qwe0bcn7f

January 13, 2025

[3]:

```
# Importing Libraries
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
```

[4]:

```
# Load Data
transaction_data = pd.read_excel(r"C:
 ↪\Users\ashwi\Downloads\QVI_transaction_data.xlsx")
purchase_behaviour_data = pd.read_csv(r"C:
 ↪\Users\ashwi\Downloads\QVI_purchase_behaviour.csv")
```

[5]:

```
# Data Inspection
print("Transaction Data Info:")
print(transaction_data.info())
print("\nPurchase Behaviour Data Info:")
print(purchase_behaviour_data.info())

# Checking for missing values
print("\nMissing Values in Transaction Data:")
print(transaction_data.isnull().sum())
print("\nMissing Values in Purchase Behaviour Data:")
print(purchase_behaviour_data.isnull().sum())
```

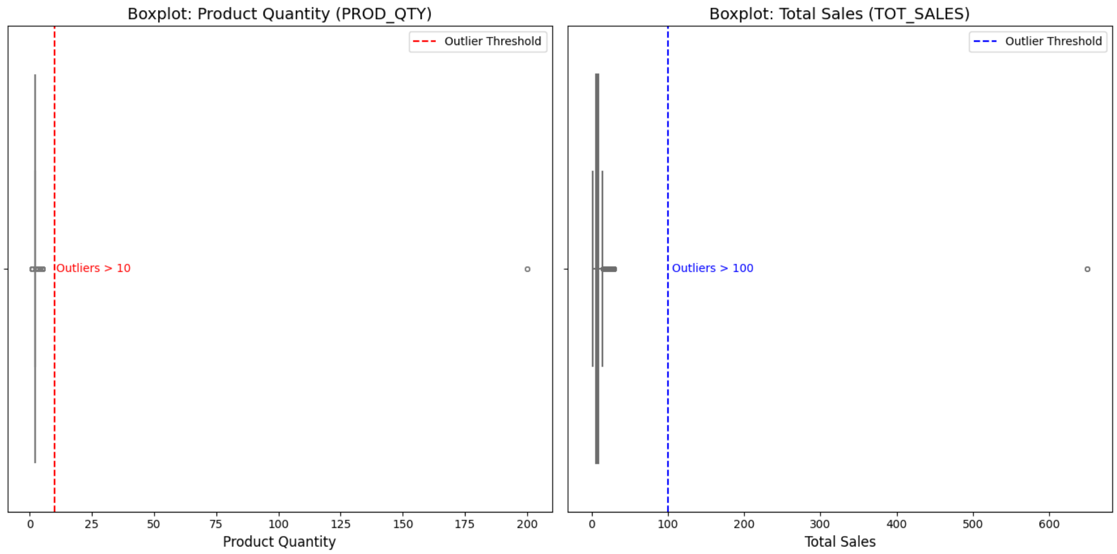
```
Transaction Data Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 264836 entries, 0 to 264835
Data columns (total 8 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   DATE            264836 non-null  int64
 1   STORE_NBR       264836 non-null  int64
 2   LYLTY_CARD_NBR  264836 non-null  int64
 3   TXN_ID          264836 non-null  int64
 4   PROD_NBR        264836 non-null  int64
 5   PROD_NAME       264836 non-null  object
 6   PROD_QTY        264836 non-null  int64
 7   TOT_SALES       264836 non-null  float64
dtypes: float64(1), int64(6), object(1)
```

```
memory usage: 16.2+ MB
None

Purchase Behaviour Data Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 72637 entries, 0 to 72636
Data columns (total 3 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   LYLTY_CARD_NBR    72637 non-null  int64
 1   LIFESTAGE         72637 non-null  object
 2   PREMIUM_CUSTOMER  72637 non-null  object
dtypes: int64(1), object(2)
memory usage: 1.7+ MB
None

Missing Values in Transaction Data:
DATE              0
STORE_NBR         0
LYLTY_CARD_NBR    0
TXN_ID            0
PROD_NBR          0
PROD_NAME         0
PROD_QTY          0
TOT_SALES         0
dtype: int64

Missing Values in Purchase Behaviour Data:
LYLTY_CARD_NBR      0
LIFESTAGE           0
PREMIUM_CUSTOMER    0
dtype: int64
```

[6]:

```
# Outlier Detection
# Define figure size and layout
fig, axes = plt.subplots(1, 2, figsize=(14, 7))

# Boxplot for Product Quantity (PROD_QTY)
sns.boxplot(data=transaction_data, x='PROD_QTY', ax=axes[0], color='lightblue',␣
  ↪fliersize=4, linewidth=1.5)
axes[0].set_title('Boxplot: Product Quantity (PROD_QTY)', fontsize=14)
axes[0].set_xlabel('Product Quantity', fontsize=12)
axes[0].tick_params(axis='both', which='major', labelsize=10)

# Highlighting the outlier area
axes[0].axvline(10, color='red', linestyle='--', linewidth=1.5, label='Outlier␣
  ↪Threshold')
```

```
axes[0].legend(fontsize=10)
axes[0].text(10.5, 0, 'Outliers > 10', color='red', fontsize=10, verticalalignment='center')

# Boxplot for Total Sales (TOT_SALES)
sns.boxplot(data=transaction_data, x='TOT_SALES', ax=axes[1], color='salmon', fliersize=4, linewidth=1.5)
axes[1].set_title('Boxplot: Total Sales (TOT_SALES)', fontsize=14)
axes[1].set_xlabel('Total Sales', fontsize=12)
axes[1].tick_params(axis='both', which='major', labelsize=10)

# Highlighting the outlier area
axes[1].axvline(100, color='blue', linestyle='--', linewidth=1.5, label='Outlier Threshold')
axes[1].legend(fontsize=10)
axes[1].text(105, 0, 'Outliers > 100', color='blue', fontsize=10, verticalalignment='center')

# Adjust spacing
plt.tight_layout()
plt.show()
```



[7]:

```
# Removing Outliers
outlier_transactions = transaction_data[(transaction_data['PROD_QTY'] > 10) | (transaction_data['TOT_SALES'] > 100)]
print("\nOutlier Transactions:")
print(outlier_transactions)
```

```
# Removing outliers from transaction data
transaction_data_cleaned = transaction_data[~transaction_data['TXN_ID'].
 ↪isin(outlier_transactions['TXN_ID'])]
```

```
Outlier Transactions:
        DATE  STORE_NBR  LYLTY_CARD_NBR  TXN_ID  PROD_NBR  \
69762  43331        226          226000  226201         4
69763  43605        226          226000  226210         4

                              PROD_NAME  PROD_QTY  TOT_SALES
69762  Dorito Corn Chp     Supreme 380g       200      650.0
69763  Dorito Corn Chp     Supreme 380g       200      650.0
```

[8]:

```
# Feature Engineering
# Extracting Pack Size
transaction_data_cleaned['PACK_SIZE'] = transaction_data_cleaned['PROD_NAME'].
 ↪str.extract(r'(\d+)g').astype(float)

# Extracting Brand
transaction_data_cleaned['BRAND'] = transaction_data_cleaned['PROD_NAME'].str.
 ↪split().str[0]
```

```
C:\Users\ashwi\AppData\Local\Temp\ipykernel_27332\181266301.py:3:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  transaction_data_cleaned['PACK_SIZE'] =
transaction_data_cleaned['PROD_NAME'].str.extract(r'(\d+)g').astype(float)
C:\Users\ashwi\AppData\Local\Temp\ipykernel_27332\181266301.py:6:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  transaction_data_cleaned['BRAND'] =
transaction_data_cleaned['PROD_NAME'].str.split().str[0]
```

[9]:

```
# Merge Data
merged_data = pd.merge(
    transaction_data_cleaned,
    purchase_behaviour_data,
    on="LYLTY_CARD_NBR",
    how="inner"
)

# Exploratory Data Analysis
# Summary statistics
print("\nMerged Data Info:")
print(merged_data.info())
print("\nSummary Statistics:")
print(merged_data.describe(include='all'))
```

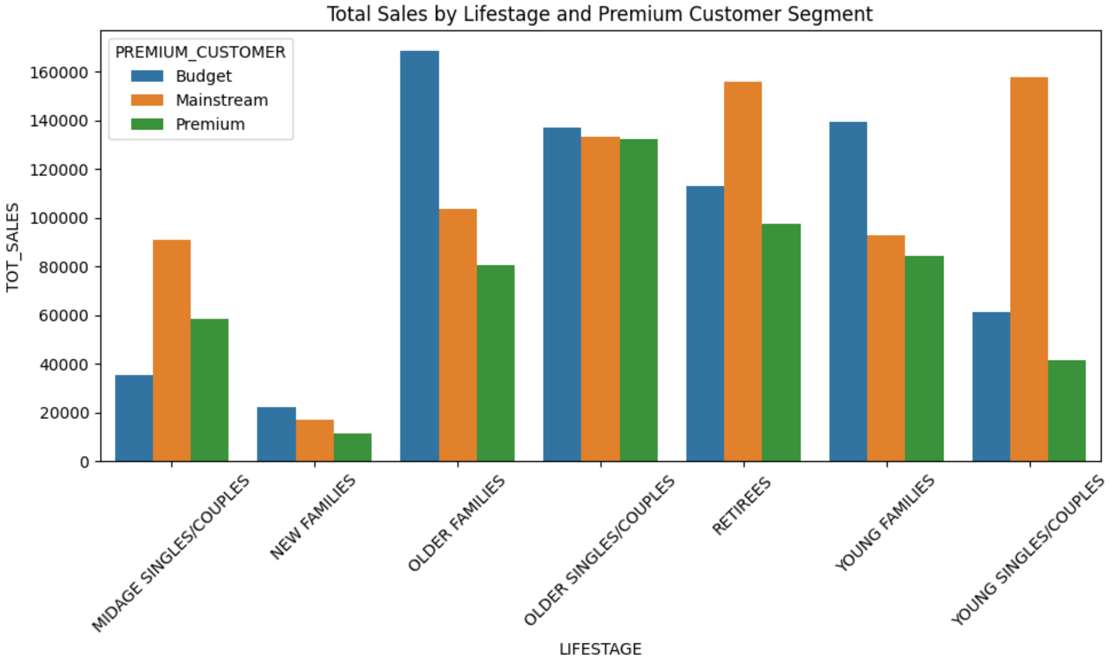
```
Merged Data Info:
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 264834 entries, 0 to 264833
Data columns (total 12 columns):
 #   Column            Non-Null Count   Dtype
---  ------            --------------   -----
 0   DATE              264834 non-null  int64
 1   STORE_NBR         264834 non-null  int64
 2   LYLTY_CARD_NBR    264834 non-null  int64
 3   TXN_ID            264834 non-null  int64
 4   PROD_NBR          264834 non-null  int64
 5   PROD_NAME         264834 non-null  object
 6   PROD_QTY          264834 non-null  int64
 7   TOT_SALES         264834 non-null  float64
 8   PACK_SIZE         258770 non-null  float64
 9   BRAND             264834 non-null  object
 10  LIFESTAGE         264834 non-null  object
 11  PREMIUM_CUSTOMER  264834 non-null  object
dtypes: float64(2), int64(6), object(4)
memory usage: 24.2+ MB
None

Summary Statistics:
                 DATE      STORE_NBR  LYLTY_CARD_NBR        TXN_ID  \
count   264834.000000  264834.000000    2.648340e+05  2.648340e+05
unique            NaN            NaN             NaN           NaN
top               NaN            NaN             NaN           NaN
freq              NaN            NaN             NaN           NaN
mean     43464.036230     135.079423    1.355488e+05  1.351576e+05
std        105.389007      76.784063    8.057990e+04  7.813292e+04
min      43282.000000       1.000000    1.000000e+03  1.000000e+00
25%      43373.000000      70.000000    7.002100e+04  6.760050e+04
50%      43464.000000     130.000000    1.303570e+05  1.351365e+05
75%      43555.000000     203.000000    2.030940e+05  2.026998e+05
max      43646.000000     272.000000    2.373711e+06  2.415841e+06
```

```
             PROD_NBR                               PROD_NAME       PROD_QTY  \
count   264834.000000                                  264834  264834.000000
unique            NaN                                     114            NaN
top               NaN  Kettle Mozzarella   Basil & Pesto 175g            NaN
freq              NaN                                    3304            NaN
mean        56.583554                                     NaN       1.905813
std         32.826444                                     NaN       0.343436
min          1.000000                                     NaN       1.000000
25%         28.000000                                     NaN       2.000000
50%         56.000000                                     NaN       2.000000
75%         85.000000                                     NaN       2.000000
max        114.000000                                     NaN       5.000000

            TOT_SALES      PACK_SIZE   BRAND              LIFESTAGE  \
count   264834.000000  258770.000000  264834                 264834
unique            NaN            NaN      29                      7
top               NaN            NaN  Kettle  OLDER SINGLES/COUPLES
freq              NaN            NaN   41288                  54479
mean         7.299346     182.324276     NaN                    NaN
std          2.527241      64.955035     NaN                    NaN
min          1.500000      70.000000     NaN                    NaN
25%          5.400000     150.000000     NaN                    NaN
50%          7.400000     170.000000     NaN                    NaN
75%          9.200000     175.000000     NaN                    NaN
max         29.500000     380.000000     NaN                    NaN

       PREMIUM_CUSTOMER
count            264834
unique                3
top          Mainstream
freq             101988
mean                NaN
std                 NaN
min                 NaN
25%                 NaN
50%                 NaN
75%                 NaN
max                 NaN
```

```
[10]: # Sales by Lifestage and Premium Segment
      sales_by_segment = merged_data.groupby(['LIFESTAGE',␣
       ↪'PREMIUM_CUSTOMER'])['TOT_SALES'].sum().reset_index()
      print("\nSales by Segment:")
      print(sales_by_segment)

      # Visualizing Sales by Segment
      plt.figure(figsize=(10, 6))
```

```
sns.barplot(data=sales_by_segment, x='LIFESTAGE', y='TOT_SALES',␣
 ↪hue='PREMIUM_CUSTOMER')
plt.title('Total Sales by Lifestage and Premium Customer Segment')
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```

```
Sales by Segment:
                 LIFESTAGE PREMIUM_CUSTOMER  TOT_SALES
0   MIDAGE SINGLES/COUPLES           Budget   35514.80
1   MIDAGE SINGLES/COUPLES       Mainstream   90803.85
2   MIDAGE SINGLES/COUPLES          Premium   58432.65
3             NEW FAMILIES           Budget   21928.45
4             NEW FAMILIES       Mainstream   17013.90
5             NEW FAMILIES          Premium   11491.10
6           OLDER FAMILIES           Budget  168363.25
7           OLDER FAMILIES       Mainstream  103445.55
8           OLDER FAMILIES          Premium   80658.40
9    OLDER SINGLES/COUPLES           Budget  136769.80
10   OLDER SINGLES/COUPLES       Mainstream  133393.80
11   OLDER SINGLES/COUPLES          Premium  132263.15
12                RETIREES           Budget  113147.80
13                RETIREES       Mainstream  155677.05
14                RETIREES          Premium   97646.05
15          YOUNG FAMILIES           Budget  139345.85
16          YOUNG FAMILIES       Mainstream   92788.75
17          YOUNG FAMILIES          Premium   84025.50
18   YOUNG SINGLES/COUPLES           Budget   61141.60
19   YOUNG SINGLES/COUPLES       Mainstream  157621.60
20   YOUNG SINGLES/COUPLES          Premium   41642.10
```

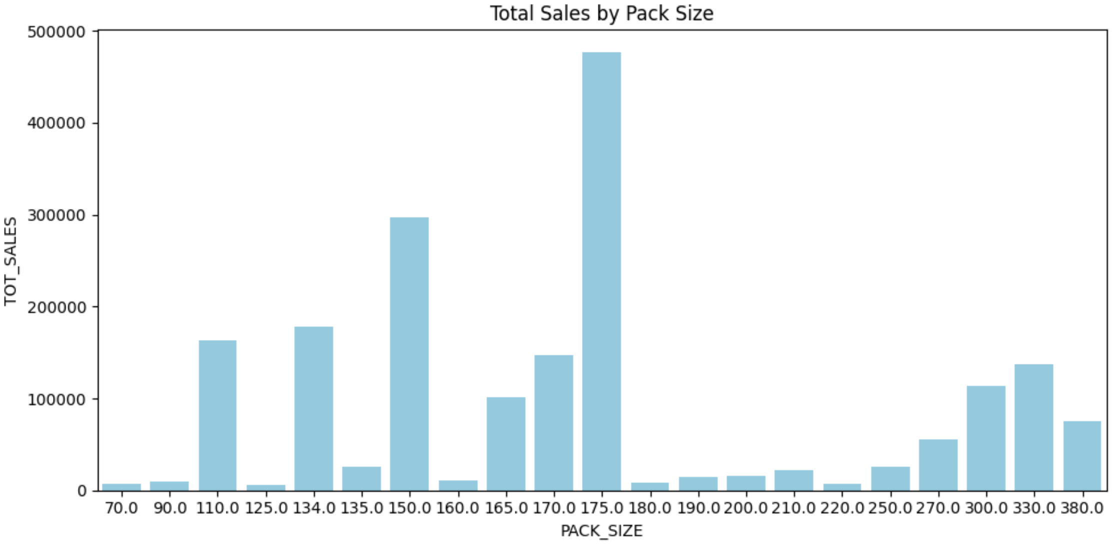


[11]:

```
# Pack Size Analysis
pack_size_sales = merged_data.groupby('PACK_SIZE')['TOT_SALES'].sum().
  ↪reset_index()
print("\nPack Size Sales Summary:")
print(pack_size_sales)

plt.figure(figsize=(10, 5))
sns.barplot(data=pack_size_sales, x='PACK_SIZE', y='TOT_SALES', color='skyblue')
plt.title('Total Sales by Pack Size')
plt.tight_layout()
plt.show()
```

```
Pack Size Sales Summary:
    PACK_SIZE  TOT_SALES
0        70.0     6852.0
1        90.0     9676.4
2       110.0   162765.4
3       125.0     5733.0
4       134.0   177655.5
5       135.0    26090.4
6       150.0   296609.7
7       160.0    10647.6
8       165.0   101360.6
9       170.0   146673.0
10      175.0   477112.4
```

```
11       180.0     8568.4
12       190.0    14412.9
13       200.0    16007.5
14       210.0    21700.8
15       220.0     6831.0
16       250.0    26096.7
17       270.0    55425.4
18       300.0   113330.6
19       330.0   136794.3
20       380.0    75419.6
```



[12]:
```python
# Recommendations
print("\nRecommendations:")
print("""
1. Target Lifestage segments with high total sales for promotional campaigns.
2. Focus on premium customers who contribute significantly to revenue.
3. Optimize stock levels for popular pack sizes.
4. Consider diversifying brand offerings based on customer preferences.
""")
```

```
Recommendations:

1. Target Lifestage segments with high total sales for promotional campaigns.
2. Focus on premium customers who contribute significantly to revenue.
3. Optimize stock levels for popular pack sizes.
4. Consider diversifying brand offerings based on customer preferences.
```

[13]:

```
# Saving Analysis
merged_data.to_csv('cleaned_merged_data.csv', index=False)
```