Exploratory Data Analysis:
U.S. Restaurant and Food Service Industry

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Introduction

❑ The year 2020 was a challenging year to many of us worldwide. Due to the ongoing COVID-19 pandemic, the number of person-to-person activities dropped sharply, which significantly hurt many industries such as retails, transportation, and travel.

❑ This analysis focuses on yet another industry largely impacted by the pandemic in the United States: the restaurant and food service industry.

❑ Analysis Tool: Python (Pandas, Matplotlib, etc.)

Mission

In this project, I will explore the top-ranking chain and independent restaurants in the United States, in an effort to investigate the following questions:

1. What type of restaurants were getting more popular in 2020?

2. What was the spread of the top-ranked restaurants, in terms of locations?

3. How did the COVID-19 negatively (or potentially positively) affect the restaurant industry?

4. Among the restaurants with most future potentials, is franchising a popular practice?

Sources of the Data

❑ For this project, the sources of the data was collected and arranged by Michal Bogacz , who originally downloaded the data from Restaurant Business Online.

❑ Specifically, the analysis performs upon 3 .csv files that give ranks of the top 250, the top 100 independent, and the future 50 restaurants in the United States in 2020.
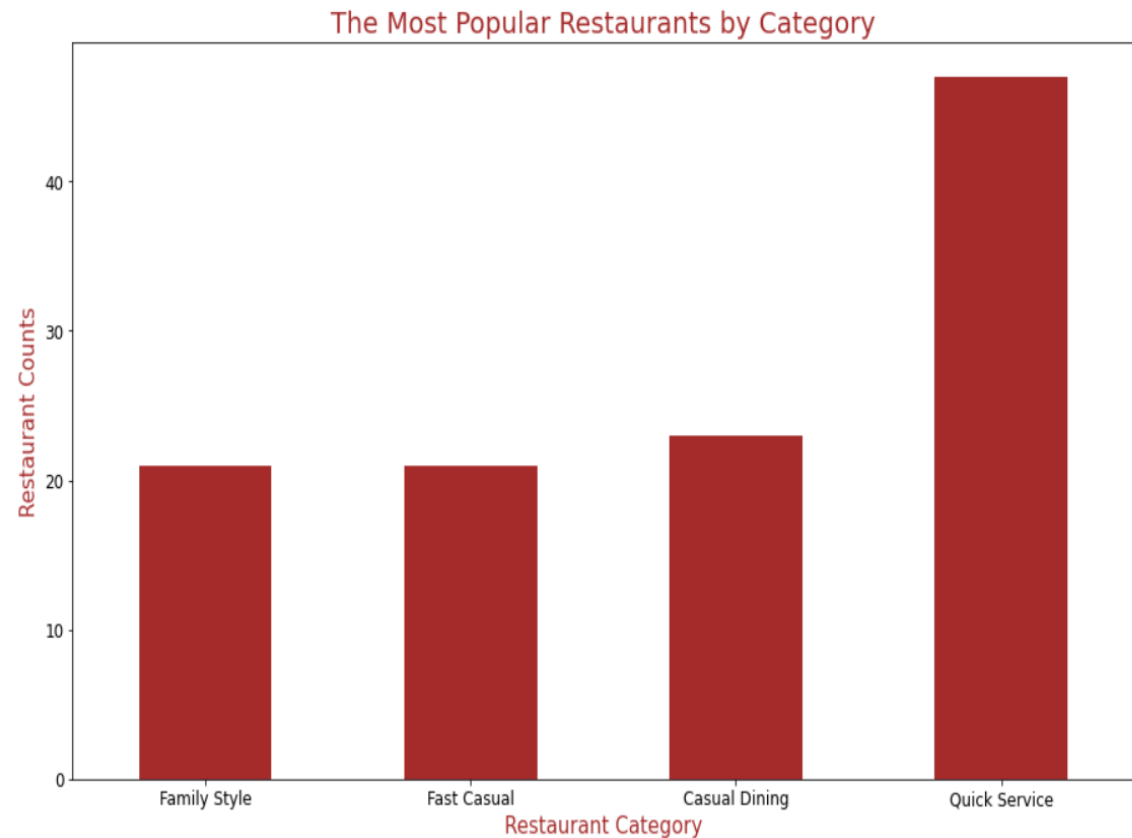
Investigation 1

WHAT TYPE OF RESTAURANTS WERE GETTING MORE POPULAR IN 2020?

First, to understand the most popular type of restaurants in the U.S. in 2020, I grouped restaurants in the Top 250 rank list based on their categories.

Restaurants by Category – Overview

➤ After excluding restaurants with unspecified category, 250 top-ranked restaurants can be divided into 4 different categories: Family Style, Fast Casual, Casual Dining, and Quick Service.

➤ While family-style, fast-casual, and casual-dinning restaurants all capture similar counts in the Top 250 restaurants rank, quick-service restaurants have twice as many counts comparing to other categories.

➤ Initial Conclusion: The data indicated that quick-service restaurants were most popular among American customers.

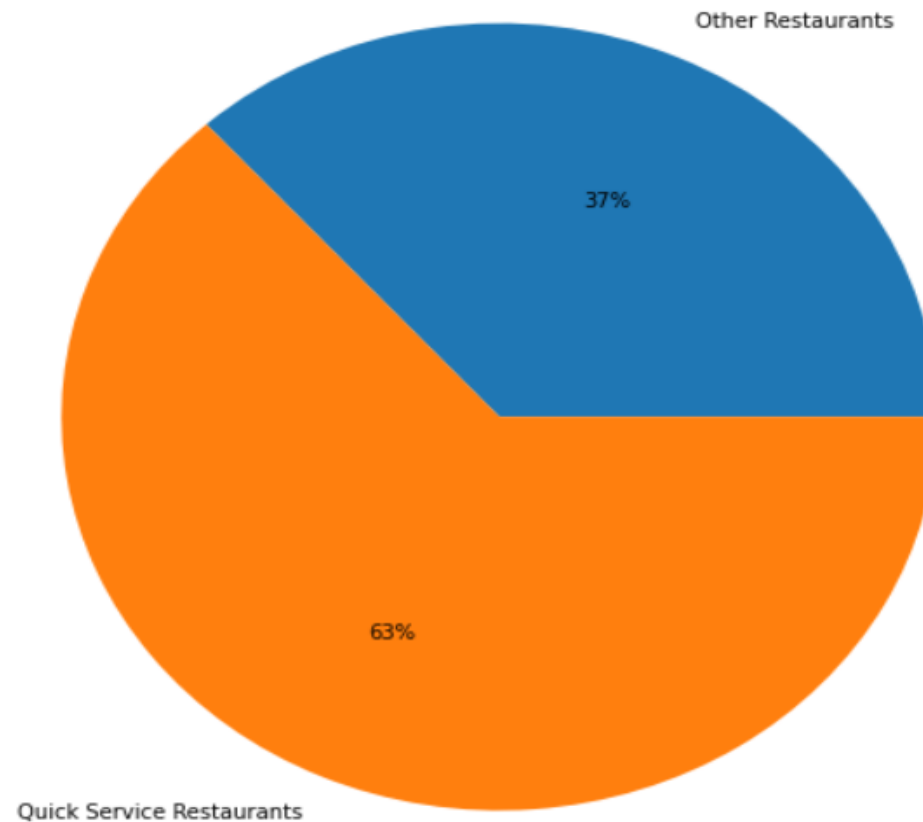The Most Popular Restaurants by Category

Then, to convince myself the initial conclusion, I further investigated the proportion of Quick Service Restaurants among the Top 30 ranked restaurants.
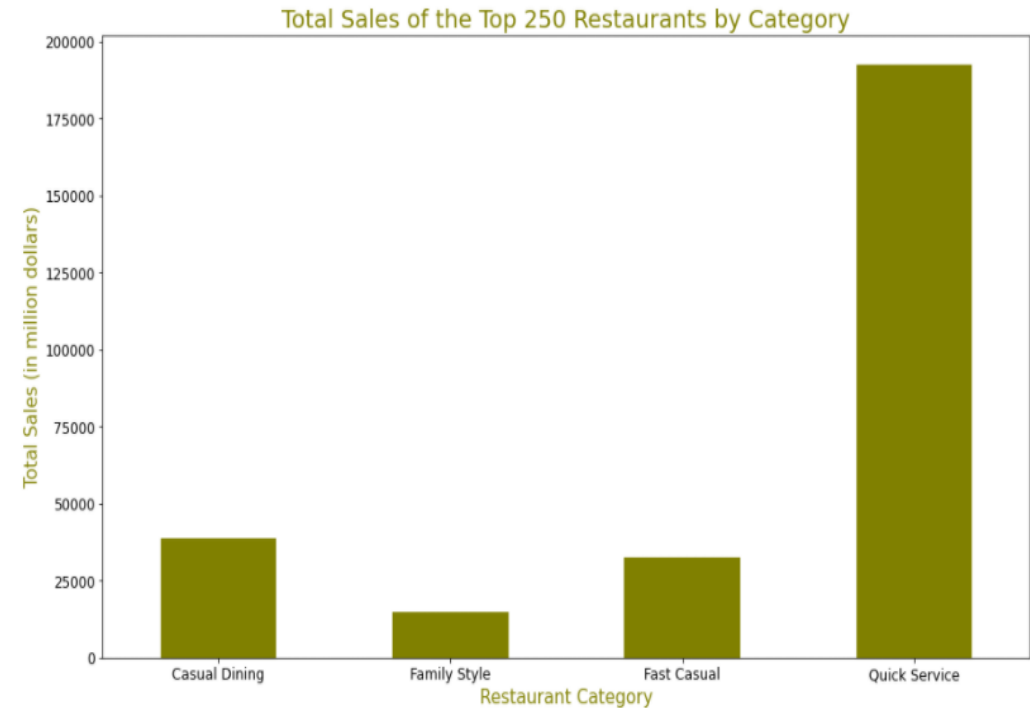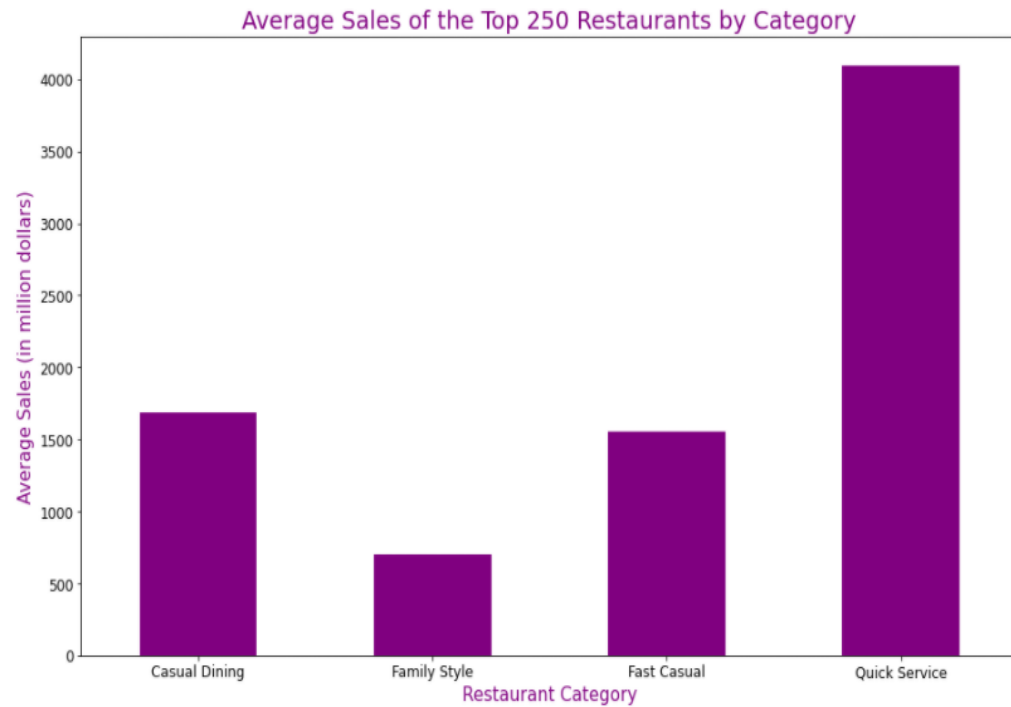
Restaurants by Category – Proportion

➢ The proportion of quick-service restaurants among the Top 30 restaurants greatly surpassed all other types of restaurants combined, which further showed people's clear preference of quick-service restaurants over others.

➢ This pattern may be caused by the reduced person-to-person activities due to the COVID-19 pandemic: people preferred a grab-and-eat style rather than an eat-and-talk style to avoid the spread of the virus.

Proportion of Quick Service Restaurants among the Top 30

Other Restaurants

37%

63%

Quick Service Restaurants

Next, I calculated the average sales and total sales of restaurants based on their categories to investigate the initial conclusion from a revenue perspective.

Restaurants by Category – Sales

Average Sales of the Top 250 Restaurants by Category
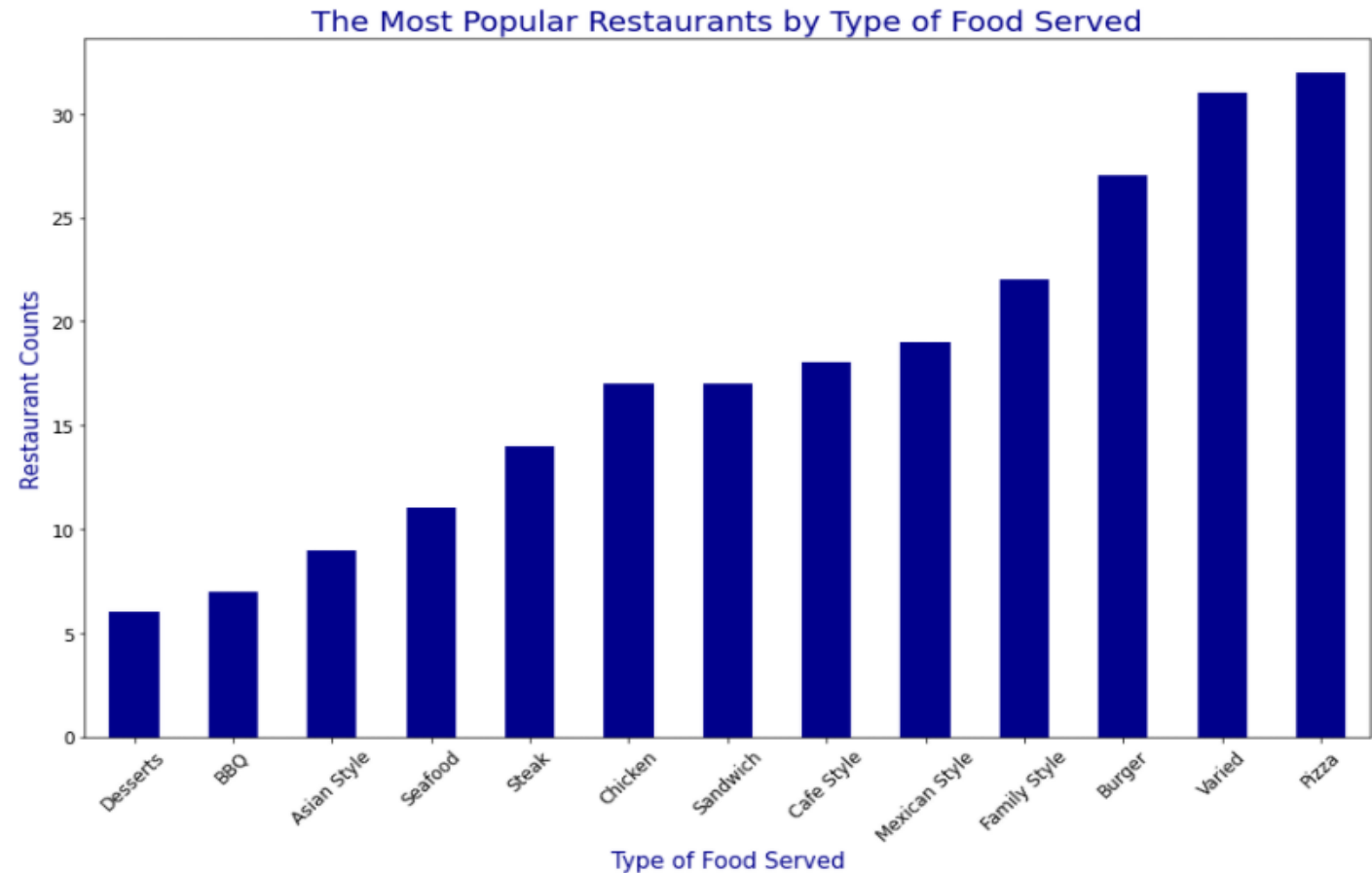
Total Sales of the Top 250 Restaurants by Category

➢ The two bar plots above both showed that quick-services restaurants generated a significantly greater amount of revenues comparing to other types of restaurants, further proved the initial conclusion from a revenue perspective.

As I was exploring the most popular type of top-ranked restaurants, I was also curious about the type of food that was liked by the customers the most. So, I grouped restaurants again by the type of food they served.

Restaurants by Category – Food Served

➢ Some of the most popular food types among top-ranked restaurants are: pizzas, burgers, and family-style dishes.

➢ Restaurants serving various kinds of food also appeared to be more competitive in the market.

➢ Generally, this result matches and supports the initial conclusion, as quick-service restaurants usually serve pizzas, burgers, etc.

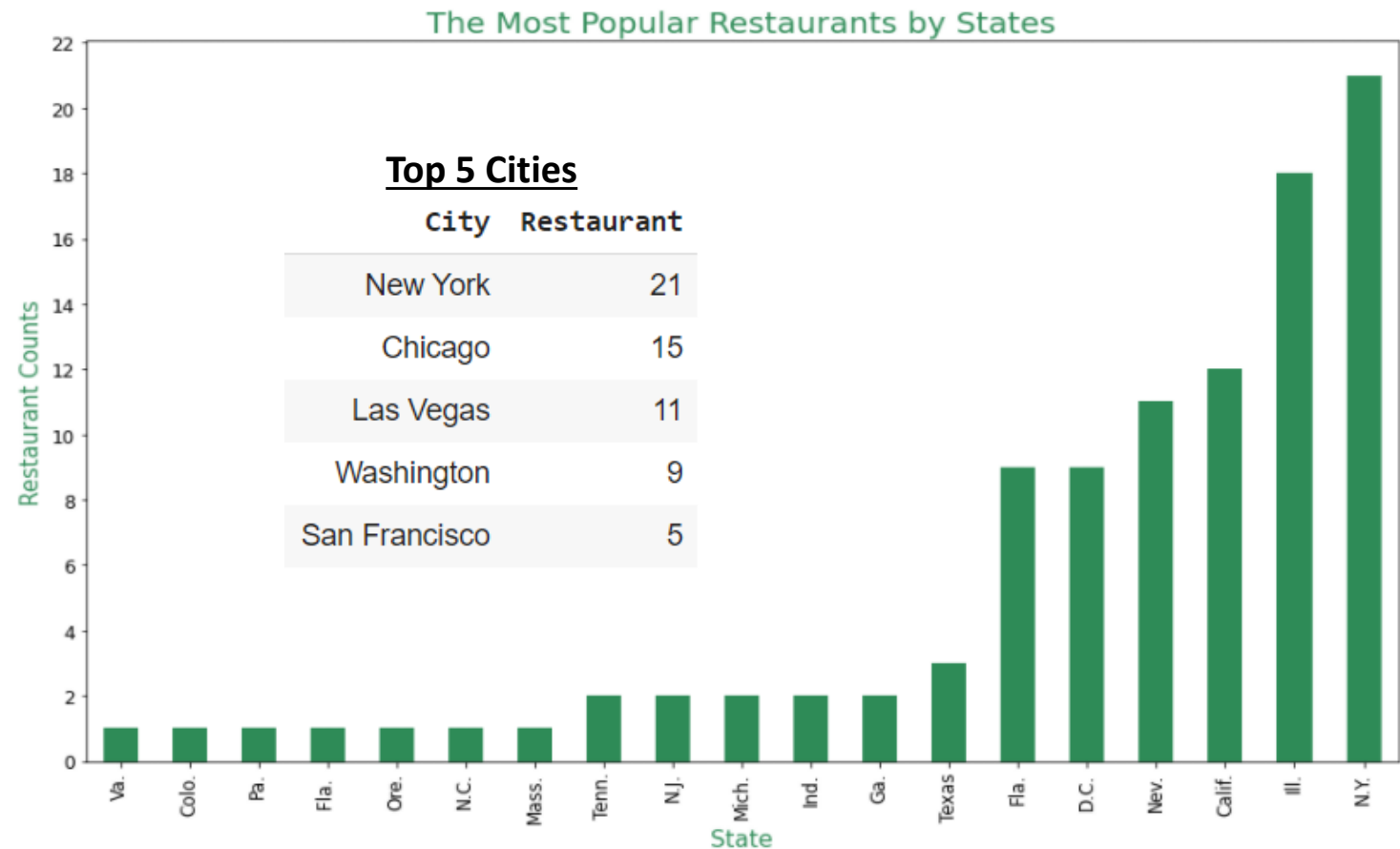The Most Popular Restaurants by Type of Food Served

Investigation 2

WHAT WAS THE SPREAD OF THE TOP-RANKED RESTAURANTS, IN TERMS OF LOCATIONS?

In this investigation, I grouped restaurants from the Top 100 Independence Rank by locations (cities and states) to find out places crowded with the most successful restaurants.

Note: For this investigation, I chose to analyze restaurants from the Top 100 Independence Rank instead of the Top 250 Rank, because most restaurants in the Top 250 Rank were Franchised restaurants with many branches all over the U.S., so their exact restaurant locations were hard to define and quantify.

Restaurants by Location – City and State

➢ Among the list of top-ranked independent restaurants, most of them are in states of New York, Illinois, and California.

➢ NYC, Chicago, Las Vegas, Washington, and San Francisco are the top 5 cities with these successful restaurants.

➢ Popular restaurants tend to locate in large, populous cities and states.

The Most Popular Restaurants by States

Top 5 Cities

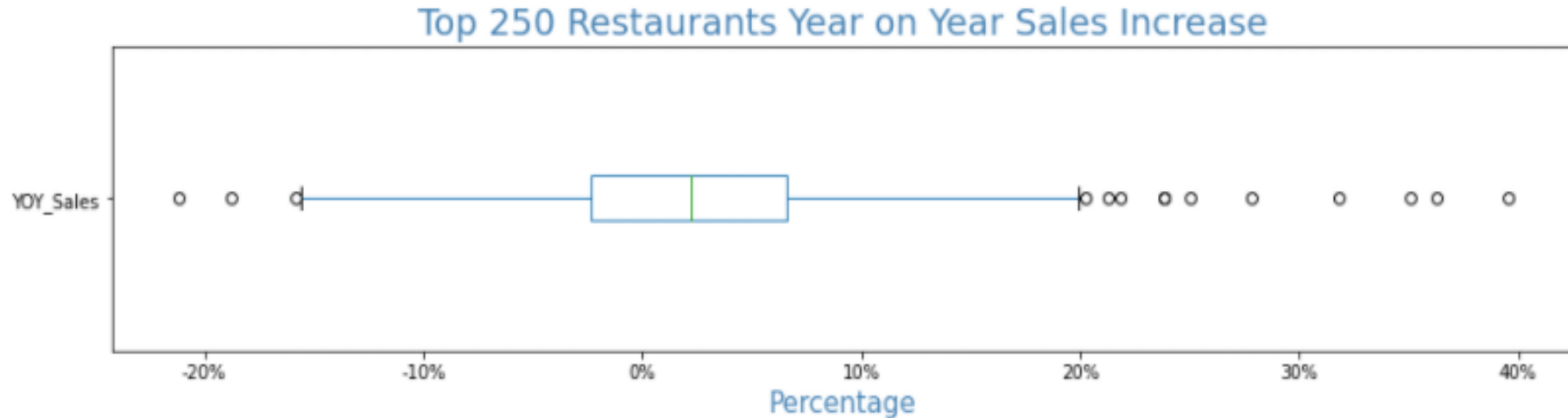| City	Restaurant
New York	21
Chicago	15
Las Vegas	11
Washington	9
San Francisco	5

Investigation 3

HOW DID THE COVID-19 NEGATIVELY (OR POTENTIALLY POSITIVELY) AFFECT THE RESTAURANT INDUSTRY?

First, to understand the restaurants' sales performance, I used a box plot to explore the statistics of restaurants in the Top 250 Rank by their year-on-year sales increase.
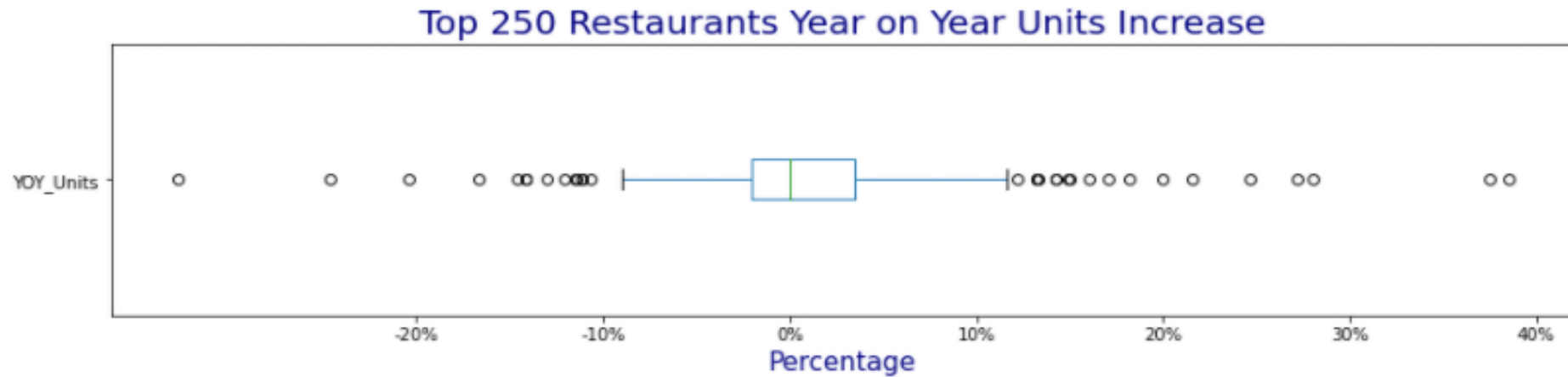
Restaurant Performance – YOY Sales

Top 250 Restaurants Year on Year Sales Increase

➢ While over half of the top-ranked restaurants in 2020 had an increased sales performance comparing to 2019; nearly half of the top-ranked restaurants suffered negative sales increase.

➢ Most restaurants' year-on-year sales increase fell between the range of approximately -3% to 7%, with a median of approximately 3%.

Next, I also used a box plot to explore the year-on-year unit increases of restaurants in the Top 250 Rank in 2020. This index is crucial, as it revealed whether the restaurants were profitable enough to expand their businesses.

Restaurant Performance – YOY Units

Top 250 Restaurants Year on Year Units Increase

➤ While over half of the top-ranked restaurants in 2020 had opened more premises comparing to 2019; nearly half of the top-ranked restaurants slowed their pace of expansion.

➤ Most restaurants' year-on-year units increase fell between the range of approximately -2% to 3%, with a median of approximately 0%.

Restaurant Performance – Conclusion

➢ In general, from the given datasets, it is inconclusive whether the COVID-19 negatively or positively affected the restaurant industry in 2020.

➢ The reasonings of this inconclusiveness are:

- Among the top 250 restaurants in U.S., the statistics of their year-on-year sales increase and units increase appeared to be of mixed results. Restaurants varied a lot in terms of their performance.

- Most restaurants in this dataset are huge, franchised restaurants; this analysis is biased since it overlooked small, individual restaurants (which theoretically would suffer more from the pandemic).

- Only the top 250 restaurants in U.S. were covered in this investigation; the dataset is too small to be sufficient and representative of the overall restaurant industry.
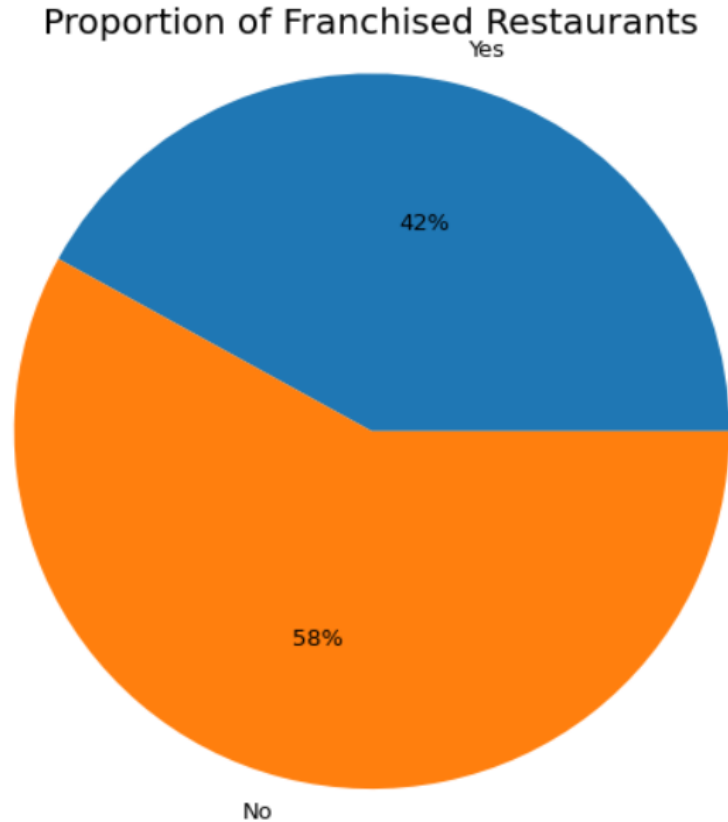
Investigation 4

AMONG THE RESTAURANTS WITH MOST FUTURE POTENTIALS, IS FRANCHISING A POPULAR PRACTICE?

In this investigation, I calculated the proportion of franchising vs. non-franchising restaurants from the Top 50 Restaurants with Future Potentials.

Restaurant Franchising – Proportion

➢ While over 40% of restaurants of future potentials had become franchised, the majority of restaurants of that category remained as individual business.

➢ The main reasons for not franchising their businesses may be:

- To ensure food and service quality
- The brand is not strong / famous enough
- Additional costs to support infrastructural / technical costs if franchised

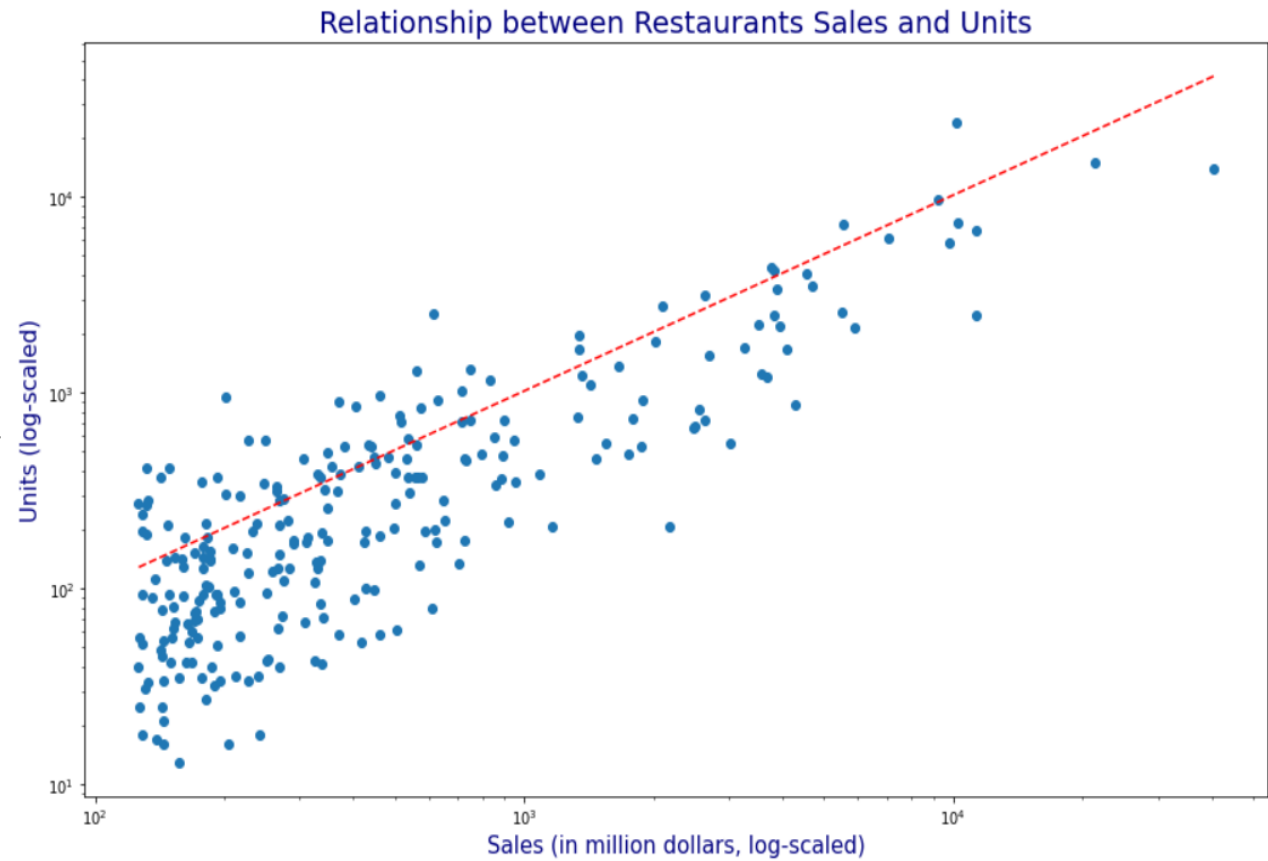
Proportion of Franchised Restaurants

Additional Investigation

RELATIONSHIP BETWEEN THE RESTAURANTS' SALES VOLUME AND THEIR NUMBER OF PREMISES

Finally, as I explored through the datasets, I was also curious to see the relationship between the restaurants' sales volume and the number of premises they have.

Restaurant Sales vs. Units of Premises

➤ After plotting the sales data and unit of premises data of the top-ranked restaurants in log scale, I found out that there was a positive correlation between the sales of the restaurants and the number of premises they have:

▪ More sales of a restaurant generally means more unit of premises of that restaurant, and vice versa.

Relationship between Restaurants Sales and Units

Summary

Exploratory Data Analysis – Summary

1. Quick-service restaurants were the most popular type of restaurants among American customers.

2. Popular restaurants tend to locate in large, populous cities and states.

3. It is inconclusive whether the COVID-19 negatively or positively affected the restaurant industry in U.S. in 2020, due to the constraint of data.

4. As for now, restaurants with future potentials tend not to be franchised.

5. In general, the sales of a restaurant is positively correlated to the unit of premises of that restaurant.