performance and economic growth using data from April 1996 to March 2009. Employing tests such as ADF, PP, KPSS, Granger Causality, Engle-Granger Cointegration, and Error Correction Model, the study finds a bidirectional relationship between stock prices (BSE and NSE) and IIP. At the quarterly level, GDP influences NSE but not BSE. The cointegration test confirms a long-run link between stock markets and economic growth, while the error correction model shows that economic growth adjusts to restore equilibrium. The findings support the 'demand-following' hypothesis in the short run, highlighting economic growth's role in market development (Paramati and Gupta, 2011).

The study investigated by Karmakar and Chakraborty in 2000, the monthly and turn-of-the-

month effects in the Indian stock market using calendar day and trading day approaches. Results show that average daily returns are significantly higher in the first half of the month and at the turn of the month compared to other days. Despite exploring possible explanations such as data mining and proxy anomalies, none fully account for these intra-months return patterns. The study concludes by suggesting trading strategies based on these findings, offering valuable insights for investors aiming to optimize the timing of their stock purchases and sales (Karmakar and Chakraborty, 2000).

2.8 Indian Stock Market Data Analysis BSE

The study conducted by Patjoshi and Tanty analyze the volatility patterns of the Bombay Stock Exchange (BSE) and its BSE 30 companies, recognizing that stock market investments are exposed to uncertainties and risks. Volatility reflects the deviation from expected returns and indicates the level of risk in the market. Using daily closing prices from January 1, 2000, to December

31, 2015, the study examines daily returns to assess the impact of individual BSE 30 companies on the BSE Sensex. Tools such as descriptive statistics, correlation, regression, and the GARCH model are employed to evaluate volatility and understand return fluctuations over the 16-year period (Patjoshi and Tanty,2017).

The study explored by Mangukiya and Gondaliya in 2021, explains the relationship between returns and volatility in the Indian stock market, focusing on the Bombay Stock Exchange (BSE) from September 2020 to February 2021. During this period, BSE returns were notably high. The study aims to analyze daily market performance and volatility using the ADF unit root test and ARCH-M model. Findings reveal that the ARCH(1) model effectively captures stock market volatility, aiding in informed buy-sell decisions. Results indicate that the market was inefficient during the study period, with stock price behavior appearing random, highlighting the challenges in predicting short-term movements (Mangukiya and Gondaliya,2021)

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).

2.9 Hindenburg Research Report on the Adani Group's stock prices

The study conducted by Ghosh in 2023 analyses the impact of the Hindenburg Research Report on the Adani Group's stock prices. Using the OLS Market Model under the Event Study Methodology, it examines nine listed Adani

companies, along with SBI and LIC—key stakeholders in the Group. The findings show significant stock price declines, with Adani Total Gas dropping by 83% and Adani Enterprises by 54% by February 28, 2023. In contrast, ACC Ltd. (21.17%), Adani Power (26.43%), and Adani Wilmar (26.48%) experienced relatively lower impacts. The report also negatively affected LIC and SBI, with both failing to generate abnormal returns for shareholders (Ghosh, 2023).

Research Gap

Despite the wealth of literature on stock price behaviour, there remains a distinct gap in studies that combine descriptive statistical analysis, long-term trend identification, and the interplay between stock price and trading turnover using monthly data over an extended time frame. Moreover, the contextual relevance of high-impact events like the Hindenburg report and their influence on stakeholder sentiment and price volatility remains under explored. The present study addresses these gaps by offering a comprehensive temporal

analysis of selected stocks, assessing the consistency of price movements, and uncovering the correlation between price behaviour and trading activity in the Indian stock market landscape.

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Chapter 3

Data Analysis and Interpretation

3.1 Introduction

The present study is structured around a comprehensive analytical framework aimed at examining the behaviour of stock prices through multiple dimensions of Adani SEZ Ltd. over a 10-year period from May 2015 to June 2025. It focuses on assessing the impact of monthly stock prices, trading turnover, price volatility, and identifying long-term trends in stock performance. The study explores the central tendency and dispersion characteristics of stock prices to gain insights into their risk-return profile by using the software Gretl. To achieve these objectives, a combination of analytical tools and techniques are employed, including Microsoft Excel for data tabulation, Gretl (Gnu Regression, Econometrics and Timeseries Library) for statistical testing and

time series analysis. Descriptive statistical tools like mean, media, minimum and maximum are used to measure central tendency and range. Measures of dispersion and shape are explained by standard deviation, C.V., skewness and kurtosis. The time series plots are applied to visualize price patterns and long-term movements. The Sign test is used to test directional differences between high and closing prices, while the Pearson Correlation coefficient is employed to assess the relationship between stock price and trading turnover.

The following are the specific objectives of the study:

1. To describe the central tendency and dispersion characteristics of stock prices.
2. To analyse the monthly price movements of over a 10 year period.
3. To identify any long-term trends in the performance of the stock
4. To examine the relationship between monthly stock prices and trading turnover.

The result of the analysis and detailed interpretation based on the output are described below

3.2 Data Description

The data set presents monthly stock market data for Adani Ports and Special Economic Zone (APSEZ), covering the period from May 2015 to June 2025. The monthly stock price resulting in 121 monthly observations ($n = 121$ months) is taken for the study. The variables like open price, low price, high price, closing price, number of shares, number of trades, total turnover are taken into consideration.

- Month – Time index from May 2015 to June 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

The data set 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 Adani SEZ 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

Variable	Mean	Median	Minimum	Maximum
Open Price	598.18	407.83	192.00	1581.0
High Price	647.37	429.27	211.90	1608.0
Low Price	551.44	374.98	169.65	1451.5
Close Price	603.19	409.13	192.60	1569.7
No of Shares	8.5550e+006	5.7656e+006	1.2658e+006	9.0869e+007
No of Trades	1.3785e+005	99594.	29400.	1.0343e+006
T. Turnover	4.7243e+009	2.8829e+009	4.6217e+008	3.3648e+010

Source: Secondary Data Gretl Output

Interpretation

The stock prices show significant volatility, with wide gaps between minimum and maximum values. The mean is consistently higher than the median, indicating right-skewed distributions and the

presence of occasional sharp price surges. The variables of trade volume highlight irregular but intense trading activity on certain days, reflecting possible market reactions to news events, investor speculation, or corporate announcements. The extremely wide range in turnover suggests episodes of heightened investor interest, possibly triggered by external shocks or strategic developments in the company or broader market. The presence of large outliers — especially in maximum price, volume, and turnover — suggests the influence of extraordinary events, such as market reports (e.g., Hindenburg), policy changes, or investor sentiment shifts. Table 3.2 show the measures of dispersion and shape of the data.

Table 3.2 Descriptive Statistics: Measures of Dispersion and Shape

Variable	SD	CV	Skewness	Ex. kurtosis
Open Price	359.27	0.60061	1.1559	0.38171
High Price	380.84	0.58829	1.0225	-0.052984
Low Price	328.18	0.59513	1.0970	0.25316

Close Price	360.52	0.59768	1.0954	0.16304
No of Shares	1.0643 e+007	1.2440	4.8988	30.391
No of Trades	1.4615 e+005	1.0603	3.8114	18.134
Total Turnover	5.3689e +009	1.1364	2.9622	10.241

Source: Secondary Data Gretl Output

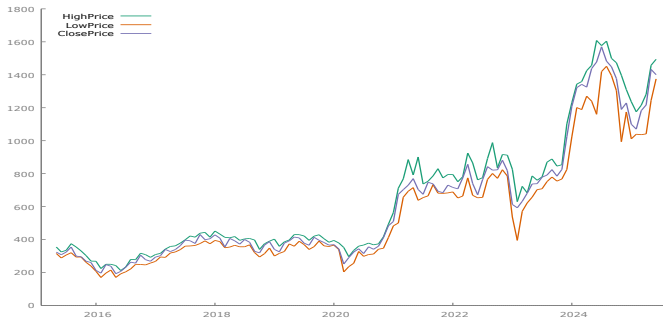
Interpretation

Prices have moderate variability, with C.V. values around 0.59–0.60, suggesting that price fluctuations are significant relative to the mean, but not excessively erratic. All price variables show positive skewness (~ 1.1), indicating that the distribution is right-tailed, with more frequent lower values and occasional high spikes. Excess kurtosis values near zero suggest that price distributions are close to normal, with no extreme outliers—except for the open price which shows slightly heavier tails. The number of shares traded and trades executed, turnover have high variation (C.V. > 1), implying substantial fluctuations in trading activity across months. This could be due

to event-driven volatility (e.g., market news, reports like Hindenburg, or broader economic factors). The data is highly skewed (skewness ~ 4.89 for shares and ~ 3.81 for trades) with very high kurtosis (30.39 and 18.13 respectively), indicating frequent low-volume months and a few extremely high-volume spikes. These outliers highlight months of intensive trading, likely triggered by external news or investor reactions.

3.4 Price Movement Analysis

This section analyses the monthly price movement of Adani SEZ Ltd. using a time series plot of Open, High, Low, and Close prices from 2015 to 2025, to identify long-term trends and short-term fluctuations in stock performance. Figure 3.1 shows the trend.



Source: Secondary Data Gretl Output

Interpretation

The line graph shows the monthly stock price trends (Open, High, low, and Close prices) of Adani Ports—from May 2015 to July 2025. From 2015 to mid-2020, stock prices were relatively stable with moderate growth. A sharp upward trend is observed from late 2020 to mid-2022, indicating strong bullish momentum. A notable dip in early 2023 is followed by volatile recovery, peaking around mid-2024. This pattern confirms long-term growth but with periodic disruptions, especially post-2020.

The graph shows high volatility starting 2021, with large fluctuations between the High and Low

prices (the gap between the orange and blue lines widens). The most significant volatility spike is in early 2023, where price values drop sharply and then rebound—corresponding with the Hindenburg report impact. Volatility remains elevated through 2024–25, indicating market uncertainty or speculative trading. Seasonal patterns are not very prominent suggesting that price changes are not driven by regular seasonal cycles (like quarterly earnings or industry cycles). However, some months in multiple years (e.g., Jan–Mar, May) show repeated price upticks or downturns, which may relate to financial year-end trading, announcements, or investor behaviour.

3.5 Test of Normality

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

H_0 1 The data for stock prices follows a normal distribution.

Table 3.3
Testing Normality

Particulars	Test Statistic Values	P -value
Open Price	75.279	4.50173e-017
Low Price	67.2655	2.47443e-015
High Price	67.3346	2.39039e-015
Close Price	72.6015	1.71708e-016
No.of Shares	776.18	2.84914e-169

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, we move forward to non -parametric test in testing of all hypotheses.

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_{02} 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 High Price and Close Price

Number of differences: $n = 122$

Number of cases with High Price > Close Price: $w = 122$ (100.00%). Under the null hypothesis of no difference, W follows $B(122, 0.5)$

$$\text{Prob}(W \leq 122) = 1$$

$$\text{Prob}(W \geq 122) = 1.88079\text{e-}037$$

Interpretation

$\text{Prob}(W \geq 122) = 7.52\text{e-}37$ (i.e., p-value is 0), and it tells us the probability of observing 122 out of 122 High price > Close price results just by chance, assuming there's no actual difference between the two. Under H_0 , W (number of High > Close cases) follows a binomial distribution $B(122, 0.5)$. Because this p-value is extremely small (much less than 0.05), we reject the null hypothesis.

There is strong statistical evidence that the High Price is consistently greater than the Close Price across all 122 observations. This may suggest intraday price decline (market cools down by closing), Profit booking towards the end of the day or a possible pattern of intraday volatility with mid-session highs.

3.7 Pearson Correlation coefficient

To assess the relationship between stock price and trading turnover. Correlation coefficients, using the observations 2015:05 - 2025:06 5% critical value (two-tailed) = 0.1779 for $n = 122$

Table 3.4 shows the correlation matrix of stock price and trading turnover.

Open Price	High Price	Low Price	Close Price	Total Turnover Rs	
1.000	0.9925	0.9847	0.9854	0.2733	Open Price
	1.0000	0.9887	0.9943	0.3058	High Price
		1.0000	0.9923	0.2397	Low Price
			1.0000	0.2776	Close Price
				1.0000	Total Turn over Rs

Interpretation of Correlation Matrix

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 in Table 3.5.

Table 3.5

Correlation Analysis

Variables	Correlation	Interpretation
Open Price & High Price	0.9925	Very strong positive correlation — when Open Price increases, High Price tends to increase significantly.
Open Price & Low Price	0.9847	Very strong positive correlation — changes in Open Price are strongly associated with changes in Low Price.
Open Price & Close Price	0.9854	Very strong positive correlation — Open and Close prices move closely together.

Variables	Correlation	Interpretation
Open Price & Total Turnover Rs	0.2733	Weak positive correlation — as Open Price increases, Total Turnover may increase slightly, but the relationship is weak.
High Price & Low Price	0.9887	Very strong positive correlation.
High Price & Close Price	0.9943	Very strong positive correlation.
High Price & Turnover	0.3058	Weak to moderate positive correlation.
Low Price & Close Price	0.9923	Very strong positive correlation.
Low Price & Turnover	0.2397	Weak positive correlation.
Close Price & Turnover	0.2776	Weak positive correlation.

All price variables (Open, High, Low, Close) are very strongly correlated with each other (above 0.98). This is expected in stock/commodity price data where prices throughout the day move closely

together. Total Turnover Rs has only weak correlations (0.24 to 0.30 range) with price variables. This suggests that turnover (trading volume $\times$ price) is not strongly influenced by price levels alone, it may be affected by other factors like market demand, speculation, or external events. The following null hypothesis is tested

H_{03} 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 (ρ) = 0.61290856.

$t(120) = 8.49718$, with

two-tailed p-value 0.0001

Interpretation

The correlation value 0.6129 indicates a moderate strong positive monotonic correlation. As the Low

Price increases, Total Turnover (total turnover in rupees) also tends to increase, but not necessarily in a linear way indicating that higher base prices might be associated with higher market activity or value of trade. The relationship is not perfect, but there is a clear positive trend in the rankings. With 120 degrees of freedom, a t-value of 8.4972 is very large and far beyond the critical value needed to establish significance. The p-value is less than 0.0001, which is highly significant. Hence, we can reject the null hypothesis.

3.8 Conclusion

This chapter analyzed the stock price behavior of Adani Ports and SEZ Ltd. over the period May 2015 to June 2025 using descriptive and inferential statistical tools. The findings indicate significant volatility in stock prices and trading activity, with positively skewed distributions and occasional outliers linked to market events. Price trends revealed long-term growth with notable disruptions, especially in 2023. Normality tests

confirmed non-normal data distribution, justifying the use of non-parametric methods. The Sign Test showed that High Prices consistently exceeded Close Prices, suggesting frequent intraday declines or profit booking. Correlation analysis found strong relationships among price variables, but turnover exhibited only weak to moderate correlation, implying other market influences. A moderate positive Spearman's rank correlation between Low Price and Turnover further highlighted a pattern of increased trading at higher price levels. Overall, the analysis reveals a dynamic stock market behavior influenced by both internal price mechanisms and external market developments.

Chapter 4

Findings and Suggestions

4.1 Introduction

This chapter presents the key findings derived from the comprehensive analysis of stock price movements and trading patterns of Adani Ports and Special Economic Zone Ltd. over the ten-year period from May 2015 to June 2025. The analysis, supported by descriptive statistics, time series visualization, correlation tests, and non-parametric methods, has revealed several insights into the behavior of stock prices, trading turnover, and market dynamics. The results reflect both internal pricing patterns and the impact of external events, highlighting the complexity and volatility of the stock market. Based on these empirical findings, a set of practical suggestions is proposed for investors, analysts, and researchers. These recommendations aim to enhance the understanding of market behavior, improve

decision-making, and support further academic investigation.

The findings have been elaborated in detail based on each of the research objectives, ensuring a clear understanding of how the analysis aligns with the study's aims.

Research Objectives

- 1 To describe the central tendency and dispersion characteristics of stock prices.
2. To analyse the monthly price movements of over a 10-year period.
3. To identify any long-term trends in the performance of the stock
4. To examine the relationship between monthly stock prices and trading turnover.

4.2 Summary of Findings

The analysis revealed high stock price volatility, strong correlations among price variables, and weak associations with turnover. Price distributions were non-normal, indicating irregular

trading patterns. A consistent trend of High Prices exceeding Close Prices suggests intraday declines. External events significantly influenced trading behavior, highlighting the market's sensitivity to news and reports.

4.2.1 Summary of data

The study utilized monthly time-series data of Adani Ports and Special Economic Zone Ltd. from May 2015 to June 2025, comprising 121 observations. The key variables analyzed include Open Price, High Price, Low Price, Close Price, Number of Shares Traded, Number of Trades, and Total Turnover (Rs.). This dataset captures stock price behavior and trading activity over a 10-year period, allowing for an in-depth examination of market trends, volatility, and relationships among price and volume variables. The data was cleaned, validated, and analyzed using Gretl and Excel to ensure reliability and accuracy for statistical interpretation

4.2.2 Ccentral Tendency and Dispersion Characteristics

1. The mean values of Open, High, Low, and Close prices were consistently higher than the median, indicating positively skewed distributions.
2. There was a wide range between minimum and maximum prices, reflecting significant price volatility.
3. Standard deviation and coefficient of variation (C.V.) for price variables ($\sim 0.59\text{--}0.60$) indicated moderate but notable variability in stock prices.
4. Skewness (~ 1.1) showed a right-tailed distribution, meaning frequent lower prices with occasional sharp rises.
5. Excess kurtosis values near zero suggested the distribution was close to normal for price data, with some mild outliers.

6. Trade volume indicators (No. of Shares, Trades, Turnover) had very high variation (C.V. > 1), implying irregular trading intensity.
7. High skewness and kurtosis in trading data indicated frequent low-activity months with a few extremely active trading periods.

The analysis shows that Adani SEZ Ltd. stock exhibits moderate volatility with a positively skewed price distribution, indicating long-term appreciation punctuated by occasional sharp rises. Trading activity is highly irregular, suggesting that market participation is event driven rather than constant.

Theoretical linkage

Efficient Market Hypothesis

The central tendency and dispersion of Adani SEZ Ltd.'s stock prices reflect the semi-strong Efficient Market Hypothesis, where prices quickly incorporate public information. The mean shows market consensus, while dispersion indicates volatility from new data or events. Higher

variability during major announcements supports efficient, information-driven price adjustments (Malkiel,1989).

4.2.3 Monthly price movements

8. Time series analysis of monthly stock prices from 2015 to 2025 showed a clear long-term upward trend in the stock performance of Adani SEZ Ltd. From 2015 to mid-2020, prices remained relatively stable with gradual growth.
9. A sharp increase in prices occurred from late 2020 to mid-2022, indicating a strong bullish phase.
10. A significant drop in early 2023 was observed, coinciding with the Hindenburg report, followed by a period of volatile recovery.
11. Price movements remained highly volatile during 2023–2025, reflecting market uncertainty and speculative trading.

12. The gap between High and Low prices widened post-2021, indicating increased intraday volatility.
13. No strong seasonal patterns were detected, but certain months (e.g., January–March, May) showed repeating trends, possibly linked to fiscal year-end or corporate announcements.

The time series analysis of Adani SEZ Ltd.'s monthly stock prices from 2015 to 2025 reveals a clear long-term growth trend interrupted by phases of sharp volatility. The post-2020 bullish surge and the impact of the 2023 Hindenburg report mark significant turning points, highlighting the stock's sensitivity to external events. While no strong seasonal patterns were found, recurring trends in specific months suggest possible links to financial cycles or corporate actions. Overall, the stock exhibited increased volatility in recent years, underscoring the importance of risk assessment for investors.

Theoretical linkage

Efficient Market Hypothesis (EMH)

According to the semi-strong form of the Efficient Market Hypothesis, stock prices reflect all publicly available information. The sharp response of Adani SEZ's stock to the 2023 Hindenburg report illustrates how markets quickly incorporate new, relevant information into stock prices. The absence of strong seasonal patterns further supports the EMH, suggesting that predictable trends are quickly arbitrated away by informed investors (Tıtan,2015).

4.2.4 Long-term Trends in the Performance of the Stock

14. The time series plot revealed a clear long-term growth trend in the stock price of Adani SEZ Ltd. over the 10-year period.
15. The stock experienced stable growth from 2015 to 2020, followed by a rapid upward trend from late 2020 to mid-2022, indicating strong investor confidence.
16. A sharp decline in early 2023, linked to the Hindenburg report, disrupted the upward trend,

but the stock showed signs of recovery by mid-2024.

17. Despite short-term fluctuations, the overall trend remains positive, indicating that the stock has recovered and continued growing over the long run.
18. The presence of short-lived downturns suggests that the stock is sensitive to external market events, but maintains a resilient long-term performance.
19. The analysis confirms that Adani SEZ stock is suitable for long-term holding, despite periodic market shocks.

The analysis of long-term trends in Adani SEZ Ltd.'s stock performance demonstrates a strong and resilient upward trajectory over the 10-year period. Despite the sharp decline following the Hindenburg report in early 2023, the stock recovered steadily, reaffirming investor confidence. The overall growth trend highlights the stock's suitability for long-term investment, with short-term volatility largely influenced by

external events. This resilience underlines the company's strong fundamentals and market position, making it a favorable choice for long-term investors.

Theoretical linkage

Fundamental Analysis Theory

This theory shows a company's intrinsic value is determined by its financial health, business model, and future growth potential. The steady recovery of Adani SEZ's stock following the sharp decline in early 2023 triggered by the Hindenburg report suggests that investors ultimately recognized the firm's strong fundamentals and long-term value, leading to renewed confidence and upward price correction (Abarbanell and Bushee, 1997).

4.2.5 Correlation between Monthly Stock Prices and Trading Turnover

20. The Pearson correlation analysis revealed very strong positive correlations (above 0.98) among stock price variables (Open, High, Low, Close).

21. The correlation between price variables and total turnover was weak to moderate (ranging from 0.24 to 0.30), indicating that turnover is not strongly influenced by price alone.
22. Turnover variability may be influenced by external factors like market sentiment, news, speculation, or corporate announcements rather than just price movements.
23. The Spearman's rank correlation between Low Price and Total Turnover was moderately strong ($\rho = 0.6129$), suggesting a positive monotonic relationship — higher prices tend to coincide with higher trade values.
24. A significant t-value and p-value (< 0.0001) led to the rejection of the null hypothesis, confirming a statistically significant association between price and turnover rankings.
25. This indicates that market activity increases during high-price months, though not always in a linear manner.

The analysis shows a moderate but statistically significant relationship between stock prices and trading turnover. While prices correlate strongly with each other, turnover is influenced by other factors like sentiment or news. Higher prices generally coincide with increased trading activity, though the relationship is not perfectly linear or consistent.

Theoretical linkage

Mixture of Distributions Hypothesis

The Mixture of Distributions Hypothesis suggests that trading volume and price changes are jointly driven by the flow of new information into the market. Under this view, higher prices often coincide with greater turnover because both reflect responses to fresh public or private information, though the relationship is not perfectly linear (Harris,1987).

4.3 Suggestions

Based on the results of the study, the following suggestions are made for investors, stakeholders, and future researchers:

For Investors

1. Adopt a long-term investment approach since the stock has shown consistent appreciation over the decade despite temporary setbacks.
2. Be cautious during price peaks where intraday declines are common, especially for short-term trades.
3. Invest during corrective phases, particularly after market shocks, to benefit from recovery momentum.

For Financial Analysts and Market Observers

1. Consider both price movements and trading activity to assess market sentiment more accurately.

4.3.1 Scope for further Studies

The present analysis offers a foundation for understanding the stock performance and trading patterns of Adani SEZ Ltd., but several areas remain open for deeper exploration. Future studies could expand the dataset to include intraday price movements and high frequency trading data to examine minute level volatility and investor reactions. Additionally, a comparative study across companies or sectors could reveal whether similar trends exist in other infrastructure or energy related firms. Researchers may also explore the impact of social media sentiment and digital news on trading turnover using sentiment analysis tools. Further, the effectiveness of regulatory interventions and policy shifts, such as mandatory Aadhaar linkage or SEBI announcements, could be assessed for their influence on investor confidence and market behavior. Finally, incorporating behavioral economics surveys among retail and institutional investors could offer qualitative insights into psychological factors driving event-based trading decisions.

4.4 Conclusion

The study of Adani SEZ Ltd.'s stock performance from 2015 to 2025 reveals a strong long-term growth trend, interrupted by phases of sharp volatility driven by external events such as the 2023 Hindenburg report. Despite these disruptions, the stock demonstrated resilience and steady recovery, reaffirming its potential as a long-term investment. While price variables showed high internal correlation, trading turnover was only moderately linked to price, highlighting the role of investor sentiment, news, and speculation in shaping market activity. Theoretical frameworks such as the Efficient Market Hypothesis, Fundamental Analysis Theory, and Behavioral Finance provide a comprehensive understanding of these trends. Digital platforms, regulatory changes, and market psychology continue to influence investor behavior and trading dynamics. Overall, the findings underscore the importance of combining quantitative analysis with behavioral insights to make informed investment decisions in a rapidly evolving financial environment. The

study also opens up several avenues for future research and deeper market analysis.

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