

Retail Sales & Profit Analysis – Technical Report

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1. Executive Summary

This technical report documents a comprehensive analysis of historical retail sales data to evaluate revenue trends, product performance, shipping efficiency, and the impact of discounts on profitability. Using SQL (BigQuery) for data preparation, Python (Prophet) for revenue forecasting, and Power BI for interactive visualization, this analysis provides detailed insights into key business metrics.

Key findings include:

- Technology products drive the highest revenue and profit margins.
 - Furniture has high revenue but low profitability.
 - Optimal discount ranges were identified, and excessive discounts significantly reduce profit.
 - Peak sales months are September, November, and December.
 - Shipping patterns indicate underutilization of faster shipping methods.
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2. Introduction

2.1 Problem Statement

Retail businesses need detailed visibility into their sales, discounts, product categories, and customer segments to:

- Forecast revenue growth
- Identify underperforming products or categories
- Optimize discounting and shipping strategies

2.2 Objectives

- Clean and prepare raw retail transaction data for analysis
- Conduct exploratory data analysis to uncover trends and insights
- Forecast revenue using time-series modeling
- Identify optimal discount ranges and shipping methods to maximize profitability

2.3 Dataset Overview

- **Source:** Historical retail transactions

- **Timeframe:** ~4 years (~10,195 transactions)
 - **Key Columns:** Order/Ship Date, Revenue, Profit, Quantity, Discount, Product Category, Sub-Category, Customer Segment, Shipping Mode
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3. Data Preparation & Methodology

3.1 Data Cleaning

- Missing values in product and customer details were handled using SQL queries.
- Date columns were converted for time-series analysis.
- New features created: Year, Quarter, Month, Discount Ranges, Peak Month Flags.

3.2 Tools & Techniques

Tool	Purpose
SQL (BigQuery)	Data cleaning, aggregation, segment analysis
Python (Pandas, Prophet)	Revenue forecasting, trend analysis
Power BI	Dashboard visualization, drill-down for KPIs

3.3 Assumptions & Limitations

- Costs of shipping methods are not included.
 - Advertising spend and external market factors are not accounted for.
 - Forecasting assumes consistent market conditions.
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4. Exploratory Data Analysis (EDA)

4.1 Revenue Trends

- Revenue growth over the past 4 years:

Year	Peak Month Revenue	Total Revenue	% of Total Revenue
2021	233,505	494,040	47.26%
2022	216,132	472,923	45.69%
2023	250,436	613,934	40.79%
2024	291,694	745,567	39.12%

- Peak sales occur in September, November, and December; slowest months are January and February.

4.2 Product Performance

- Profit share by product categories/sectors:

Category/Sector % of Profit

Technology	50.14
Office Supplies	43.11
Furniture	6.75
Home Office	21.10
Corporate	32.25
Consumer	46.65

- Top 5 products by revenue:

Product	Revenue	% of Total Revenue
Canon imageCLASS 2200 Advanced Copier	61,599.83	2.65%
Fellowes PB500 Electric Punch	27,453.38	1.18%
Cisco TelePresence EX90	22,638.48	0.97%
HON 5400 Series Task Chairs	21,870.57	0.94%
GBC DocuBind TL300 Electric Binding	19,823.47	0.85%

4.3 Discount Analysis

- Profit losses for high discount ranges:

Discount Range Profit Loss

21-40%	39,130
41-60%	29,164
61-100%	70,866

- Optimal discount range is 11-20% for maximum profitability.

4.4 Shipping Analysis

Shipping Mode Total Orders Avg Delivery Days

Same Day	547	0.04
First Class	1,548	2.18
Second Class	1,979	3.24
Standard	6,120	5.00

- Standard shipping is most common but slowest; faster shipping options are underutilized.
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5. Methodology Details

- **SQL Scripts:** Data cleaning, aggregation, and feature creation.
 - **Python Notebook:** Forecasted revenue using Prophet; generated trend analysis charts.
 - **Power BI:** Created an interactive dashboard showing revenue trends, product performance, discount impact, and shipping efficiency.
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6. Key Insights

- **Revenue & Product Mix:** Technology products, especially copiers and phones, drive high profitability. Furniture generates revenue but very low profit.
 - **Discount Optimization:** Reducing high discounting can prevent profit loss.
 - **Shipping Efficiency:** Encouraging faster shipping options could improve customer satisfaction.
 - **Forecasting:** Revenue projected to grow significantly post-2026, requiring operational readiness.
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7. Conclusion

This technical analysis provides a **complete, data-driven view of retail sales performance**. Key takeaways:

- Revenue growth is steady with peaks in Q4 each year.
 - Product and discount strategies can be optimized to improve profitability.
 - Further analysis can include cost-benefit of shipping methods and customer segmentation to refine marketing and pricing strategies.
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8. Next Steps

1. Conduct **customer segmentation** for targeted pricing and marketing strategies.
2. Evaluate **Furniture pricing or cost structures** to reduce losses.
3. Perform **detailed shipping cost analysis** to balance speed and cost efficiency.
4. Expand **forecasting** to include seasonal promotions or external market trends.