Retail/E-Commerce Sales Analytics Report

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1 Project Overview

This project analyzes retail e-commerce performance to close the gap between growing sales and lagging profit margins. The business problem is margin erosion driven by high returns, aggressive discounting, uneven regional performance, and a suboptimal product mix. Using transactional sales, returns, cost, and channel data, the work quantifies where revenue leaks occur and recommends targeted actions—optimize discounts, reduce returns, rebalance product mix, and prioritize profitable regions/channels—to restore unit economics and drive sustainable growth.

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2 Project Objectives

The project aims to:

1. Analyze sales and profitability drivers across product categories, brands, and channels.
2. Evaluate the financial impact of returns and discounts on net sales and net profit.
3. Compare regional and geographical performance to highlight markets with high sales but low profitability.
4. Identify trends and seasonality in sales and profit margins across years and quarters.
5. Highlight actionable insights and recommendations to improve overall profitability.

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3 Dataset Description

- **Rows & Columns:** 3,46,369 rows, 14 columns
- **Key Columns:**
    1. `id` → Row Number
    2. `dates` → Transaction date
    3. `qtr_year` → Time periods identifiers
    4. `channel` → Sales channel (e.g., Online, Retail store)
    5. `brand` → Product brand
    6. `product_category` → Category of product
    7. `country_name` → Geographical info
    8. `return_amount` → Value of returned products
    9. `discount_amount` → Value of discounts offered
    10. `total_cost` → Total cost of goods sold
    11. `total_sales` → Gross sales

12. `net_sales` → Sales after returns & discounts
13. `net_profit` → Profit after deducting costs
14. `profit_margin` → Profitability ratio (%)

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4 Data Preparation

The analysis was based on data stored in a **PostgreSQL** relational database. Data from five separate tables was extracted and consolidated into a single sales summary table, providing a comprehensive view of sales, costs, returns, discounts, and profitability across products, channels, and regions.

Although the source data was already clean, basic data validation and standardization were performed to ensure accuracy and consistency:

- Verified that numerical fields (sales, cost, returns, discounts) were consistent with expected business logic.
- Standardized categorical fields such as product categories, brands, channels, and countries.
- Ensured time-related fields (dates, years, quarters) were in proper formats for trend analysis.
- Reconfirmed derived metrics:
  - Net Sales = Total Sales – Returns – Discounts
  - Net Profit = Net Sales – Total Cost
  - Profit Margin (%) = (Net Profit ÷ Net Sales) × 100

The resulting sales summary table was clean, consistent, and ready for exploratory analysis and reporting.

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5 Exploratory Data Analysis (EDA)

Q1: Which brands contribute most to net sales and net profit?

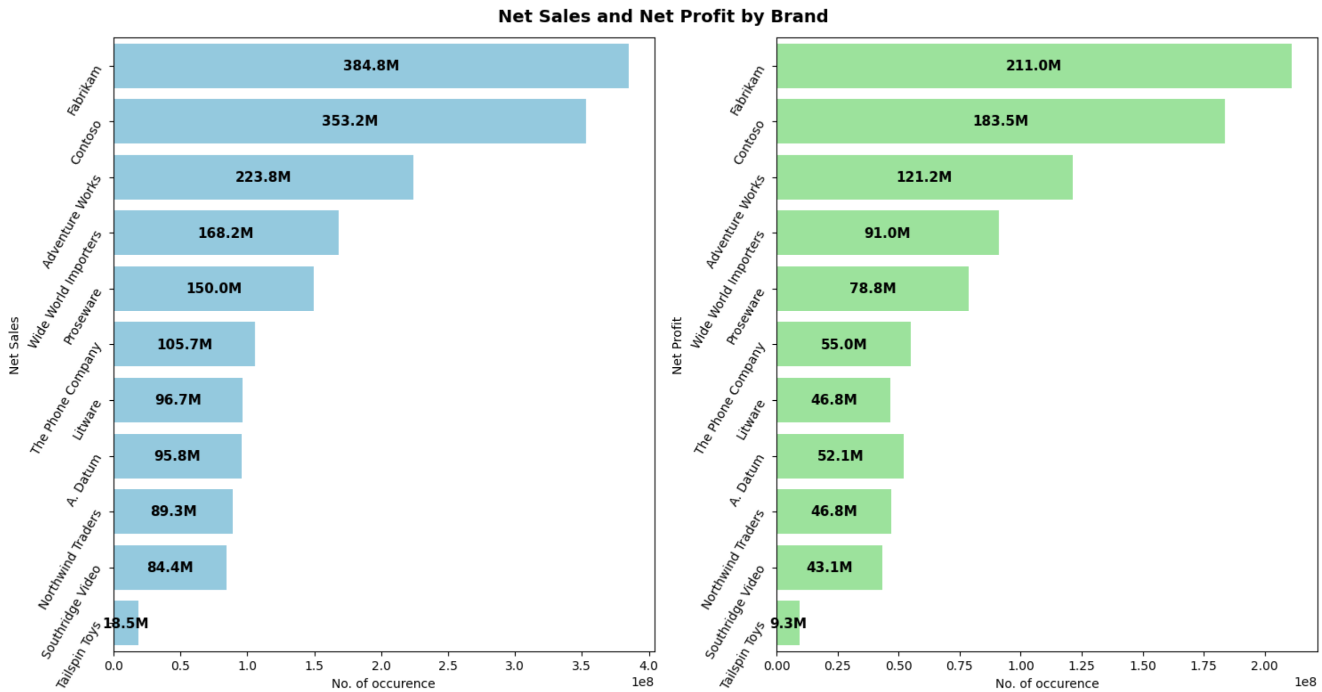

Figure 1: Net Sales & Net Profit by Brand

Insights :

1. Net Sales by Brand (Left Plot):
   - Identifies the brand Fabrikam (384.8M) as the primary driver of Sales, followed by Contoso (353.2M).
   - Fabrikam is more prominent among customers, It can be due to better quality, reputation or marketing.
   - Fabrikam have better pricing strategy, product innovation, distribution or brand loyality.
2. Net Profit by Brand (Right Plot):
   - Fabrikam is the most profitable brand with net profit around 211M million, leading the pack by a significant margin, followed by Contoso with 183.5M net profit.
   - The lowest profit contributors such as Southridge Video and Tailspin Toys are below 10 million net profit, suggesting limited profitability or potential areas for strategic review.

Q2: Which sales channels are the most and least profitable?

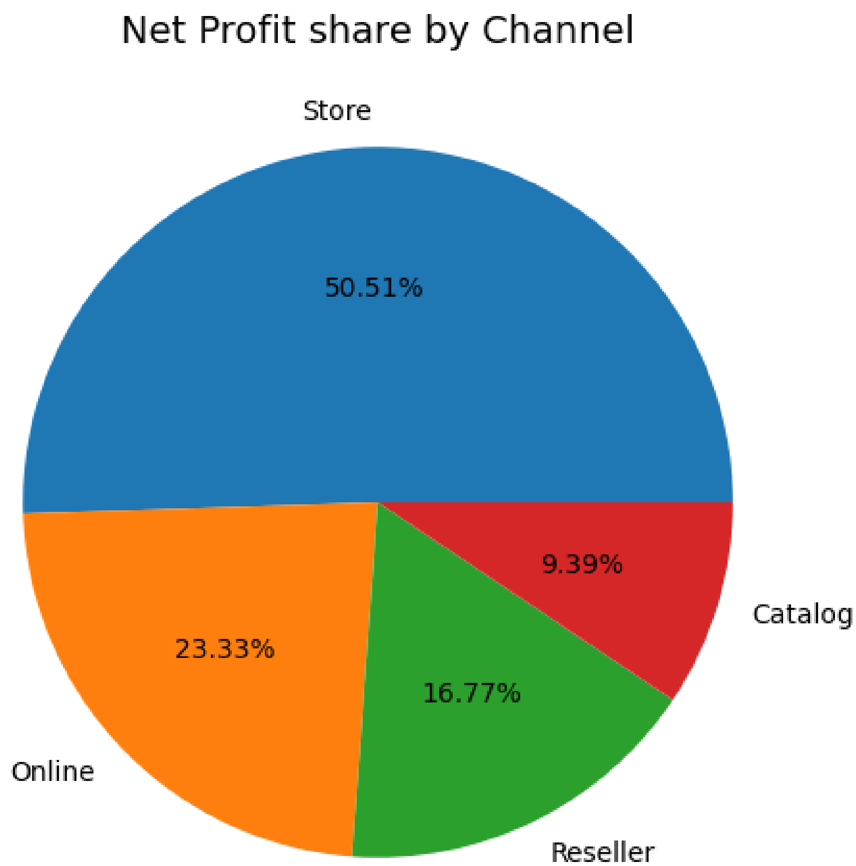

Figure 2: Net Profit by Sales Channel

Insights :

1. Store channel is generating most of the profit which is above 50% of Net Profit.
2. Lowest profit is generated through catalog channel (9.39%).
3. Likely due to higher sales volume despite having the smallest profit margin.

Q3: What is the percentage contribution of discount amount, return amount, net sales, and net profit by each product category to the total figures?

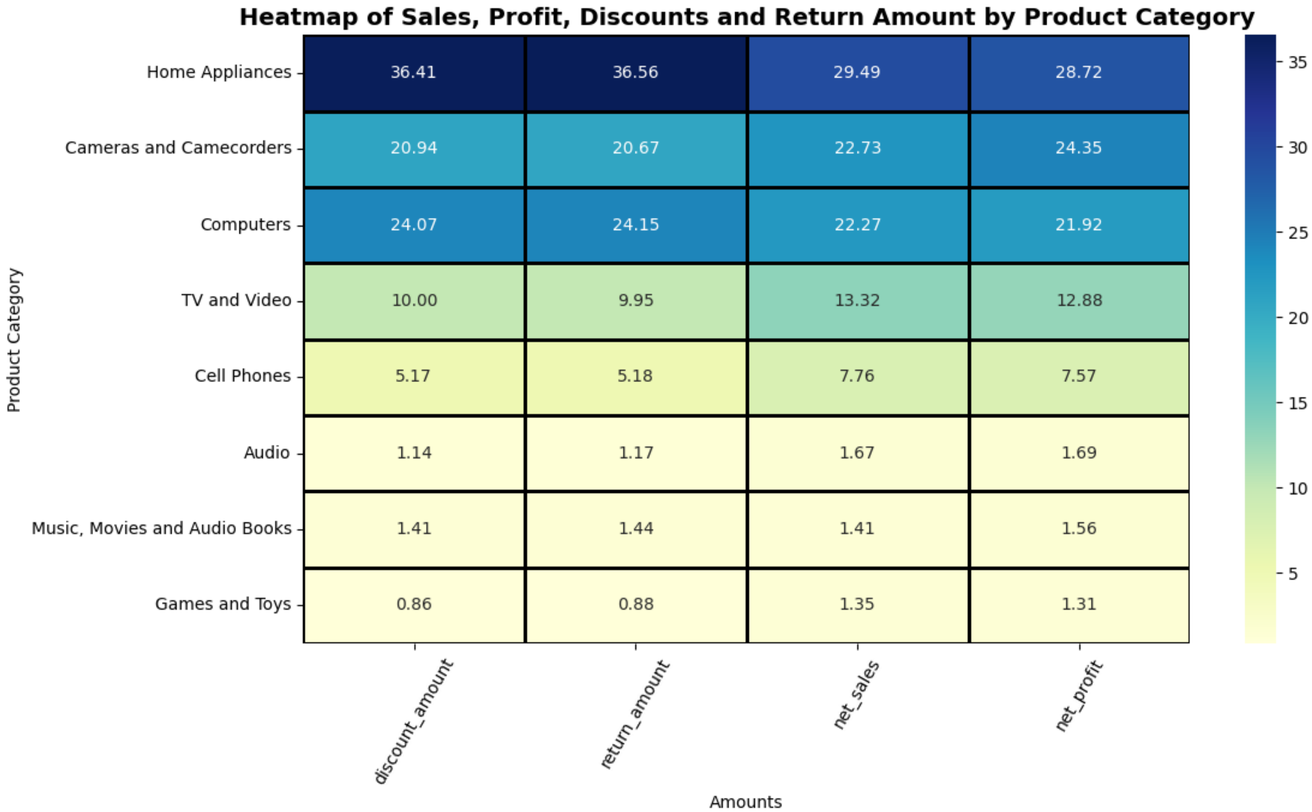

Figure 3: Sales, Profit, Discounts and Returns by Product Category

Insights :

1. Discount Amount :
   - Home Appliances has highest discount among all product category (36.41%), followed by Computers (24.07%).
   - Discount is very high in Home Appliances category due to high sales price per unit.
2. Return Amount :
   - Home Appliances has highest returns among all product category (36.56%), followed by Computers (24.15%).
   - It may be due to product quality issue like defects, malfunctioned or unmat customer expectations.
   - Some categories are more susceptible to return fraud or policy abuse.
3. Net Sales :
   - Home Appliances has highest sales among all product category (29.49%), followed by Cameras and Camecorders (22.73%).
   - This is due to popularity among customers.
   - May warrant focused marketing efforts or investment.
4. Net Profit :
   - Home Appliances product category is generating the highest profit (28.72%), followed by Cameras and Camecorders (24.35%).

- Likely due to higher sales volume because when compare to profit margin there is no significant difference.

Q4: How discount amount and return amount impact profitablity?

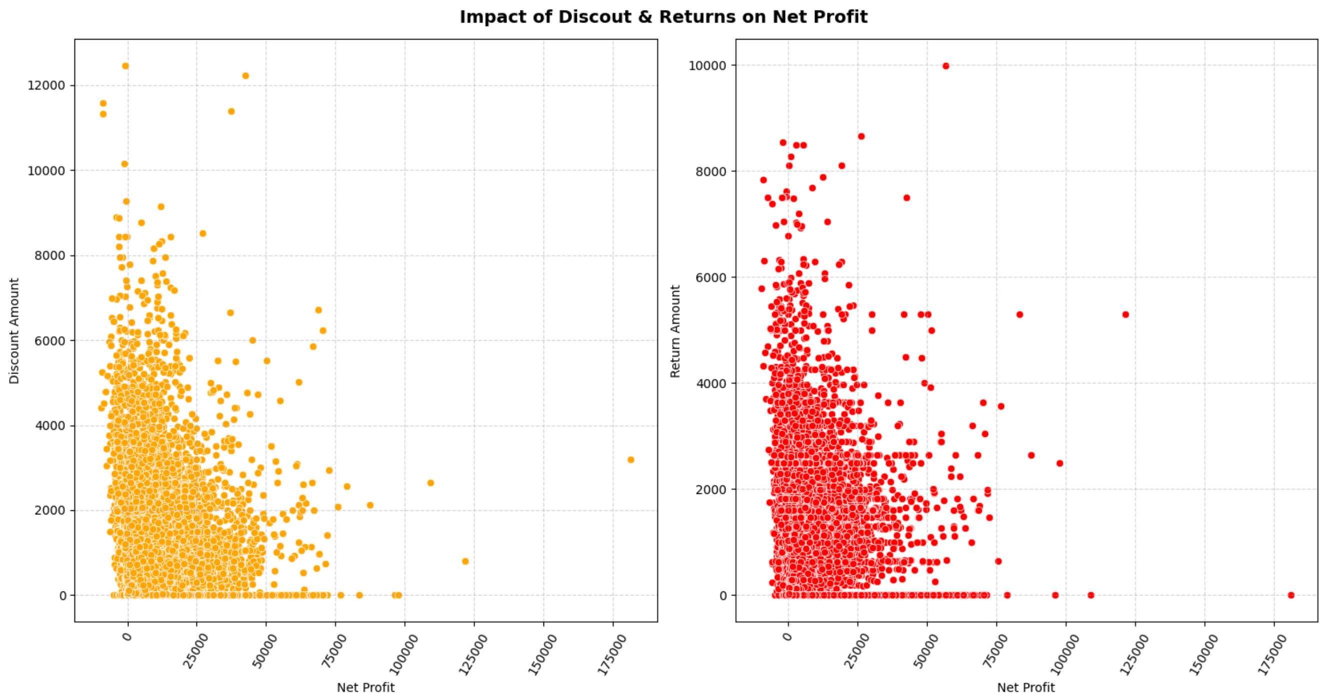

Figure 4: Impact of Discount & Returns on Net Profit

Insights :

1. Net Profit vs. Discount Amount (Left Plot):

   - Higher discount amounts generally correlate with lower or negative net profits, indicating discounts can erode profitability.
   - Most transactions cluster around low discount amounts and moderate net profits, suggesting careful discount use supports profitability.
   - Large net profits rarely coincide with high discount amounts, implying that top profits come from low or no discount sales.

2. Net Profit vs. Return Amount (Right Plot):

   - Increasing return amounts are associated with reduced net profits, showing returns negatively impact profitability.
   - Most data points show low returns and low to moderate net profit, highlighting that returns are typically small but impactful.
   - High net profits are uncommon alongside large returns, underlining the detrimental effect of returns on overall profit.

Q5: How do regional variations influence total sales and net profit performance, and what factors contribute to these differences across geographic markets?

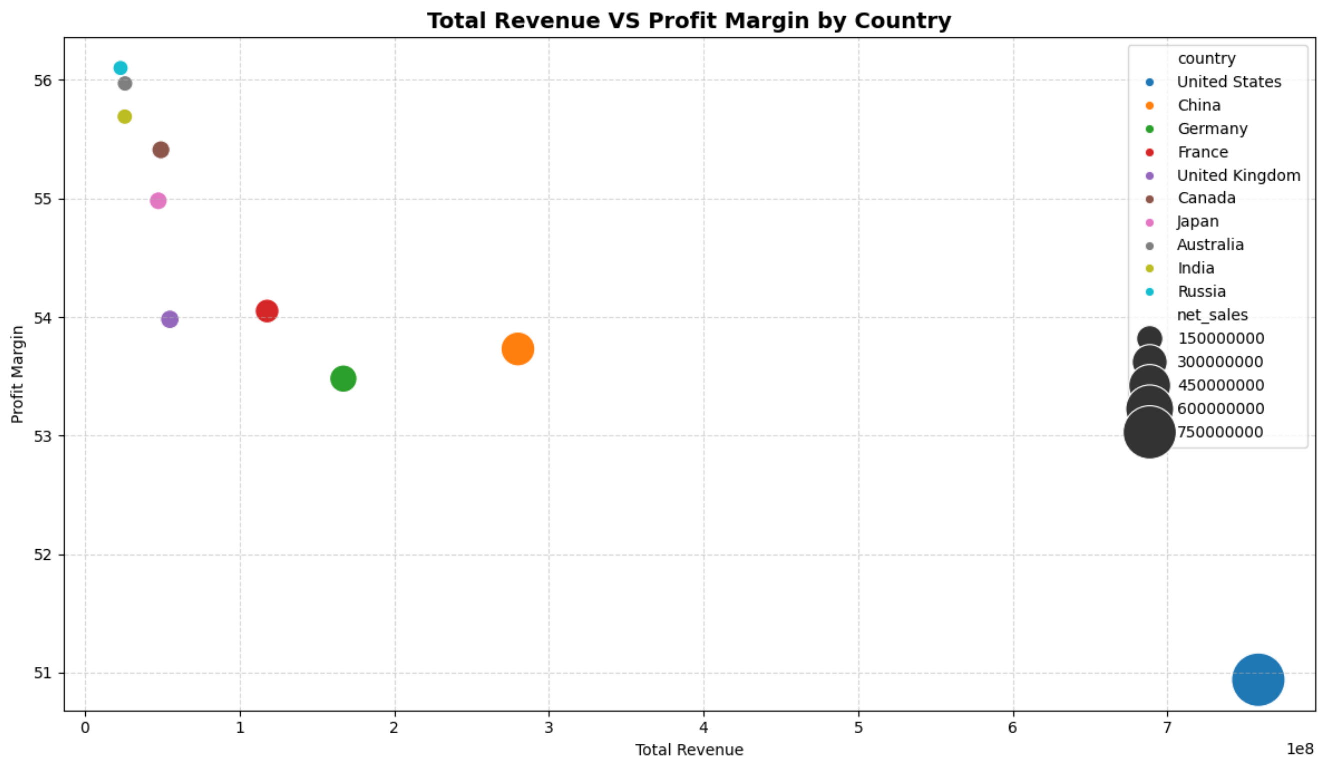

Figure 5: Sales vs Profit Margin by Country

Insights :

1. **High Sales ≠ High Profitability :** United States has highest net sales, but lowest profit margin. This could be due to intense competition, higher cost and aggressive discounting.
2. **Cost Structures & Business Matter :** High operational costs, supply chain challanges, pricing strategies, or local regulation can reduce the profit margins even where sales are strong.
3. **Consistent Business Model :** This small range of profit margin indicate that the company has fairly consistent pricing and cost model accross these countries.

Q6: To what extent do discounts and returns influence overall net sales, and what strategic actions can be taken to optimize their impact on the organization's bottom line?

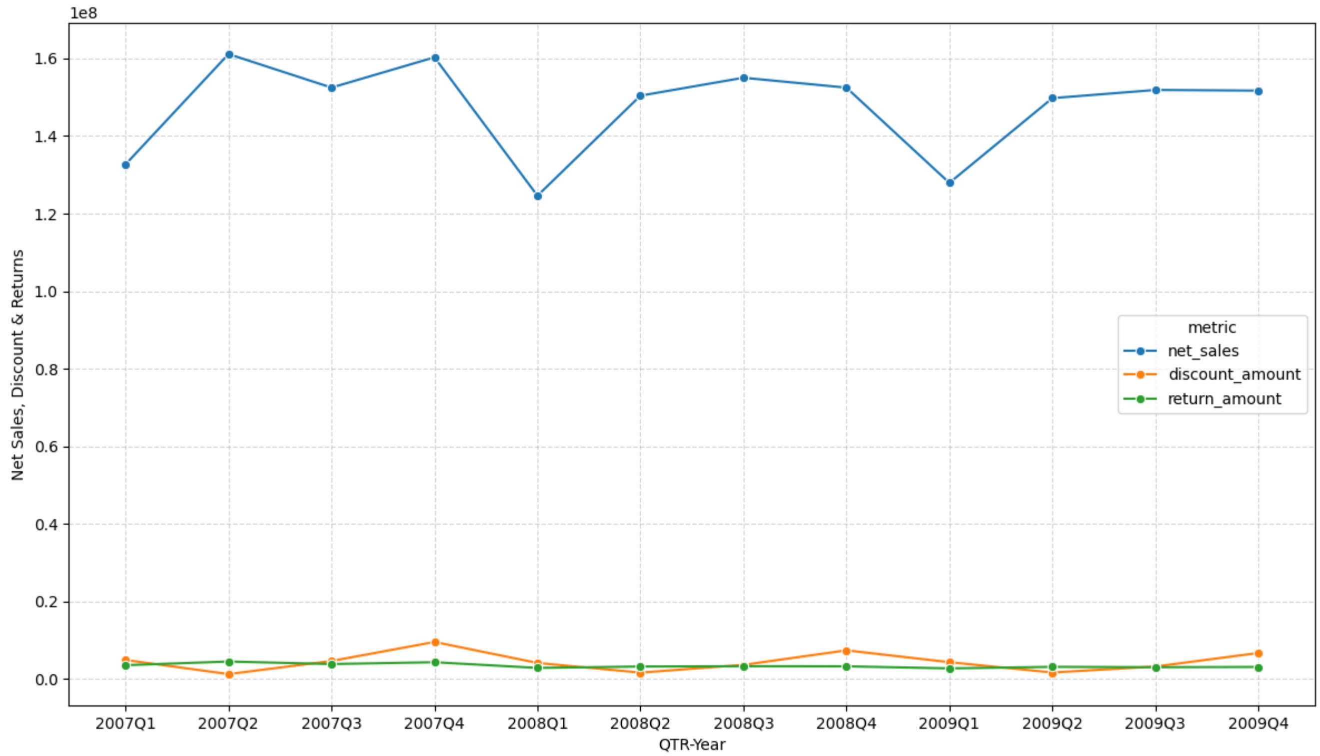

Figure 6: Impact of Discounts and Returns on Net Sales

Insights :

1. Significant increases in discount amounts directly improve net sales, highlighting the importance of disciplined pricing for maintaining healthy financial performance.
2. Periods with stable or lower discounts and consistently show stronger net sales, suggesting that keeping these figures under control is one of the most effective ways to protect business profitability.
3. These patterns suggest that managing discount timing and preparing for post-holiday slowdowns are important levers to optimize profitability across quarters.
4. Return has very low impact on sales over time.

Q7: Is profit margin improving or declining over time?

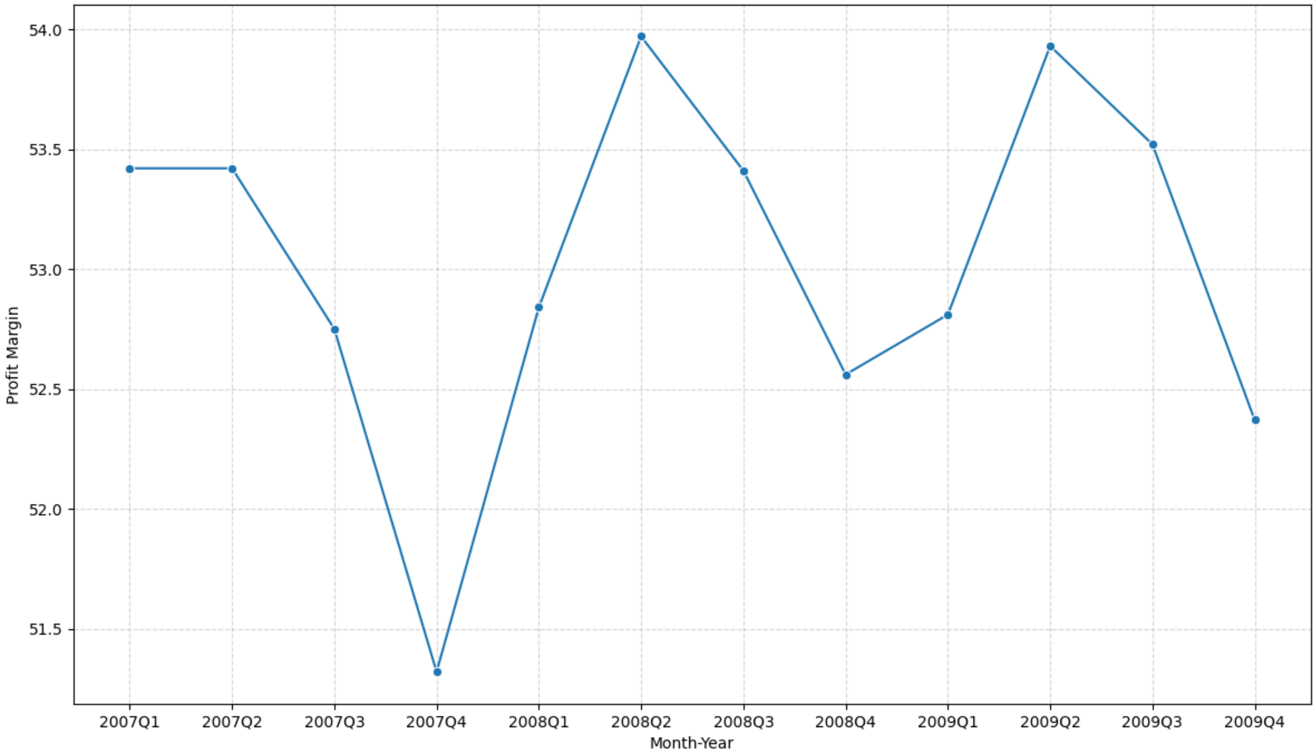

Figure 7: Profit Margin over time

Insights :

1. Retailers feel pressure to offer promotions to win customers from competitiors, sacrificing margins to retain or grow market share.
2. Shoppers expect deals and are less loyal to brands, switching easily to find the best price.
3. Holidays are often used to clear out inventory, sometimes at the cost of profitablity.

Q8: How do profit margins vary among different countries, and what factors might explain these differences?

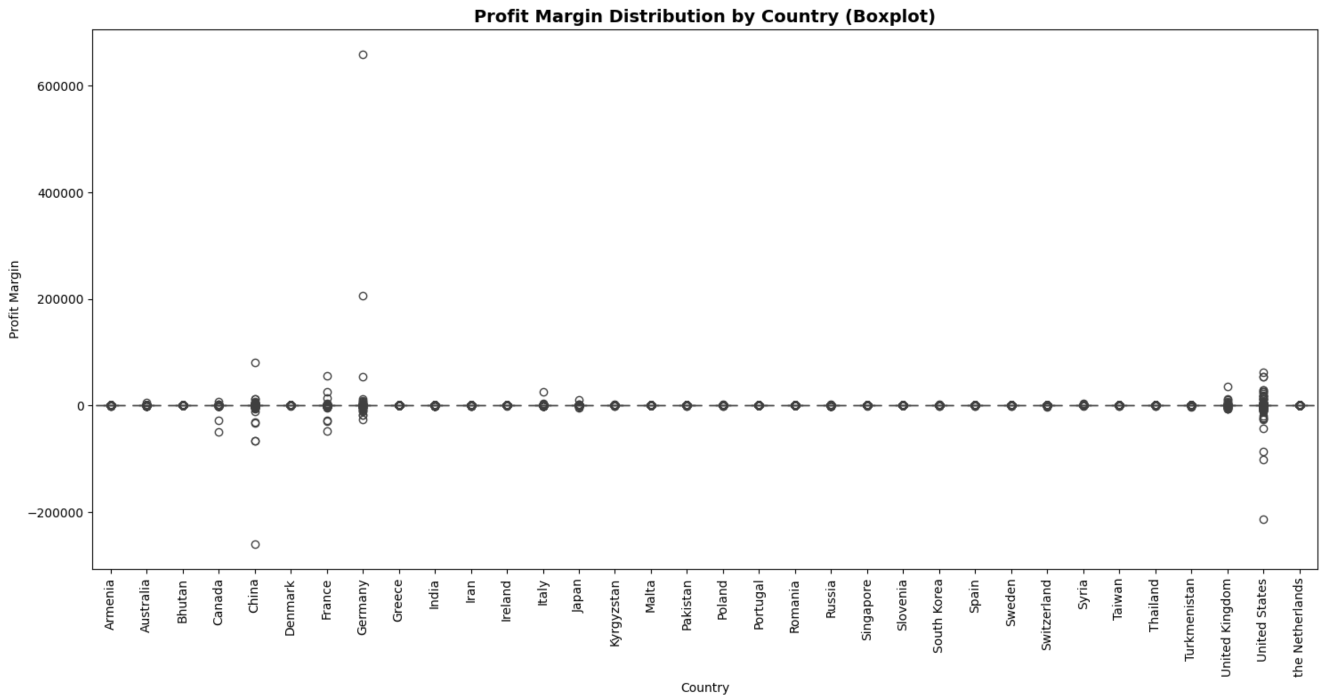

Figure 8: Profit Margin Distribution by Country

Insights :

1. Most Profit Margins are near 0 :
   - For almost all countries, the boxes (IQR) and medians are clustered around 0.
   - This means the majority of sales have very small profit margins, possibly close to break-even.
2. Presence of extreme outliers :
   - Countries like China, Germany and United States show very high outliers (up to 600000+).
   - Negative outliers are also present (below -200000), meaning in some cases losses were very large.

ANOVA on Profit Margin Across Countries :

A one-way Analysis of Variance (ANOVA) was conducted to examine whether average profit margins differ significantly across different countries. This test helps identify if the variation in profit margins between countries is greater than would be expected by chance.

The ANOVA results showed an F-statistic of 0.3691, with a p-value of 0.999646. Since the p-value is greater than the significance level of 0.05, we fail to reject the null hypothesis that profit margins are equal across all countries.

This indicates that there is no statistically significant difference in profit margin distribution among countries. These findings suggest that country-specific factors may influence profitability, providing useful insights for targeted business strategies and regional performance improvements.

6 Key Insights

1. The catalog channel currently underperforms in profit generation relative to other channels.
2. Home Appliances has highest sales (29.5%) but high returns (36.6%).
3. United States has highest sales but lowest profit margin (50.9%).
4. During holiday session where profit margin decline repidely.

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7 Recommendations

Based on the analysis, the company should:

1. Investigate cost structures, pricing strategies or customer engagement to improve margins in Catalog channel.
2. Conduct a detailed quality and customer satisfaction analysis to identify root causes for the high return rates in the home appliances category.
3. For the United States, conduct a comprehensive analysis of pricing, discounting strategies, operational expenses, and return rates, and focus on optimizing these factors to enhance overall profit margin.
4. Monitor discount strategies closely during holiday periods to control profit erosion.
5. Optimize inventory for seasonal demand.

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8 Conclusion

This report reviews how sales and profits vary across different channels and regions, and points out where improvement is needed. The catalog channel is currently making less profit compared to others, meaning costs or pricing strategies need attention. Home appliances sell the most but have a high rate of returns, which lowers overall profit. The United States leads in total sales but has the smallest profit margin, so pricing and cost management there should be reviewed. Finally, profit margins drop quickly during holiday seasons because of heavy discounting. Addressing these issues with focused actions will help ensure stronger and more sustainable business growth.
