

# Exploratory Data Analysis

## Guidelines

## Exploratory Data Analysis Part 1: Economic perspective

1. Goods-producing industries vs service-producing industries -> Which industry sector has been more affected by the pandemic during 2020? How do consumer expenditures explain the Income of Goods vs Services Industries? How do consumer expenditures explain the GDP of Food and Beverage-Goods vs Food and Beverage-Services?
  - Plot Income by Industry, BEA
    - Compare performance Goods versus Services
  - Plot Wages and Salaries by Industry, BEA (Table 2.2B)
    - Compare performance Goods versus Services
  - Plot Consumer Expenditures, BEA (Table 2.8.7)
    - Compare Goods versus Services Expenditures
  - Plot Real GDP expanded detail (Table 1.5.3) or Contribution to Percent Change expanded detail (Table 1.5.2)
    - Compare Food and Beverage Goods vs Food and Beverage Services GDP.
    - How much of the total GDP belongs to Goods vs Services?
    - How much of the total GDP in Food and beverage belongs to Goods vs Services?
  - Plot Consumption Index by major product (Table 2.3.5. Next release date: December 22. We can incorporate Q4!)
    - Compare Food and Beverage Goods vs Food and Beverage Services expenditures.
    - How much of the total PCE belongs to Goods vs Services?
    - How much of the total PCE in Food and beverage belongs to Goods vs Services?
  - GDPKeySource\_2q (monthly information until Q2 2020)
2. Food focus: Monthly Retail and Food Services
  - By kind of Business. Who is the most affected?
  - Focus on impact in Restaurants and other eating places, Full-service restaurants, and limited services eating places. Who is the most affected?
3. Employment/Unemployment
  - Unemployment\_total\_2005to2020.
  - Compare unemployment Goods versus Services from 2005 to 2020 (unemployment\_total\_2005to2020).
  - Compare unemployment interesting sectors, focus on food-related sector
  - Unemployment of restaurants from 1990 until Nov.2020 (monthly analysis)

# Exploratory Data Analysis Part 2: A consumer perspective

1. Consumer Behavior: Dining-in impact
  - Restaurants Reservations: Overall impact of Covid-19 on the industry through seated diners
    - Plot % seated diners: showing % seated diners comparisons in the US and on a granular level (states).
    - Plot % of seated diners year over year by the same day of the week from the same week in the previous year. National and on a granular level (states).
2. Overall expenditures and changes in consumer behavior. **Relevant demographics: gender, states, cities, income, children at home, marital status**
  - Spending variables
    - Plotbar EIP: Use of Economic Impact Payment (Stimulus) and plot EIPSPND (Spending use of Economic Impact Payment). Percent change of EIPSPND overtime split by food and others (weekly and grouping by demographics).
    - Plot Difficulty with expenses (EXPNS\_DIF)
  - Shopping variables
    - Plot CHNGHOW1-CHNGHOW12: Spending and shopping change
    - Plot Purchases modality
    - Cash/credit card
    - Resumed/avoided eating at restaurants
    - Fewer trips to stores and trips transit.
  - Why spending/shopping changed: Barplot reasons split by demographics.
3. Mobility Changes in Response to COVID-19 (for EDA part 2, granular data by county)
  - Compare visits and length of stay at different places (Descartes Lab Mobility Change dataset, states). **Check which states have more granular data.**
  - The relative amount of route requests for each country/region, subregion, or city compared to the baseline volume on January 13, 2020. The dataset record ranges from Jan 2020 to October 2020.
  - Visit length and average duration in restaurants, groceries (Foursquare Mobility Reports)

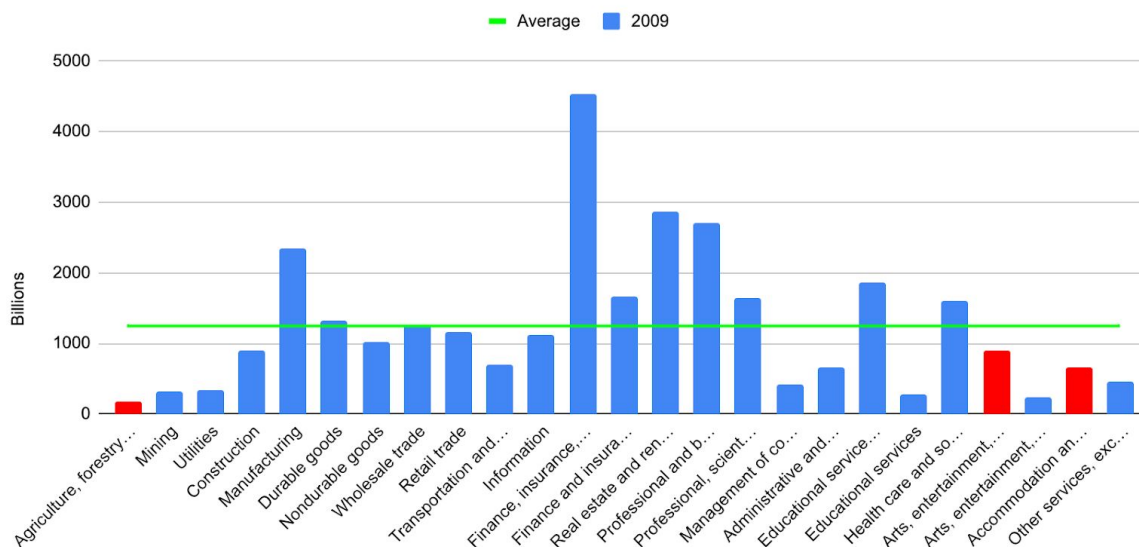
# Part 1: Economic perspective

## 1.1 GDP Setting

In order to assess impact, we must consider how GDP has been affected before and after COVID impact (year 2020).

### GDP under Private Industry - 2019 #s

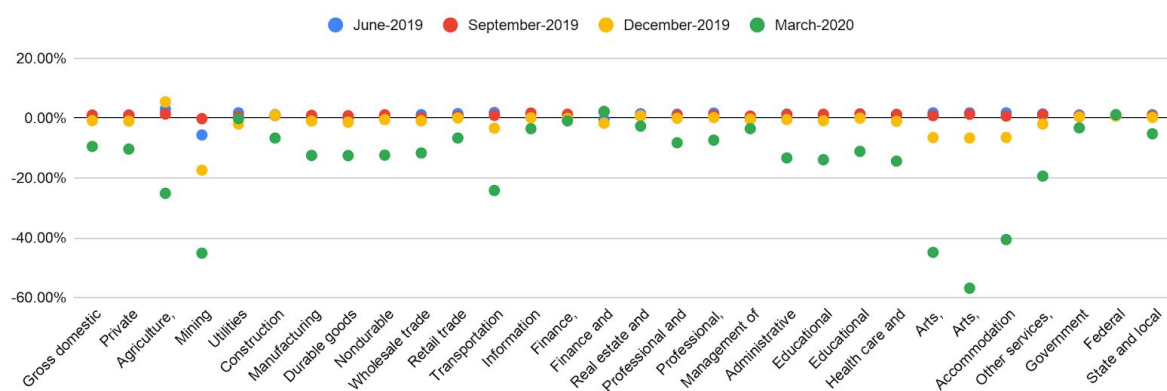
Table 14. Gross Domestic Product by Industry Group: Level and Change from Preceding Period Billions of dollars



The graph above illustrates the contribution of different industries (under private industry) that impact GDP. We took the liberty to highlight in red those industries that surround restaurants. Industries are not the biggest contributors to GDP (in terms of weight), however, they do encompass a large workforce and business owned operations.

### 1.1.1 Volatility Over the Years

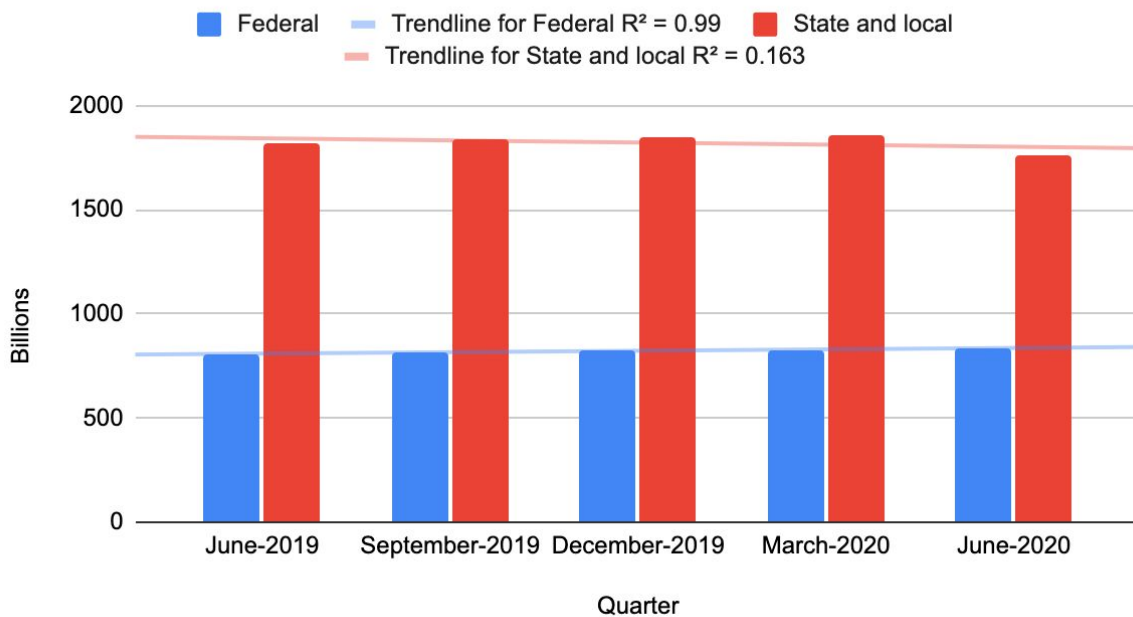
#### Volatility in Contribution to GDP



We noticed a trend in the latter quarters of 2019 and first quarter of 2020 [see figure above] where volatility increases significantly. Our hypothesis is that the advent of COVID has greatly impacted GDP in total and clearly certain industries over time.

Meanwhile, GDP as contributed by Government remains relatively fixed. Makes sense given the amount of resources that have been needed to support relief efforts.

## Government GDP



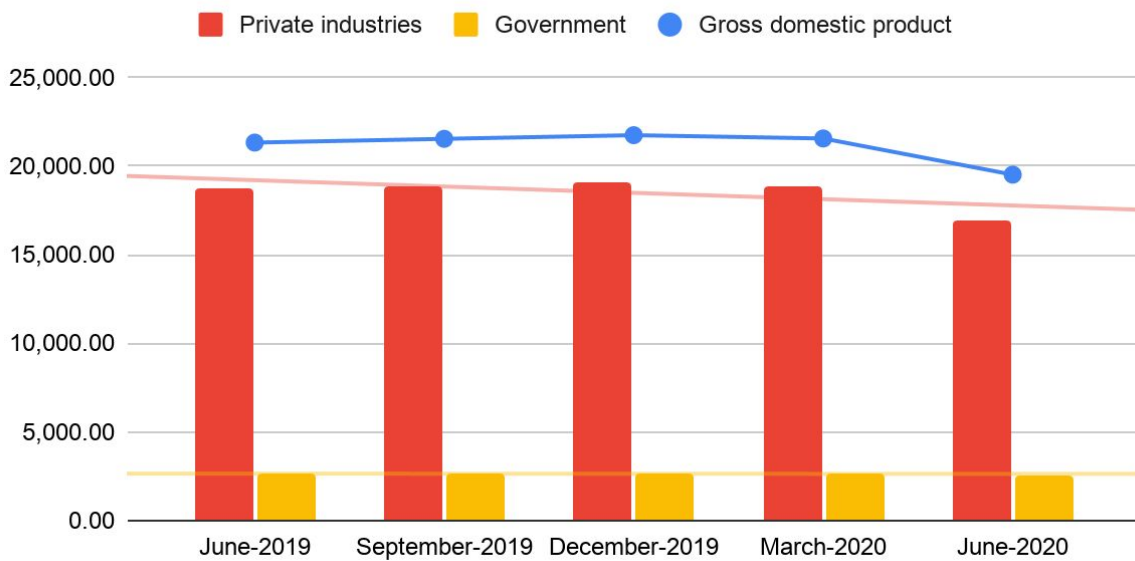
State and local government contribute (almost double) the amount that Federal does. The trend lines remain flat.

### 1.1.2 GDP Impact of Covid

Assessing GDP trends, we see that GDP for the US has gone down as a direct result of the largest contributor (in size), Private Industries, going down, even though Government remains flat. You can also notice that the rate at which GDP decreases is directly correlated to that of Private Industry.

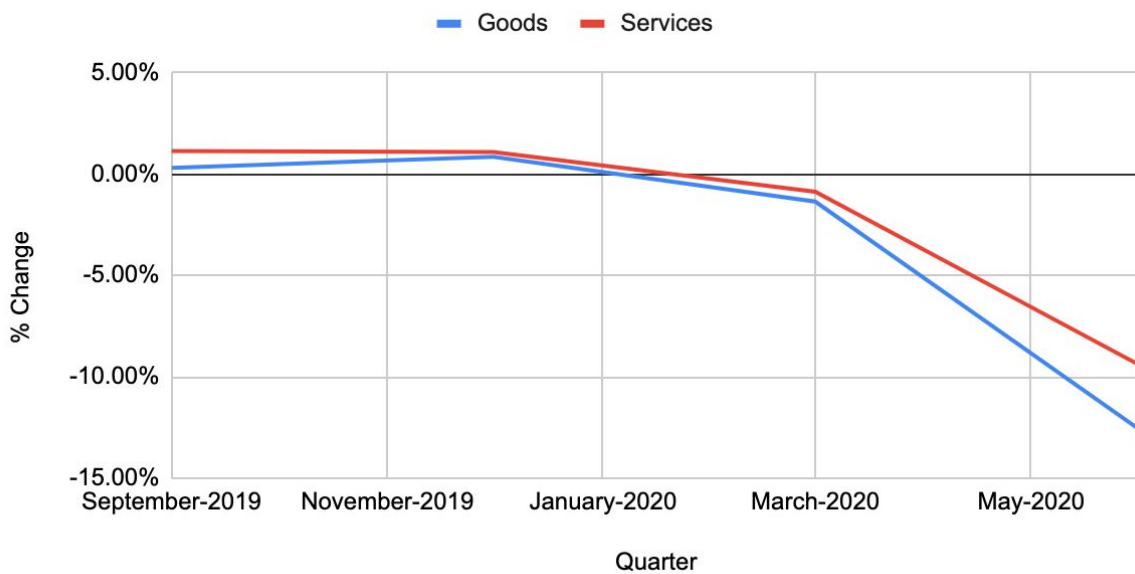
## Elements of GDP Trends

Billions



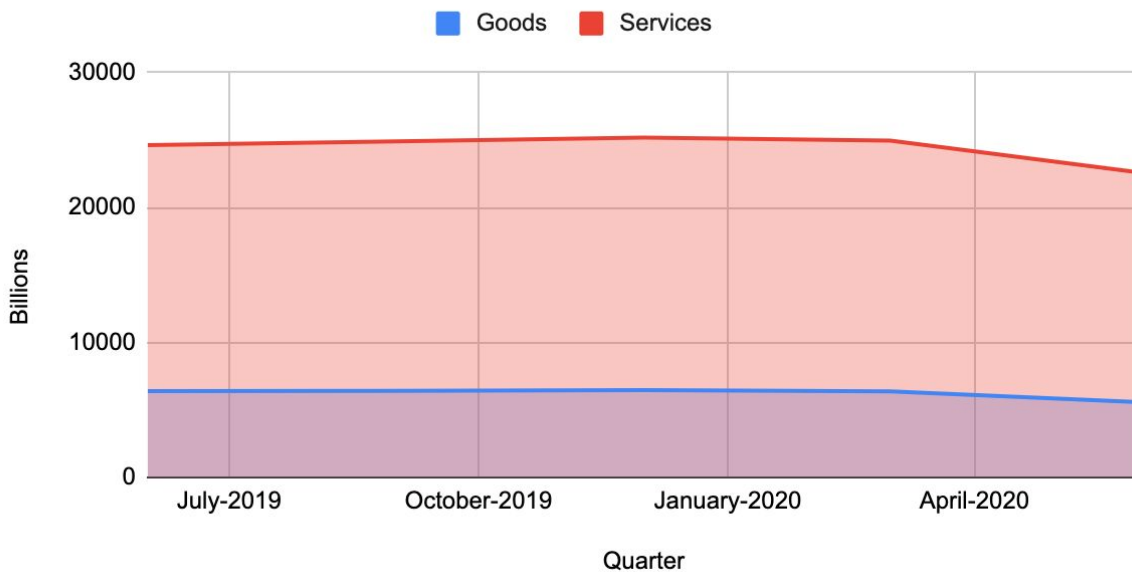
## Goods vs Services

[% Change from Preceding Period]



## Goods vs Services

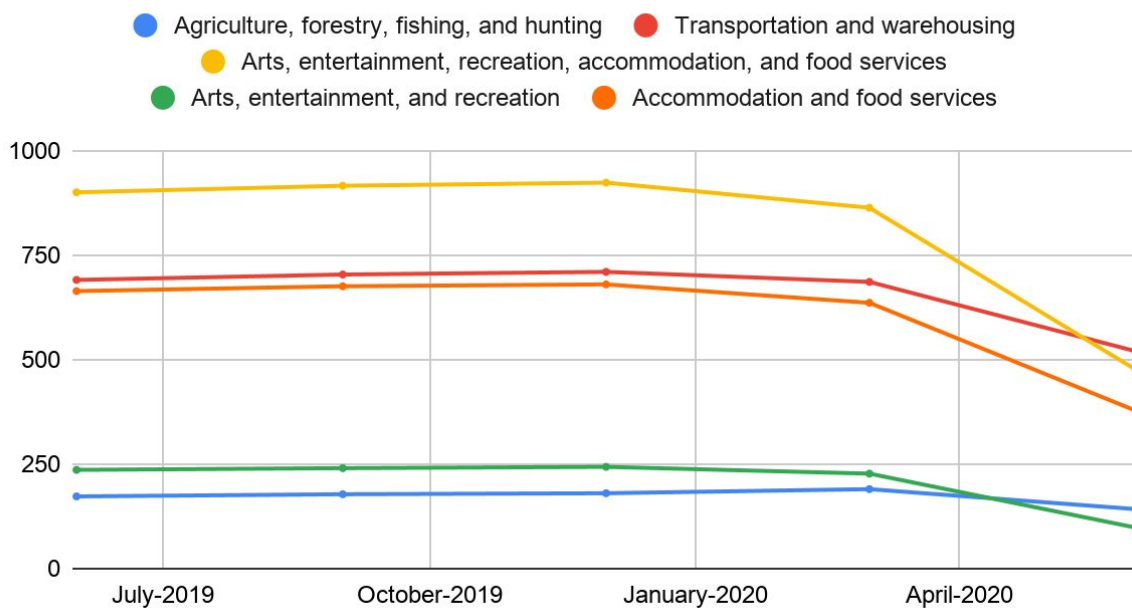
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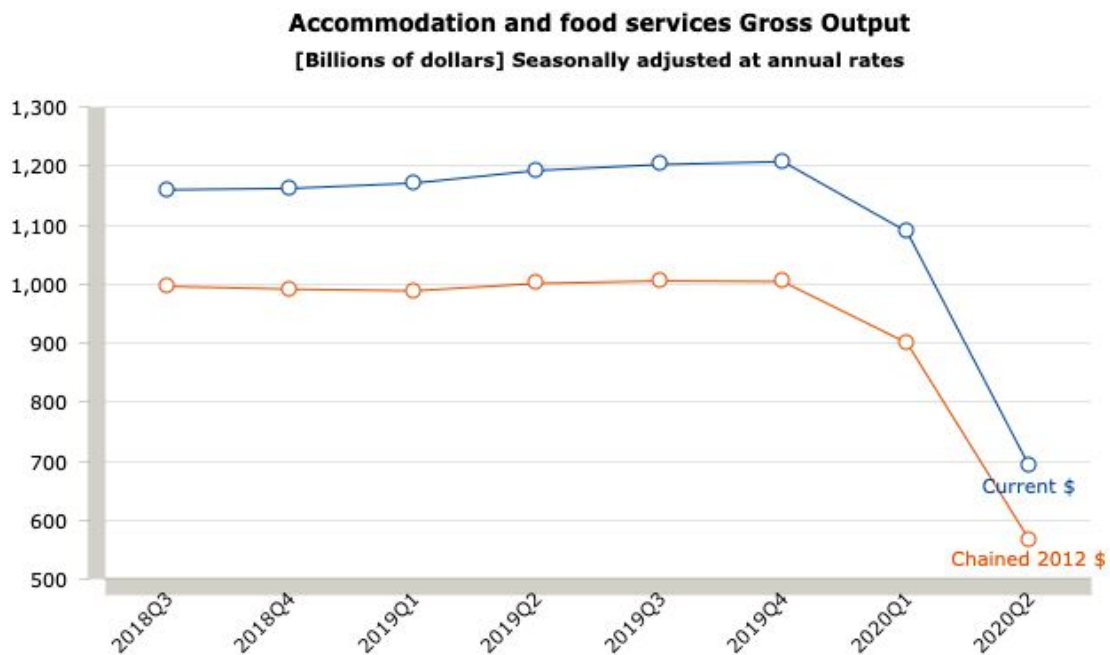


### 1.1.3 Impact of Restaurant Industry

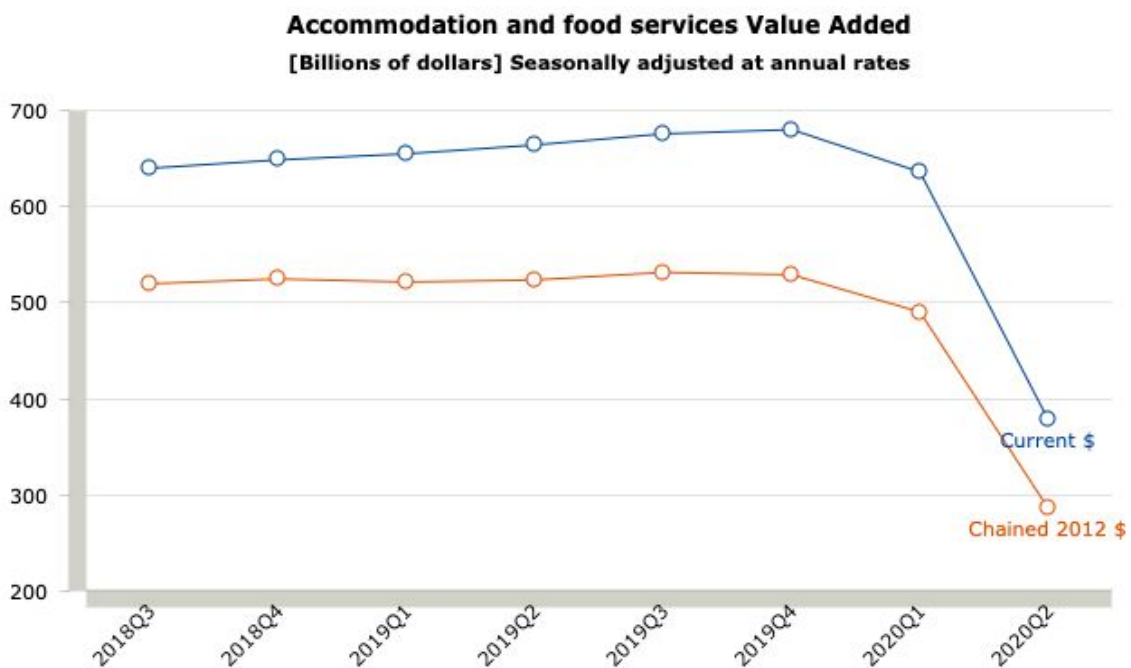
Assessing this, the industries that we are investigating (that in some way are a derivative or main driver of the restaurant industry) are also the ones that have experienced the most volatility, and in particular, losses in latter quarters.

## Relevant Industries





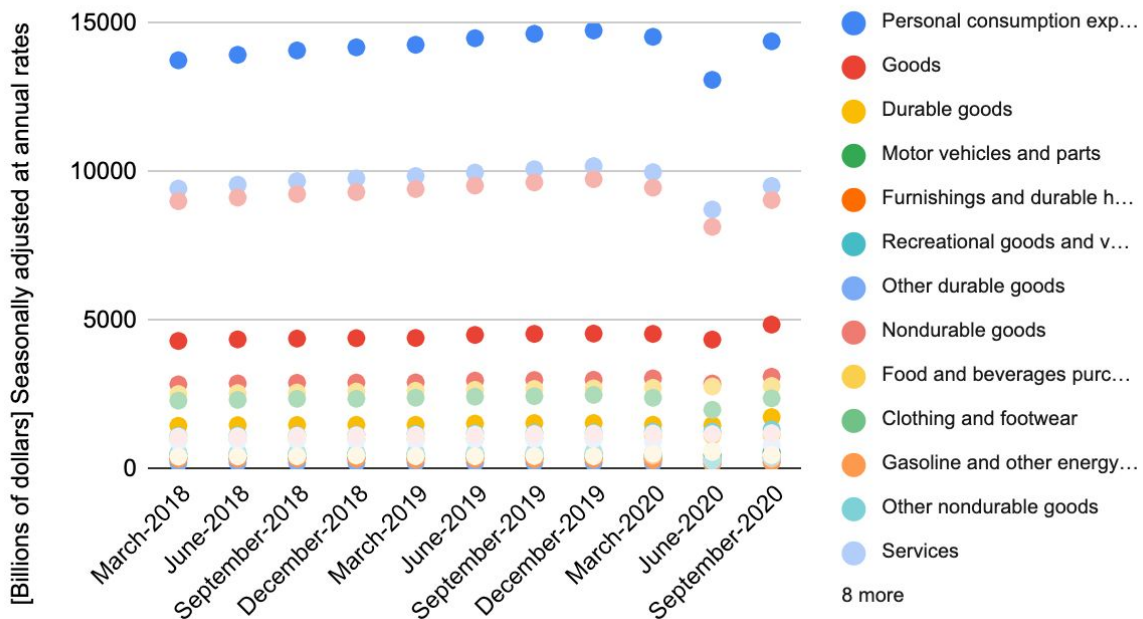
In 2020Q2, Accommodation and food services nominal gross output decreased to \$691.1 billion. Real gross output, adjusted for changes in price, decreased 84.3 percent.



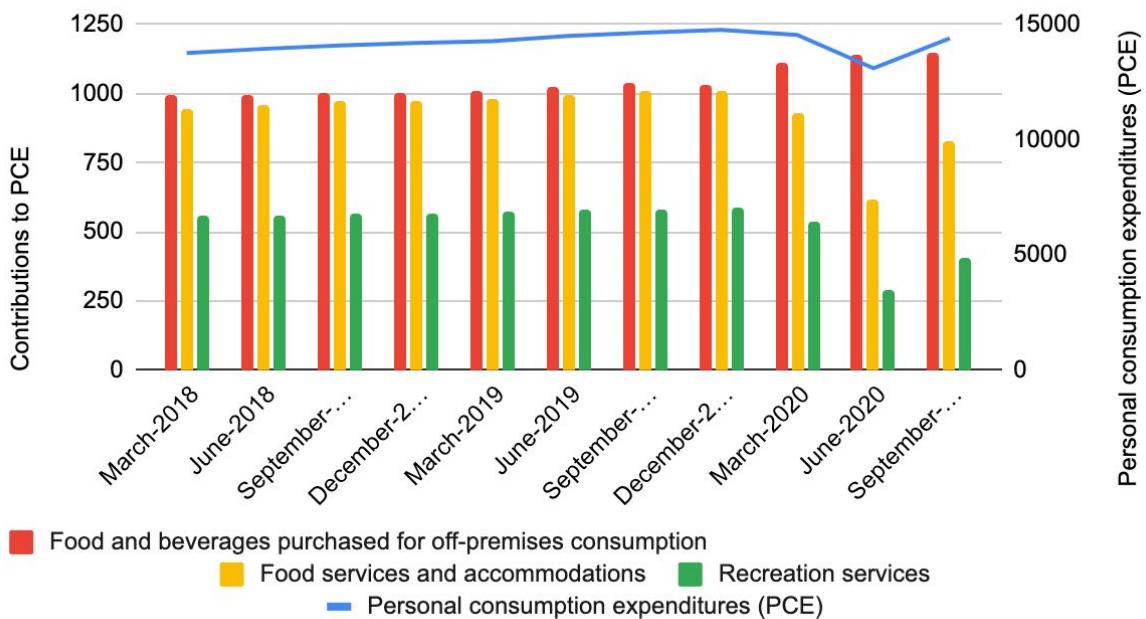
In 2020Q2, Accommodation and food services nominal value added was 1.9 percent of GDP and decreased to \$378.1 billion. Real value added decreased 88.4 percent and contributed -4.38 percentage points to the change of -31.4 percent in real GDP.

## 1.2 Personal Consumption Expenditures

### Macro PCE



### Personal consumption expenditures (PCE) vs. Economic Rows

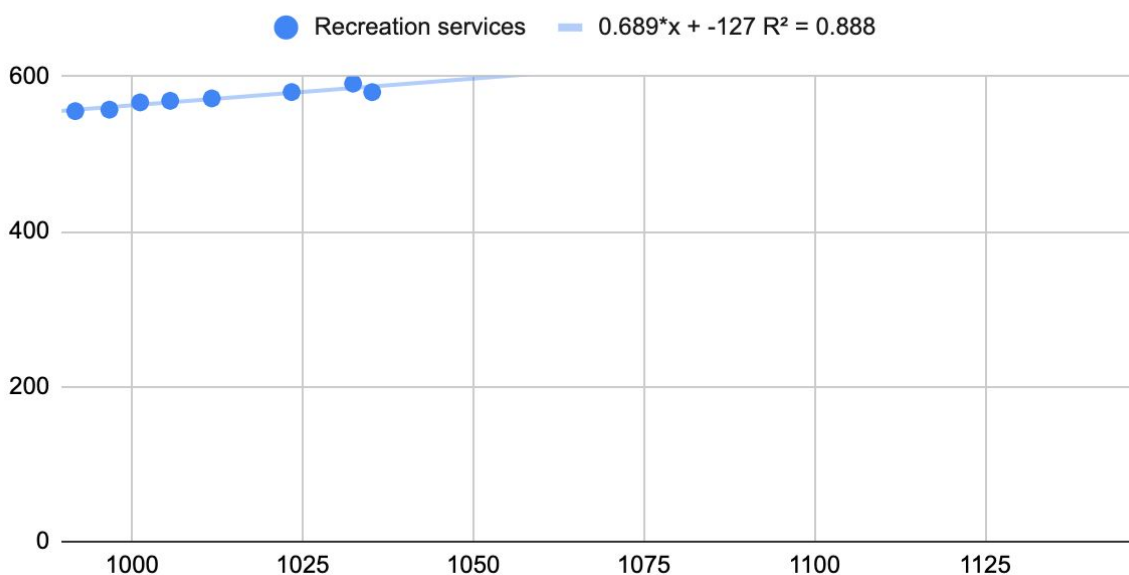




Correlation [Food and beverages purchased for off-premises consumption vs Food services and accommodations]:	-0.7462325036
Correlation [Food and beverages purchased for off-premises consumption vs Recreation services]:	-0.805404823

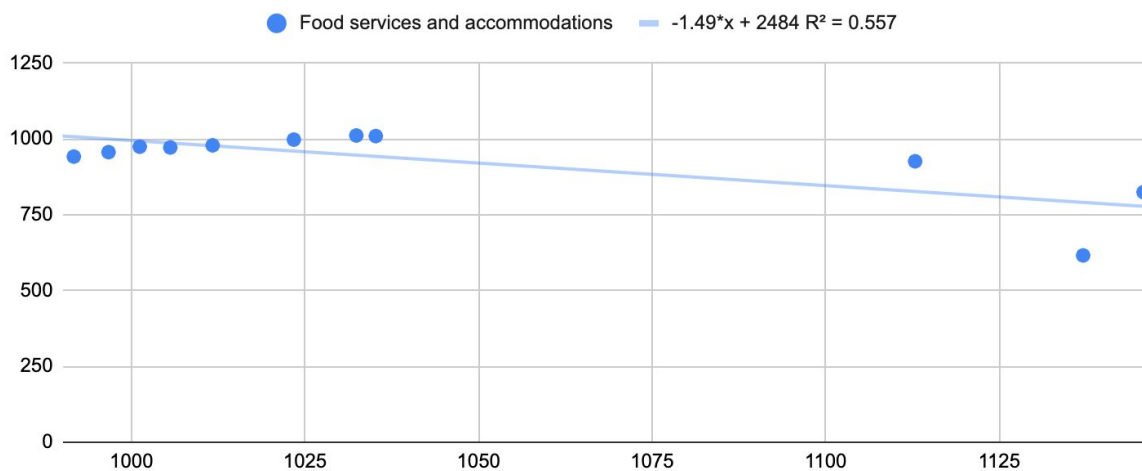
## Regression

Food and beverages purchased for off-premises consumption



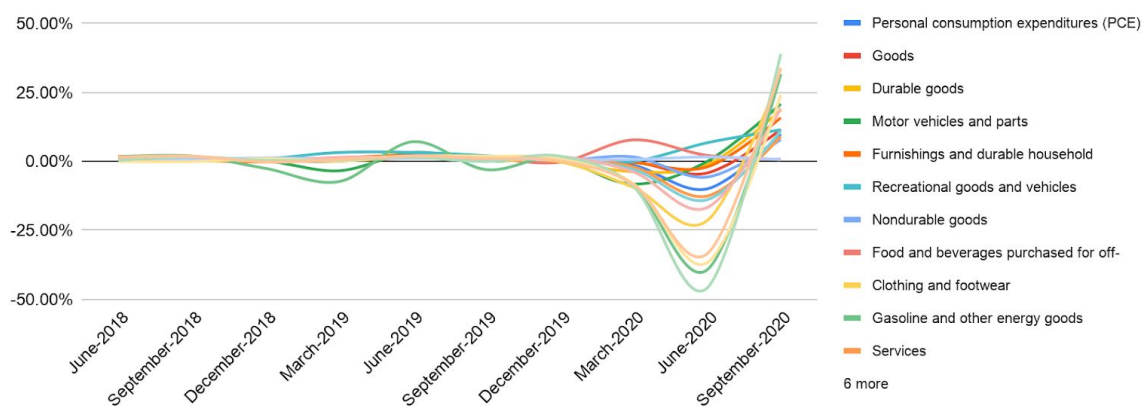
## Regression

Food and beverages purchased for off-premises consumption

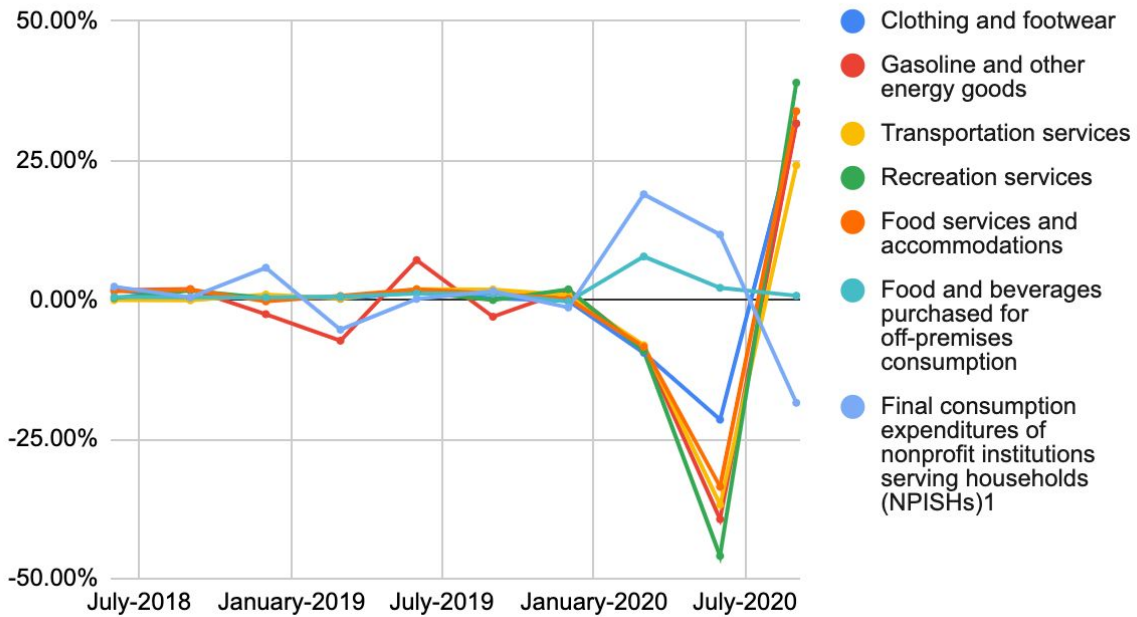


Durable goods	1.42%	0.41%	0.30%	0.09%	2.78%	1.09%	0.08%	-3.71%	-1.21%	18.63%
Motor vehicles and parts	1.06%	0.46%	0.15%	-3.40%	3.23%	0.15%	0.48%	-8.25%	0.00%	20.80%
Furnishings and durable household equipment	1.92%	0.49%	-0.20%	1.27%	2.20%	1.23%	-0.25%	-0.47%	-2.00%	15.85%
Recreational goods and vehicles	1.30%	1.08%	1.02%	3.23%	3.25%	2.04%	0.14%	0.05%	6.75%	11.47%
Other durable goods	1.73%	-1.01%	0.05%	0.79%	1.79%	1.26%	-0.40%	-5.60%	-19.39%	38.12%
Nondurable goods	1.14%	0.69%	0.31%	0.19%	2.09%	0.64%	0.25%	1.61%	-5.67%	7.95%
Food and beverages purchased for off-premises consumption	0.50%	0.45%	0.44%	0.61%	1.16%	1.15%	-0.27%	7.80%	2.17%	0.77%
Clothing and footwear	1.88%	0.13%	0.63%	0.20%	1.35%	0.30%	-0.17%	-9.48%	-21.47%	31.65%
Gasoline and other energy goods	1.72%	1.95%	-2.55%	-7.31%	7.15%	-3.02%	1.76%	-8.81%	-39.34%	31.65%
Other nondurable goods	1.25%	0.71%	0.97%	2.07%	1.76%	1.36%	0.41%	2.94%	0.26%	5.50%
Services	1.39%	1.26%	0.95%	0.80%	1.20%	1.12%	1.04%	-2.00%	-12.58%	9.07%
Household consumption expenditures (for services)	1.34%	1.29%	0.72%	1.10%	1.24%	1.10%	1.15%	-2.95%	-13.91%	11.03%
Housing and utilities	1.23%	0.81%	1.25%	1.02%	1.13%	1.12%	0.70%	0.72%	1.60%	0.69%
Health care	1.12%	1.62%	0.01%	1.49%	1.43%	0.69%	1.76%	-3.87%	-16.75%	19.26%
Transportation services	-0.02%	-0.06%	0.97%	0.26%	1.91%	1.87%	0.90%	-8.13%	-36.74%	24.16%
Recreation services	0.34%	1.69%	0.35%	0.55%	1.43%	-0.02%	1.90%	-9.16%	-45.94%	38.99%
Food services and accommodations	1.55%	1.88%	-0.26%	0.72%	1.93%	1.16%	0.20%	-8.41%	-33.51%	33.86%
Financial services and insurance	1.15%	1.60%	1.38%	0.73%	1.48%	1.34%	1.27%	0.12%	-1.57%	2.64%
Other services	3.15%	1.29%	1.22%	1.81%	0.00%	1.84%	1.33%	-2.59%	-17.86%	7.31%
Final consumption expenditures of nonprofit institutions serving households (NPISHs) <sup>1</sup>	2.38%	0.46%	5.78%	-5.33%	0.18%	1.58%	-1.35%	18.96%	11.72%	-18.45%
Gross output of nonprofit institutions <sup>2</sup>	2.21%	1.60%	0.77%	0.85%	0.60%	0.64%	0.97%	0.18%	-5.09%	2.35%
Less: Receipts from sales of goods and services by nonprofit institutions <sup>3</sup>	2.14%	2.03%	-1.09%	3.29%	0.76%	0.30%	1.82%	-6.46%	-12.63%	14.31%

## Personal consumption expenditures (PCE), Goods, Durable goods, Motor vehicles and parts, Furnishings and durable household equipment...

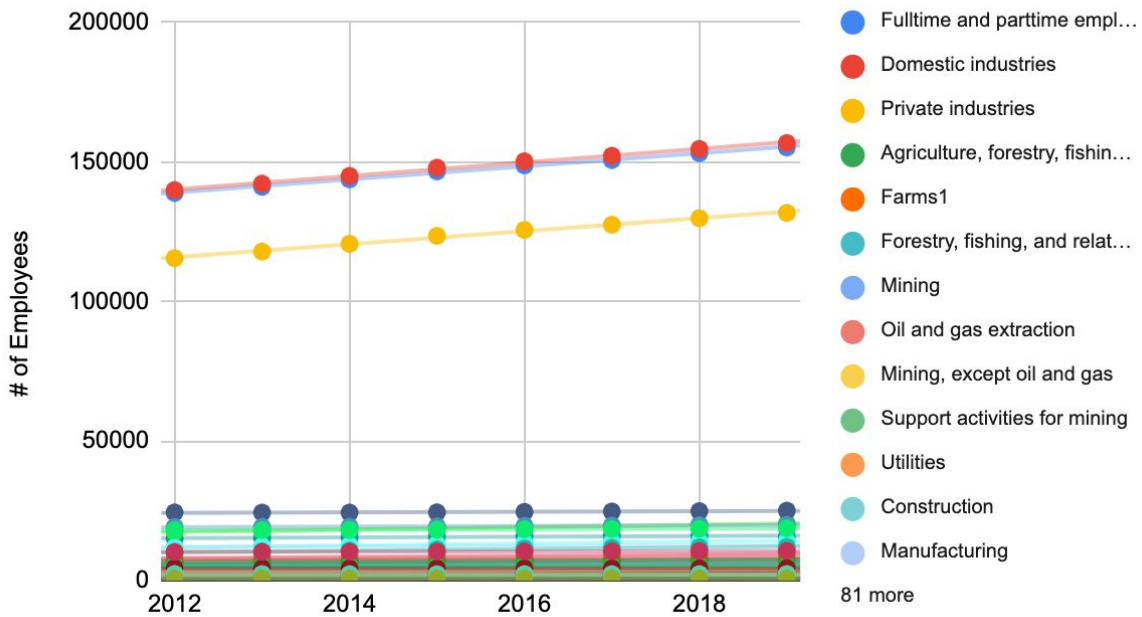


## Most Volatile Industries



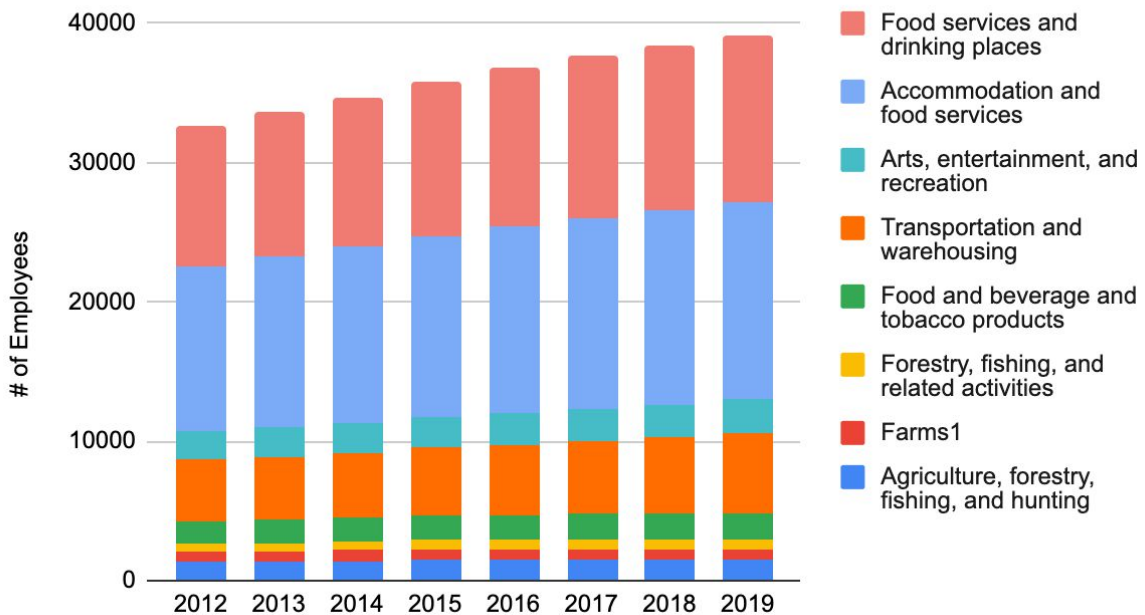
## 1.3 Employment Impact

### Macro Employment Analysis



81 more

## Relevant Industries to Restaurants



### 1.3.1 Unemployment Data

The coronavirus continues to deliver unprecedented economic numbers and so we continue our analysis by looking at unemployment. It is no secret that some industries fared much better than others in the pandemic. In the upcoming section we seek to answer a few questions. How has the restaurant industry fared compared to other industries? How do the numbers change and fluctuate? How do the numbers compare to the Great Recession?

For the upcoming graphs, we used unemployment data from the St. Louis Federal Reserve Bank which tracked national monthly unemployment numbers by industry from 2005 to 2020. We included this range to compare the present coronavirus recession to the Great Recession following the 2008 financial crisis, the most recent recession. The first thing to address is that this Dataset did not have restaurants as its own category. Restaurants are lumped into “Leisure and Hospitality”(L&H) which also includes other service based sectors such as bars, theme parks, and hotels. All of these sectors have been hit very hard by the coronavirus. Another is that unemployment seen for a specific month is taken on the 1st of that month rather than an average of the unemployment in that month. For example, April unemployment is measured on April 1st rather than being an average of unemployment for April. So unemployment for a specific month may be more reflective on how the previous month ended rather than a general view of the entire month.

The first graph shows the monthly national unemployment in all sectors compared to L&H. The first thing to note is that L&H is more volatile and has on average higher unemployment, even during times of prosperity. From the graph we can see the seasonal change in unemployment with winter months having higher L&H unemployment compared to summer. L&H was severely hit during the pandemic with unemployment peaking in April at 39.3% while national unemployment stood at 14.4%. April is when many Americans got laid off or furloughed and thus the numbers show this. This is especially seen in the L&H unemployment where there is nearly a 25% difference. This is bigger than the difference in peak unemployment in January 2010 at 14.2% (L&H) vs 10.6% (Total) during the Great Recession. After this spike the numbers quickly level off for both categories. The beginning

of October shows 16.3% unemployment in L&H versus 6.6% unemployment for all categories. This is a remarkable improvement from April but shows just how far L&H has to go. We don't expect the numbers to get that much better as we enter the third wave.

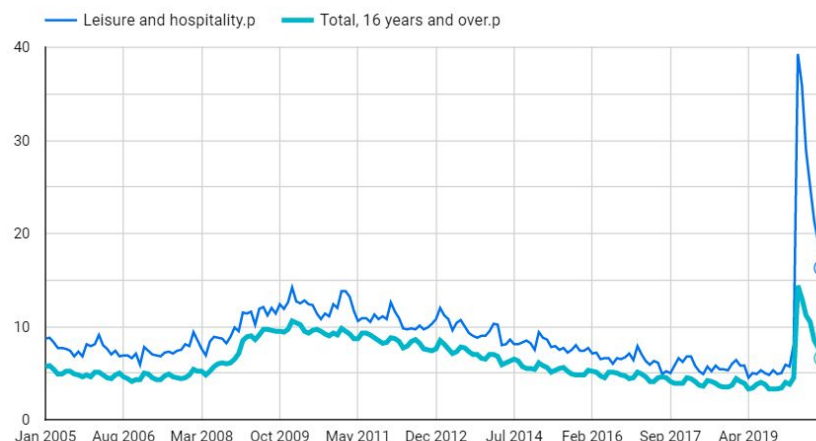


Figure: Monthly unemployment in all sectors compared to L&H.

The second graph below shows monthly national unemployment in the sectors of Leisure and Hospitality (L&H), Professional and Business Services (PBS), Durable goods, and Non-durable goods from 2005 to 2020. We can see from the graph that L&H still eclipses the other sectors by an absurd amount. With L&H at 39.3% unemployment in April, the next highest sector was Durable goods with 15.1% unemployment. In January 2010, the last period of mass unemployment, there was very little difference between the unemployment of L&H (14.2%) and Durable goods (14.1%). Part of this can be attributed to the fact that the Great Recession was much more of a traditional recession brought on by a financial crisis rather than a pandemic. PBS and Non-Durable goods have similar peak April unemployment at 9.8% and 10.2% respectively. In the following months all industries shown begin to recover fast as more restrictions across the country are lifted. Durable goods by October actually has the lowest unemployment rate (4.6%) of all the sectors chosen. Again we expect the numbers to change once unemployment data for November and December begins to come in.

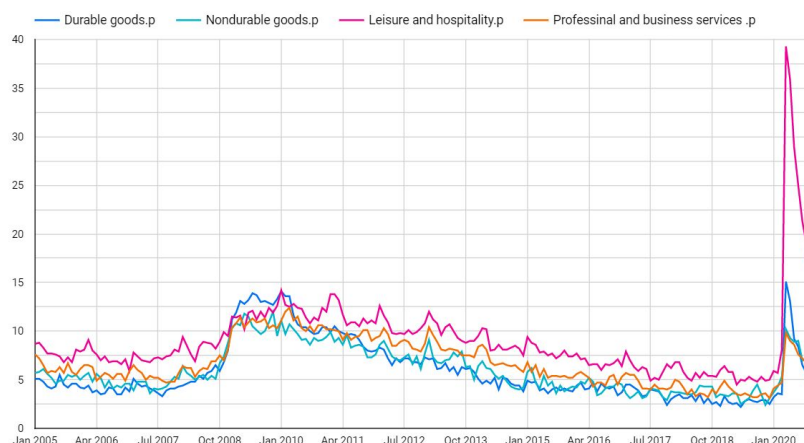


Figure: Monthly national unemployment in the sectors of Leisure and Hospitality (L&H), Professional and Business Services (PBS), Durable goods, and Non-durable goods from 2005 to 2020

Into the supersector of Leisure and Hospitality, the historical employment in the Food services and drinking places Industry is exposed in the Figure below. On the upper plot, we explore the number of employees in the industry (thousand) from 1990 to 2020. On the lower plot, the same curve during 2020. Among the 20.5 million U.S. jobs lost in April, about 5.5 million of them were in the restaurant industry. The huge loss has erased about three decades' worth of restaurant and bar jobs, with employment levels in the industry back to where they were in the late '80s.

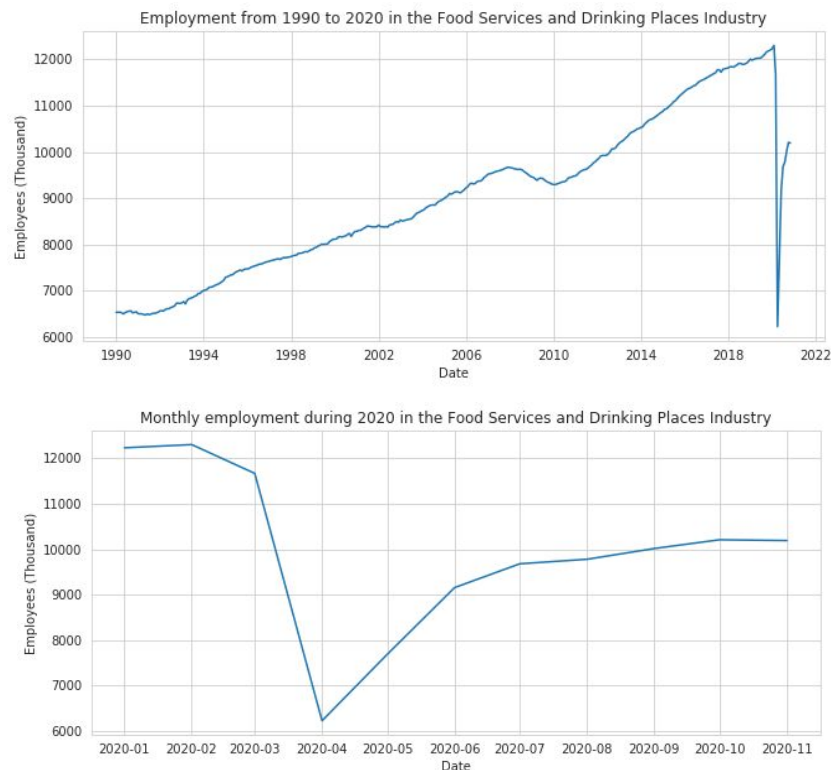


Figure: Employment in the restaurant industry from 1990 to 2020

## Part 2: A consumer perspective

### 2.1 Consumer Behavior: Dining-in impact

#### 2.1.1 Seating Dining Data

The pandemic has had an enormous amount of impact on restaurants but amongst all the mayhem it can be hard to tell how much effect this has had on daily operations. In this section we review Seating Data from Restaurants around the world, including the United States. This dataset tells us the percentage change in how many seats are occupied from the baseline of February 18th, a few weeks before the pandemic, all the way to November 24th. This can help us answer the questions of how much of daily operations was impacted? How have restaurants in certain cities or states fare against each other? Are there any discernible patterns we can see?

The figure shown below shows the relative change in seating data from baseline value (February 18th) to today. We are comparing the states of California, Texas, as well as the US in general to track how seating data has affected these states individually. All three

closely mirror each other up until May 1st where restaurants were beginning to open in Texas as well as the rest of the US. California restaurants started to resume operations during memorial day weekend (May 23rd). California and the rest of the United States closely mirror each other for the rest of the graph with California lagging slightly behind. Texas had a much more aggressive reopening strategy and the graph shows this with Texas consistently having a higher percentage of people seated compared to the US and California. Texas even manages to return to baseline seating on Labor Day weekend (September 6th). However these gains are short lived. As the trend line shows, seating begins to decline after Halloween weekend (October 29th to 31st) as the US third wave begins to pick up speed.

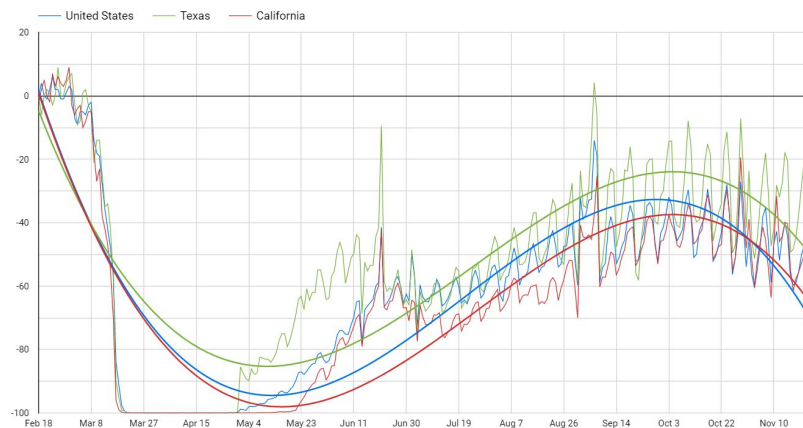


Figure 2.1: Relative change in seating data from baseline value in Texas, California and Nationwide

Next we look closer at the state of California which is famously or infamously known for its strict coronavirus regulations. We compare the state of California, the cities of Los Angeles and San Francisco, as well as the US as a whole. This can give us clues as to how urban areas and their restaurants fared since Urban areas tended to have even more strict coronavirus regulations. The graph below shows that large California cities and their restaurants tended to be worse off compared to the rest of the country. Both LA and SF opened up more cautiously and experienced their first modest increase in seating on June 21st. For the rest of the pandemic these cities continue to have modest increases in seating but still never being able to achieve anything close to baseline seating. Like everybody else though, the cities experience great decline in seating following Halloween weekend (October 29th to 31st) and into the third wave.



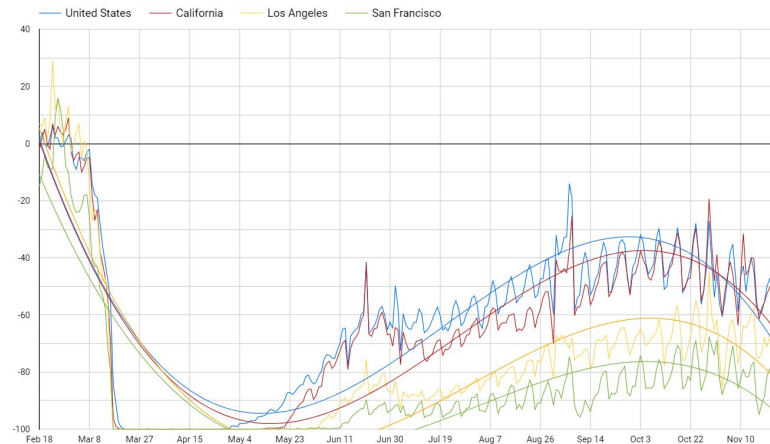


Figure 2.2: Relative change in seating data from baseline value in California, Los Angeles, San Francisco and Nationwide

## 2.2 Overall expenditures and changes in consumer behavior

### 2.2.1 Difficulty with Expenditures and Shopping behaviors

In this section, we focus on Phase 2 of the Household Survey, which started on the 13th week of the study (August, 19th) onwards and contains variables related to changes in shopping behaviors and difficulty with expenses. Why analyze difficulty with expenses? As it was mentioned before, one of the possible insights of our project comes from the identification of vulnerable groups that could be part of the extension of the food affordability federal efforts that generate opportunities for restaurant owners to keep their businesses being part of social impact projects.

Firstly, we explore some background information on the composition of the sample population during the weeks covered in this analysis (weeks 13th-17th of the survey):

- **Region:** 32.5% of the surveyed people belong to the West Region, followed by 31.5% who live in the South; 20.3% in the Midwest, and 15.5% in the Northeast.
- **Gender:** 58.8% of the surveyed people are identified as women (binary options only).
- **Race:** 81.6% identify themselves as white; 8.1% as black; 5.1% as Asian and 5% other race or race in combination.
- **Educational attainment:** 29.2% of the surveyed people have a Bachelor's degree across the country, followed by 24.8% who have completed a Graduate's degree and 21.6% an incomplete college degree. Only 2% have less than a high school or an incomplete high school.
- **Generation:** 60% of the surveyed people belong to Generation X and Z, 25% to Millennials, 19.8% to Generation Jones, 15% to Baby Boomers, and 6.5% to Silent Generation.

Population by Region, Racial, and Educational attainment variables are combined in the following charts (Figure 2.3). From there, we conclude that the distributions of race and educational attainment are not precisely the same, but similar across the regions (in the South, black people represent 15%, more than double that in the rest of the regions and the West, other races and Asian people are the 15% in combination, more than the double that



in the other places). Additionally, the number of people and kids in households is shown in Figure 2.4. 63% of the survey respondents don't have children and 70% reveal to have at most 3 members in the household.

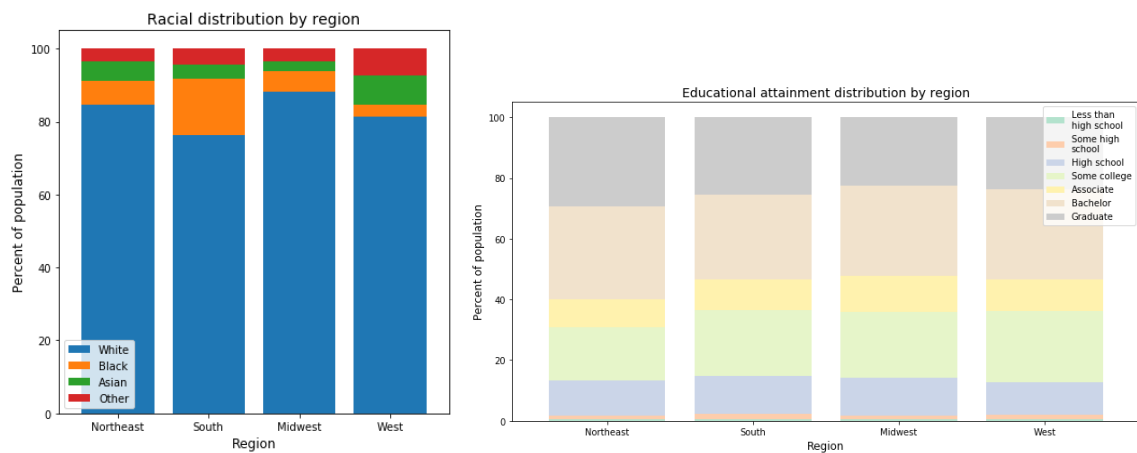


Figure 2.3: Percentage of the sample population by region and race (on the left) and population by region and educational attainment (on the right).

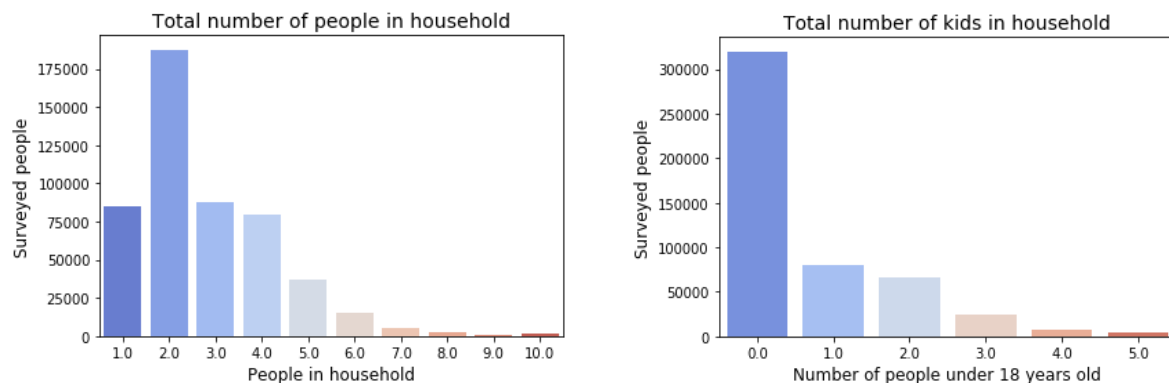


Figure 2.4: Total number of kids and members of the household across the Household survey during weeks 13th-17th.

## Difficulty with expenses by region and race

The plot below shows the results for the following question: *In the last 7 days, how difficult has it been for your household to pay for usual household expenses, including but not limited to food, rent or mortgage, car payments, medical expenses, student loans, and so on?* Split by race and region, we can explore scenarios in four subplots (one by race and everyone split itself into regions): In the first subplot, related to white people, we see that at least 12.5% of them don't have difficulty at all (EXPNS\_DIF 1, the blue bars) across the regions, and the level of difficulty (from a little to very difficult) is similar in proportions in the four regions (orange, green and red bars). Instead, in the second subplot, representing the black population across the regions, the patterns of difficulty are less homogeneous over the region. In the South, more than 15% of black people don't present difficulties, but in the West less than 5%. The same situation happens in the fourth subplot (races in combination). The higher the red and green bars, the greater the difficulty with expenses.

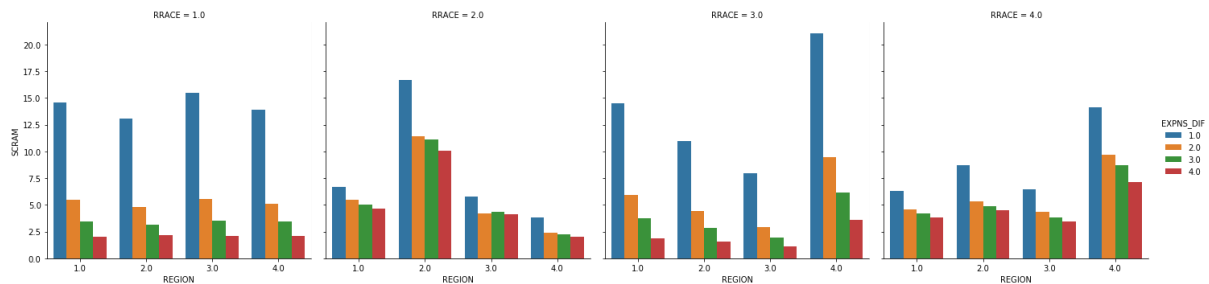


Figure 2.5: Difficulty with expenses by region and race

## Follow-up: Difficulty in the metropolitan area selected for Milestone 2

### Changes in shopping behaviors

The survey asks respondents about changes they made in the last 7 days in their shopping behaviors according to purchase/payment modalities and eating at restaurants. Figure 2.6 reveals the percentage of people who declared did more purchases using one of the specified modalities during the last 7 days: made more purchases online, as opposed to in store, more purchases by curbside pick-up, and more purchases in-store. All of them mutually excluded since the surveyed person can select only one of them.

In the graph below, we see the cumulative percentage of change over time to explore the trends over the three modalities. Nationwide, online purchases are highly preferred and they increased across the weeks as an alternative to in-store and curbside purchases, which were decreasing over time. Curbside pick-up has gained track in recent years facing the long shipping time and high shipping cost of completely online purchases, but this year the contactless alternative could be the choice of the majority. At a granular level, the preferences by educational attainment, generation, and race are exposed in Figure 2.7. By educational attainment, online purchases are widely preferred over in-store and pick-up purchases, especially in higher educational levels. By generation, we see that more than 10% of boomers, silent and jones respondents favored in-store purchases and by race, more than 20% of black people and other races increased their in-store and pick-up purchases. By region, 17% of respondents in the South and Midwest revealed made more in-store and pick-up purchases. In the West and Northeast, at most 13% made the same choices.

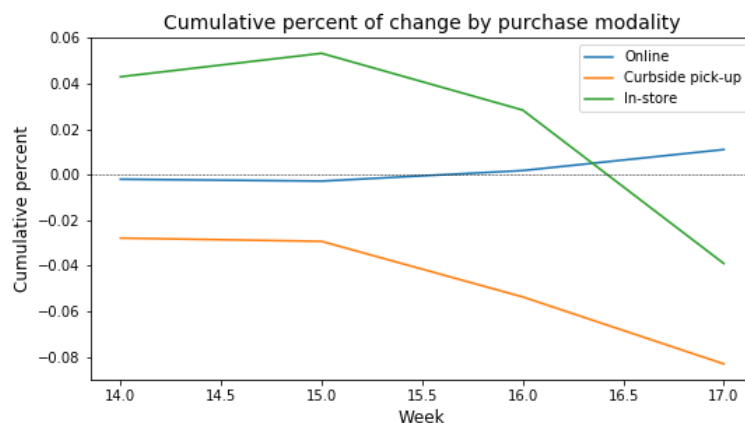


Figure 2.6: Cumulative percentage of changes in purchase modality, from August 19th to October 26th

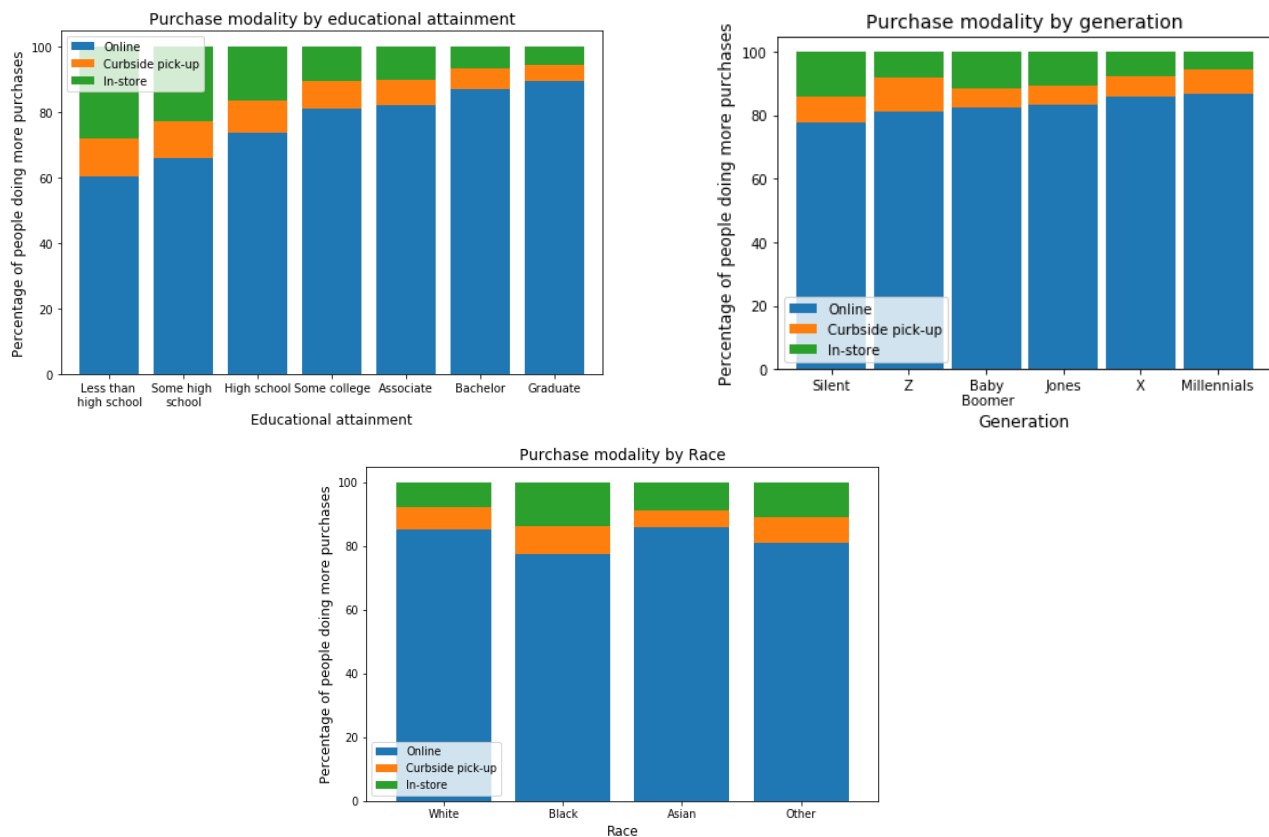


Figure 2.7: Purchase modality by educational attainment, generation, and race

The same analysis was made for payment modality. The surveyed participants were asked about their payment changes during the last 7 days. By region, 8.2% of surveyed participants from Midwest used more cash last week and 6.9% made the same payment choice in the Northeast. For West and South, was 7.3 and 7.5% respectively.

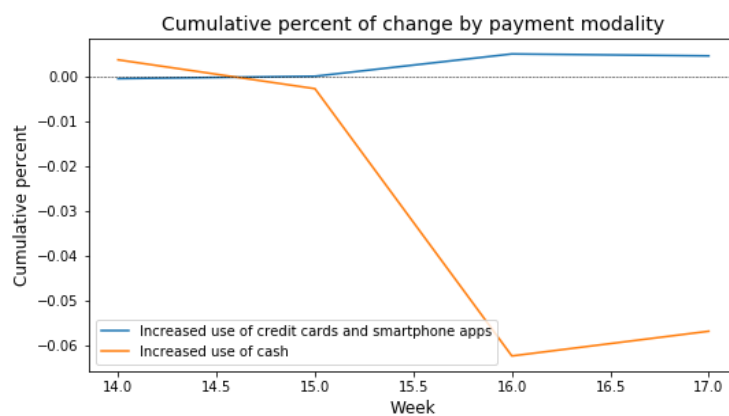


Figure 2.8: Cumulative percentage of changes in payment modality, from August 19th to October 26th

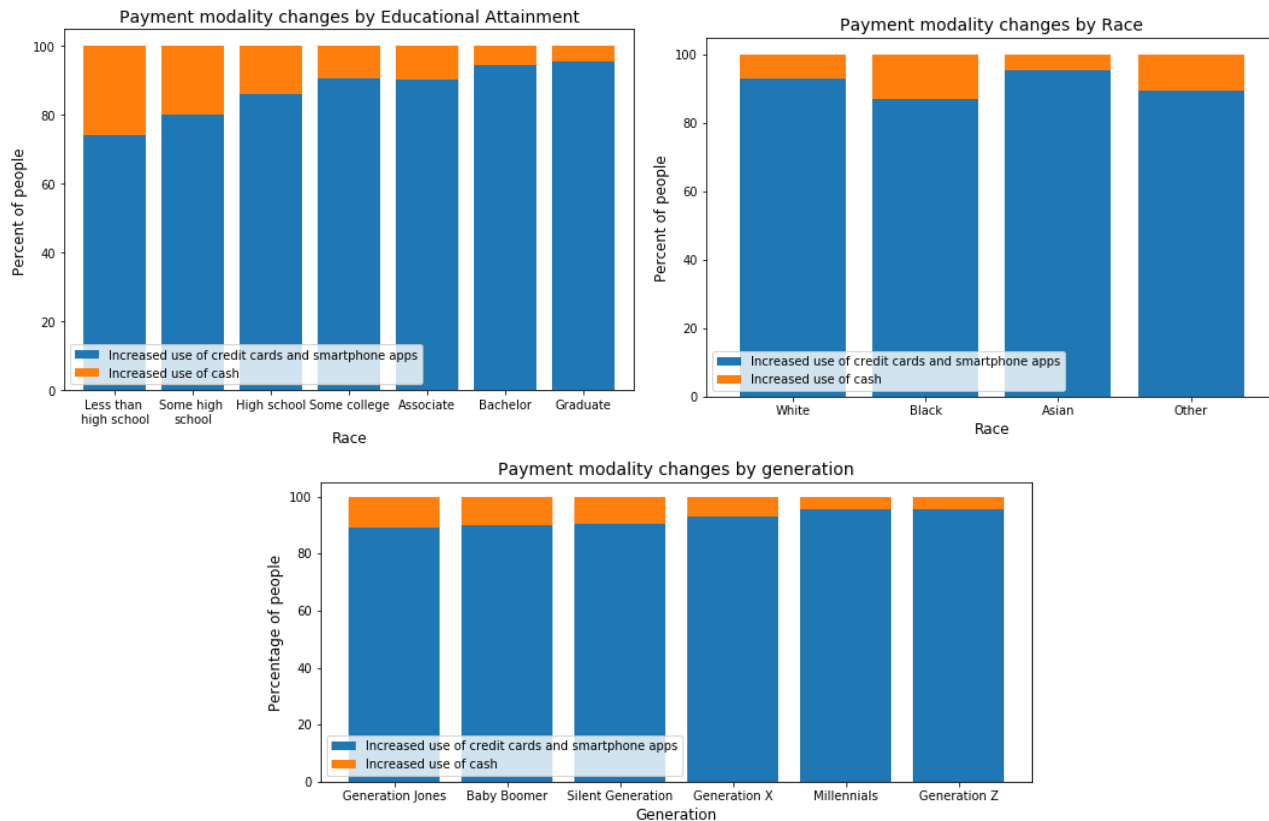


Figure 2.9: Purchase modality by educational attainment, generation, and race

And finally, the survey asked if people resumed or avoided eating at restaurants during the last 7 days. According to Figure 2.10, the percentage of people resumed eating at restaurants was increasing over the weeks. Across the country, more than 85% of the sample population resumed eating at restaurants, with the highest % in the West region (87%). As exposed in Figure 9, surveyed people with higher educational attainment resumed eating at restaurants in lower proportion than people with lower educational levels during the weeks analyzed (around 84-87% versus 93%). By generation the proportions are similar (between 82-86% of population resumed eating at restaurants) and by race, white householders revealed the lower level of resume (84% versus more than 90% in the rest of subgroups).

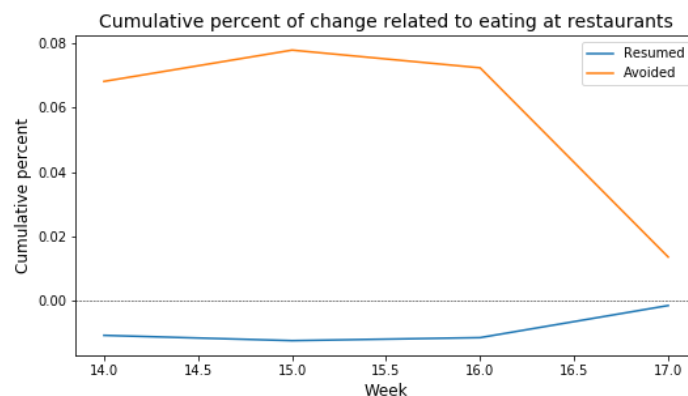


Figure 2.10: Cumulative percentage of changes in eating at restaurants, from August 19th to October 26th.

**Follow-up: Plot results using geo-locations by state and city as part of Milestone 1.**

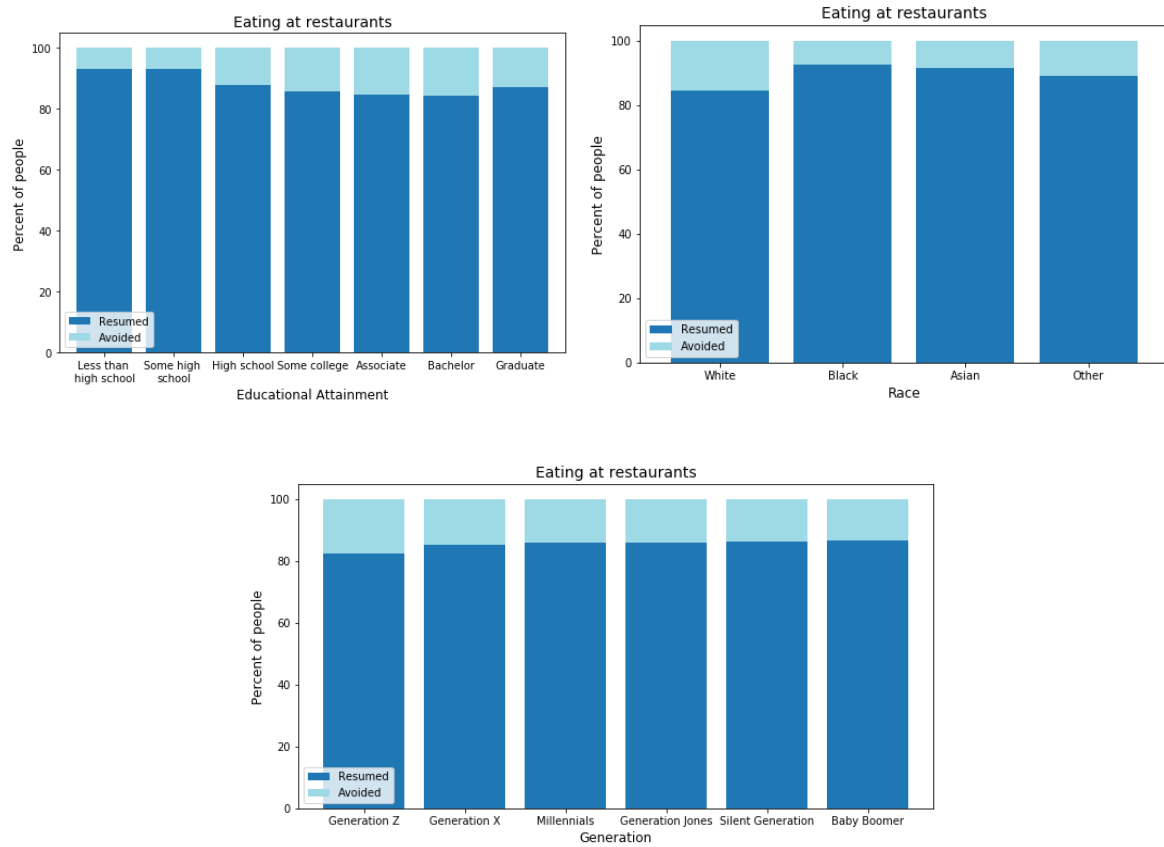


Figure 2.11: Resumed eating at restaurants by educational attainment, generation, and race

## 2.3 Mobility Changes in Response to COVID-19

### 2.3.1 Apple Mobility Reports

How much has changed the number of route requests that people have made during this year? How the transportation types have been affected during the year with regard to the baseline volume (nationwide and by states)? Based on the reference volume of requests, can we identify states more/less disrupted in terms of weekly and monthly directions requests (by type of request)?

The figure below explores the nationwide directions requests over the year by type of transportation relative to a baseline volume (January 13th, 2020), consistent with normal. The overall route requests dropped significantly with the lockdowns across the country, but from April, driving and walking requests increased at the same strong rate, especially during the summer season, but both declined from the spring. Transit experienced a slow increase during the autumn to keep practically constant from the summer onwards.

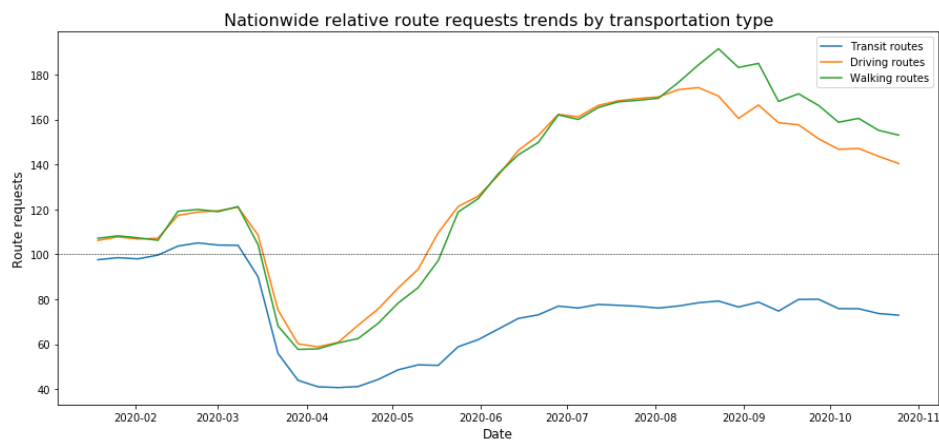


Figure 2.12: Route requests trends by type of transportation

Between the weeks 11th and 13th governors in different states announced statewide orders to stay at home for non-essential workforce (California, New York, New Jersey, Ohio, Louisiana, Massachusetts). It's interesting to note that between weeks 11 and 19, the mean of route requests for driving and walking are under the baseline across the country. From there, the mean of directions requests is over the median and the deviation of the weekly average by state increases. The increment of the percentiles 50 and 75 of the weekly requests answers to seasonality (summer vacations) and the variability into every boxplot can be explained for the independent management that every state did related to the stay-at-home restrictions.

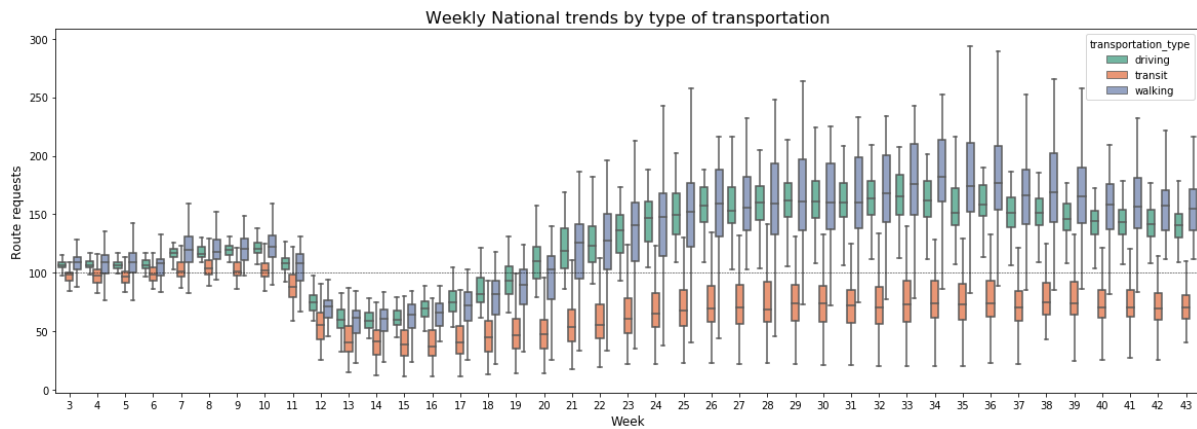


Figure 2.13: Weekly directions requests across the country during the year

Then, by state, we can identify the states more disrupted (who boxplots are located so far off the baseline, which is a reference point of normal requests by type of transportation and it's related to every particular state). Based on Figure 2.14, Hawaii, Washington, New York, California, Oregon, Illinois and Massachusetts, to name a few, are the most disrupted states by changes in transit transportation. Some of them have high variability over the year, as New York and Massachusetts, compared to California, Hawaii or Washington. On the right, only Kansas, Oklahoma, Idaho, New Hampshire, South Carolina, Arkansas, Alabama and Mississippi locate their boxplots (and precisely the mean of the transit requests) over the baseline.

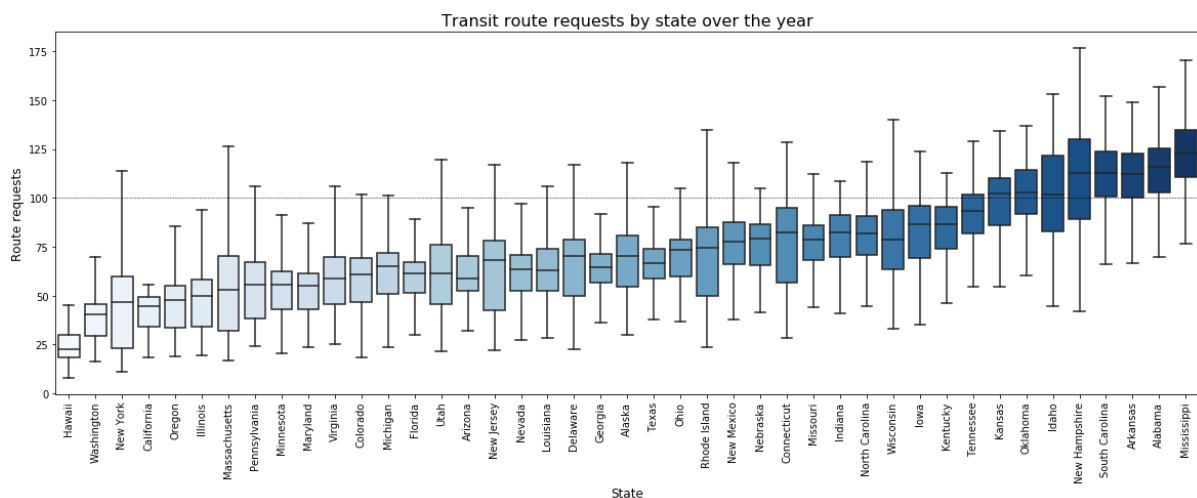


Figure 2.14: Transit requests by state during the year

Driving and walking requests are over the baseline in almost all the states, except in Hawaii (Figure 2.15 and 2.16). Maine, Idaho, South Dakota and Wyoming are furthest from the baseline in both types of transportation. On the left, Florida, New York, California, Massachusetts and Louisiana keep closest (and even) under the baseline in driving and walking directions requests.

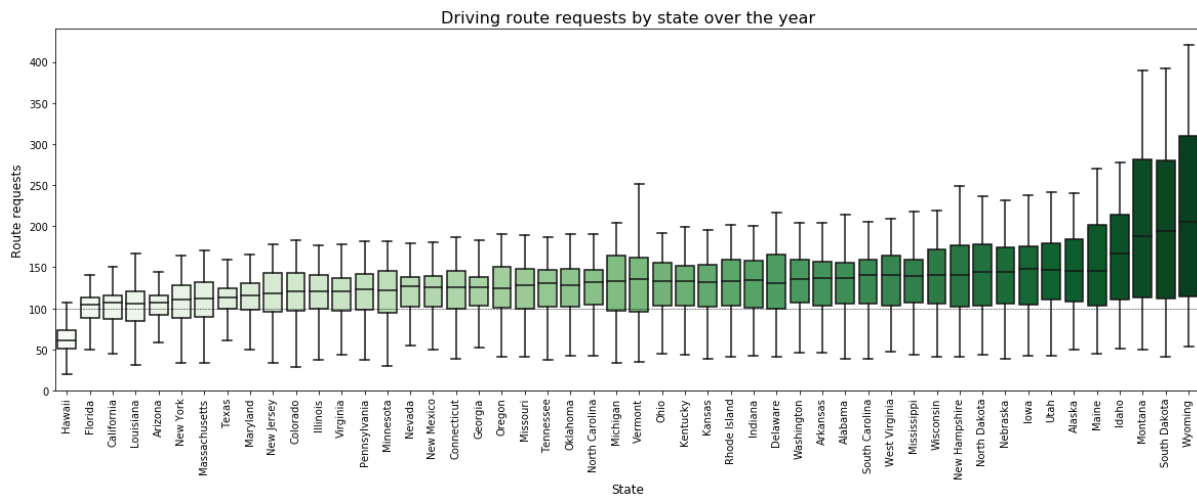


Figure 2.15: Driving requests by state during the year

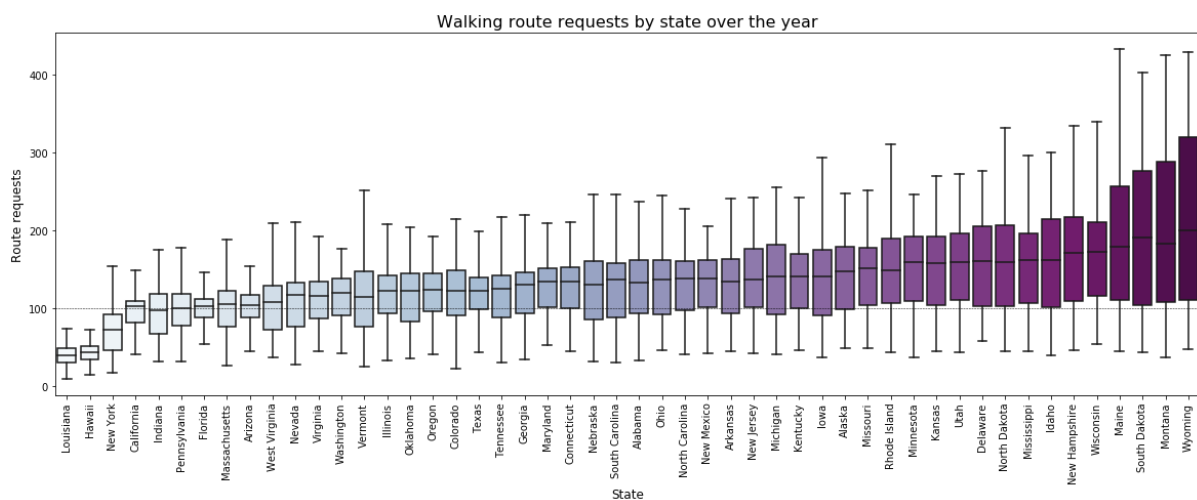


Figure 2.16 :Walking requests by state during the year

## 2.3.2 Foursquare Foot Traffic

How much has changed the foot traffic in food venues (grocery, convenience, discount stores versus fast food and casual dining restaurants)? Foot traffic is a term used in business to describe the number of customers that enter a store, mall, or location and it is an important metric because higher foot traffic tends to lead to higher sales and revenue numbers. We want to explore disruptions and changes on foot traffic in venues related to food (restaurants specifically). This data set contains indexed foot traffic to different categories of venues nationally, split by region and in some particular cities (SF, NYC, LA, and Seattle).

In Figure 2.17 we explore the foot traffic in venues where people can get food: stores (convenience, discount, big box, grocery stores) and restaurants (casual dining and fast-food restaurants). The plot below shows how all the venues, except for casual dining, have kept around the baseline foot traffic (even higher between March and April). Then, in Figure 2.18, the same analysis exposes the abrupt drop in foot traffic in the casual dining venue in April across all the regions of the country. From May the venue is recovering in all the regions, but they are still far away from the baseline. Additionally, foot traffic has been slightly higher in



the South and Midwest than in the Northeast and West. On the other hand, the Fast Food venue was also disrupted but on a smaller scale than casual dining. From May, the Midwest is upper to the baseline, Northeast and South are around the baseline, but the West is still under the normal foot traffic. Finally, in Figure 2.19 we go deeper into the West region and compare the foot traffic at the Fast Food venue in the metropolitan areas Los Angeles, Seattle-Tacoma and SF Bay Area. New York, from the Northeast is also included. Los Angeles and SF Bay Area are the most affected areas so far.

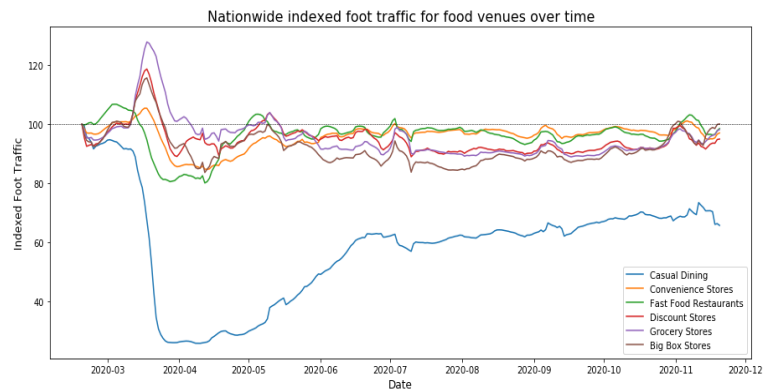


Figure 2.17: Nationwide indexed foot traffic in food venues during the year



Figure 2.18: Indexed foot traffic in Casual Dining versus Fast Food Restaurants during the year by Region

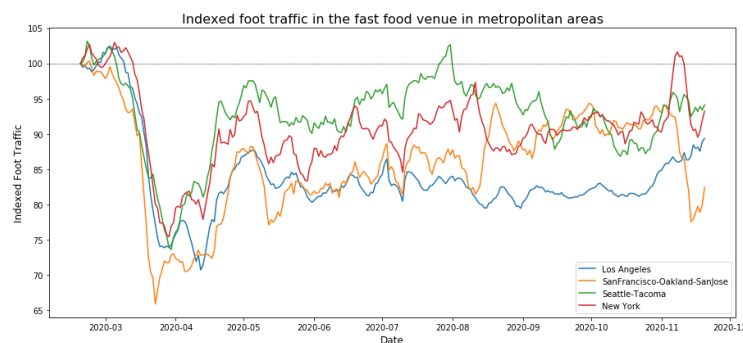


Figure 2.19: Indexed foot traffic at Fast Food Venues in 3 metropolitan areas from the West (Los Angeles, Seattle-Tacoma and SF Bay Area) and 1 metropolitan area from the Northeast (New York).

### 2.3.3 Descartes Lab Data

From the previous sections, we collected information about mobility trends related to route requests and foot traffic into venues, but, how much has changed the distance that people move daily? This data shows how the max distance mobility has changed compared to a baseline, defined as the median of max distance mobility measured during 2020-02-17 to 2020-03-07. Data provides a daily and by state representing the distance that a typical member of the given population moved (in kms) and indexed distance over the daily baseline. From Figure 2.20 and 2.21, it can be seen that the median mobility in states from Northeast and West are lower than the distance mobility in the South and Midwest regions. According to Figure 18, Wyoming, North and South Dakota are the only states which median indexed mobility are over the baseline. They also have the highest level of variability of mobility over the year. On the left, California is the furthest state from the baseline and the daily distance in this sample population doesn't exceed the 4 kms. Figure 2.22 shows the mobility over time by region.

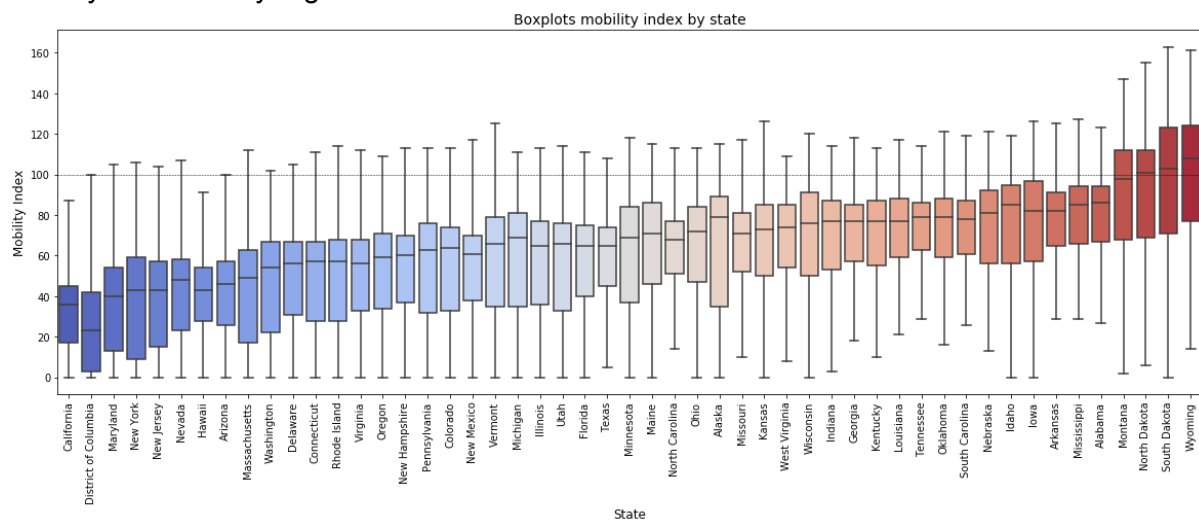


Figure 2.20: Indexed mobility changes by state

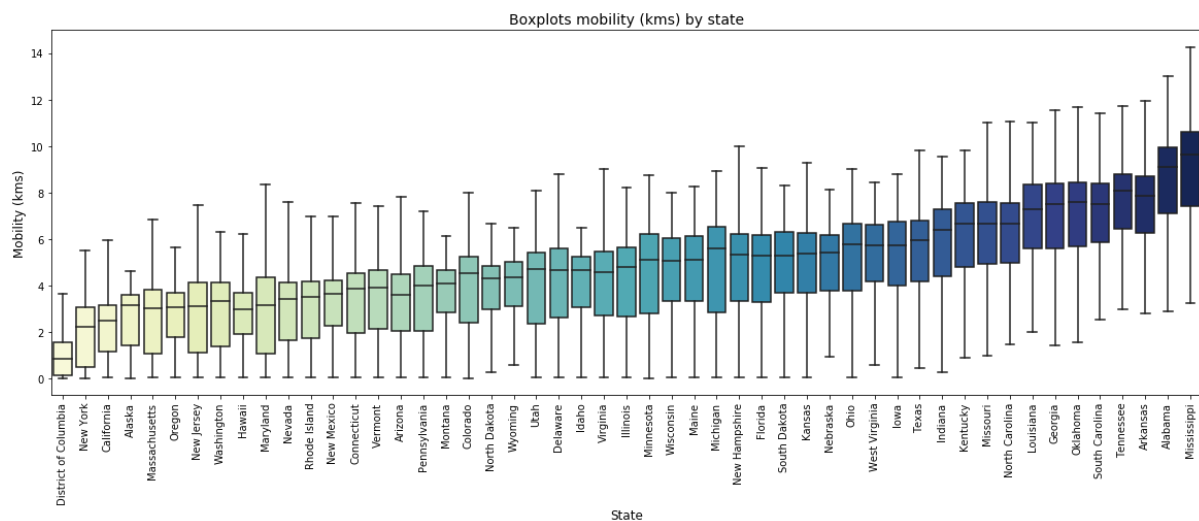


Figure 2.21: Mobility changes (kms) by state

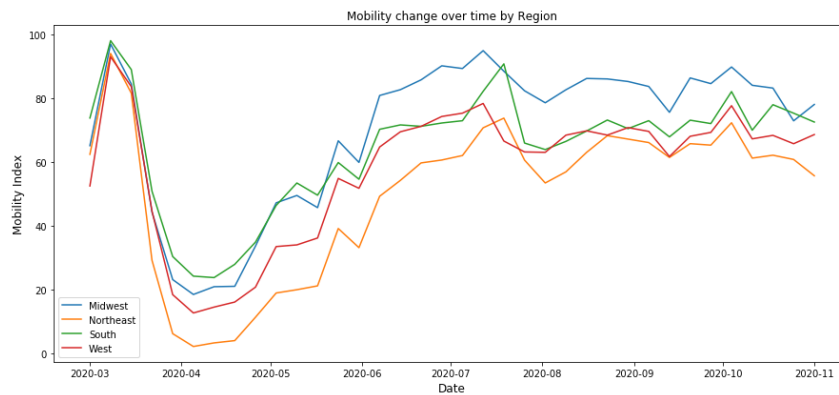


Figure 2.22: Figure 19: Mobility changes (kms) by state

### 2.3.4 Summary Shopping behaviors and Mobility Data

- West and Northeast regions are recovering slowly from their regular foot traffic, related to the South and Midwest.
- The sample population in the Household Survey that prefers in-store and pick-up purchases is higher in the South and Midwest than in the West and Northeast.
- States from West and Northeast also have the most disruptions on transit, driving and walking directions requests.
- Casual dining is the most disrupted food venue during the year across the country.
- Split by region, the food traffic recovering in the casual dining venue is slightly slow in the West and Northeast than in the South and Midwest. The West is also the region with slow foot traffic recovering in the fast food restaurants venue.
- West and Northeast are the places with higher use of contactless payment methods.
- West is the region where more people resumed eating at restaurants during week 13th and 17th from the Household Survey.
- Comparing LA, SF Bay Area, Seattle and NY, Los Angeles and SF Bay Area are the most affected areas so far in the indexed foot traffic at the fast food venue.
- Median mobility in states from Northeast and West are lower than the distance mobility in the South and Midwest regions.
- California is the furthest state from the mobility baseline and the daily distance in this sample population doesn't exceed the 4 kms.

**Follow-up: Once we pick a state/city, we come back to the Household survey to analyze consumer behaviors deeper. Incorporate results of duration and average visits in the state selected.**