Business Summary Report – *Revenue Forecasting & Optimization*

Executive Summary

This project presents a robust data-driven strategy to forecast revenue, assess promotional campaign effectiveness, and optimize pricing for a simulated e-commerce platform. Using time series modeling (Prophet, ARIMA), statistical techniques, and simulation, we deliver actionable insights for business decision-making.

Project Objectives

- Forecast monthly revenue using advanced time series models.
- Quantify the impact of promotions on revenue.
- Simulate dynamic pricing strategies and visualize outcomes.
- Deploy findings in a streamlined dashboard for stakeholders.

Data Overview

Dataset	Records	Description
Transactions	50,000+	E-commerce orders including prices, dates, etc.
Promotions	~100	Discount periods and promotion types
Products	~1,000	Product-level details, pricing, categories

Key Features:

- InvoiceDate, Quantity, UnitPrice, TotalPrice
- Engineered: InvoiceMonth, PromoActive, DiscountRate

Exploratory Analysis Highlights

- Clear monthly seasonality in revenue (peak: Nov–Dec)
- Revenue dips during non-promotional periods
- Top 20% products generate ~80% of total revenue

Visuals:

- Revenue trends (line chart)
- Seasonality decomposition (STL)

- Product/category comparison (bar plots)

Forecasting Techniques

Facebook Prophet
- Captures trend, seasonality, holidays
- Forecasted next 6 months of revenue

  Metrics:
    - MAE: 1,372.94
    - RMSE: 1,986.52
    - MAPE: 8.7%

ARIMA/SARIMA

- Model tuned via pmdarima's auto_arima
- Competitive with Prophet on MAPE, slightly higher RMSE

Promotional Impact Modeling

- Regression on `PromoActive`, `DiscountRate` vs Revenue
- Insights:
    - 10–15% discount window provides max uplift
    - Promotions boost average revenue by 18%

Dynamic Pricing Simulation

- Simulated price elasticity using linear modeling
- Trade-off visualized between:
    - Aggressive discounting (high revenue, low margin)
    - Conservative pricing (stable margin, lower volume)

Interactive Dashboard

Built using Streamlit:

- Revenue Forecast: Actual vs Predicted

- Promo ROI: Comparison charts

- Pricing Simulator: Dynamic slider for discount testing

- Filters: Category, Region, Date Range

Tools & Technologies

- Python (Pandas, NumPy, Scikit-learn)

- Prophet, ARIMA (pmdarima)

- Seaborn, Plotly, Matplotlib

- Streamlit (for dashboard)

- Google Colab, GitHub, Wix

Key Takeaways

- Forecasting provides strong accuracy for planning cycles

- Promotions should target Q4 and top 20% products

- Dynamic pricing simulations can drive data-backed decisions