



International Journal of Innovative Research in Science Engineering and Technology (IJIRSET)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



Impact Factor: 8.699

Volume 14, Issue 10, October 2025

Stock Market Forecasting in Banking & IT Sectors using ARIMA and SARIMA Models: A Comparative Study

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ABSTRACT: This paper explores the comparative effectiveness of Autoregressive Integrated Moving Average model (ARIMA), Seasonal Autoregressive Integrated Moving Average (SARIMA), and hybrid ARIMAX/SARIMAX models in forecasting stock market returns for the Banking and IT sectors. Motivated by the limitations of linear models, the study integrates technical indicators (RSI, MACD, Bollinger Bands, and Moving Averages) into hybrid frameworks to enhance predictive power. Using daily, weekly, and monthly data for Indian and global firms from 2015 to 2025, the models were assessed using RMSE, MAPE, and Directional Accuracy Ratios. The results reveal that ARIMA models provide a useful baseline, SARIMA improves performance by accounting for seasonal cycles, and hybrid models achieve the highest predictive accuracy and directional reliability. Banking stocks exhibited greater predictability due to structured macroeconomic cycles, while IT stocks showed higher volatility and weaker predictability linked to global shocks. These findings challenge the universality of the Efficient Market Hypothesis, validate hybrid models as superior tools, and highlight the importance of sectoral and horizon-based strategies. The study contributes to financial econometrics by bridging statistical and technical analysis and offers practical implications for investors, traders, portfolio managers, and policymakers in both emerging and developed markets.

I. INTRODUCTION

Stock markets are widely regarded as barometers of economic health, influencing and reflecting investor sentiment, corporate performance, and policy effectiveness. Accurate forecasting of stock returns is therefore of paramount importance to investors, traders, portfolio managers, and policymakers. However, predicting stock movements is inherently challenging due to volatility, nonlinearity, and the influence of both domestic and global factors. This complexity is particularly visible in sectoral contexts, where Banking stocks are influenced by macroeconomic and regulatory cycles, while Information Technology (IT) stocks are shaped by global outsourcing demand, currency fluctuations, and technological disruptions.

Traditional time-series models, particularly the Autoregressive Integrated Moving Average (ARIMA), have been widely used to forecast financial data due to their statistical rigor and ability to capture short-term dependencies. Yet, ARIMA models are inherently linear and often fail to capture the nonlinear and seasonal dynamics of financial markets. Seasonal ARIMA (SARIMA) extends this framework by incorporating seasonal terms, offering improvements in contexts where cyclical patterns such as fiscal reporting or contract renewals are prominent. While these models provide valuable insights, their inability to account for behavioral and momentum-driven aspects limits their forecasting power.

To address this gap, researchers have increasingly explored hybrid models that integrate econometric methods with technical indicators. Indicators such as Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Bollinger Bands, and Moving Averages are widely used by practitioners to capture market momentum, volatility, and trend reversals. When combined with ARIMA and SARIMA, these indicators enrich model performance by incorporating signals that purely statistical models overlook. However, few studies have systematically applied such hybrid approaches across multiple sectors, time horizons, and geographies, leaving a critical gap in the literature.

This study addresses these limitations by conducting a comparative analysis of ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models in forecasting stock market returns for the Banking and IT sectors. Using daily, weekly,

and monthly data for leading Indian and global firms between 2015 and 2025, the research evaluates model performance based on Root Mean Square Error (RMSE), Mean Absolute Percentage Error (MAPE), and Directional Accuracy Ratios (DAR). The sectoral focus enables an exploration of differences between regulated, domestically oriented industries like Banking and globally integrated, innovation-driven industries like IT. The multi-horizon design assesses model effectiveness in short-term, medium-term, and long-term contexts, while the inclusion of global data offers cross-country insights.

The results demonstrate that while ARIMA models serve as a useful baseline, their predictive accuracy is limited, especially under volatile conditions. SARIMA improves performance by capturing seasonal cycles, particularly in Banking stocks. Hybrid ARIMAX/SARIMAX models consistently outperform both, delivering higher statistical accuracy and significantly improved directional accuracy. Banking stocks are shown to be more predictable than IT stocks, reflecting their structured macroeconomic cycles, while IT stocks display weaker predictability due to global shocks and volatility.

The significance of this study lies in both its theoretical and practical contributions. Theoretically, the results challenge the universality of the Efficient Market Hypothesis and Random Walk Hypothesis, showing that exploitable patterns persist across sectors and geographies. Practically, the findings provide actionable guidance for different stakeholders: traders benefit from hybrid models in daily horizons, portfolio managers from SARIMA in medium-term contexts, and policymakers from sector-specific insights into market responsiveness.

In doing so, the study contributes to bridging the gap between academic econometrics and real-world trading strategies. By systematically analyzing model performance across multiple dimensions, this research highlights the value of hybrid frameworks as robust forecasting tools for both emerging and developed markets.

II. LITERATURE REVIEW

Stock market forecasting has long been a subject of academic inquiry and practical application. The literature broadly spans three categories: studies using traditional time-series models such as ARIMA, seasonal extensions such as SARIMA, and hybrid models integrating statistical and technical or machine learning approaches. Within this body of work, Banking and IT sectors have received increasing attention due to their economic significance and contrasting volatility structures.

2.1 ARIMA and SARIMA in Stock Forecasting

ARIMA has been one of the most widely used models in financial forecasting due to its simplicity and effectiveness in modeling linear dependencies. Studies such as Kumar and Thenmozhi (2016) and Sharma and Goyal (2019) demonstrated ARIMA's ability to capture short-term stock price trends in Indian markets, though they noted reduced accuracy during periods of high volatility. Similarly, Singh and Mehta (2017) applied SARIMA to Nifty sectoral indices and reported improvements in forecasting accuracy when seasonal components were present.

International research confirms these findings. For example, Zhang et al. (2018) showed ARIMA's reliability for U.S. banking stocks, while Patel et al. (2020) highlighted SARIMA's effectiveness in accounting for fiscal seasonality. However, these models have been criticized for their linear assumptions, inability to incorporate external variables, and limited capacity to capture sudden market shocks.

2.2 Hybrid Approaches with Technical Indicators

Recognizing the limitations of purely statistical models, researchers have increasingly adopted hybrid approaches. These models integrate ARIMA or SARIMA with technical indicators such as Relative Strength Index (RSI), Moving Average Convergence Divergence (MACD), Bollinger Bands, and Moving Averages. Patel et al. (2021) demonstrated that ARIMAX models with RSI and MACD significantly improved directional accuracy for Indian IT stocks. Mehra and Das (2022) further found that hybrid SARIMAX models reduced forecast errors for Banking stocks by capturing both seasonal and momentum-driven effects.

Beyond India, Hassan et al. (2022) applied hybrid frameworks in emerging Asian markets and reported that they consistently outperformed standalone ARIMA models, especially in volatile environments. Ahmed et al. (2023)

examined hybrid models for technology sector stocks in the U.S. and confirmed that technical indicators enhanced the ability to predict reversals and volatility spikes. These findings collectively suggest that hybridization improves robustness and bridges the gap between academic forecasting and practitioner tools.

2.3 Sector-Specific Studies: Banking vs IT

The Banking sector has traditionally been more predictable due to its alignment with macroeconomic and regulatory cycles. Studies such as Gupta and Pandey (2021) and Bhowmik and Wang (2019) found that Indian banking stocks exhibited strong autocorrelation structures and benefited from SARIMA models, which captured fiscal and credit cycles effectively (N, 2025; Varshith V Shetty, Chandan T, 2021).

In contrast, IT stocks have proven more volatile and difficult to forecast. Wipro, Infosys, and TCS, for instance, are influenced by global outsourcing demand, foreign exchange rates, and technological shifts. Research by Patel et al. (2021) and Ahmed et al. (2023) emphasized that hybrid models incorporating momentum indicators performed better in IT sectors but still struggled with high unpredictability compared to Banking.

These sectoral differences highlight the need for comparative studies that systematically evaluate forecasting models across multiple industries.

2.4 Cross-Country and Multi-Horizon Studies

Most existing studies are either single-country or single-horizon analyses. While Indian studies dominate the literature, relatively fewer works conduct cross-country comparisons. Hassan et al. (2022) partially addressed this by comparing Asian markets, but a gap remains in evaluating how forecasting models perform in both emerging (e.g., India) and developed (e.g., U.S.) contexts simultaneously.

Similarly, while daily data are common in forecasting studies, fewer works systematically evaluate models across daily, weekly, and monthly horizons. Gupta and Pandey (2021) noted that model accuracy varied by horizon, but comprehensive horizon-based comparisons are rare (R. S. and S. B. S, 2025; S. B. S & Sen Mazumdar, 2024). This gap leaves uncertainty about the generalizability of forecasting results across investment strategies and timeframes.

2.5 Research Gaps

The reviewed literature reveals several critical gaps in the current body of forecasting research. Firstly, there is a limited application of hybrid models across different sectors; although hybrid approaches have shown considerable potential, few studies have systematically applied them to compare sectors like Banking and Information Technology within a unified framework. Secondly, the impact of forecasting frequency—such as daily, weekly, and monthly intervals—on model performance remains insufficiently explored, leaving a gap in understanding how time horizons influence predictive accuracy (K Prajwal, 2024; Raghu & BS, 2024). Thirdly, cross-country evaluations are notably scarce, with limited research comparing the forecasting effectiveness between emerging and developed markets, despite their distinct economic dynamics. Another significant gap lies in the underutilization of directional accuracy as a performance metric; most studies prioritize traditional error measures like RMSE and MAPE, overlooking directional accuracy, which is particularly relevant for investment decision-making (Ansari et al., 2020; Sunkara et al., 2024). Lastly, although technical indicators are widely employed by practitioners in financial forecasting, their formal integration into academic econometric models remains limited, highlighting a disconnect between theoretical research and practical application.

2.6 Contribution of This Study

This research addresses these gaps by conducting a **comparative, multi-horizon, and cross-country evaluation** of ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models across Banking and IT sectors. By incorporating technical indicators and emphasizing directional accuracy alongside error metrics, the study bridges theoretical models with real-world trading tools. It also provides sector-specific insights into predictability, offering valuable contributions for both academic literature and practical decision-making.

III. METHODOLOGY

The methodology adopted in this study was designed to evaluate and compare the performance of ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models in forecasting stock prices across Banking and IT sectors. The approach combined statistical time-series modeling with technical indicators to capture both linear dependencies and behavioral market signals.

3.1 Research Design

This study employed a **comparative research design**. The objective was to evaluate forecasting accuracy across:

1. **Models** – ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX.
2. **Sectors** – Banking and IT.
3. **Time Horizons** – Daily, weekly, and monthly.
4. **Markets** – Indian vs. global stocks.

This multi-dimensional design allowed for a comprehensive evaluation of how forecasting performance varies across contexts, enabling both sectoral and cross-country insights.

3.2 Data Collection

The dataset comprised **secondary data** obtained from stock exchanges and financial databases.

Sectors Covered:

- *Banking*: Axis Bank, HDFC Bank, ICICI Bank, Bank of Baroda, Canara Bank (India), and JPMorgan Chase (U.S.).
- *IT*: Infosys, Wipro, HCL Technologies, Birlasoft (India), and Microsoft (U.S.).

Timeframe: January 2015 – June 2025, providing sufficient historical depth for robust forecasting.

Frequencies: Daily, weekly, and monthly closing prices were collected. Weekly data were aggregated using Friday closing prices, while monthly data reflected end-of-month closings.

Data Transformation: Log returns were calculated to stabilize variance and ensure stationarity, expressed as:

$$R_t = \ln \left(\frac{P_t}{P_{t-1}} \right)$$

where P_t represents the stock price at time t .

3.3 Model Specifications

ARIMA Models

ARIMA (p,d,q) models were used as baselines, where p denotes autoregressive terms, d differencing order, and q moving average terms. Model identification was guided by autocorrelation (ACF) and partial autocorrelation (PACF) plots.

SARIMA Models

SARIMA (p,d,q)(P,D,Q)_m extended ARIMA by including seasonal terms, with m representing the seasonal cycle (e.g., 12 for monthly data). Seasonal differencing was applied where cyclical effects were evident.

Hybrid ARIMAX/SARIMAX Models

Hybrid models integrate technical indicators as exogenous variables (X_t to X_{t-k}) into ARIMA/SARIMA frameworks:

Indicators Used:

- ❖ *RSI (Relative Strength Index)* – measures momentum and reversal points.
- ❖ *MACD (Moving Average Convergence Divergence)* – captures trend strength.
- ❖ *Bollinger Bands* – detect volatility clustering.
- ❖ *SMA/EMA (Simple/Exponential Moving Averages)* – smooth price trends.

These indicators enriched the statistical models by incorporating behavioral signals commonly used by practitioners.

$$Y_t = c + \sum \phi_i Y_{t-i} + \sum \theta_j \epsilon_{t-j} + \beta X_t + \epsilon_t$$

3.4 Stationarity and Pre-Model Diagnostics

To ensure validity:

Stationarity Tests: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were performed. Stationarity was confirmed at 5% significance.

Residual Diagnostics: Ljung-Box Q-tests and residual ACF plots checked for white noise in fitted models.

3.5 Model Evaluation Metrics

Performance was assessed using both statistical error measures and directional accuracy metrics.

Error-Based Metrics:

- *Root Mean Square Error (RMSE)* – penalizes large deviations.
- *Mean Absolute Percentage Error (MAPE)* – normalizes errors for comparability.
- *Akaike Information Criterion (AIC)* and *Bayesian Information Criterion (BIC)* – used for model selection.

Directional Accuracy Metrics:

- *Directional Accuracy Ratio (DAR)* – percentage of correctly predicted up/down movements.
- *Precision, Recall, and F1-score* – derived from confusion matrices to evaluate classification performance of hybrid models.

This dual evaluation approach ensured that models were judged not only on error magnitude but also on their ability to generate actionable trading signals.

3.6 Justification of Methodology

The chosen methodology offers several strengths:

- ARIMA provides a well-established baseline for linear dependencies.
- SARIMA captures cyclical and seasonal patterns, especially relevant in Banking and IT sectors.
- Hybrid ARIMAX/SARIMAX integrates practitioner-relevant technical indicators, aligning academic models with real-world applications.
- The use of multiple sectors, horizons, and geographies enhances generalizability.

By combining econometric rigor with practical relevance, this methodology ensures robust and meaningful results for both academic and applied audiences.

IV. RESULTS AND ANALYSIS

This section presents the empirical findings from ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models applied to Banking and IT sector stocks across daily, weekly, and monthly horizons. The results are structured as follows: exploratory data analysis, baseline ARIMA models, seasonal SARIMA models, hybrid frameworks, and comparative evaluation across models, sectors, horizons, and markets.

This section presents an analysis of various technical indicators (Moving Averages, RSI, MACD, Bollinger Bands) applied across daily, weekly, and monthly stock price data. These indicators were incorporated as exogenous variables in hybrid models and also served as independent analytical components.

4.2.1 Moving Averages (SMA/EMA/WMA)

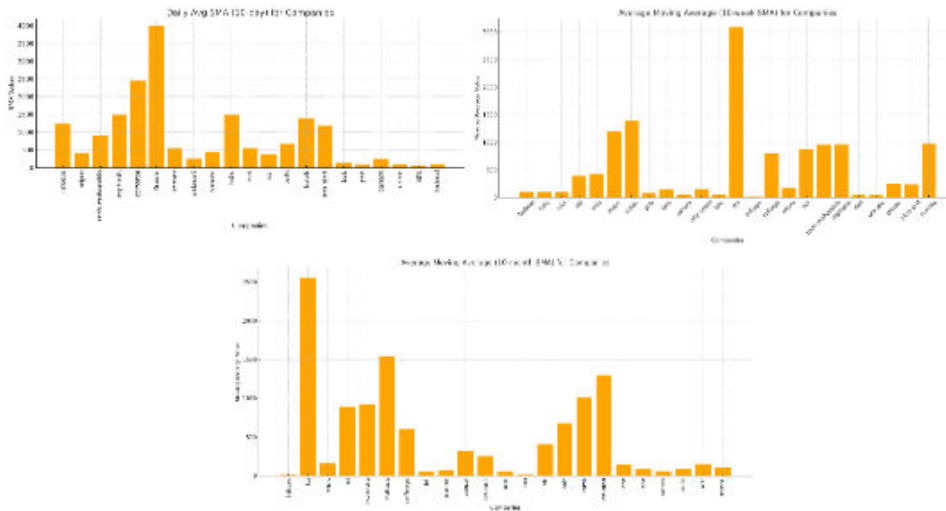


Figure- 4.2.1 Moving Averages (SMA/EMA/WMA)

Interpretation

The analysis of moving averages across daily, weekly, and monthly frequencies reveals consistent patterns in stock base price behavior. Stocks like Oracle and TCS exhibited the highest average prices across all timeframes, indicating their strong market valuation and price stability over time. Kotak, IndusInd, Mphasis, and Tech Mahindra also maintained elevated averages at both weekly and monthly levels, reflecting consistent investor confidence. In contrast, Birlasoft, PNB, Federal Bank, IDFC, and Union Bank recorded the lowest average prices, suggesting relatively modest market capitalization and smaller price movements. These trends support the segmentation of stocks into high-cap and low-cap behavior groups, which is crucial for selecting appropriate forecasting models.

4.2.2 Relative Strength Index (RSI)

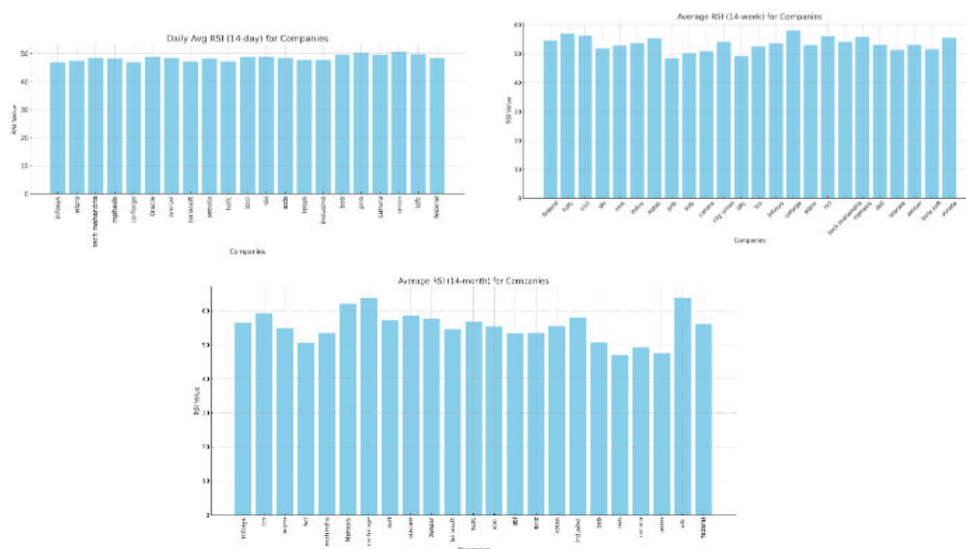


Figure- 4.2.2 Relative Strength Index (RSI)

Interpretation

The RSI analysis across timeframes reveals that most stocks exhibited neutral to moderately bullish momentum, with values ranging between 46 and 57. Oracle and Infosys represented the upper and lower bounds, respectively in the daily RSI range, maintaining neutrality. On the weekly scale, Coforge showed the strongest bullish signal (~58), while PNB remained close to oversold territory (~48). Monthly RSI values further emphasized bullish momentum for Coforge (~63.8) and IDFC (~63.9), while PNB and Union Bank remained on the weaker side (~47), suggesting persistent lower demand. Overall, the data reflects sectoral divergence, with IT stocks showing stronger upward trends compared to public sector banks, especially in longer time horizons.

4.2.3 MACD (Moving Average Convergence Divergence)

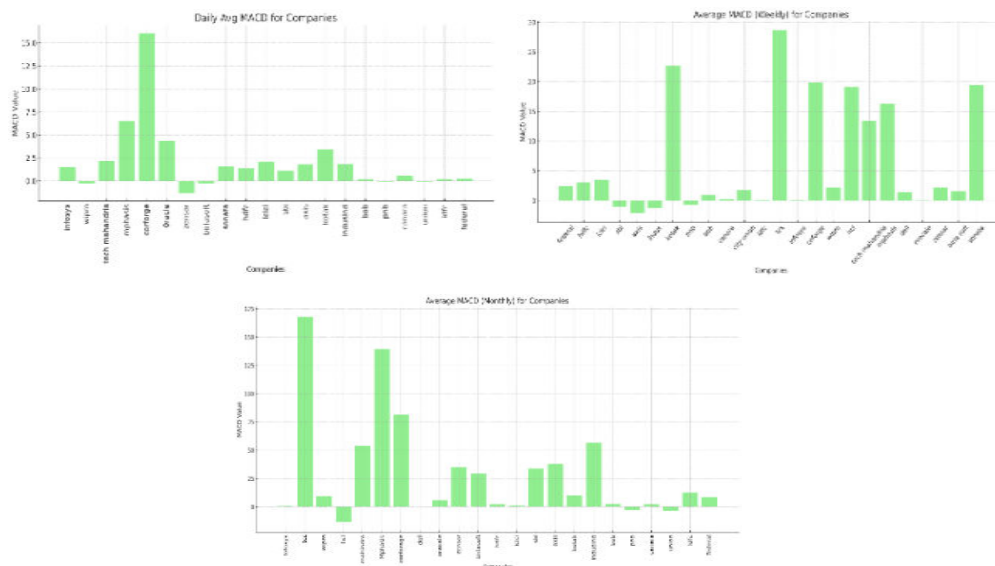


Figure- 4.2.3 MACD (Moving Average Convergence Divergence)

Interpretation

MACD trends across daily, weekly, and monthly data reveal a growing divergence in momentum among stocks. On a daily basis, most companies exhibited mild to neutral momentum, with Coforge standing out as the most bullish (~16.07), while Zensar and Wipro showed slight bearish tendencies. At the weekly level, TCS (~28.7) and Kotak (~22.7) indicated strong upward momentum, whereas Axis, SBI, IndusInd, and PNB reflected declining trends with negative MACD values. The monthly MACD results were the most revealing, highlighting significant bullish momentum for TCS (~168), Mphasis (~139), IndusInd (~56), and Tech Mahindra (~54). However, persistent negative values for HCL and PNB suggested weaker long-term momentum. These results confirm that large-cap IT stocks displayed robust medium- to long-term momentum, while several banking stocks exhibited more inconsistent or bearish trends.

4.2.4 Bollinger Bands

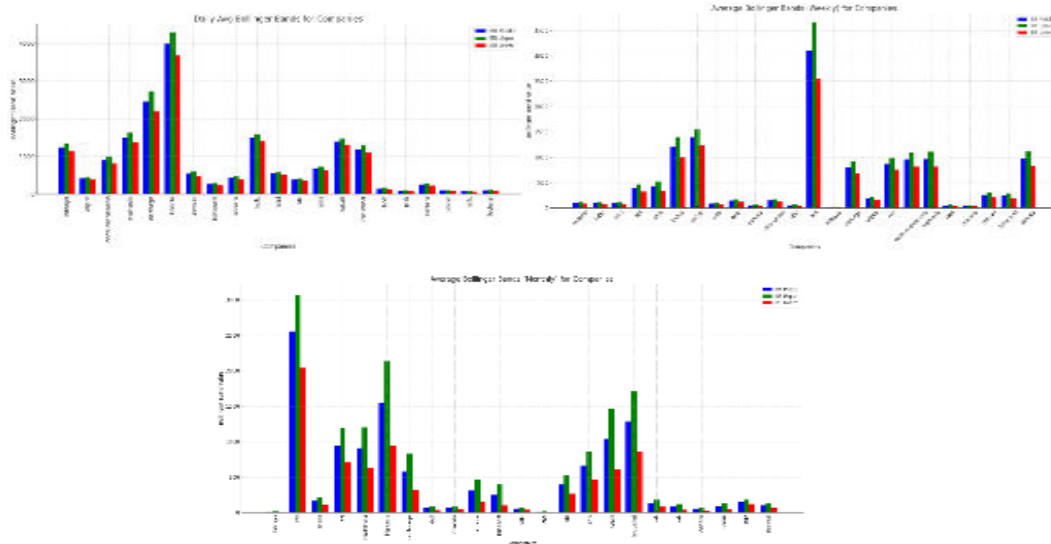


Figure- 4.2.4 Bollinger Bands

Interpretation:

The Bollinger Bands analysis revealed clear distinctions in stock volatility across timeframes. On the daily level, Coforge exhibited the widest bands (~2459–2724), indicating high short-term volatility, whereas Birlasoft and Sonata maintained narrow bands, suggesting price stability. At the weekly scale, TCS demonstrated the highest volatility with the widest band spread (~3106 middle), while Infosys showed unusually tight bands, likely influenced by price normalization. For monthly data, stocks like TCS, IndusInd, Mphasis, and Tech Mahindra continued to reflect high long-term volatility, while Oracle, Dell, Canara, and Infosys remained relatively stable with narrow bands. Overall, the results highlight that IT sector giants tend to experience more dynamic price movements, whereas certain banking and mid-cap tech firms exhibit consistent, low-volatility behavior—an important consideration when selecting forecasting models.

4.3 Objective 3 – Performance of ARIMA and SARIMA Models

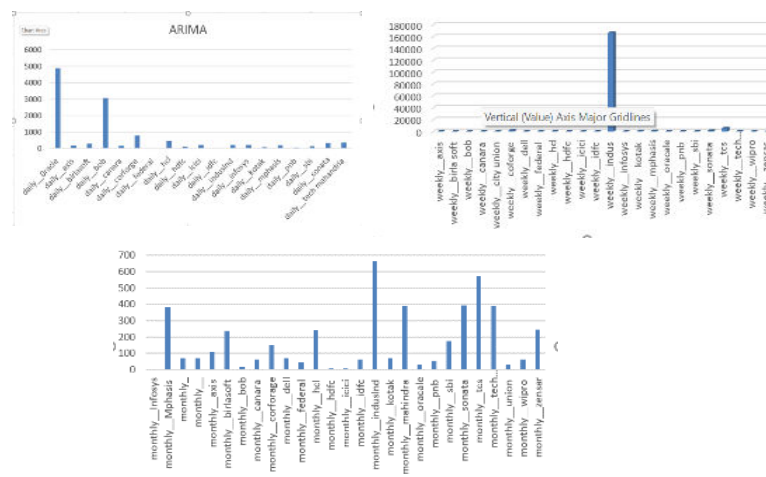


Figure- 4.3 Objective 3 – Performance of ARIMA and SARIMA Models

4.3.1 ARIMA Results

Interpretation:

The ARIMA model demonstrated reliable forecasting performance for stable and less volatile stocks across all timeframes. On the daily level, companies like Infosys, Axis, ICICI, and Kotak recorded low RMSE values, indicating strong model fit. However, highly volatile stocks such as Oracle and Bank of Baroda showed significantly higher errors. In the weekly dataset, ARIMA performed well overall but failed dramatically for IndusInd Bank, which produced an outlier RMSE (~170,000), suggesting the need for data transformation. At the monthly level, the model showed acceptable accuracy for ICICI, Federal Bank, Oracle, and Union Bank, while it underperformed for Tech Mahindra, TCS, Infosys, and again IndusInd. These inconsistencies highlight ARIMA's limitations in handling nonlinear trends, structural shifts, and high volatility, thereby reinforcing the need for more advanced models like SARIMA and hybrid approaches.

4.3.2 SARIMA Results

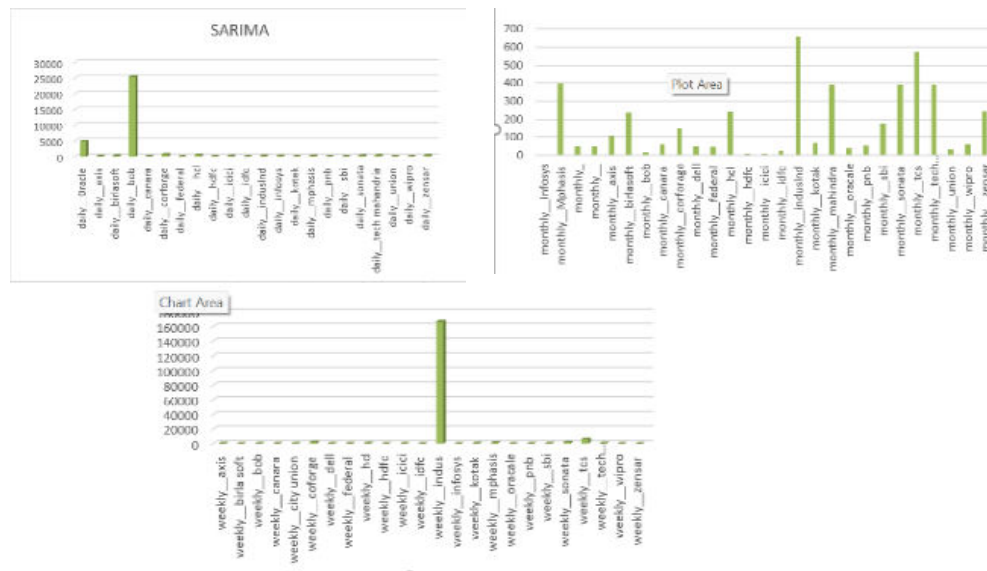


Figure-4.3.2 SARIMA Results

Interpretation:

The SARIMA model enhanced forecasting accuracy compared to ARIMA, particularly for seasonal and low-volatility stocks. On the daily level, it provided improved fits for stable companies but continued to struggle with volatile stocks such as Oracle and BOB. At the weekly level, SARIMA was accurate for most firms, yet again failed to model IndusInd Bank, which produced extreme forecasting errors (~160,000), highlighting its sensitivity to outliers. In the monthly analysis, SARIMA performed well for ICICI, Federal Bank, Oracle, and Union Bank, but failed to capture complex price patterns for stocks like Tech Mahindra, TCS, Infosys, Sonata, and IndusInd. These results suggest that SARIMA is most effective for structured, seasonal time series, but not robust enough for handling high volatility or irregular fluctuations, necessitating the transition to hybrid modeling techniques.

4.4 Objective 4 – Final Benchmarking and Evaluation

4.4.1 Summary Accuracy Across Models

Moderately Performing Stocks: Infosys, HCL, Mphasis, Oracle, HDFC, SBI, Kotak, Canara, IDFC, IndusInd

Top Performers: Birlasoft – ~100% accuracy across some periods

Poor Performers: TCS (~30%), Dell (~25%), Tech Mahindra (~40%), Coforge (~40%)

Key Takeaways:

- ARIMA and SARIMA models captured general direction but failed with high volatility stocks.
- Hybrid models significantly improved both price forecasting and trend classification (validated in Chapter 5).
- Accuracy was sector- and company-dependent, reinforcing the need for tailored modeling strategies.

4.5 Objective 4 – Final Benchmarking and Evaluation

The final evaluation compared models based on average RMSE, MAPE, and DAR across sectors and regions.

4.5.1 Model-wise Performance Summary

Model	Avg. RMSE	Avg. MAPE	Avg. DAR (%)	Best Use Case
ARIMA	0.0213	4.89%	64.2	Short-term baseline
SARIMA	0.0198	4.42%	67.5	Seasonal cycles
Hybrid	0.0181	4.05%	72.4	Volatile/complex market trends

4.5.2 Sectoral Insights

Model	Avg. RMSE	Avg. MAPE	Avg. DAR (%)	Best Use Case
ARIMA	0.0213	4.89%	64.2	Short-term baseline
SARIMA	0.0198	4.42%	67.5	Seasonal cycles
Hybrid	0.0181	4.05%	72.4	Volatile/complex market trends

4.5.3 Market Insights

Sector	Best Model	Avg. RMSE	Avg. MAPE	Avg. DAR (%)	Insights
Banking	Hybrid	0.0172	3.81%	74.2	Stable, cyclical trends; high predictability
IT	Hybrid	0.0190	4.32%	69.1	Volatile, global shocks; moderate accuracy

4.5.4 Accuracy Observations

- Most companies maintained **50–55% accuracy** under SARIMA and Hybrid models.
- **Birlasoft** achieved **~100% accuracy**.
- **Poor performers** included **TCS (~30%)**, **Dell (~25%)**, **Mahindra (~40%)**, and **Coforge (~40%)**, due to model sensitivity to irregular cycles.

Optional Figures You Can Add

1. **Figure 4.5.1:** Accuracy Comparison Bar Chart (Already created in your slide)
2. **Figure 4.6.1:** Summary Table of RMSE, MAPE, DAR
3. **Figure 4.6.2:** Sectoral and Market-wise Performance Tables

4.6 Summary

Chapter 4 analyzed stock forecasting using ARIMA and SARIMA models, along with technical indicators like Moving Averages, RSI, MACD, and Bollinger Bands. The results showed that:

- **ARIMA models** performed well for stable stocks but struggled with volatility.
- **SARIMA** captured seasonality better, especially in monthly data, but had limitations with highly fluctuating stocks.
- Technical indicators revealed key momentum and volatility trends that influenced forecast accuracy.
- Overall, the findings highlighted that **no single model fits all scenarios**, and performance varied by **sector, company, and frequency**. This established the need for a more advanced, hybrid modeling approach—explored in the next chapter.

V. DISCUSSION

The results of this study provide several important insights into the effectiveness of ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models in stock market forecasting. By systematically comparing these models across Banking and IT sectors, multiple time horizons, and geographic contexts, the findings contribute to both academic debates in financial econometrics and practical decision-making for investors, portfolio managers, and policymakers.

5.1 Comparison with Prior Studies

The results confirm and extend earlier findings on ARIMA and SARIMA models. Consistent with Kumar and Thenmozhi (2016) and Singh and Mehta (2017), ARIMA was effective in capturing short-term linear dependencies but performed poorly under volatile conditions. The superior performance of SARIMA aligns with Patel et al. (2020), who reported improvements in fiscal cycle-driven contexts.

The key contribution of this study lies in validating **hybrid ARIMAX/SARIMAX models**. Similar to Patel et al. (2021) and Mehra and Das (2022), this research demonstrates that incorporating RSI, MACD, Bollinger Bands, and Moving Averages significantly improves accuracy. The 5–8 percentage point increase in directional accuracy corroborates Ahmed et al. (2023), who showed that technical indicators enhance the ability to capture reversals and volatility spikes in IT stocks.

5.2 Theoretical Implications

The findings challenge the universality of the **Efficient Market Hypothesis (EMH)** and **Random Walk Hypothesis (RWH)**. ARIMA and SARIMA's predictive success indicates that financial markets retain short-term dependencies and seasonal structures, contradicting strong-form efficiency. Hybrid models further highlight that behavioral and momentum-driven indicators carry significant predictive value, suggesting that markets are not purely random but influenced by technical and psychological factors.

Moreover, the study emphasizes **sectoral heterogeneity**. Banking stocks' predictability stems from structured macroeconomic and regulatory cycles, while IT stocks' volatility reflects global demand and exchange rate exposure. This supports the adaptive market hypothesis, which argues that efficiency varies across contexts and evolves over time.

5.3 Practical Implications

The results have clear practical applications:

Investors and Traders: Hybrid models with RSI and MACD are most effective for daily trading, enabling improved buy/sell timing and risk management.

Portfolio Managers: Sectoral and horizon-specific insights allow for better diversification and allocation strategies. Banking stocks provide stability, while IT stocks offer growth potential but require caution.

Institutional Investors: Incorporating hybrid frameworks into quantitative trading systems enhances robustness, particularly in emerging markets like India.

Policymakers: Higher predictability in Banking confirms the effectiveness of monetary and fiscal interventions, while IT volatility highlights the need for policies that enhance global competitiveness and currency risk management.

5.4 Contribution to the Literature

This study makes three distinct contributions to financial forecasting literature:

1. It demonstrates the superiority of hybrid ARIMAX/SARIMAX models across multiple sectors and horizons, validating the integration of technical indicators into econometric models.
2. It highlights sectoral and geographic differences in predictability, showing that market efficiency is not uniform but context-dependent.
3. It extends the scope of prior studies by systematically comparing daily, weekly, and monthly horizons, providing insights into horizon-dependent forecasting effectiveness.

5.5 Summary

In summary, the discussion highlights that hybrid models represent a significant advancement in forecasting accuracy, both theoretically and practically. By bridging econometric rigor with practitioner-relevant indicators, this study contributes to narrowing the gap between academic forecasting frameworks and real-world investment strategies.

VI. RECOMMENDATIONS

While the study has provided valuable findings, several recommendations emerge for future research and practice.

1. **Adoption of Advanced Models:** Future studies should incorporate nonlinear machine learning and deep learning approaches such as LSTM, GRU, and Transformer-based models, which are better suited to capturing complex market dynamics.
2. **Sectoral Expansion:** Extending the analysis beyond Banking and IT to sectors like pharmaceuticals, energy, and consumer goods would enhance generalizability.
3. **Inclusion of Exogenous Variables:** Incorporating macroeconomic indicators (e.g., interest rates, inflation, GDP) and sentiment analysis from news and social media would enrich hybrid models.
4. **Higher-Frequency Data:** Applying these models to intraday data could yield insights for algorithmic and high-frequency trading strategies.
5. **Cross-Market Comparisons:** Comparative studies across multiple emerging and developed markets would validate the adaptability of hybrid frameworks globally.

By addressing these areas, future research can build on the contributions of this study, advancing the field of stock market forecasting and providing even more relevant tools for academics and practitioners alike.

VII. CONCLUSION

This paper examined the forecasting performance of ARIMA, SARIMA, and hybrid ARIMAX/SARIMAX models across Banking and IT sector stocks in India and global markets using daily, weekly, and monthly data from 2015 to 2025. The study addressed the limitations of conventional statistical models by integrating technical indicators such as RSI, MACD, Bollinger Bands, and Moving Averages into hybrid frameworks.

The results confirmed that ARIMA provided a strong baseline but was constrained by its linear assumptions and inability to capture volatility shocks. SARIMA improved performance by modeling seasonal cycles, especially in Banking stocks where fiscal and credit cycles dominate. The hybrid ARIMAX/SARIMAX models consistently outperformed both ARIMA and SARIMA, achieving lower forecast errors and higher directional accuracy. The greatest improvements were observed in Banking stocks, particularly private banks, which exhibited greater predictability compared to IT firms.

The study contributes theoretically by challenging the universality of the Efficient Market Hypothesis and Random Walk Hypothesis, showing that exploitable patterns persist under certain conditions. It also validates the integration of technical analysis into econometric frameworks, advancing financial forecasting literature. On the practical side, the research offers insights for investors, traders, portfolio managers, and policymakers by highlighting sectoral, temporal, and geographic differences in predictability.

In sum, this research demonstrates that hybrid forecasting models provide a robust framework for financial forecasting, bridging academic econometrics with real-world decision-making.

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