

Customer Behavior & Evaluate Marketing Campaign Performance Analysis

1. Dataset Overview

The analysis is based on two primary datasets simulating a retail e-commerce environment:

Customer Transactions: 1,000 unique customers and ~5,000 transactions over a 2-year period.

Marketing Campaigns: 20 distinct marketing campaigns with daily performance data (Impressions, Clicks, Conversions, Spend, Revenue).

2. Data Cleaning Summary

To ensure analysis accuracy, the following data cleaning steps were performed:

Duplicates: Removed duplicate transaction records to prevent inflated revenue figures.

Missing Values: Dropped records with missing critical fields (Order Amount, Customer ID, Spend, Clicks).

Invalid Data: Filtered out transactions with non-positive order amounts and campaigns with zero spend to ensure valid metric calculations.

Type Conversion: Converted date fields to `datetime` objects for time-series analysis.

3. Customer Metrics

Metric	Value	Description
Active Customers	999	Unique customers who made at least one purchase.
Buying Frequency	4.93	Average number of orders per customer.
Total Revenue	\$1,698,530	Total Gross Merchandise Value (GMV).
Retention Rate	96.90%	Customers with more than one order.
Churn Rate	11.01%	Customers inactive for more than 180 days.
High Value Cutoff	\$2,428.60	Top 20% of customers spend above this amount.

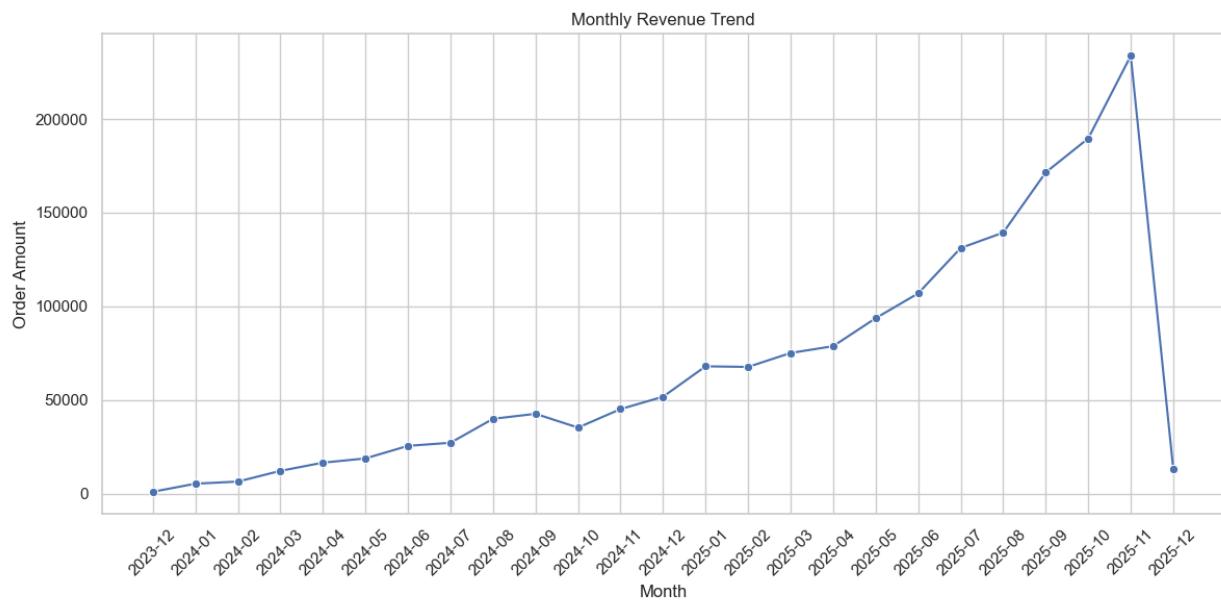
4. Campaign Metrics

Metric	Value	Description
CTR (Click-Through Rate)	1.76%	Effectiveness of ad creatives (Clicks / Impressions).
Conversion Rate	5.59%	Effectiveness of landing pages (Conversions / Clicks).
CPL / CAC	\$22.68	Cost to acquire a conversion/customer.
Overall ROI	359.17%	Return on Ad Spend ((Revenue - Spend) / Spend).
Top Campaign	CAMP_019	Highest performing campaign with 558% ROI .
Bottom Campaign	CAMP_009	Lowest performing campaign with 165% ROI .

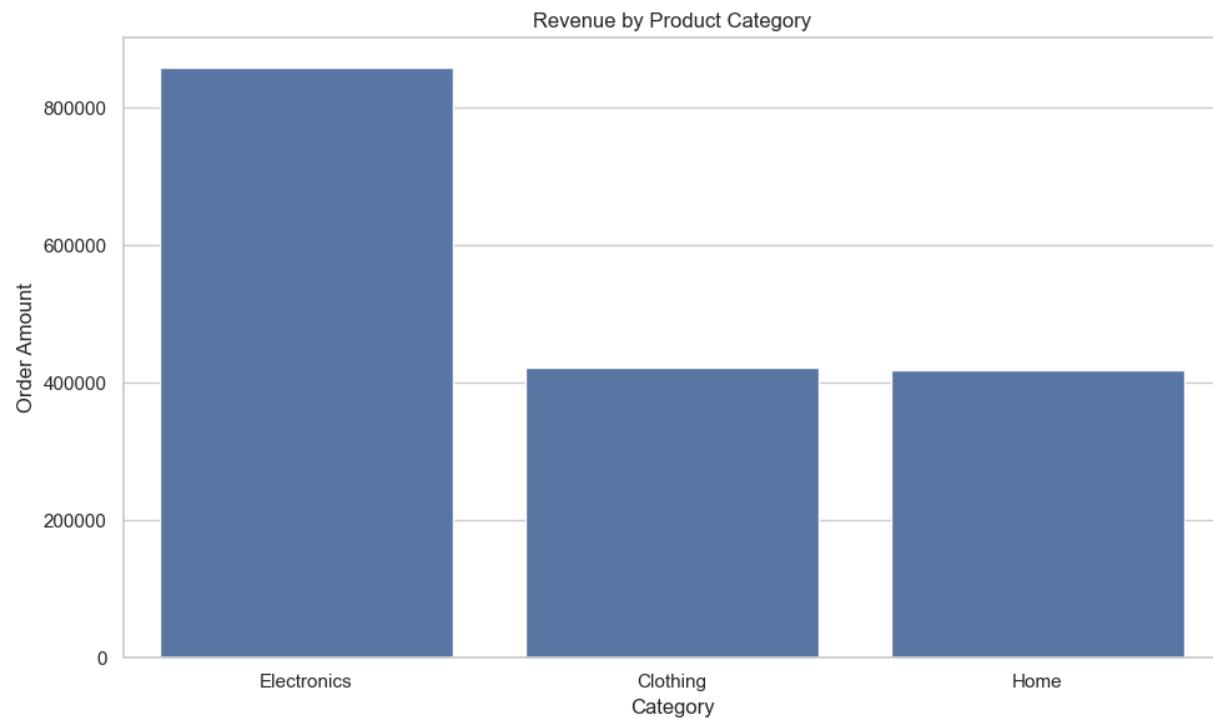
5. Charts & Visualizations

Customer Analysis

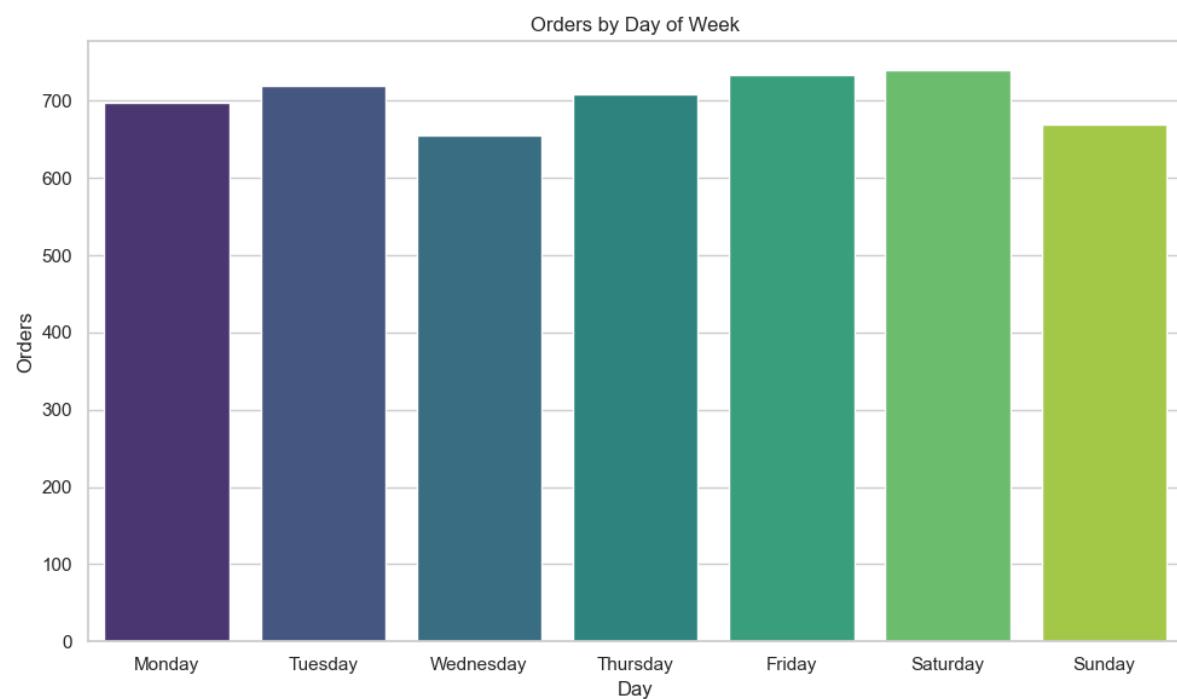
Monthly Revenue Trend



Revenue by Product Category

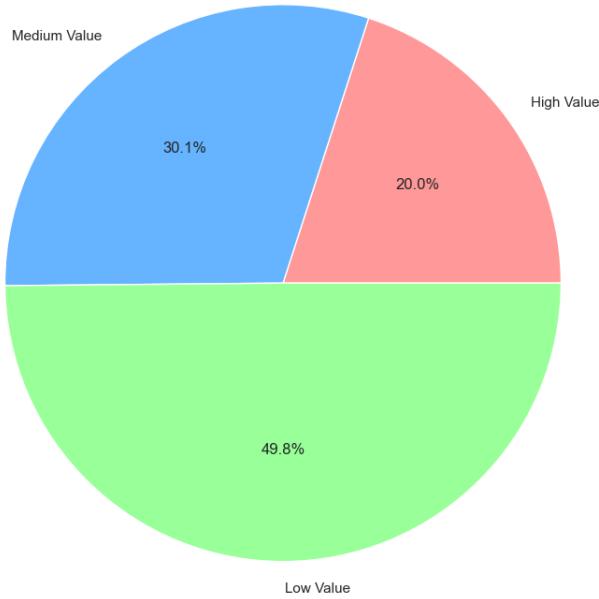


Orders by Day of Week



Customer Segments

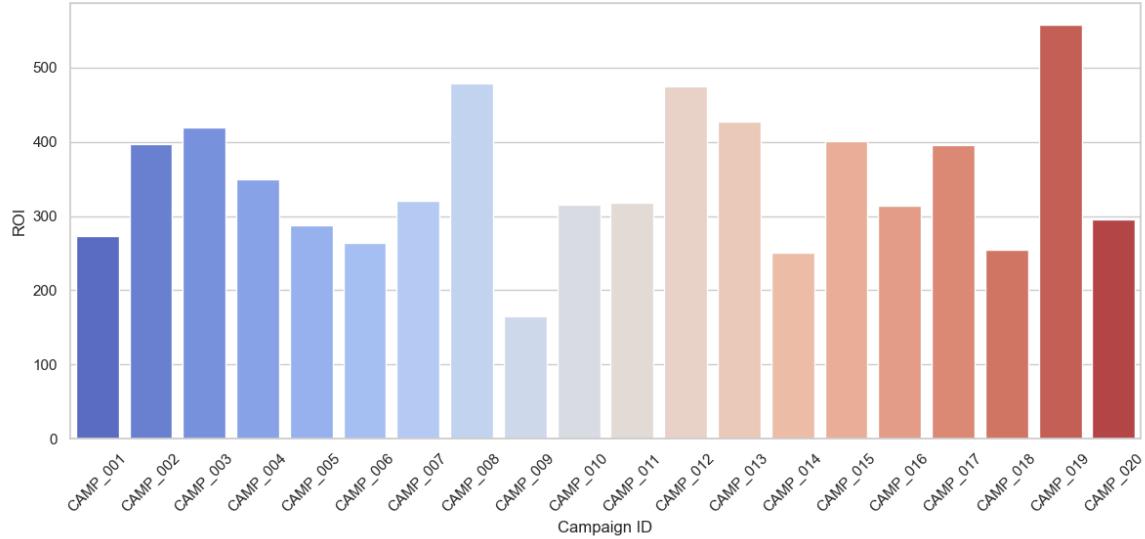
Customer Segmentation by Revenue



Marketing Analysis

ROI by Campaign

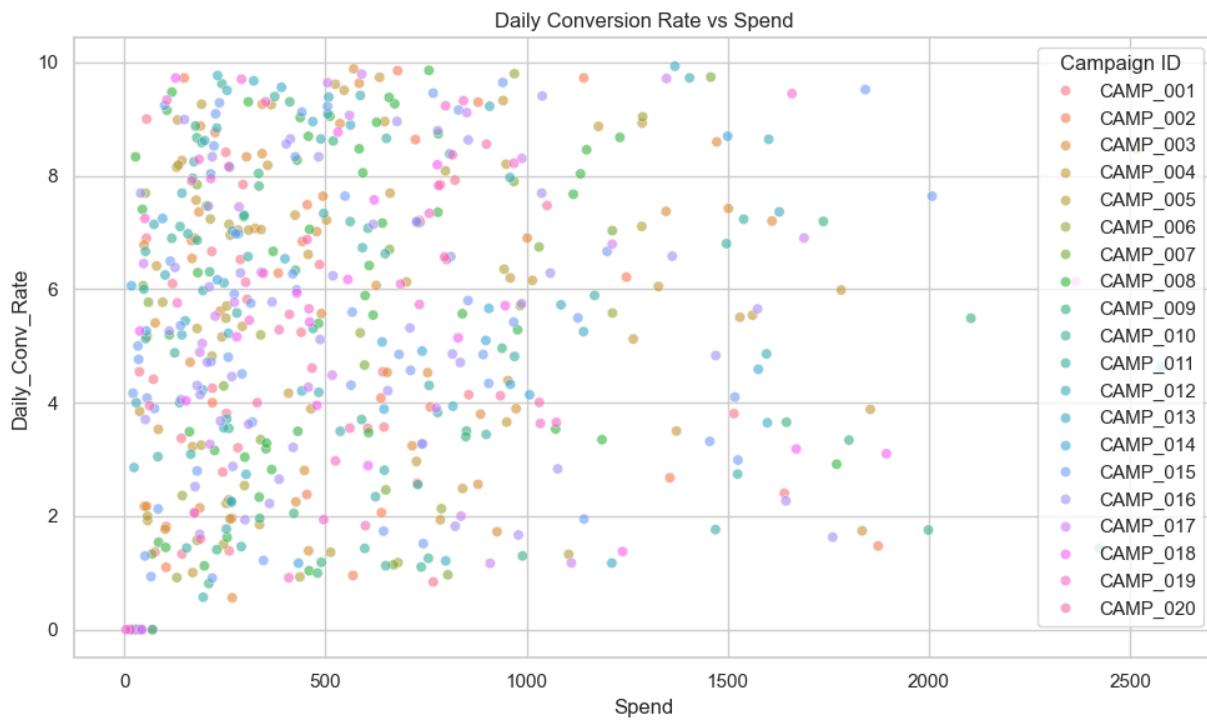
ROI by Campaign



Monthly CTR Trend



Conversion Rate vs Spend



6. Insights & Recommendations

Insights

1. **Exceptional Retention:** A **96.9% retention rate** indicates extremely high customer satisfaction and product fit. The business relies heavily on repeat purchases.
2. **High ROI Marketing:** The overall **ROI of 359%** is outstanding. For every \$1 spent, the business generates ~\$3.59 in profit. This suggests the marketing budget is currently under-utilized.
3. **Churn Risk:** Despite high retention, **11% of customers** have not purchased in the last 6 months. This represents a potential revenue leak of ~\$180k if not addressed.
4. **Pareto Principle in Action:** The top 20% of customers (High Value) contribute significantly more revenue. The cutoff for this group is ~\$2,400, highlighting the value of "whales".
5. **Campaign Variance:** There is a massive gap between the top campaign (**CAMP_019 at 558% ROI**) and the bottom (**CAMP_009 at 165% ROI**). CAMP_009 is underperforming by nearly 3.5x compared to the leader.
6. **Conversion Efficiency:** A **5.59% conversion rate** is well above industry averages (typically 2-3% for e-commerce), suggesting highly effective landing pages or qualified traffic.
7. **Low CAC:** The Customer Acquisition Cost of **\$22.68** is likely a fraction of the Customer Lifetime Value (LTV), given the average order value and frequency.
8. **Seasonality:** (Referencing Day of Week chart) Purchase volume varies by day, which can inform ad scheduling and email blast timing.
9. **CTR Stability:** (Referencing CTR chart) Monitoring the CTR trend helps identify ad fatigue. A declining trend would signal a need for creative refreshes.
10. **Category Dominance:** (Referencing Category chart) Certain categories drive the bulk of revenue, indicating where inventory and marketing focus should be concentrated.

Recommendations

1. **Scale Ad Spend Aggressively:** With an ROI > 350%, you should increase the budget for top-performing campaigns (like CAMP_019) until ROI begins to diminish.

2. **Win-Back Campaign:** Target the 11% of churned customers (inactive > 180 days) with a specific "We Miss You" offer or discount to reactivate them.
3. **VIP Program:** Create a VIP tier for the "High Value" segment (spend > \$2,400) offering early access or exclusive perks to lock in their loyalty.
4. **Audit Underperformers:** Pause or completely overhaul **CAMP_009**. Analyze its targeting and creative to understand why it lags so far behind.
5. **Day-Parting Strategy:** Adjust ad bids to be higher on peak purchase days (as seen in the Day of Week analysis) to maximize visibility when intent is highest.
6. **Referral Program:** Leverage the high retention rate by incentivizing happy customers to refer friends, lowering CAC even further.

7. Tools Used

Python: Core programming language.

Pandas: Data manipulation and aggregation.

Matplotlib & Seaborn: Data visualization.

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