Dynamic Pricing & Revenue Optimization

Introduction

Pricing strategy is a critical driver of business performance. Setting an optimal price requires understanding how customers respond to price changes while considering seasonal and promotional effects. However, real-world transactional data often lacks sufficient price variation to directly measure customer price sensitivity.

This project applies business analytics and economic modeling to evaluate pricing strategy and identify the revenue-maximizing price point.

Problem Statement

Organizations frequently rely on historical sales data for pricing decisions, but such data may not contain controlled price changes needed to estimate demand elasticity. The challenge is to derive pricing insights from operational data and simulate realistic demand behavior to support revenue optimization.

Objectives

- Analyze price-demand relationships
- Identify seasonal patterns in demand
- Assess impact of discounts on sales
- Develop a demand estimation framework
- Simulate pricing scenarios using elasticity modeling
- Determine the optimal price that maximizes revenue

Data Description

The dataset consists of e-commerce transactional records containing:

Variable	Description
Order Date	Transaction timestamp
Units Sold	Quantity purchased
Unit Price	Selling price per unit
Discount	Promotional reduction

The dataset reflects operational sales rather than experimental pricing.

Methodology

Data Preparation

- Data cleaning and handling missing values
- Feature engineering such as month and weekend indicators

Exploratory Data Analysis

Exploratory analysis revealed limited historical price variation, seasonal fluctuations in demand, and a positive relationship between discounts and units sold.

Demand Modeling

A regression-based approach was used to estimate demand drivers. However, the model indicated weak direct price-demand signals due to insufficient price variability in historical data.

Elasticity-Based Demand Simulation

To overcome data limitations, an economic elasticity framework was applied. Demand was modeled using price elasticity concepts, allowing realistic simulation of customer response under varying price levels.

Revenue Optimization

Revenue was computed across simulated price scenarios. This produced a non-linear revenue curve with a clear maximum, indicating the revenue-maximizing price region.

Visualization

A Tableau dashboard was developed to communicate pricing insights, demand behavior, seasonal trends, and promotional impact.

Results

- Historical data showed weak natural price elasticity
- Demand varies significantly across months
- Discounts positively influence demand
- A revenue-maximizing price region was identified
- Demand transitions from inelastic to elastic as price increases

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Business Implications

The analysis demonstrates the need for elasticity-based pricing models, highlights the importance of seasonal pricing strategies, and supports the strategic use of discounts. These insights enable data-driven pricing decisions and revenue optimization.

Tools & Technologies

- Python (Pandas, NumPy, Scikit-learn)
- Tableau

Conclusion

This project illustrates the integration of analytics and economic reasoning in pricing strategy. By combining historical data insights with elasticity modeling, it identifies optimal pricing regions and demonstrates how business analytics can guide managerial decisions.