IMPACT OF INFLATION ON CONSUMER SPENDING PATTERNS: A DATA ANALYSIS REPORT USING R FOR A U.S. RETAIL CHAIN

1. Background

Amid rising inflation in the U.S. from 2021 to 2023, a national grocery and convenience chain noticed shifting patterns in customer behavior. The leadership team wanted a deeper understanding of how inflation impacted purchasing frequency, category-level sales, and average basket value. We were asked to analyze point-of-sale data using R and deliver a structured report to guide pricing, promotion, and inventory decisions.

2. Objective

- To examine how consumer spending patterns changed across product categories due to inflation
- To measure trends in average basket value, frequency of visits, and substitution behaviors
- To recommend pricing and stocking strategies based on category-level resilience and volatility

3. Data Used

Source: Internal POS data + U.S. Consumer Price Index (CPI)

Dataset Structure:

- Transaction-level data from 200 stores (monthly frequency, Jan 2021 – Dec 2023)
- Total observations: 7.2 million rows

Key Variables:

- Transaction_ID, Date, Store_ID, Customer_ID (anonymized), Category, Item_Price, Quantity, Total_Bill, Promo_Applied, Basket_Count, Item_Description
- External CPI data merged monthly at national level (CPI_All_Items, CPI_Food, CPI_Household)

4. Analysis Methodology

4.1 Data Preparation

- Cleaned missing values and standardized category tags using dplyr
- Created derived metrics: Unit_Price, Basket_Value, Quantity_Per_Visit, Promo_Share
- Merged CPI data using lubridate::floor_date() and left_join()

4.2 Descriptive Analysis

- Monthly trend plots: ggplot2 line charts for average basket value and visit frequency
- Category-wise summaries: group_by() + summarise() for volume and revenue trends
- Inflation vs. spend comparison: created real_price_indexed columns to adjust prices

4.3 Statistical Testing

- Conducted paired t-tests for pre-inflation (2021) vs. peak inflation (2022) category sales
- Applied ANOVA on Basket_Value ~ Category across CPI quartiles
- Correlation analysis (cor() and corrplot) for CPI vs. category-wise spend

5. Key Results

Insight Area	Finding
Price Sensitivity	Demand for snacks and household items dropped 13% during inflation peaks
Resilient Categories	Packaged food and essentials showed <3% variance, even with CPI increase
Substitution Effect	Consumers replaced branded cleaning products with generic labels
Promo Effectiveness	Promo-driven sales rose from 18% to 29% in Q2–Q3 2022
Regional Disparities	Urban stores saw a faster decline in discretionary spending

6. Interpretation and Recommendations

- **Adjust discounting logic**: Focus promotions on inflation-sensitive categories such as snacks and cleaning supplies
- **Increase inventory buffer** for essentials that showed low price elasticity

- Launch **generic brand placement** in cleaning and household care, especially in price-sensitive ZIP codes
- Create **location-specific discount calendars** aligned with CPI trends and local spend dips
- Use **basket composition monitoring** as a leading indicator for economic stress

7. Reporting Output

- **R Markdown Report (PDF, 24 pages)**
  - CPI vs. sales plots with interpretation
  - Revenue change heatmaps by category and store region
  - Statistical test outputs with conclusions
- **Excel Summary File**
  - Pivot tables: category × month × region
  - CPI-adjusted price tracker
  - Top substitution pairs (branded to generic)
- **Visual Assets**
  - Exported charts: inflation trend overlays, basket comparison plots
  - High-resolution summary infographics for stakeholders

8. Business Impact

- Report was integrated into the **2024 merchandising strategy** across 3 regional hubs
- Helped identify **4 low-performing branded SKUs** for delisting
- Informed **dynamic pricing pilot** for 2024 with CPI-linked logic
- Allowed leadership to present data-backed inflation responses to board and investors