

# **Data-Driven Insights on Credit-Card Spending Behaviour: A Comprehensive Analysis**

## **1. Summary :**

This report presents an in-depth analysis of the credit-card spending behaviour across various cities, focusing on the impact of factors such as card type, expenditure type, and gender. The analysis utilizes data visualization, exploratory data analysis (EDA), year-over-year trends, and statistical testing. Key findings include significant variations in spending patterns across major and cities and insights into how these patterns evolve over time. Additionally, statistical tests like the Chi-square test were used to understand the relationships between categorical variables.

## **2. Introduction :**

The dataset under analysis includes demographic information and the corresponding spending patterns. The features in the dataset are:

- **Gender (Male/Female)**
- **Credit card type (Gold, Platinum, Silver)**
- **Expenditure type (Bills, Transport, Food, Entertainment)**
- **City (Indian Cities)**
- **Amount spent on credit cards (Numerical)**

The primary objective of the analysis is to understand how various factors influence credit-card spending behaviour across different cities and over time. This report will utilize exploratory data analysis (EDA), data visualization, and statistical methods to uncover insights from the dataset.

## **3. Data Pre-processing :**

Before performing the analysis, pre-processing steps were performed to prepare the dataset :

- The '**Amount**' column was normalized by dividing values by 1000 to express them in thousands for better interpretability.
- The '**Amount**' column was then converted to a '**float32**' data type for memory optimization.
- The '**Date**' column was converted into a datetime format to allow for temporal analysis.
- Columns were renamed, such as renaming '**Amount**' to '**Amount (K)**', for clarity.

Additionally, the dataset was filtered to focus on the major cities and their respective spending patterns. This allowed for a more specific analysis of urban spending behaviour.

#### **4. Exploratory Data Analysis (EDA) :**

To analyse spending behaviour across different cities and credit card types, multiple data visualizations were created in Power BI. These visualizations helped identify trends in consumer spending patterns based on gender, expenditure categories, and historical data.

##### **Key Analytical Visualizations:**

1. Bar Graph demonstrating average Spending by Credit Card Type and Gender.
2. Bar Graph showcasing Spending Distribution Across Expenditure Categories by Gender.
3. **Trends in Average Spending Over Time by Credit Card Type across gender.**
4. **Trends in Average Spending Over Time by Credit Card Type across expenditure type.**
5. Stacked Bar Graph representation Credit Card Utilization Across Different Expenditure Categories

## 5. City-Wise Analysis of Spending Behaviour :

This section presents the spending behaviour across major cities:

- **Data from major cities** like Delhi, Mumbai, and Bengaluru account for a significant portion of the dataset.
- We compare **average spending** across cities to understand how spending differs geographically.

### Data Insights :

#### 1) Ahmedabad :

##### 1.1 Credit Card Spending by Gender & Card Type

- *Female Customers:*
  - **Platinum** dominates, **followed by Gold** in total spending.
  - **Females** spend **more than males** across **all credit card types**.
- *Male Customers:*
  - **Silver** has the **highest** spending, **followed by Gold** and **Signature** (both at ~154K) in historical data.
- *Recent Shift (2015 Data):*
  - Among **males**, **Silver** is the **top** performer, followed by **Platinum**.
  - Among **females**, **Platinum** leads, but **Signature** has **overtaken Gold**, showing a **changing preference** trend.

##### 1.2 Spending Patterns by Expenditure Type

- *Gender-Based Spending Differences:*
  - **Females** spend significantly **more** on **Bills** than males.
  - **Males** spend **more on Entertainment, Grocery, Fuel, and Food**.
- *Overall Spending Distribution (Across All Cards):*
  - **Bills** account for the **highest average** spending (831K).
  - **Food** has the **lowest average** spending (587K).
- *Top Performing Cards by Expenditure Type:*
  - **Bills** → **Gold & Platinum** dominate.
  - **Entertainment** and **Food** → **Platinum** leads.

- **Fuel** → Silver leads.

## **Business Insights and Actions :**

### **1. Female Customers Are Higher Spenders – Opportunity to Strengthen Engagement**

- Since females spend more across all credit card types, customized rewards and promotions targeting their preferences (Bills, Gold/Platinum benefits) could further boost their spending.
- Designing **premium loyalty** programs for **Gold & Platinum female cardholders** focused on **bill payments** (e.g., **cashback** or **higher reward points**) could boost the engagement of more females with the particular card type.

### **2. Changing Preferences Among Males – Signature & Silver on the Rise**

- **Silver** holds the **top** rank whereas **Platinum** cards are becoming more **relevant** for **male** customers.
- **Enhancing Silver** card **benefits**, **boosting Platinum** card promotions and **increasing** the **eligibility** of **male** customers for **signature** cards can help in keeping up with growth momentum and compete with Gold.

### **3. Category-Specific Card Promotions Could Drive Sales**

- Since spending patterns differ across categories, the benefits should be aligned accordingly:
  - **Bills (Highest Spending Category)** → **Gold & Platinum** promotions should focus on **utility bill cashback**.
  - **Entertainment & Food** → **Platinum** card incentives (e.g., **movie ticket discounts, dining perks**) could further leverage its existing dominance.
  - **Fuel** → Since **Silver** is the **top performer**, **fuel-based cashback** or **discounts** can strengthen its positioning.
- Furthermore, the **declining position of Silver** cards among **females** and **Signature** card **among men** in Ahmedabad needs to be addressed by **revamping** the **respective card benefits**.

## 2) Pune :

### 2.1 Gender-Based Spending Trends on Credit Cards

- **Females outspend males** on **Gold** and **Platinum** historically, whereas **males** dominate **spending** on **Silver**.
- **Signature** card spending is **nearly equal** between **genders**, indicating balanced adoption.
- **Highest spenders:**
  - Among **women** → Gold sees the highest usage.
  - Among **men** → Silver is the preferred card type.
  - **Signature** card is the **least used** across **both genders**.

#### Business Insight:

- **Gold** and **Platinum** cards are **high-value segments** for **women**, suggesting **premium benefits** targeted at **female customers** (e.g., luxury rewards, exclusive discounts).
- **Silver** card is the **primary choice for men**, meaning **marketing lower-tier card benefits** (like cashback, fuel rewards) towards men could be impactful.
- **Signature** being the **least used** suggests it might need **repositioning** or **better incentives** to increase adoption.

### 2.2 Changing Card Preferences Over Time (2015 Trends)

- In **2015**, **females** shifted towards **Gold** followed by **Platinum**, reinforcing that premium cards are key in this segment.
- For **males**, **Silver** remained **dominant**, but **Gold** rose to **second** place.

#### Business Insight:

- The **steady rise of Gold and Platinum among females** shows a **premiumization trend**, making **exclusive lifestyle** and **travel perks** **attractive** to this segment.
- Since **males** are starting to **adopt Gold**, a **targeted campaign** focusing on **Gold's benefits (travel, dining, cashback)** might help shift them from Silver.

### 2.3 Category-Wise Spending Differences Between Genders

- **Women** spend **more** on **Fuel, Bills, and Travel**, whereas **men** spend more on **Food, Entertainment, and Grocery**.
- Highest & Lowest Spendings:
  - **Women's highest spend** → Fuel
  - **Women's lowest spend** → Grocery
  - **Men's highest spend** → Food
  - **Men's lowest spend** → Bills

#### Business Insight:

- **Fuel rewards & travel benefits** should be key offerings for **women-focused cards (Platinum & Gold)**.
- **Dining and entertainment cashback** should be emphasized for **men** to attract their spending behaviour.
- **Grocery** spending is **low for women** but **higher for men**, so **grocery rewards** should **target male** consumers.

### 2.4 Category-Wise Spending by Card Type

- **Highest spending category:** Fuel (621K), **Lowest:** Grocery (540K).
- Card Dominance by Category:
  - **Fuel, Bills and Travel:** Silver card dominates
  - **Food:** Signature card dominates
  - **Entertainment:** Gold dominates
  - **Grocery:** Platinum dominates

#### Business Insight:

- **Silver** card is heavily used **for essential expenses (fuel, bills, travel)**. A higher cashback on these categories could improve customer retention.
- **Gold** and **Signature** dominate **discretionary spending (food, entertainment)**. Premium lifestyle perks, dining discounts, and entertainment subscriptions could enhance user engagement.
- **Platinum** dominates **grocery spending**, suggesting high-value customers use it for essential purchases, **making grocery-based premium perks (free delivery, loyalty points) an attractive feature**.

### 3) Bengaluru :

#### 3.1 Gender-Based Spending Trends on Credit Cards

A joint bar graph plotting average spend per card type by gender reveals **that women consistently outspend men across all card types. Notably:**

- **Signature cards** show the **highest average spend among women.**
- For men, **Silver cards** lead in average spend, whereas **Gold cards** see the lowest.

##### **Business Insight:**

- Signature cards may offer features that resonate more with women (e.g., luxury perks, travel benefits).
- Men's preference for Silver may indicate value-seeking behaviour (e.g., cashback, fuel rewards). Tailored campaigns can focus on those benefits.

#### 3.2 Changing Card Preferences Over Time (2015 Trends)

- **Platinum cards dominate in 2015**, showing growth from 2013, especially among females.
- **Silver cards** hold the second spot and have shown consistent growth.
- **Signature cards remain least used**, particularly among males.
- Among males, **Silver remains most used**, while **Platinum is the least.**

##### **Business Insight:**

- The rise of Platinum among women supports a premiumization trend, suggesting positioning of Platinum with aspirational lifestyle rewards.
- Male customers continue to show loyalty to Silver; upgrade nudges toward Platinum may require compelling reward restructuring.

#### 3.3 Category-Wise Spending Differences Between Genders

In the joint bar graph of average spending by expenditure type (gender-wise):

- **Women dominate spending on Bills**, significantly more than men.
- Men spend marginally **higher than women on Entertainment and Food.**

### **Business Insight:**

- Bill payments form a major use-case for women, offering potential for bundling card features (e.g., bill pay cashback, utility discounts).
- Targeted male-oriented promotions can focus on dining and entertainment categories.

### **3.4 Category-Wise Spending by Card Type**

- Across card types, **Bills contribute the highest average spend**, followed by **Food, Entertainment**, and **Fuel (lowest)**.
- Within each expenditure type:
  - **Signature cards** lead for Bills and Fuel.
  - **Gold cards** lead in Entertainment.
  - **Platinum cards** dominate Food.

### **Business Insight:**

- Signature cards may be optimized for utility-based expenses, appealing to users prioritizing essential spend.
- Gold and Platinum can be differentiated based on lifestyle vs. essentials — e.g., Gold for leisure, Platinum for dining/household.
- Fuel being lowest across types might signal either lack of relevance or opportunity for better positioning.

Such an extensive analysis for all the cities can reveal insights and help in tailoring business with focus on individual cities to boost the credit card usage.

## **6. Hypothesis Testing :**

To assess potential relationships between key categorical variables — **Gender, Card Type**, and **Expenditure Type**—across different cities, we performed a series of **Chi-square tests of independence**. These were conducted city-wise, and tests were only applied when the Chi-square assumptions were met (i.e., **all expected frequencies > 5**). The three primary relationships tested were:



## 1. Gender vs Card Type Usage — City-wise Chi-Square Test :

This analysis aimed to identify whether gender influences credit card type preferences within each city. For each city:

- A contingency table was constructed between **Gender** and **Card Type**.
- The **Chi-square test** was conducted only **when all expected cell counts were greater than 5**.
- Based on the resulting p-values:
  - $p < 0.05$** : Gender and Card Type are **statistically dependent**, indicating gender-based preference differences.
  - $p \geq 0.05$** : Gender and Card Type are **statistically independent**.  
If test assumptions weren't met, the test was not performed for that city.

For instance, although visual cues suggested a notable difference in credit card usage between genders in **Pune**, the Chi-square test returned a **p-value** of **0.34**, indicating **no statistically significant** association. While the test indicated statistical independence, visual patterns suggest that further investigation using balanced or stratified data could provide clearer insights.

## 2. Gender vs Expenditure Type — City-wise Chi-Square Test

To explore whether the **type of credit card used is associated with the type of expenditure**, we tested the relationship between **Gender** and **Expenditure Type** for each city:

- A contingency table between **Gender** and **Expenditure Type** was created per city.
- The **Chi-square test** was applied where assumptions were satisfied.
- Interpretation:
  - $p < 0.05$** : Statistically significant association.
  - $p \geq 0.05$** : No significant association.
- Infeasible tests (assumption violations) were skipped.

The results highlighted cities where gender-based **spending behaviour significantly differed across categories** such as travel, entertainment, groceries, etc. These findings support the design of **gender-specific business strategies** like customized loyalty programs, targeted promotions, and region-specific marketing campaigns.

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This analysis revealed which cities exhibited **distinct patterns between card preferences and how people spend**, aiding banks or financial institutions in tailoring card features or benefits toward specific spending categories.

```
City: Delhi
Gender vs Card Type - p: 0.014406413201986578
→ Dependent
Gender vs Exp Type - p: 0.0032564765590939308
→ Dependent
Card Type vs Exp Type - p: 0.8073711347632427
→ Independent
-----
City: Greater Mumbai
Gender vs Card Type - p: 3.3786811179547874e-05
→ Dependent
Gender vs Exp Type - p: 1.0050296977112737e-08
→ Dependent
Card Type vs Exp Type - p: 0.7074206696656069
→ Independent
-----
City: Bengaluru
Gender vs Card Type - p: 1.5464850249929327e-05
→ Dependent
Gender vs Exp Type - p: 4.72944684472417e-06
→ Dependent
Card Type vs Exp Type - p: 0.15410367642225842
→ Independent
-----
City: Ahmedabad
Gender vs Card Type - p: 0.013725208534738857
→ Dependent
Gender vs Exp Type - p: 2.442729993770186e-07
→ Dependent
Card Type vs Exp Type - p: 0.820335466240427
→ Independent
-----
City: Pune
Gender vs Card Type - p: 0.3406569811096716
→ Independent
Gender vs Exp Type - p: 0.06292990639116539
→ Independent
Card Type vs Exp Type - p: 0.17885472022216994
→ Independent
```