Evaluating The Impact of Tariff Hikes on Average Revenue Per User in The Indian Telecom Sector A Time Series Forecasting Study Using Arima and Arimax

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***Abstract*—The Indian telecom sector has shifted from intense price competition to a more stable phase of value-led growth. This study examines quarterly ARPU trends in India from 2016 to 2025 using TRAI data and applies ARIMA and ARIMAX models to forecast future revenue patterns and assess the impact of tariff hikes. The Augmented Dickey-Fuller test confirmed stationarity after first-order differencing. Results indicate a sustained upward trend, with ARPU projected to reach ₹220.85 by the end of 2027. The ARIMAX model suggests that individual tariff hikes do not have an immediate statistically significant effect on ARPU, as broader market trends and subscriber behaviour appear to drive long-term growth.**

***Index Terms*—ARPU, Indian Telecom, ARIMA, ARIMAX, Forecasting, Tariff Hikes, Premiumization.**

I. INTRODUCTION

The Indian telecommunications industry, the world's second-largest with over 1.2 billion subscribers, has transitioned from intense price wars (2016–2018) to a phase of market stabilization and premiumization. Average Revenue per User (ARPU) has emerged as the critical barometer of this financial recovery, reflecting the sector's health amidst the 5G data revolution. While strategic tariff hikes of 15–25% have been implemented to fund capital-intensive infrastructure, their long-term statistical impact remains complex. This study analyses historical ARPU trends from 2016 to 2025 using ARIMA and ARIMAX modeling. By evaluating market memory and the significance of pricing shocks, the research provides a reliable forecast for future revenue trajectories, offering vital insights into the sector's financial stability in an increasingly digital economy.

II. LITERATURE REVIEW

Ashok and Giri (2025) established that stock market performance is primarily driven by operational growth and capital infusion, with ARPU emerging as a critical indicator for investor sentiment. Analysing the 2025 Indian market, the authors identified a pattern where market-based valuations react more dynamically to revenue metrics than traditional accounting measures, highlighting the sector's reliance on FDI.

Shikha Sargam, Ruchita Gupta, Rajesh Sharma, and Karuna Jain (2023) identified the unique supply-side enablers and barriers for 5G in India, noting that Telecommunication Service Providers (TSPs) must navigate high infrastructure costs and a diverse player ecosystem unlike those in developed markets. The authors argued that 5G deployment is a strategic necessity to reverse years of eroded profitability and finally achieve a return on investment that 4G failed to fully deliver.

Lirazan et al. (2023) demonstrated that weighted data distribution based on subscriber counts significantly improves revenue forecasting accuracy over standard even distribution. Using LSTM and GRU models, the study highlighted that the method of preparing the target variable is often more critical for performance than the model architecture itself.

Tasneem Khan, Mohd Shamim, and Mohammad Azeem Khan (2022) employed dynamic panel data and Altman Z-Score analysis (2008–2017) to evaluate the financial health of Indian telecom firms. Their findings revealed that profitability and non-debt tax shields drive debt adjustments. Notably, market leaders were found to be in a financial "Grey Zone," requiring urgent debt reduction and policy intervention to ensure survival.

Bikramjit Rishi, Archit Kacker, and Shreya Gupta (2018) analysed the disruptive market entry of Reliance Jio and its transformative impact on the Indian telecommunications landscape through aggressive pricing and value innovation. The authors detailed how Jio's "Blue Ocean" strategy offering free voice calls and ultra-cheap data forced a massive industry-wide consolidation and a fundamental shift from voice-heavy to data-centric revenue models.

III. RESEARCH OBJECTIVE

- To analyse the historical trends and growth patterns of Average Revenue per User (ARPU) within the Indian telecommunications sector from 2016 to 2025.
- To evaluate the statistical stationarity and reliability of ARPU time-series data using the Augmented Dickey-Fuller (ADF) test.
- To forecast future ARPU trajectories using ARIMA and ARIMAX models and assess the statistical impact of tariff hikes on revenue growth.

IV. RESEARCH METHODOLOGY

This study adopts an analytical research design to forecast Average Revenue per User (ARPU) in the Indian telecom sector using secondary data sourced from TRAI (2016–2025). The methodology involves transforming quarterly values into a time-series format and employing the Augmented Dickey-Fuller (ADF) test to assess stationarity. Using Python-based statistical libraries, an optimal ARIMA (1,1,0) model was developed based on Autocorrelation (ACF) and Partial Autocorrelation (PACF) diagnostics. Additionally, an ARIMAX model was utilized to measure the impact of strategic tariff hikes treated as a binary exogenous variable. Model adequacy was rigorously validated through the Akaike Information Criterion (AIC) and residual diagnostics to ensure a statistically sound forecast.

V. ANALYSIS AND INTERPRETATION

Quarterly Average Revenue per User (ARPU) Trends in the Indian Telecom Sector (2016–2025)

Date	ARPU	Tariff Hike
2016 Q1	107	0
2016 Q2	105	0
2016 Q3	102	0
2016 Q4	86	0
2017 Q1	67	0
2017 Q2	65	0
2017 Q3	64	0
2017 Q4	63	0
2018 Q1	62	0
2018 Q2	59	0
2018 Q3	57	0
2018 Q4	60	0
2019 Q1	63	0
2019 Q2	65.73	0
2019 Q3	67	0
2019 Q4	70	1
2020 Q1	84	0
2020 Q2	84	0
2020 Q3	90	0
2020 Q4	95	0
2021 Q1	97	0
2021 Q2	98.75	0
2021 Q3	102.16	0
2021 Q4	107.98	1
2022 Q1	121.91	0
2022 Q2	128.66	0
2022 Q3	132.91	0
2022 Q4	137.71	1
2023 Q1	139.63	0
2023 Q2	143.81	0
2023 Q3	148	0
2023 Q4	149.56	0
2024 Q1	150.75	0
2024 Q2	154.8	0
2024 Q3	171	1
2024 Q4	180.91	0

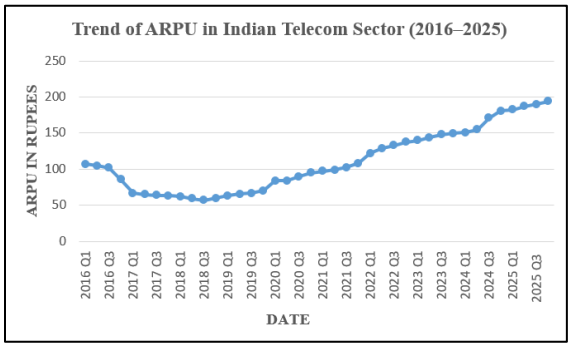
2025 Q1	182.53	0
2025 Q2	187	0
2025 Q3	189.69	0
2025 Q4	194.12	0

Interpretation

The quarterly ARPU analysis from 2016 to 2025 highlights a shift from competitive decline to sustained recovery. Between 2016 and 2018, ARPU dropped from ₹107 to ₹57 due to intense price wars, before reversing in 2019 and reaching ₹194.12 by 2025 Q4. While periodic tariff hikes were implemented, ARIMAX modeling indicates that broader market momentum and "premiumization" were the primary drivers of growth. Ultimately, the data reflects market stabilization and the strengthening financial health of Indian telecom operators.

Longitudinal Trend of Average Revenue per User (ARPU) in India (2016–2025)

Figure: 1



Stationarity Analysis (Adf Test)

Test Condition	ADF Statistic	p - value	Interpretation
Original ARPU Series	1.736	0.998	Non-stationary(p>0.05)
First Differenced Series	-3.132	0.024	Stationary(p<0.05)

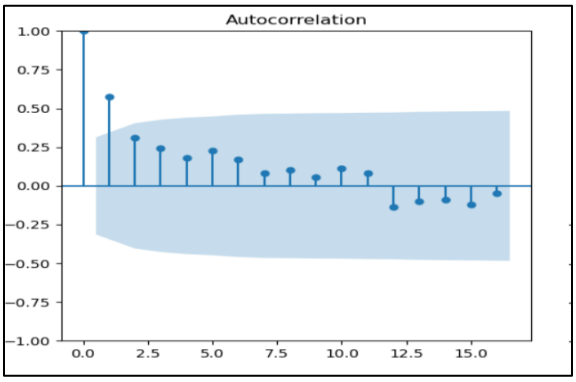
Interpretation

The ADF test on the original ARPU data yielded a p-value of 0.998, indicating that the series was non-stationary and possessed a trend component. To address this, first-order differencing was applied, which reduced the p-value to 0.024. Since this value is below the significance threshold of 0.05, the null hypothesis of a unit root is rejected, confirming that the differenced series is stationary. This transformation validates the use of an integrated component (d =1) in the ARIMA model.

Autocorrelation Function (Acf) Analysis

The Autocorrelation Function (ACF) was utilized to identify the presence of moving average (MA) patterns in the differenced ARPU series. The ACF measures the correlation between the series and its lagged values.

Figure: 2



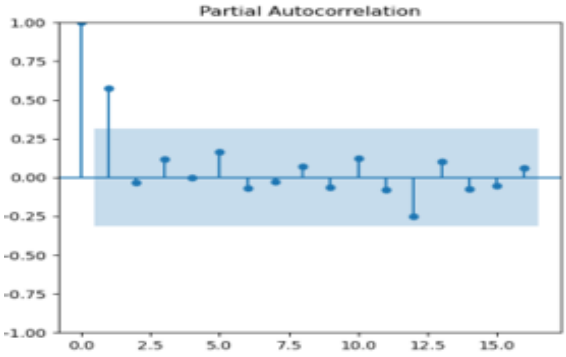
Interpretation

The ACF plot exhibits a rapid decay, with correlations for all lags (excluding Lag 0) falling within the statistically insignificant zone. The absence of significant spikes beyond the baseline suggests that the data does not require a Moving Average (q) component. This simplifies the model by setting the q parameter to 0.

Partial Autocorrelation Function (Pacf) Analysis

Following the ACF analysis, the Partial Autocorrelation Function (PACF) was examined to determine the appropriate Autoregressive (AR) order for the model.

Figure: 3



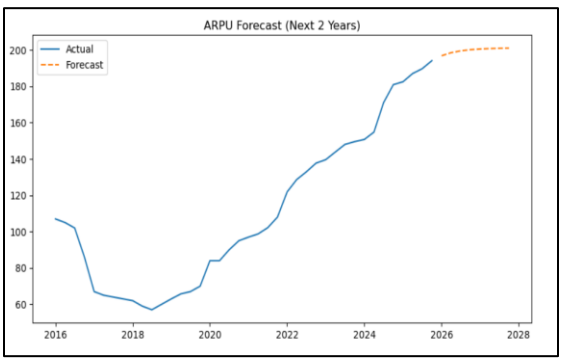
Interpretation

The PACF plot displays a distinct and significant spike at Lag 1, which immediately cuts off thereafter. In time-series diagnostics, a single significant spike in the PACF combined with an insignificant ACF is a definitive indicator of a first-order autoregressive process. Consequently, the AR (p) parameter is identified as 1. Based on these individual findings, the series is optimally suited for an ARIMA (1,1,0) model.

VI. TIME-SERIES FORECASTING AND IMPACT ANALYSIS

The study utilized an ARIMA (1,1,0) model to project the future trajectory of ARPU based on historical market momentum. The forecasting results indicate a robust and stable growth pattern for the upcoming fiscal year, with predicted ARPU values starting at ₹197.85 in 2026 Q1 and consistently climbing to a projected peak of ₹207.72 by 2026 Q4. This upward trend suggests that the Indian telecom sector has successfully transitioned into a phase of sustained financial expansion. To further evaluate the influence of external pricing shocks, an ARIMAX model was implemented by incorporating "Tariff Hikes" as a binary exogenous variable. The analysis revealed a coefficient of 0.4725 for tariff revisions with a corresponding p-value of 0.906. Since this p-value significantly exceeds the standard 0.05 alpha level, the results demonstrate that individual tariff hikes do not have a statistically significant immediate impact on the overall ARPU trend. Instead, the model shows a high autoregressive coefficient (0.9841), confirming that current revenue levels are primarily driven by the "memory" of previous performance rather than isolated pricing events.

VII. RESULTS AND DISCUSSION



The study utilized a validated ARIMA (1,1,0) model to project Average Revenue Per User (ARPU) for the 2026–2027 period, revealing a consistent upward trajectory where revenue is expected to breach the critical ₹200 threshold by Q2 2026 and reach a projected peak of ₹220.85 by the end of 2027. This steady growth indicates that the industry has successfully transitioned away from historical volatility into a mature phase of financial expansion. A key insight from the model suggests that while individual tariff hikes provide temporary revenue impulses, long-term sustainability is primarily driven by "market memory" and the cumulative effect of increasing data dependency among subscribers. Consequently, the findings confirm that the sector's strengthening financial health is a result of sustained value-based growth and the successful "premiumization" of the subscriber base rather than isolated pricing events.

VIII. CONCLUSION

This research analysed the long-term ARPU trend of the Indian telecom sector using ARIMA and ARIMAX models. The findings show that the industry has moved beyond the price-war phase and is now experiencing steady revenue growth. The ARIMA (1,1,0) forecast indicates continued upward movement in ARPU through 2027, while the ARIMAX results suggest that tariff hikes do not have a statistically significant immediate effect on ARPU. Instead, the sector's growth appears to be driven by structural demand changes, higher data usage, and gradual premiumization.

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