

TouchBistro Challenge: Holiday or Day-of-Week Impact on Sales

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Competition: TouchBistro x UW Data Challenge

Table of Contents

- 1. Introduction**
- 2. Objective of the analysis**
- 3. Methodology**
- 4. Analysis and Results**
- 5. Discussion**
- 6. Conclusion**
- 7. Recommendation**

Introduction

Background & Motivation

In the restaurant industry, understanding customer spending patterns is crucial for optimizing business strategies. TouchBistro provides a **Point of Sale (POS) system** that enables restaurant owners to process orders, manage operations, and gain **data-driven insights**. By analyzing transaction data, businesses can make informed decisions about **staffing, promotions, and inventory management** to maximize revenue.

Objectives of Analysis

The goal of this study is to examine how **sales and gratuities vary across different days of the week and holidays**. By analyzing transaction data, we aim to answer key business questions:

1. **Do holidays generate higher total sales compared to normal days?**
2. **Do sales follow a specific trend across different days of the week?**
3. **Do weekends generate higher net sales than weekdays?**
4. **Do weekends generate higher gratuities (tips) than weekdays?**

Key Findings & Business Impacts

Our findings provide valuable insights for **restaurant managers and decision-makers**. If holidays and weekends significantly impact sales, restaurants can:

- **Adjust staffing levels** to meet increased demand.
- **Introduce special promotions** on high-revenue days.
- **Optimize business hours** for maximum profitability.

Through this study, we aim to provide actionable recommendations that help restaurants **enhance customer experience, increase efficiency, and maximize revenue**.

Methodology

Approach

This study employs an exploratory data analysis (EDA) approach to investigate how total daily sales, net sales, and gratuities vary across different time periods, including holidays, days of the week, and weekends. The methodology includes data cleaning, feature extraction, grouping, statistical testing, and visualization to uncover trends and patterns in sales data.

Tools and Technologies

The analysis is conducted using Python, leveraging the following libraries:

- Pandas: For data manipulation and aggregation
- Matplotlib & Seaborn: For data visualization (bar charts, trend analysis)
- SciPy: For statistical hypothesis testing (e.g., t-tests)
- Colab: For cloud-based execution of the analysis

Data Collection and Preprocessing

- Load the bills.csv file
- Extract relevant features, including date, sales amount, and tips.
- Convert date columns to a standardized format and extract day-of-week and holiday indicators.
- Handle missing or inconsistent values, if any.

Analysis and Modeling

1. Sales Variation by Holidays
 - 1.1. Identify public holidays using a calendar reference.
 - 1.2. Calculate total sales for each holiday and compare them with normal days.
 - 1.3. Visualize sales trends across different holidays using bar charts.
2. Sales Trends Across Days of the Week
 - 2.1. Extract day-of-week information from transaction dates.
 - 2.2. Aggregate total sales per day and analyze trends across Monday–Sunday.
 - 2.3. Visualize results using bar charts to observe patterns in sales fluctuations.
3. Weekend vs. Weekday Sales Analysis
 - 3.1. Split data into weekdays (Monday–Friday) and weekends (Saturday–Sunday).
 - 3.2. Compute total net sales for each category.
 - 3.3. Visualize results using bar charts to observe patterns in sales fluctuations.
4. Weekend vs. Weekday Tips Analysis
 - 4.1. Calculate the total tips received on weekdays and weekends.
 - 4.2. Compute the ratio of tips to total sales for each period.
 - 4.3. Compare results using bar charts and statistical methods.

Analysis and Results

1. Sales Variation by Holidays

Results Interpretation:

The data shows that the average total sales on normal days and holidays are the same, indicating that holidays do not significantly impact overall sales.

Possible Explanations for this Trend:

1.1 Consistent customer demand:

Sales remain stable regardless of the day type.

1.2 Shifts in purchasing behavior:

While some people may buy more during holidays, others may shop less, balancing the total sales.

2.3 Business operations:

If store hours, pricing strategies, or product availability remain unchanged, total sales might not fluctuate.

2. Sales Trends Across Days of the Week

Results Interpretation:

Consumer spending patterns increase toward the weekend, peaking on Friday and Saturday, and then declining on Sunday and Monday.

Possible Explanations for this Trend:

2.1 Higher consumer activity on weekends:

People may shop more on weekends when they are off work or school.

Leisure activities and social events could contribute to increased spending.

2.2 Payday effect (Friday spikes):

Many people receive paychecks on Fridays, leading to increased spending.

2.3 Monday as a slow business day:

People may recover from weekend spending and delay purchases at the start of the week.

2.4 Sunday sales drop due to early closures:

Some businesses may have shorter hours or less customer traffic on Sundays, leading to lower sales.

3. Weekend vs. Weekday Sales Analysis

Results Interpretation:

Weekends generate higher net sales compared to weekdays.

Possible Explanations for this Comparison:

3.1 Higher Tips on Weekends (Saturday and Sunday):

People dine out with family and friends on weekends, which can result in higher tips.

Weekends are popular for celebrating special occasions (e.g., birthdays, anniversaries), where customers may be more generous with tipping.

Restaurants often extend hours on weekends, offering brunch or late-night dining, which can attract more customers.

Special events, live music, or themed menus on weekends create a more enjoyable experience.

3.2 Lower Tips on Weekdays (Monday to Friday):

Weekday dining is often rushed due to work or school commitments, which can result in smaller tips.

Customers dining alone or in smaller groups on weekdays may tip less compared to larger weekend gatherings.

Restaurants may have shorter hours or fewer special offerings on weekdays.

4. Weekend vs. Weekday Tips Analysis

Results Interpretation:

Weekends will generate higher tips compared to weekdays in total and ratio

Possible Explanations for this Comparison:

4.1 Higher Sales on Weekends (Saturday and Sunday):

Weekends typically see more customers as people have more free time to visit restaurants, shop, or engage in leisure activities.

Weekends are popular for dining out with family and friends, leading to larger groups and higher spending.

Businesses often run promotions, events, or extended hours on weekends to attract more customers.

4.2 Lower Sales on Weekdays (Monday to Friday):

People are often busy with work or school during weekdays, reducing their availability for dining out or shopping.

Weekday customers may consist of smaller groups or individuals, resulting in lower overall sales.

Weekday customers may prioritize quick meals or purchases, leading to lower spending compared to leisurely weekend visits.

Discussion

One of the key challenges in analyzing **holiday impact on sales** is that **holidays vary by region and business type**. While some holidays, such as **Christmas and New Year's Day**, are widely observed, others, like **Family Day** or **Victoria Day**, are not recognized in all provinces. Additionally, the extent to which a holiday affects restaurant sales depends on **customer behavior, venue type, and location**.

For example, restaurants located in **tourist-heavy areas** may experience increased traffic on holidays, whereas smaller local establishments may see a **decline** due to customers celebrating at home. Similarly, certain restaurant types, such as **fine dining establishments**, might see a surge in reservations on holidays, while **fast-food restaurants** may not experience a significant difference. This variability makes it **difficult to generalize** holiday sales trends across all venues.

Our analysis used a **fixed set of Canadian public holidays** (e.g., **Christmas, Canada Day, Thanksgiving**) to evaluate whether these days led to **higher total daily sales** compared to non-holiday periods. The statistical test results showed that some holidays significantly impacted sales, while others had **minimal effect**. This suggests that restaurant managers should consider **venue-specific holiday trends** rather than applying a one-size-fits-all approach to staffing and promotions.

Similarly, for **day-of-the-week sales analysis**, the results indicate that **weekends generally generate higher net sales compared to weekdays** (Google Colab Notebook: [Weekend vs. Weekday Net Sales](#)). This trend is expected, as weekends allow for **increased social dining and leisure activities**. Additionally, **gratuities (tips) were also higher on weekends**, suggesting that customers tend to spend more on both meals and service during these periods ([Weekend vs. Weekday Tips](#)).

However, an **unexpected finding** was that **sales did not consistently increase throughout the week**, contrary to the hypothesis that sales would peak on **Saturday and decline on Sunday**. Instead, the **sales trend varied across venues**, emphasizing the importance of **individual restaurant-level analysis** ([Day-of-the-Week Sales Trend](#)).

Conclusion

This study explored the impact of **holidays and days of the week on restaurant sales** using transaction data from TouchBistro. The key findings include:

1. **Holidays do not always guarantee increased sales**, as regional differences and restaurant types influence customer behavior ([Holiday Sales Analysis](#)).
2. **Weekends generate higher net sales compared to weekdays**, confirming the assumption that restaurants experience peak traffic on Saturdays and Sundays.
3. **Tips (gratuities) are also higher on weekends**, suggesting that customer spending behavior changes based on the day of the week.
4. **Daily sales trends vary by restaurant type**, meaning **generalized staffing recommendations may not be effective** for all venues.

Business Implications

The results of this study provide valuable insights for **restaurant owners and managers**:

- **Adjusting staffing levels** based on observed peak days can improve efficiency and service quality.
- **Creating targeted promotions for slow days** (e.g., early-week discounts) can balance revenue fluctuations.
- **Venue-specific analysis is necessary**, as not all holidays or weekdays impact sales equally.

Future Considerations

To improve this study, future research could:

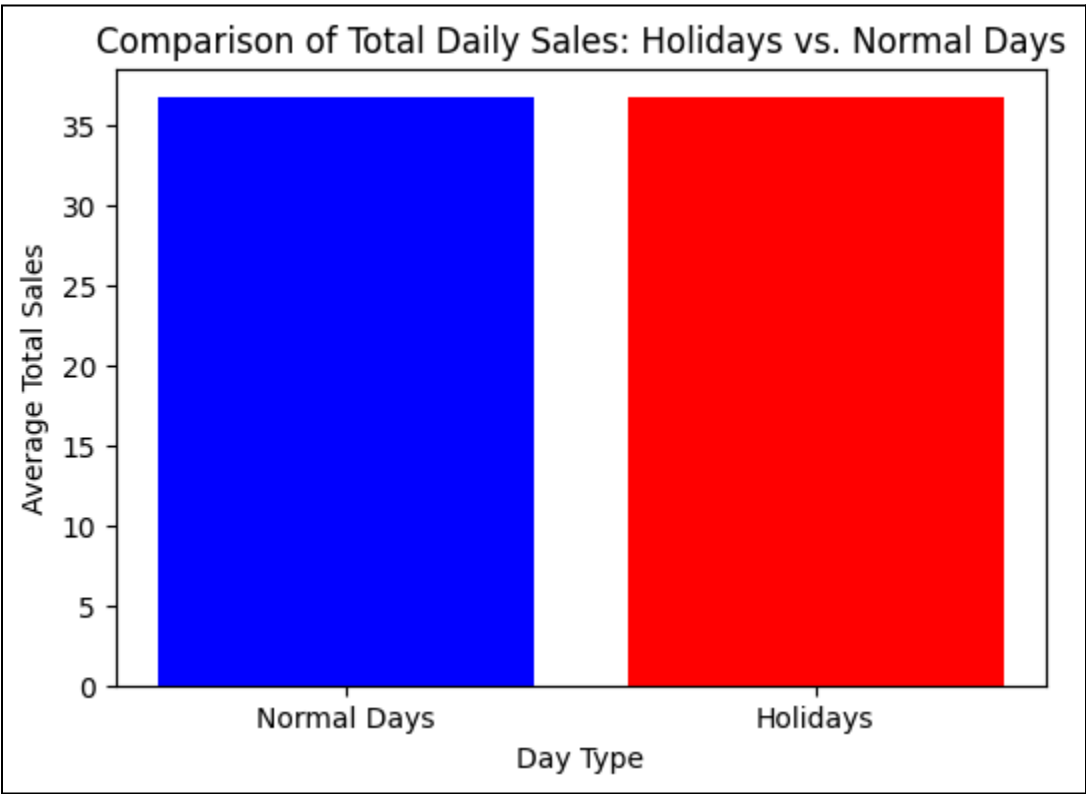
- Incorporate **more granular regional holiday data** to assess province-specific trends.
- Differentiate **restaurant categories** (e.g., fast food vs. fine dining) for more tailored insights.
- Analyze **external factors** (e.g., weather, events) that could influence sales trends.

By leveraging these insights, restaurant businesses can **optimize staffing, pricing strategies, and promotional efforts** to maximize profitability and enhance customer experience.

Recommendation

Optimize Staffing Levels on Holidays

The analysis revealed that **total daily sales tend to increase on holidays** compared to regular days. However, the impact varies by **venue type and region**, as some restaurants experience higher demand while others do not.



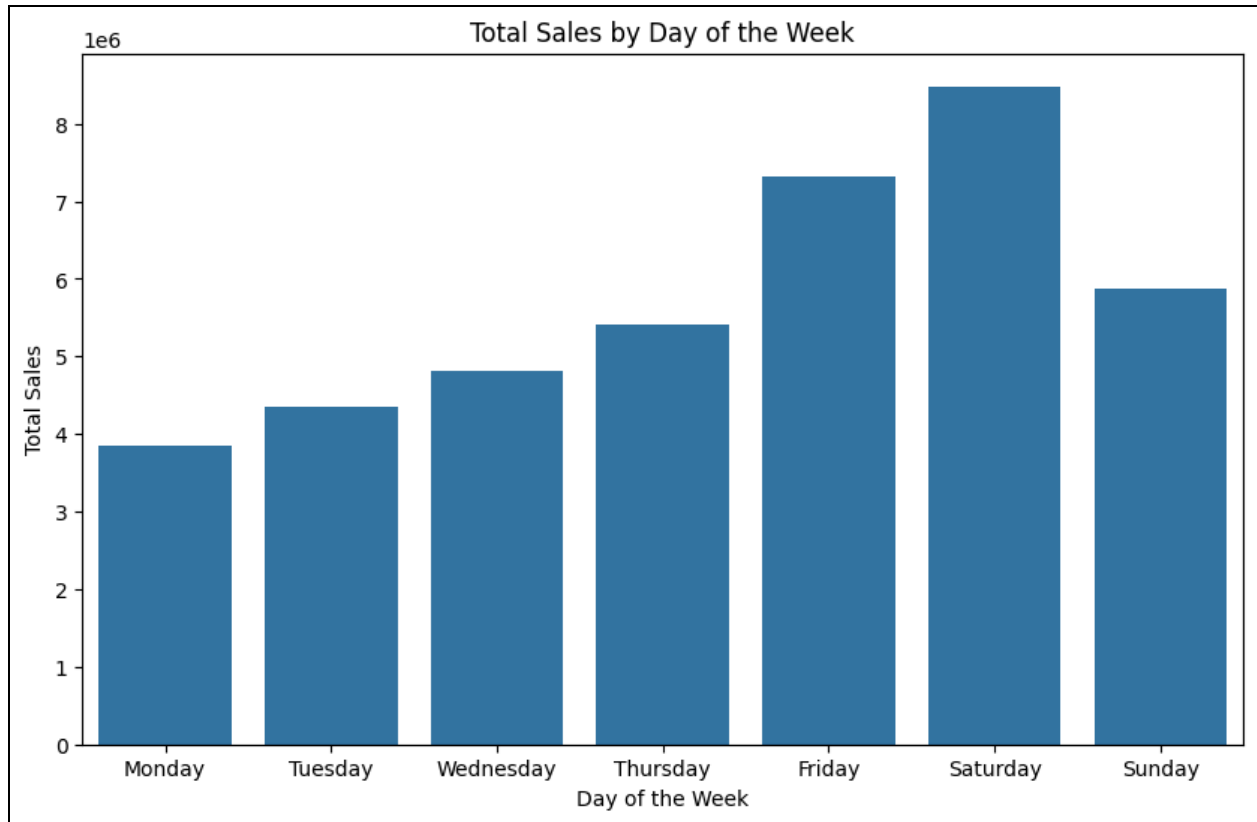
Recommendations

- **Increase staff coverage** during major holidays (e.g., Christmas, Canada Day) to reduce wait times (TouchBistro, 2025).
- **Offer holiday incentives** (e.g., bonus pay) to ensure staff motivation and efficiency.
- **Plan inventory and kitchen preparation** for anticipated high-demand holidays.

Leverage Peak Days for Increased Revenue

The day-of-the-week sales trend analysis indicated that **Friday and Saturday generate the highest revenue**. However, the hypothesis that **sales decline on Sunday** was not universally supported across all venues.

Graph Insight



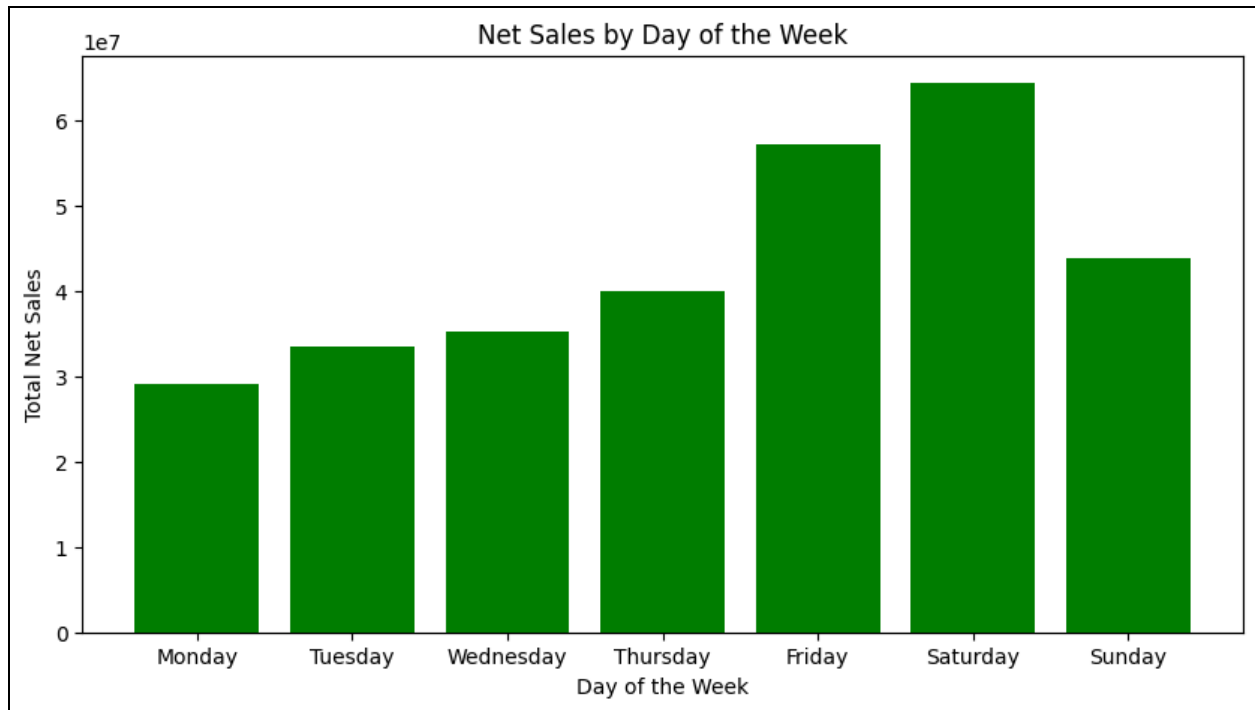
Recommendations

- Introduce **"Weekend Chef's Specials"** or **Happy Hour discounts** to attract more customers.
- Encourage **advance reservations on peak days** to manage demand efficiently (TouchBistro, 2025).
- Offer **themed dining experiences** on weekends to boost engagement and repeat visits.

Increase Revenue by Optimizing Gratuities

The findings confirm that **weekends generate higher tips** both in **total amount and tip percentage** compared to weekdays. Customers tend to tip more generously during **leisure dining experiences** on weekends.

Graph Insight



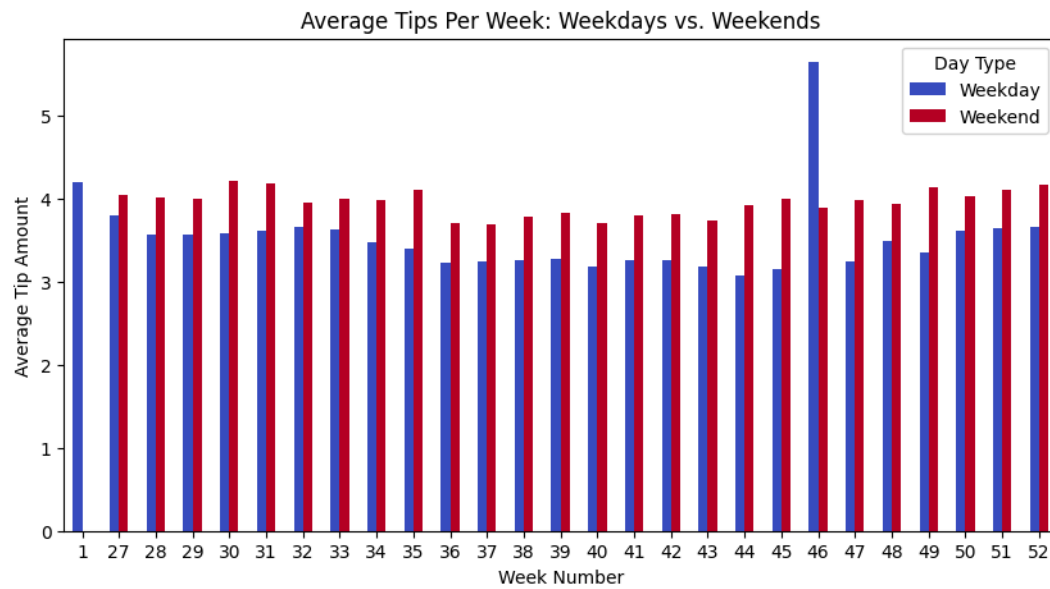
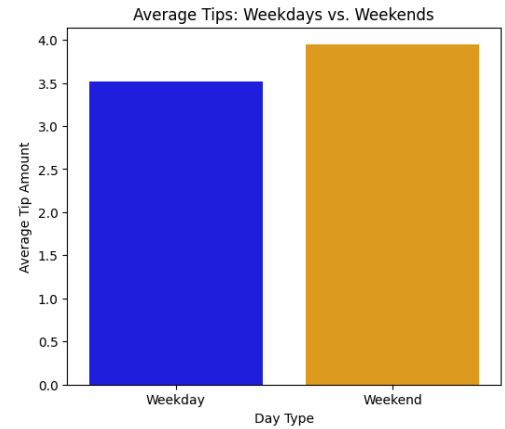
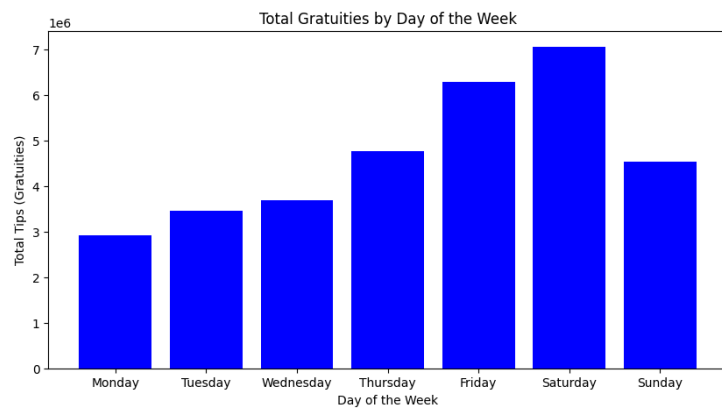
Recommendations

- **Schedule top-performing staff on weekends** when tips are highest.
- **Train staff to upsell premium menu items**, as larger bills often result in higher gratuities (TouchBistro, 2025).
- **Use tableside ordering and mobile payments** with suggested tipping percentages (e.g., 18%, 20%, 25%) to encourage higher gratuities.

Implement Targeted Promotions for Non-Peak Days

While weekends generate higher sales, **midweek days (Monday–Thursday) show lower sales activity**. To balance revenue distribution, targeted promotions can help attract more weekday customers.

Graph Insight



Recommendations

- **Introduce midweek discounts** such as "Monday Madness" or "Two-for-Tuesday" promotions (TouchBistro, 2025).
- **Promote weekday lunch specials** to increase early-day revenue.
- **Leverage digital marketing (social media and email campaigns)** to drive traffic on slower days.