SALES CHANNEL EFFECTIVENESS ANALYSIS USING R FOR A U.S. RETAIL BRAND

1. Background

A mid-sized U.S. retail apparel brand with nationwide operations sold products through three primary channels—company-owned stores, their own e-commerce platform, and third-party marketplaces (like Amazon and Walmart).

Leadership was unsure which channel combinations were most profitable and which customer segments contributed the most to channel-specific performance. They engaged us to perform a formal statistical analysis using R to guide budget reallocation, campaign optimization, and performance forecasting.

2. Objective

- To compare average revenue and transaction values across three sales channels using statistical testing
- To identify key factors driving total revenue through multiple regression modeling in R
- To deliver clear, evidence-backed recommendations for optimizing channel-specific investments

3. Data Used

Source: Internal CRM and sales performance database (Q1–Q3, 2023)

Dataset Details:

- 3,750 aggregated weekly observations across 50 U.S. metro markets
- Fields included:
    - Week, Store_ID, Channel (Store / Online / Marketplace), Region, Marketing_Spend, Units_Sold, Total_Revenue, Avg_Transaction_Value, Customer_Type

4. Methodology

4.1 Data Preparation

- Cleaned and aggregated data using dplyr

- Created dummy variables for Channel and Region
- Verified assumptions for ANOVA and regression (normality, homogeneity, multicollinearity)

4.2 Statistical Analysis

- **One-way ANOVA** to compare Avg_Transaction_Value across sales channels
- **Tukey HSD** post-hoc test to determine pairwise differences
- **Multiple Linear Regression** using:
    - Total_Revenue as the dependent variable
    - Predictors: Channel, Units_Sold, Marketing_Spend, Region, Customer_Type
- Checked model fitness with adjusted R^2, residual plots, and VIF diagnostics

5. Statistical Results

Test Type	Key Findings
ANOVA	Significant differences in Avg_Transaction_Value ($p < 0.001$)
Tukey HSD	Marketplace vs. Online had lowest value gap ($p = 0.03$)
Regression ($R^2 = 0.81$)	Units_Sold and Channel:Online were the strongest predictors
VIF Scores	All < 3, indicating low multicollinearity

Top coefficients in regression:

- Units_Sold: $\beta = 27.3$ ($p < 0.001$)
- Marketing_Spend: $\beta = 5.6$ ($p = 0.004$)
- Channel:Online: $\beta = 1123.4$ ($p < 0.001$)
- Channel:Marketplace: $\beta = 764.2$ ($p = 0.017$)

6. Interpretation and Action

- **Online channel** outperformed others in revenue impact per dollar spent
- **Brick-and-mortar stores** had higher transaction values but lower sales volumes
- **Third-party marketplaces** showed wide variance across regions and should be optimized locally

- Marketing allocation strategy was revised:
    - **+18% to Online**
    - **–10% from Store Promotions**
    - **Region-specific adjustments** for Amazon and Walmart campaigns

7. Reporting Output

- **R Markdown Report (PDF, 20 pages)**:
    - Data cleaning steps
    - Full ANOVA and regression outputs
    - Visualizations: bar plots, residuals, coefficient charts
    - Strategic recommendations by channel
- **Excel Sheet**:
    - Summary tables of metrics by channel
    - Scenario planner with "what-if" logic based on regression coefficients
- **Slide Deck (Optional)**:
    - Visual summary for executive presentation

8. Business Impact

- **Marketing ROI improved by 15%** in Q4 post-budget adjustment
- Online revenue increased by **22%** quarter-over-quarter
- Leadership added "channel profitability analysis" as a standing KPI
- R model framework now used internally for **monthly forecasting and budget planning**