Time Series Business Case Studies

# 1. Forecasting Monthly Sales for a Retail Chain

\*\*Industry:\*\* Fashion Retail

\*\*Problem Statement:\*\*  
Improve inventory and staffing decisions by forecasting monthly store sales.

\*\*Data Used:\*\*  
- Monthly sales for 5 years  
- Promotions and holiday data

\*\*Analysis & Modeling Steps:\*\*  
- Plotted trend and seasonality  
- ADF test → Non-stationary  
- Applied differencing  
- Chose SARIMA based on evaluation metrics

\*\*Model Chosen:\*\*  
SARIMA(1,1,1)(1,1,1)[12]

\*\*Outcome & Impact:\*\*  
- Reduced overstock by 18%  
- Prevented $120K in lost sales  
- Improved staffing efficiency by 22%

\*\*Time Series Principles Applied:\*\*  
- Trend  
- Seasonality  
- Stationarity  
- Autocorrelation

# 2. Predicting Energy Demand for Utility Company

\*\*Industry:\*\* Energy & Utilities

\*\*Problem Statement:\*\*  
Forecast hourly electricity demand to optimize grid operations and prevent blackouts.

\*\*Data Used:\*\*  
- Hourly usage data  
- Weather and temperature data

\*\*Analysis & Modeling Steps:\*\*  
- High frequency → seasonality + temperature pattern  
- ADF test → stationarity achieved with log + differencing  
- Chose SARIMA and LSTM for comparison

\*\*Model Chosen:\*\*  
LSTM (performed better due to nonlinear patterns)

\*\*Outcome & Impact:\*\*  
- 95% accuracy on peak demand prediction  
- $500K saved on emergency load balancing

\*\*Time Series Principles Applied:\*\*  
- Seasonality (daily/hourly)  
- Noise reduction  
- Autocorrelation

# 3. Airline Passenger Volume Forecasting

\*\*Industry:\*\* Travel & Aviation

\*\*Problem Statement:\*\*  
Predict monthly international passenger numbers to manage booking systems and flight scheduling.

\*\*Data Used:\*\*  
- Monthly passenger count for 10 years

\*\*Analysis & Modeling Steps:\*\*  
- Clear seasonal peak (summer, holidays)  
- Trend + strong seasonality  
- Used decomposition, then Prophet

\*\*Model Chosen:\*\*  
Prophet

\*\*Outcome & Impact:\*\*  
- Optimized fleet planning  
- Improved flight schedule efficiency by 28%

\*\*Time Series Principles Applied:\*\*  
- Trend  
- Seasonality  
- Decomposition

# 4. Web Traffic Forecasting for Media Company

\*\*Industry:\*\* Digital Media

\*\*Problem Statement:\*\*  
Predict daily website traffic to allocate server resources and advertising slots.

\*\*Data Used:\*\*  
- Daily page views, user engagement, marketing calendar

\*\*Analysis & Modeling Steps:\*\*  
- Weekend dips, weekday spikes  
- ADF test + rolling mean = stationarity issue fixed  
- Used ARIMA + Prophet comparison

\*\*Model Chosen:\*\*  
Prophet

\*\*Outcome & Impact:\*\*  
- Better ad placement timing  
- Avoided 3 major server downtimes due to accurate traffic forecasting

\*\*Time Series Principles Applied:\*\*  
- Seasonality  
- Noise  
- Lagged features

# 5. Forecasting Demand for Ride-Sharing Service

\*\*Industry:\*\* Transportation / Mobility

\*\*Problem Statement:\*\*  
Predict hourly ride demand across cities to optimize driver allocation and pricing.

\*\*Data Used:\*\*  
- Hourly ride data  
- Weather, event, location info

\*\*Analysis & Modeling Steps:\*\*  
- Strong autocorrelation at daily and weekly levels  
- Used LSTM and XGBoost with lag features  
- Feature engineering critical

\*\*Model Chosen:\*\*  
XGBoost with time-lagged features

\*\*Outcome & Impact:\*\*  
- Increased ride availability by 25%  
- Boosted driver earnings by 18% in high demand zones

\*\*Time Series Principles Applied:\*\*  
- Autocorrelation  
- Lag features  
- Trend and cyclic pattern modeling