📋 Problem Statement:

The pandemic has forced all public places to shut down. As a result, many businesses, such as eateries, struggle to cover financial costs to continue with their services. To make up for severe financial debt, restaurants resort to inflating their menu prices. The problem with this action is that restaurants are attracting fewer customers. Customers are their main source of income, and part of it is used to cover financial costs. Human resources are also a big factor for costs that the company faces, and after the multiple layoffs during the pandemic, companies are starting to recover.

Businesses often do not efficiently allocate their resources, such as staff. They might overhire for slower business periods, or not hire enough staff during peak times.

Our Original Thought Process:

We wanted to attract more customers to determine the amount of discount to give based on the time when the most customers show up. Ideally, this is the time when customers show up the least. We proposed a plan to figure out the net bill total and frequency of customers based on specific times of the day, day of the week and date of the year for each concept. However, because of a low sample of discounts that could be easily read and interpreted, we chose a different path.

❣️ Our Mission:

Our mission is to create a model that allocates an appropriate number of staff on a given week/day/holiday/hour based on the data sets. That is, if more customers show up in a given time frame, the restaurant can use the data from the model to decide to hire more or less personnel during those peak times.

⚙️How We Built It:

We created graphs using the columns:

- “business_date”,
- “bill_paid_at_local”,
- “concept”,
- “city”,
- “bill_total_net”
- “venue_xref_id”

We then found the frequency of the bills using the Python Pandas + NumPy libraries to gain insights on trends. Then, we trained a model with scikit-learn's Random Forest Regressor using those columns to predict an average number of customers that the restaurant could expect on any day when given a user inputs a concept, a date, and a time.

🔎 **Insights:**

- It appears that the bill net total is higher during the summer season and then gradually decreases as the seasons get colder.
- We compared the bill net total for a holiday to the average bill net total in the month that it's in. We find that Canada Day is on par with the monthly average; Civic Holiday, Labour Day, Thanksgiving, Remembrance Day, Boxing Day and especially Christmas are less.
- Similar trends are shown in the US but with less money. This might be due to probably less chains are using TouchBistro's services in the US or just not a lot of them contributed their data for this challenge
- Similarly we compared the bill net total for a holiday to the average bill net total in the month that it's in. We find that Independence Day, Labor Day, Indigenous People's Day, Veterans Day and Thanksgiving make more than the monthly average; Christmas makes less
- Total bills paid throughout all concepts, customers overall tend to come in during peak hours between 11-14 and 17-20.
- Different concept food vendors see different peak times, bakeries peak around 12 - 16, fine dining peaks around 17-20
- Fridays and Saturdays tend to be the peak businesses days
- Friday and Saturday usually have more transactions. However, Monday for fast casual, it is more than all other data.

🤔 **Challenges We Ran Into:**

Formatting the data was a big challenge as we had to work with a lot of categorical data such as dates, cities, and concepts. Training the model was also a challenge because of the large

Our Solutions / Conclusion:

We created a model to predict the number of customers on any day of a given year. By doing so, we can allow restaurants to efficiently allocate a certain number of staff each day so that there is no shortage or waste.

For instance the model states that throughout all concepts:

- The mean number of bills in an hour is: 10.44
- The median of bills in an hour is: 6
- The max number of bills in an hour is: 370

For specific concepts:

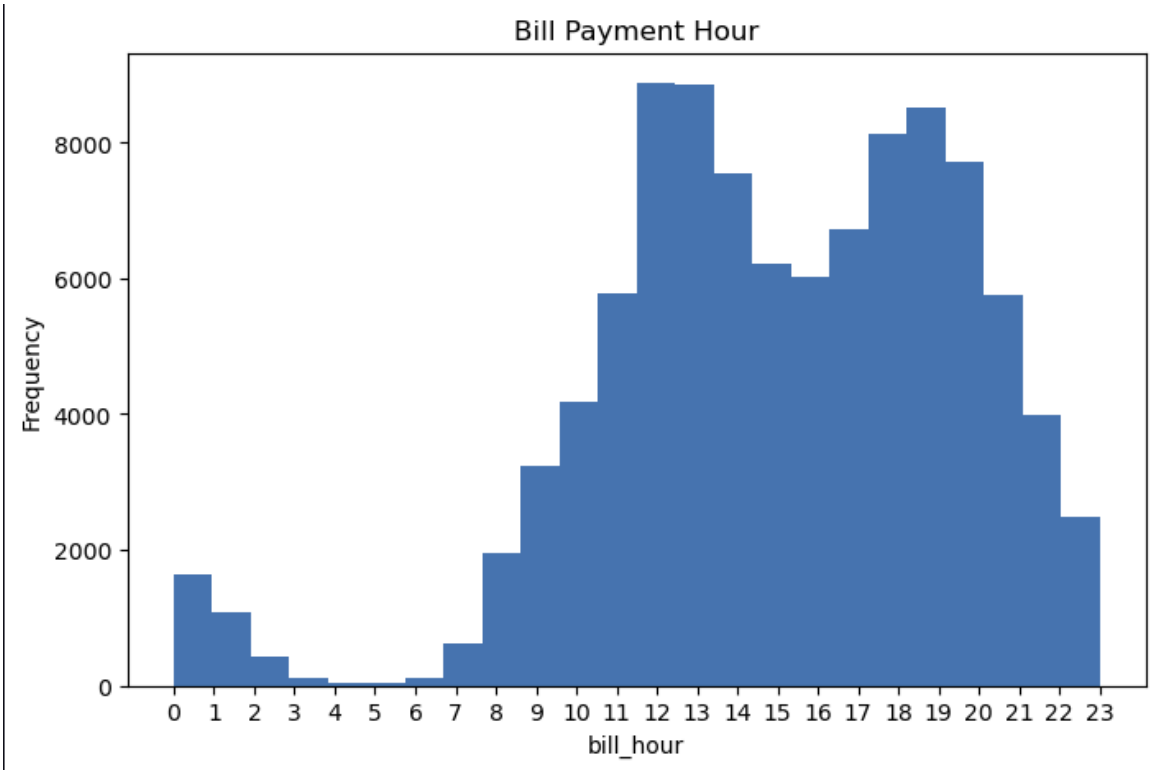
- At Bars on Saturdays at 8PM, there will be: 12.7 Transactions
- At Bars on Fridays at 10PM, there will be: 13.5 Transactions

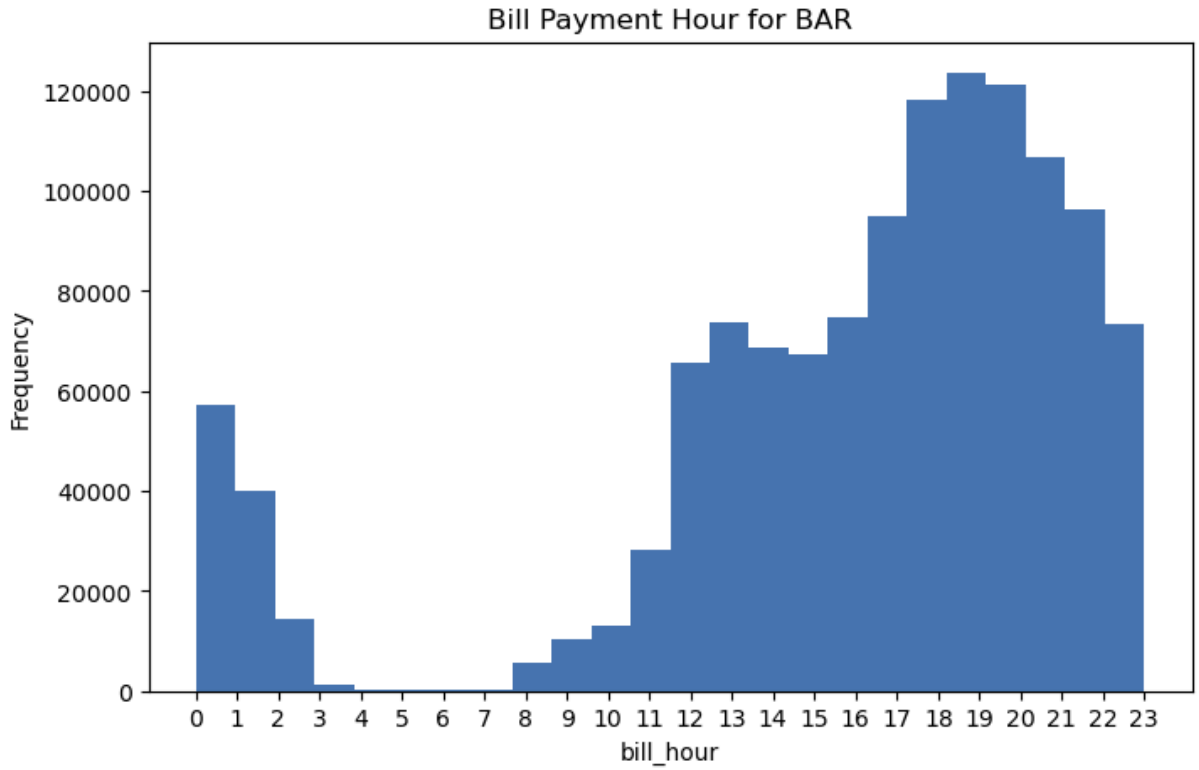
✈️ **What's next:**

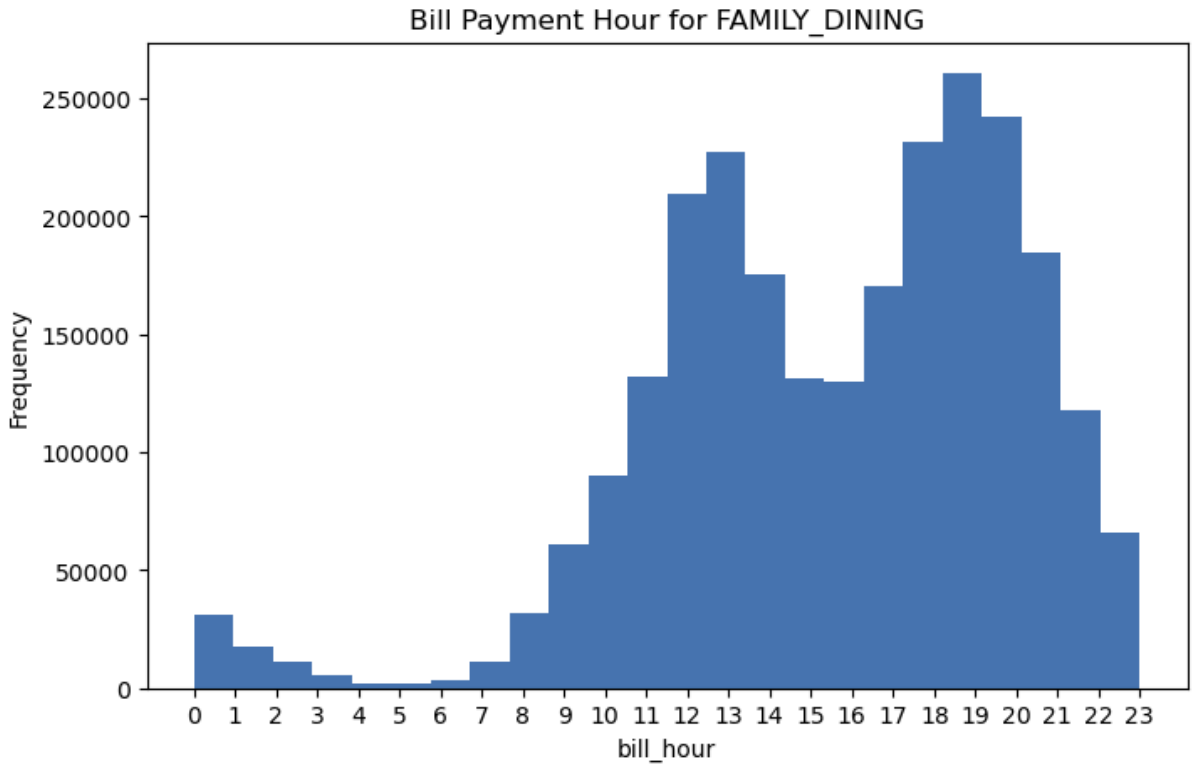
To improve the accessibility for viewers, we would use UI interfaces. One of the software we could consider is using Streamlit.

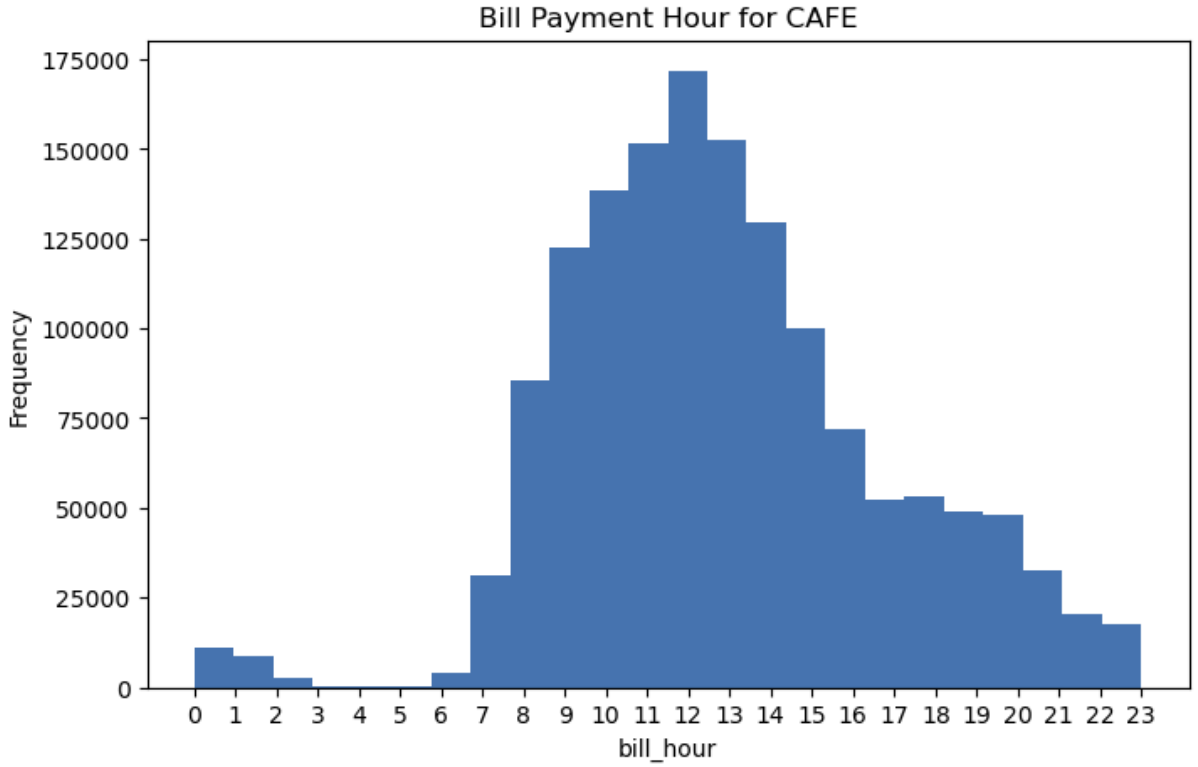
With more data we can provide more specific insights for each specific restaurant instead of a city/concept in general and create a dashboard to display those results for businesses.

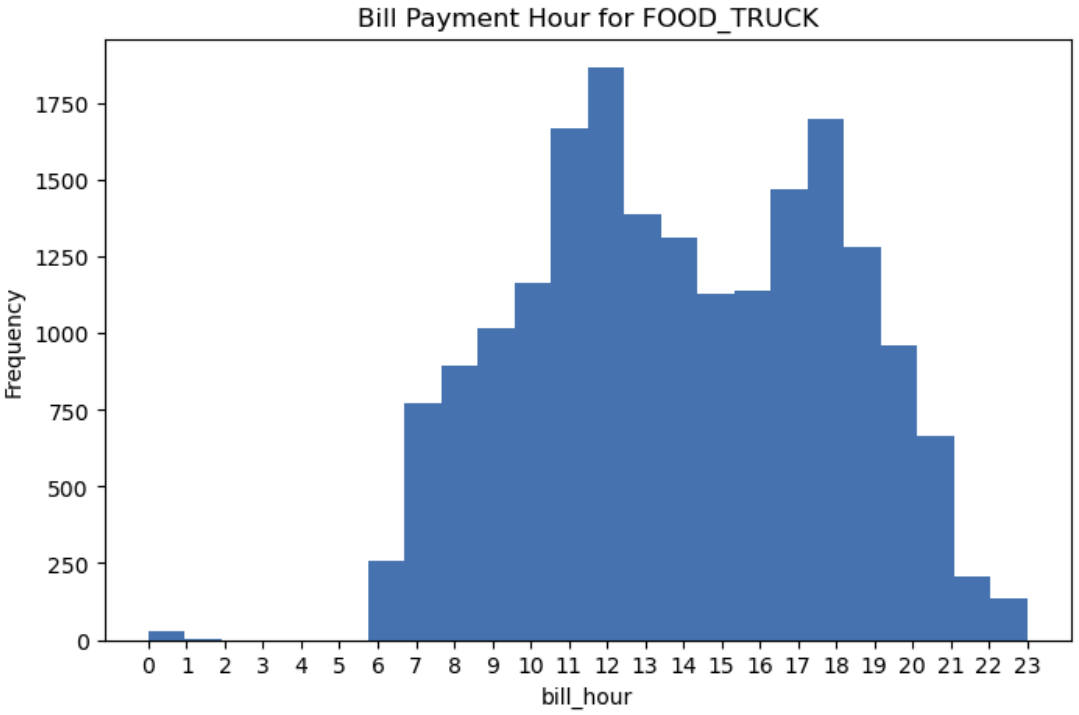
Additional Graphs/Insights For Reference:

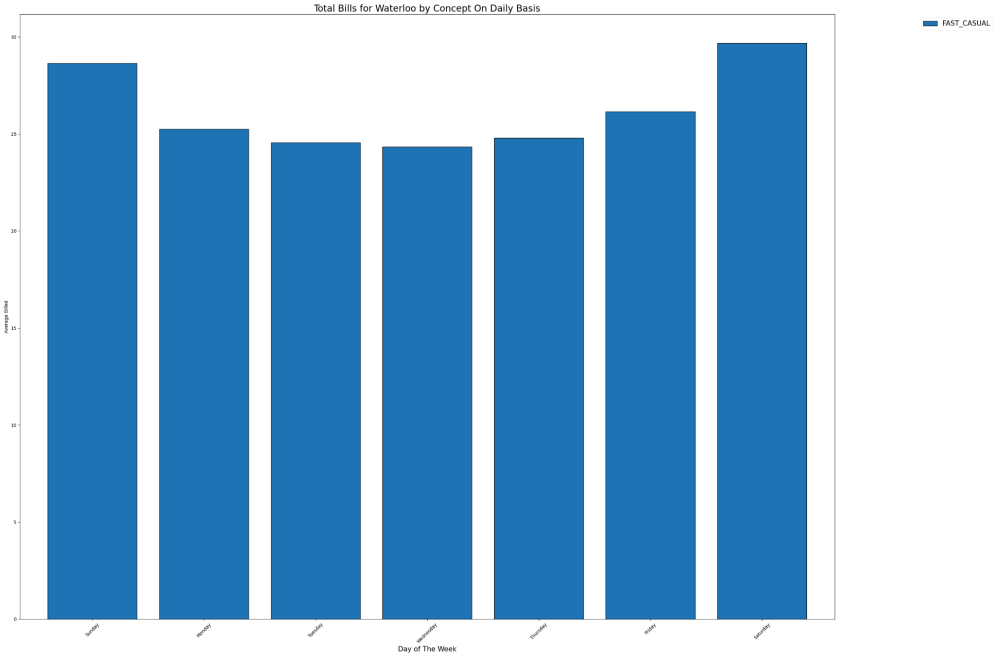


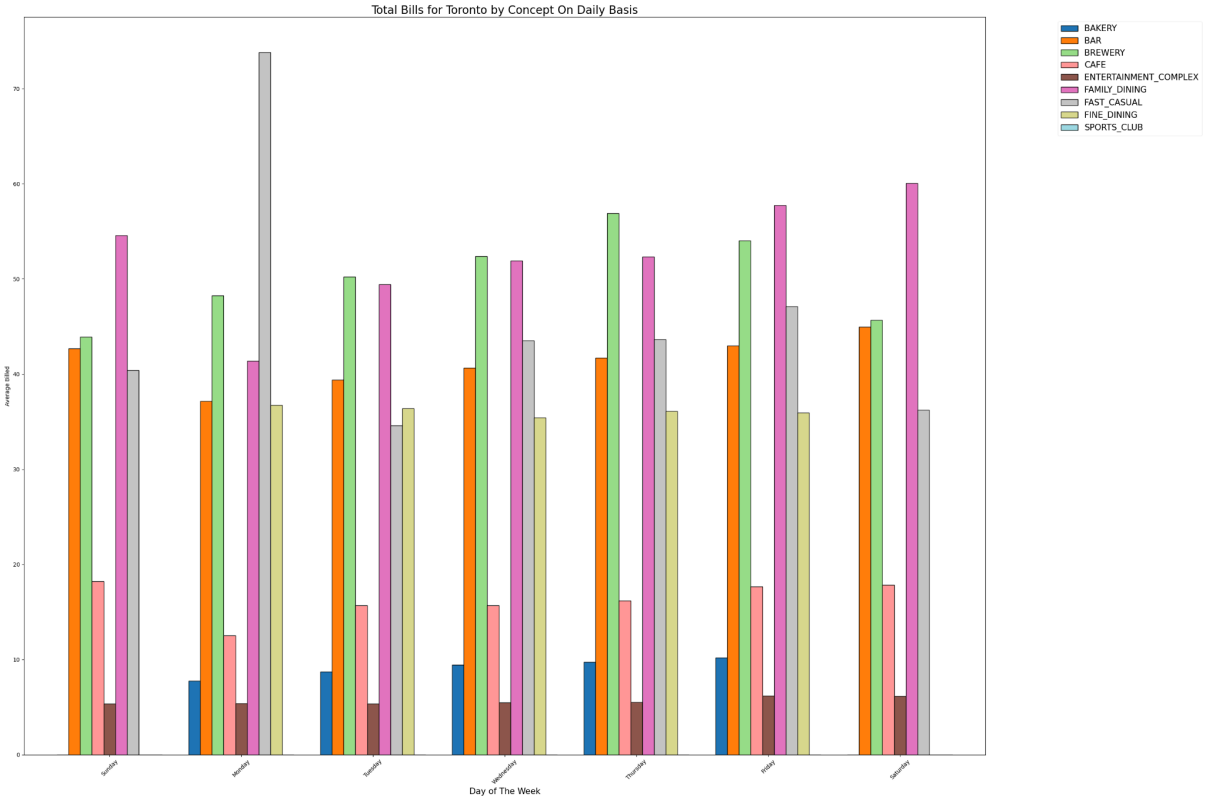



Bill Payment Hour for FAMILY_DINING
Frequency
250000
200000
150000
100000
50000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
bill_hour

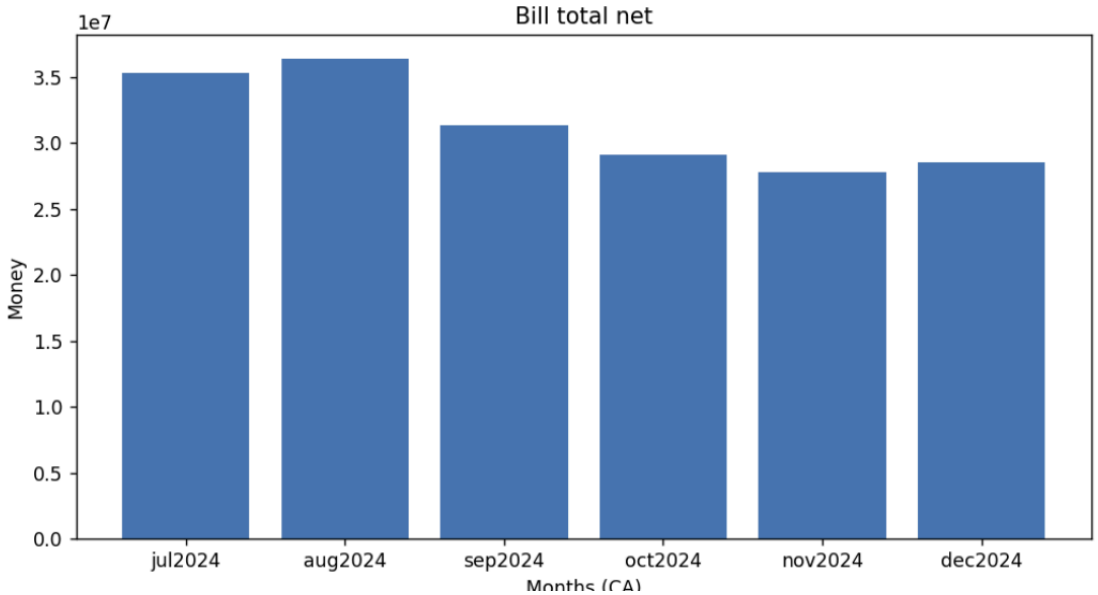

Bill Payment Hour for CAFE
Frequency
175000
150000
125000
100000
75000
50000
25000
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
bill_hour

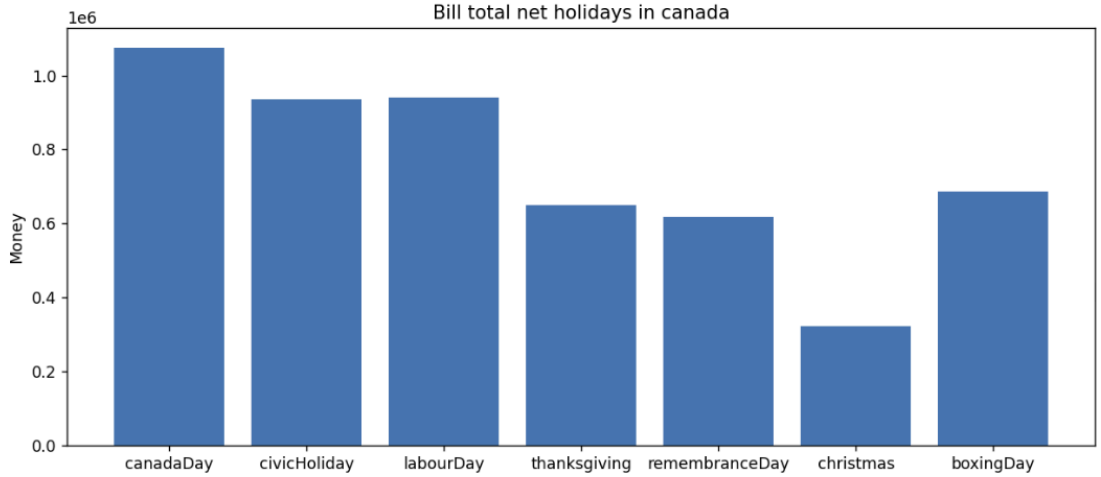

Bill Payment Hour for FOOD_TRUCK
Frequency
1750
1500
1250
1000
750
500
250
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
bill_hour


Total Bills for Waterloo by Concept On Daily Basis
FAST_CASUAL
Day of The Week


Total Bills for Toronto by Concept On Daily Basis
BAKERY
BAR
BREWERY
CAFE
ENTERTAINMENT_COMPLEX
FAMILY_DINING
FAST_CASUAL
FINE_DINING
SPORTS_CLUB
Average Billed
0
10
20
30
40
50
60
70
Sunday
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Day of The Week

(Canada)


Bill total net
1e7
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Money
jul2024
aug2024
sep2024
oct2024
nov2024
dec2024


Bill total net holidays in canada
1e6
1.0
0.8
0.6
0.4
0.2
0.0
Money
canadaDay
civicHoliday
labourDay
thanksgiving
remembranceDay
christmas
boxingDay

(United States)