# The Effect of Covid-19 on Types of Consumer Spending

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## Introduction

Disease epidemics have interrupted human society and way of life dating back to the earliest days of recorded history. As Covid-19, a new form of a deathly disease, rapidly infected the United States beginning in March 2020, the human way of life was once again disrupted on a multitude of levels. Shopping and spending, one of the most basic activities that we as humans take for granted, was disrupted by the closure of stores as the country sprawled into a country wide lockdown following an announcement of a global pandemic on March 11, 2020. Households were forced to find other ways to accumulate their goods and services while limiting trips outside of their residence. Our project aims to study the effect of Covid-19 on consumer spending while taking into account relevant restrictions put in place by both state and national governments.

Within our study, we look at Covid-19 daily case rate and daily death rate as percent changes, and we focus on 12 types of consumer spending: total spending; accommodation and food service; arts, entertainment, and recreation; general merchandise and apparel; grocery and food store; health care and social assistance; transportation and warehousing; retail with grocery; retail without grocery; consumers living in high median income ZIP codes; consumers living in low median income ZIP codes; and consumers living in middle median income ZIP codes. Additionally, we hold eight common restrictions: close school, close workplace, cancel public events, restrict gatherings, close public transport, stay at home requirement, restrict internal movements, and international travel control.

For our analysis, we use panel data models with state and month fixed effects. We believe that using panel data will give us the most accurate representation of consumer spending over time. Using data from the Opportunity Insights Economic Tracker and the Coronavirus

Government Response Tracker, we study the effects of Covid-19 case and death rates on consumer spending. Additionally, we examine the restrictions that impact consumer spending.

Since March, Covid-19 has been a topic of relevance to many researchers in the United States. We first perform a literature review focusing on topics similar to ours in order to gain ideas, insight, and a better understanding of our topic. Next, we use our knowledge along with knowledge acquired from our review to build the most robust model possible to analyze our data. We decide to use a panel data model with fixed effects as our base model, and we run 12 versions of this model, substituting in our spending variables as the dependent variable. Afterwards, we perform a robustness check on our model to confirm that it is the strongest one we could have built using the data we collected.

From our results, we conclude that Covid-19 case and death rates have a statistically significant impact on consumer spending across all categories. We conclude that an increase in Covid-19 case rate is associated with a decrease in consumer spending. Furthermore, an increase in Covid-19 death rate is associated with a decrease in consumer spending across most categories with the exception of general merchandise and apparel, retail without grocery, and consumers in low median income zip codes, which were associated with an *increase* in consumer spending. Relevant restrictions include closing public transport, which, on average, had the greatest positive effect on consumer spending and school and work closing which, on average, had the greatest negative effect on consumer spending.

Finally, we evaluate the fit and implications of our model. We find that our model fits the data well with adjusted R-squared values ranging from 0.73-0.87 on average. We consider implications of our model such as the panel data model assumption and omitted variable bias;

however, we note that omitted variable bias is unlikely due to the relatively high adjusted R-squared values. We end our study by considering potential future work of interest.

## Literature Review

Since March, the beginning of Covid-19 in the United States, there have been numerous ongoing studies looking at the impact of Covid-19 on consumer spending. Each study looks at consumer spending, in addition to additional factors, from a unique lens. As Econ 203 students, our ultimate goal is to use these studies to gain insight and ideas to tweak, modify, and explore our data. In a recently revised November 2020 study entitled "How did Covid-19 Affect Spending and Employment?" from the National Bureau of Economics (NBER), researchers Chetty, Friedman, Hendren, and Stepner use the same data we collected from The Opportunity Insights Team in order to analyze the impact of Covid-19 on consumer spending, business revenues, and employment rates to overall measure how Covid-19 affected the economy. The data collected was disaggregated by ZIP code, industry, income group, and business size. Using county fixed effects, the researchers conclude that high-income individuals, particularly those residing in areas of high rates of Covid-19 infection, substantially decreased their spending causing the reduction of revenues of small businesses in affluent ZIP codes. While this study looks at three key indicators in conjunction with Covid-19, our project chooses to focus on consumer spending. Like this study, we too include the spending habits of high, medium, and low income ZIP codes. Our study dives deeper into consumer spending patterns, and we add nine additional consumer spending categories to analyze spending patterns in relation to Covid-19. We perform our analysis using state, rather than county, fixed effects (Chetty et al., 2020).

In our analysis, we look at 12 types of consumer spending. In relevance to our study, an NBER study entitled "How Does Household Spending Respond to an Epidemic? Consumption During the 2020 COVID-19 Pandemic" by researchers Baker, Farrokhnia, Meyer, Pagel, and Yannelis explores individual household Covid-19 spending patterns during weekly periods between February 26 and March 27. The researchers focus on individual household financial data from a personal financial website and conclude that users' spending was radically altered across major categories, such as services, food and restaurants, and transportation. They also noted there was a sharp increase in spending, particularly in retail, credit card spending, and food items. However, they reported a sharp decrease in overall spending as the pandemic continued. Their study is similar to ours in the sense that they looked at categories of consumer spending. Unlike our study, the researchers broke spending down by the severity of the outbreak in each state. Although our research project does not take demographic information such as age, education, family size, and the number of children, as they did, we do take additional restriction variables into consideration instead, such as school and work closings and restrictions on movements (Baker et al. 2020).

A key component of our project is studying the effects of restrictions, such as school and work closings and a stay at home requirement, on consumer spending in relation to Covid-19 rates. As part of our analysis, we include eight common restrictions as independent dummy variables. A relevant NBER study entitled "The Cost of the Covid-19 Crisis: Lockdowns, Macroeconomic Expectations, and Consumer Spending" conducted by researchers Coibion, Gorodnichenko, and Weber focuses on how differential timing of lockdowns due to Covid-19 causally affects households' spending. This study looked at the effect of the timing of lockdowns on consumer spending through the lens of a customized survey with 10,000 respondents. The

researchers found that aggregate consumer spending dropped by 31 log percentage points with the largest drops in travel and clothing. While this study looks at lockdowns rather than restrictions, it resembles our project in the sense that the researchers looked at the effect of Covid-19 on spending patterns within 13 various spending categories taking lockdowns into account. In our research project, we use this idea to create models using separate spending categories and to study how certain restrictions further effect spending during Covid-19. Since we are using data collected from credit/debit usage, our spending categories as well as data differs than the survey analysis conducted here. This study was also published in May 2020, which was mid-pandemic with lockdowns and restrictions still in place in many states. Our data spans from the beginning of Covid-19 in the United States until mid November 2020, so our analysis takes place over a longer period of time with a greater number of restrictions (Coibion et al. 2020).

## Economic Model

Within our analysis we considered the effect of Covid-19 on consumer spending holding restriction dummy variables constant. Our data was panel data consisting of 11,936 daily observations in all 50 states across the United States plus Washington D.C. We considered 12 unique types of spending, listed in our introduction, and studied the impacts of both Covid-19 case and death rates. Our expectation is that the increase in both Covid-19 case rates and death rates respectively will negatively impact consumer spending across all 12 spending categories. The purpose of our distinctive spending categories was to measure the differences in the extent of the changes in spending patterns between categories. We chose to separate our data into spending categories and analyze differences between them because there are some types of

spending that are essential to life and others which are nonessential. Although we continue to predict Covid-19 case and death rates to have a negative impact on consumer spending throughout all categories, we expect that consumer spending will decline less for essential goods and services, such as grocery food and store, and we expect it to decline more for nonessential goods and services, such as art, entertainment, and recreation.

As previously mentioned, our data includes 50 U.S. states plus Washington D.C. along with daily observances of spending patterns, Covid-19 rates, and common state wide restrictions. We chose independent variables which we believed would have the greatest impact on consumer spending, our dependent variable, over the time period from March to November. Our key independent variables in our model are Covid-19 case rate and Covid-19 death rate. By utilizing natural log transformations of our Covid-19 related variables, we are able to interpret effects of Covid-19 as percent changes. Our second set of independent variables are a group of common restrictions, previously listed in the introduction, formatted as dummy variables (0 if the restriction is not in place or partially in place; 1 if the restriction is fully in place). By turning restrictions into dummy variables, our model will be able to easily add or subtract relevant restrictions from while holding them constant.

Lastly, we choose to include month and state fixed effects in our model. We do this because our model tracks a large set of observations over time and we want to be able to control for potentially omitted variables that may differ across states but remain constant over time. By incorporating fixed effects into our model, we are choosing to use a panel data model. With this model, we keep the panel data model assumption in mind. In order to control for omitted variable bias, we assume that our chosen fixed effects, month and state, vary across spending categories but are constant over time.

Our initial analysis is based on a set of 12 regressions relative to consumer spending categories, previously listed in the introduction. Our dependent variable consumer spending is portrayed as percent changes relative to spending between January 4-31, a time period before the pandemic. In each of the 12 regressions we substitute one type of consumer spending as the dependent variable. The equation of the model we chose to use on each spending variable follows:

*(Spending variable)it = B0 + B1(ln(Covid-19 case rate))it + B2(ln(Covid-19 death rate))it + B3(restriction DVs)it + B4(fixed effects)i + eit*

As previously mentioned, our expectation is that the increase in both Covid-19 case and death rates respectively would negatively impact consumer spending across all 12 spending categories. Specifically, we hypothesize the coefficients on our X-variables, both the logs of Covid-19 case and death rates and the restriction dummy variables, to be strictly negative. The intuition follows that as the Covid-19 case and death rates increase, with fixed effects and holding restrictions constant, consumer spending across all 12 models will decrease.

## Data

We collected our data from two main sources. We collected daily data on Covid-19 case and death rates as well as daily data on consumer spending from the Opportunity Insights Economic Tracker. We used the Coronavirus Government Response Tracker to accumulate daily data on restrictions put in place by state governments over the course of the pandemic. In total, we collected 11,936 observations from March 11, 2020, the date the World Health Organization declared Covid-19 a global pandemic, to November 22, 2020, the date of our data collection, differentiated by state, month, day, and year. Figure 1 (Appendix) lists the descriptive statistics associated with each described variable. A heat map is used on this table in order to draw

attention to extreme, and potentially notable, values. It is important to add that the heat maps are separated by column (mean, standard deviation, min/max) and split into three subsections: spending variables, Covid-19 variables, and restriction DVs with the restriction index left out. This is to ensure the heat maps accurately reflect relatively to subsets of data. Notable features, along with additional visualizations are provided in the breakdown that follows.

The dependent variables in our model consisted of 12 spending categories. We utilized aggregated and anonymized consumer data on credit and debit spending, collected by Affinity Solutions Inc. and provided to the Opportunity Insights Economic Tracker. We collect data disaggregated by state, month, day and year. The data consists of seasonally adjusted percent changes of credit and debit card spending relative to January 4-31, 2020, a substantial time period before the effects of Covid-19 in the United States. Figure 3 (Appendix) depicts the mean values of spending changes across our data collection period. Transportation and warehousing and arts, entertainment, and recreation experienced the largest changes in consumer spending, experiencing declines by 0.521 and 0.560 respectively.

The independent variables of interest in our model were daily Covid-19 case and death rates. We obtained daily data on Covid-19 case and death rate per 100,000 people, collected by the Opportunity Insights Economic Tracker from the New York Times Covid-19 Repository. To simplify our interpretations, we take the natural log of both the Covid-19 case rate and death rate. Because of this, the coefficients in our model can be interpreted as percent changes. The Covid-19 case rate had a mean percent change of -1.84%, while the Covid-19 death rate had a mean percent change of 1.93%.

Another key set of independent variables in our model were our eight restriction variables, listed in our introduction. Within our raw data, each restriction variable took on values

between 0 and either 2, 3, or 4. Within each restriction in the raw data, 0 signified no restriction set in place and the maximum value signified a statewide mandate of the restriction in place. Values in between 0 and the maximum were partial ranks of the restrictions which we take out next for simplicity. We set up our restriction variables as dummy variables to equal 1 if the highest statewide restriction was put into place and to equal 0 otherwise. As an example, the school closing restriction variable could take on possible values from 0-3. We set our school closing dummy variable to equal 1 if the original school closing restriction variable was equal to 3 (entire statewide school closure) and to equal 0 if the original school closing restriction variable was equal to 2 or less (both partial school closure and no school closure). We repeated this process for all eight restriction variables. Figure 2 (Appendix) depicts a visual representation of the mean of the dummy variable within each restriction category. It is relevant that school closings, restrictions on gatherings, and canceling public events had the highest rates of restriction with mean values of 0.65, 0.577, and 0.795 respectively. We also created a new variable called “restrictionindex” which measured the index (number) of restrictions out of eight total that were put into place (dummy variable equal to 1) within each observation. The purpose of this was to generalize restrictions as a whole to see if the number of restrictions affects consumer spending due to Covid-19 differently than each individual restriction. While we do not use this variable in our final model, we use it during our robustness check, so we note here that the average number of restrictions is 2.92 with a standard deviation of 1.72 restrictions.

## Empirical Results

Our results, detailed in Figures 4-6, align somewhat, but not completely, with our expectations of the effect of the Covid-19 case and death rate on various types of consumer

spending. We initially predicted that both case and death rate would negatively impact consumer spending across all categories. It turns out that Covid-19 case rate consistently negatively affects consumer spending across all categories, while Covid-19 death rate negatively affects consumer spending for most categories but positively affects consumer spending in some cases. Covid-19 death rate *positively* affects consumer spending on general merchandise and apparel, retail without grocery, and consumers in low median income zip codes, though only spending on retail without grocery is statistically significant. Consumer spending on retail without grocery is statistically significant at the 1 percent level meaning that a one-unit increase in the percentage of the Covid-19 death rate is associated with a 0.003 unit increase in consumer spending on retail without grocery.

When comparing Covid-19 case and Covid-19 death rate directly, the impact of case rate tends to be larger (further from zero) than the impact of death rate. This concludes that a one-unit change in deaths is smaller than a one-unit change in cases. It can further be implied that there is a larger effect on spending from an increase in the case rate than there is from an increase in the death rate.

The negative effect of Covid-19 case rate was most extreme within the arts, entertainment, and recreation category of spending (Figure 4, Appendix). A one-unit increase in the percentage of Covid-19 case rate is associated with a 0.024 unit decrease in arts, entertainment, and recreational spending at a statistically significant level. As the Covid-19 case rate increases, people are less likely to spend their money on arts, entertainment, and recreation. The negative effect of Covid-19 death rate was most extreme within the healthcare and social assistance spending category (Figure 4, Appendix). Here, a one-unit increase in the percentage of Covid-19 death rate is associated with a 0.020 unit decrease in healthcare and social assistance

spending at a statistically significant level. As the Covid-19 death rate increases, people are less likely to spend their money on healthcare and social assistance. Although we previously predicted the sign of this coefficient to be negative within our generalized prediction, we note that it is surprising that the amount of consumer spending on healthcare and social assistance decreases as the percentage of Covid-19 deaths increases.

While all eight restriction variables appear to be statistically significant in the majority of consumer spending categories, closing public transport had the largest *positive* effect on consumer spending in general. From Figures 4-6 (Appendix), we note that closing public transport had a statistically significant positive effect on all 12 of the spending variables aside from general merchandise and apparel, where the effect was still positive but not statistically significant. An increase in the closing of public transport is associated with an increase in consumer spending across all sectors. Intuitively, this makes sense because public transport is a common way for households to travel to purchase goods and services they may need. The closing public transport dummy variable had the greatest impact on consumers in middle median income zip codes (0.047). An intuition for this fact is that consumers in median income households tend to utilize public transportation the most, and are therefore most affected.

On the other end of the spectrum, the school closing and work closing restriction variables had the largest *negative* impact on consumer spending across all sectors. Referring back to Figures 4-6 (Appendix), school closing and work closing had a statistically significant effect on all 12 spending categories. An increase in the closing of schools is associated with a decrease in consumer spending, and an increase in the closing of workplaces is associated with a decrease in consumer spending. The signs of these coefficients align correctly with our predicted signs. We had predicted that as schools and workplaces close, students and workers would not

have to commute every day, and consumer spending would decrease. Our regressions prove this to be true at a statistically significant level.

Most of the adjusted R-squared values in the regression results (Figures 4-6, Appendix) lie within the 0.73-0.87 range. This means that our models were able to explain the majority of the variation in spending changes. A couple spending categories acquired adjusted R-squared values much lower than the previously mentioned range. Adjusted R-squared values were particularly low in arts, entertainment, and recreation (0.497), healthcare and social assistance (0.417), and grocery food and store (0.503). This implies that the fit of our models on these spending categories may have not been as fit as the others; however, it is important to note that the adjusted R-squared value is much less meaningful than statistical significance or economic intuition. Since our results in these three categories are statistically significant, it is hard to tell whether or not the adjusted R-squared had a negative impact on the fit of these models.

As a robustness measure on our model, we ran additional models with and without the natural log of Covid-19 case and death rates, using the restriction index variable rather than the eight single restriction dummy variables, and with alternate combinations of day, month, and state fixed effects, including models with no fixed effects. While we chose to run and display results from the model specified in the economic model section of our paper due to its effectiveness, below are samples for some of the models we ran during our robustness check:

- Model without natural log of Covid-19 variables:

  $(Spending\ variable)it = B0 + B1(Covid\text{-}19\ case\ rate)it + B2(Covid\text{-}19\ death\ rate)it + B3(restriction\ DVs)it + B4(fixed\ effects)i + eit$

- Model without natural log of Covid-19 variables or fixed effects:

  $(Spending\ variable)i = B0 + B1(Covid\text{-}19\ case\ rate)i + B2(Covid\text{-}19\ death\ rate)i + B3(restriction\ DVs)i + ei$

- Model using restriction index rather than restriction DVs:

  *(Spending variable)it = B0 + B1(ln(Covid-19 case rate))it + B2(ln(Covid-19 death rate))it + B3(restriction index)it + B4(fixed effects)i + eit*

Since we used panel data models to estimate the effect of our variables, we had to make the assumption that our chosen fixed effects varied across spendings but were constant over time. We ran different regressions with month and state fixed effects in order to control for those differences in spendings, and this approach allowed us to control for such unobserved heterogeneity and to eliminate omitted variable bias. Most of our adjusted R-squared in regression results are in the 0.73-0.87 range, meaning that our models were able to explain the majority of the variation in spending changes, and omitted variable bias is unlikely to have occurred.

## Conclusion

Our models show that Covid-19 case and death rates, holding state restriction variables constant, do indeed have an effect on various types of consumer spending at a statistically significant level. While a few relationships in our regressions were not statistically significant, a compelling majority of relationships proved to be statistically significant. We concluded that an increase in the percentage of Covid-19 case rate is associated with a decrease in consumer spending across all categories at a statistically significant level. Additionally, an increase in the percentage of Covid-19 death rate is associated with an increase in consumer spending on general merchandise and apparel, retail without grocery, and consumers in low median income zip codes, and it is associated with a decrease in consumer spending in all other spending categories. Focusing on our eight restriction variables, closing public transport had the greatest

positive effect on consumer spending across all categories, and school and work closings had the greatest negative effect across those same categories.

While our model proved itself to be quite successful, with adjusted R-squared values ranging from 0.73-0.87 on average, there are a few notable implications of our findings. In order to run our model, we rely on the panel data model assumption. In order to control for omitted variable bias, we had to assume that our chosen fixed effects, month and state, varied across spending categories but were constant within each category over time. We acknowledge that this may not be the case as each month's effect varies across states but may not be consistent for each state during each month. We also note that due to the relatively high adjusted R-squared values throughout our models, omitted variable bias is unlikely to have occurred.

Although we feel that we experimented with many of the potential combinations and transformations of variables within our current dataset, a future study could include additional control variables, such as each state's political leaning, geography, and accessibility on top of our current model. These factors may explain differences in people's spending changes from more in-depth and diverse perspectives. Another research idea on a more global level would be to look at the effect of Covid-19 on spending in other countries compared to the U.S. by comparing changes in overall GDP, imports, and exports. Such a study would include even more variation in estimated results. It would be interesting and necessary to include more control variables such as demography, technological development, and currency exchange rates relative to the U.S.

## Appendix

Figure 1: Descriptive statistics shown with relative heat maps

| | Variable | Mean | Std. Dev. | Min. | Max. |
|---|---|---|---|---|---|
| Y Variables | Total spending (%) | -0.091 | 0.11 | -0.508 | 0.215 |
| | Accommodation and food service (%) | -0.388 | 0.161 | -0.951 | 0.03 |
| | Arts, entertainment, and recreation (%) | -0.56 | 0.148 | -1.27 | 0.864 |
| | General merchandise and apparel (%) | -0.132 | 0.177 | -0.712 | 0.41 |
| | Grocery and food store (%) | 0.137 | 0.121 | -0.538 | 1.12 |
| | Health care and social assistance (%) | -0.246 | 0.221 | -2.07 | 1.68 |
| | Transportation and warehousing (%) | -0.521 | 0.116 | -1.05 | 0.113 |
| | Retail with grocery (%) | 0.084 | 0.096 | -0.286 | 0.516 |
| | Retail without grocery (%) | 0.062 | 0.128 | -0.372 | 0.559 |
| | Consumers in high median income zip codes (%) | -0.117 | 0.135 | -0.778 | 0.787 |
| | Consumers in middle median income zip codes (%) | -0.08 | 0.138 | -0.7 | 0.553 |
| | Consumers in low median income zip codes (%) | -0.089 | 0.112 | -0.67 | 0.295 |
| X Variables | ln (Covid-19 case rate) (%) | -1.84 | 1.13 | -7.62 | 1.62 |
| | ln (Covid-19 death rate) (%) | 1.93 | 1.43 | -6.06 | 5.2 |
| | School closing DV | 0.65 | 0.477 | 0 | 1 |
| | Work closing DV | 0.136 | 0.343 | 0 | 1 |
| | Cancel public events DV | 0.577 | 0.494 | 0 | 1 |
| | Restrictions on gatherings DV | 0.795 | 0.403 | 0 | 1 |
| | Close public transport DV | 0.091 | 0.288 | 0 | 1 |
| | Stay at home requirement DV | 0.236 | 0.424 | 0 | 1 |
| | Restrict internal movement DV | 0.253 | 0.435 | 0 | 1 |
| | International travel control DV | 0.182 | 0.386 | 0 | 1 |
| | Restriction index | 2.92 | 1.72 | 0 | 8 |

Figure 2: Distribution of means of restriction variables

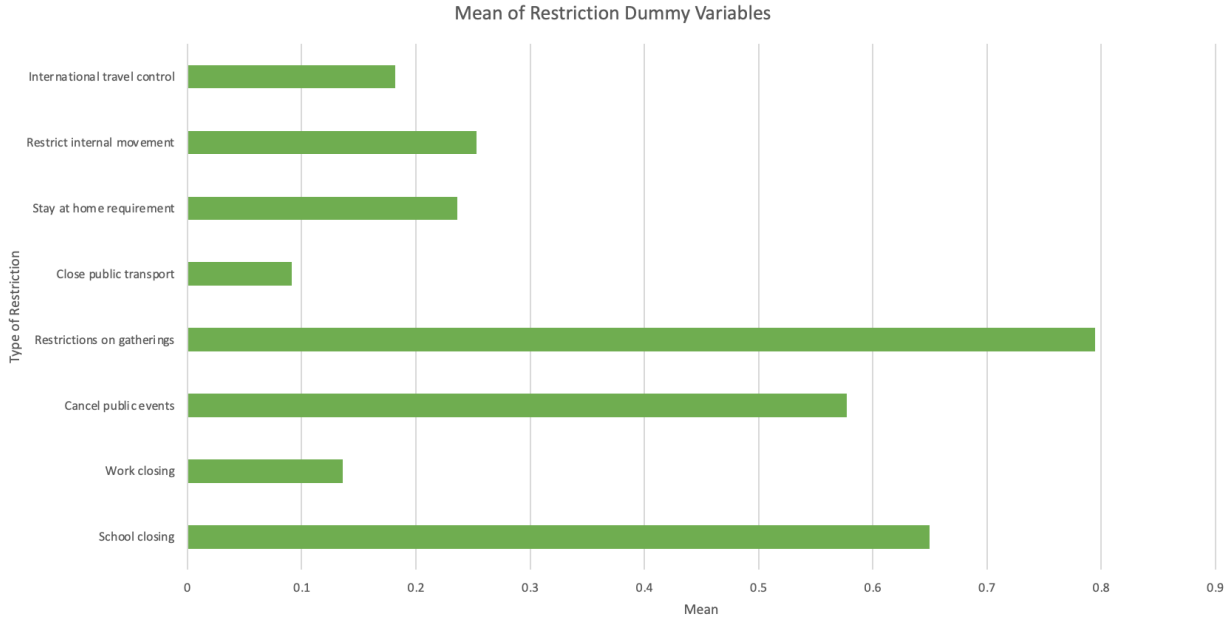


Figure 3: Mean spending distribution by spending category

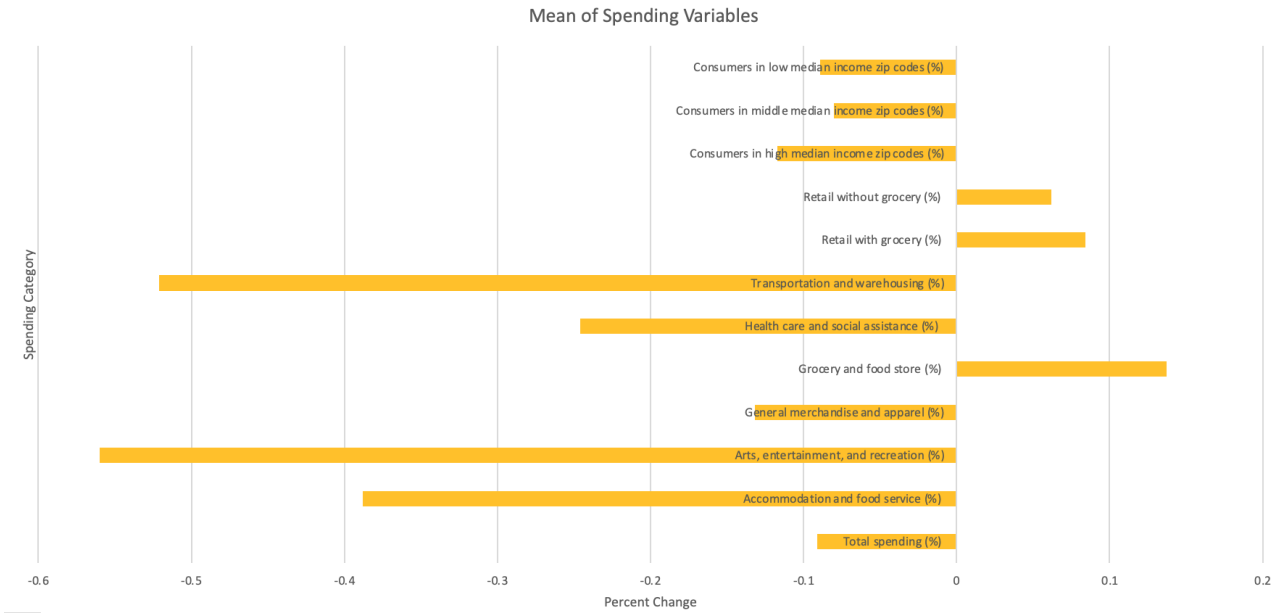

Figure 4: Spending categories with fixed effects -miscellaneous categories (table 1 of 3)

| Spending (Y) variable | Arts, entertainment, and recreation (%) | General merchandise and apparel (%) | Transportation and warehousing (%) | Health care and social assistance (%) |
|---|---|---|---|---|
| ln(Covid-19 case rate) (%) | -0.024**<br>(0.002) | -0.018**<br>(0.001) | -0.014**<br>(0.001) | -0.020**<br>(0.003) |
| ln(Covid-19 death rate) (%) | -0.002<br>(0.002) | 0.001<br>(0.001) | -0.006**<br>(0.001) | -0.009**<br>(0.003) |
| School closing DV | -0.027**<br>(0.004) | -0.57**<br>(0.003) | -0.041**<br>(0.002) | -0.035**<br>(0.006) |
| Work closing DV | -0.024**<br>(0.004) | -0.046**<br>(0.003) | -0.018**<br>(0.002) | -0.045**<br>(0.007) |
| Cancel public events DV | -0.001<br>(0.003) | -0.020**<br>(0.002) | -0.001<br>(0.001) | 0.010**<br>(0.005) |
| Restrictions on gatherings DV | -0.009**<br>(0.004) | 0.013**<br>(0.003) | -0.013**<br>(0.002) | -0.007**<br>(0.006) |
| Close public transport DV | 0.017**<br>(0.007) | 0.008<br>(0.005) | 0.042**<br>(0.003) | 0.035**<br>(0.011) |
| Stay at home requirement DV | -0.041**<br>(0.004) | -0.020**<br>(0.003) | -0.033**<br>(0.022) | -0.061**<br>(0.007) |
| Restrict internal movement DV | -0.007**<br>(0.004) | 0.004<br>(0.003) | -0.012**<br>(0.002) | -0.007<br>(0.006) |
| International travel control DV | 0.021**<br>(0.005) | 0.034**<br>(0.004) | 0.005*<br>(0.002) | 0.021**<br>(0.008) |
| Monthdum1-7 | Yes | Yes | Yes | Yes |
| statefips | Yes | Yes | yes | Yes |
| # of obs. | 11,936 | 11,936 | 11,936 | 11,936 |
| Adj. R-squared | 0.497 | 0.805 | 0.808 | 0.417 |

Standard error follows coefficient in parentheses
Month and state fixed effects included
*Significant at the 5 percent level
**Significant at the 1 percent level

Figure 5: Spending categories with fixed effects - food related (table 2 of 3)

| Spending (Y) variable | Accommodation and food service (%) | Grocery and food store (%) | Retail with grocery (%) | Retail without grocery (%) |
|---|---|---|---|---|
| ln(Covid-19 case rate) (%) | -0.019*<br>(0.001) | -0.008**<br>(0.001) | -0.014**<br>(0.001) | -0.018**<br>(0.001) |
| ln(Covid-19 death rate) (%) | -0.0004<br>(0.001) | -0.006**<br>(0.001) | -0.0002<br>(0.001) | 0.003**<br>(0.001) |
| School closing DV | -0.060*<br>(0.002) | -0.029**<br>(0.003) | -0.017**<br>(0.002) | -0.014**<br>(0.003) |
| Work closing DV | -0.025*<br>(0.002) | -0.044**<br>(0.003) | -0.051**<br>(0.002) | -0.054**<br>(0.003) |
| Cancel public events DV | -0.014*<br>(0.002) | -0.001**<br>(0.002) | -0.005**<br>(0.002) | -0.006**<br>(0.002) |
| Restrictions on gatherings DV | -0.0003*<br>(0.002) | 0.013**<br>(0.003) | 0.010**<br>(0.002) | 0.009**<br>(0.002) |
| Close public transport DV | 0.037*<br>(0.004) | 0.024**<br>(0.005) | 0.022**<br>(0.004) | 0.022**<br>(0.004) |
| Stay at home requirement DV | -0.037*<br>(0.002) | -0.009**<br>(0.003) | -0.009**<br>(0.002) | -0.010**<br>(0.003) |
| Restrict internal movement DV | -0.012*<br>(0.002) | -0.005*<br>(0.003) | -0.007**<br>(0.002) | -0.006*<br>(0.002) |
| International travel control DV | 0.014*<br>(0.003) | 0.018**<br>(0.004) | 0.036**<br>(0.003) | 0.047**<br>(0.003) |
| monthdum1-7 | Yes | Yes | Yes | Yes |
| statefips | Yes | Yes | Yes | Yes |
| # of obs. | 11,936 | 11,936 | 11,936 | 11,936 |
| Adj. R-squared | 0.877 | 0.503 | 0.630 | 0.723 |

Standard error follows coefficient in parentheses
Month and state fixed effects included
*Significant at the 5 percent level
**Significant at the 1 percent level

Figure 6: Spending categories with fixed effects - median incomes and total (table 3 of 3)

| Spending (Y) variable | Consumers in low median income zip codes (%) | Consumers in middle median income zip codes (%) | Consumers in high median income zip codes (%) | Total Spending (%) |
|---|---|---|---|---|
| ln(Covid-19 case rate) (%) | -0.018**<br>(0.001) | -0.016**<br>(0.001) | -0.013**<br>(0.001) | -0.015**<br>(0.001) |
| ln(Covid-19 death rate) (%) | 0.007**<br>(0.001) | -0.001<br>(0.001) | -0.006**<br>(0.001) | -0.001<br>(0.001) |
| School closing DV | -0.023**<br>(0.003) | -0.028**<br>(0.002) | -0.030**<br>(0.002) | -0.028**<br>(0.002) |
| Work closing DV | -0.035**<br>(0.003) | -0.035**<br>(0.002) | -0.033**<br>(0.002) | -0.034**<br>(0.002) |
| Cancel public events DV | -0.003<br>(0.002) | -0.006**<br>(0.001) | -0.012**<br>(0.002) | -0.008**<br>(0.001) |
| Restrictions on gatherings DV | 0.006*<br>(0.003) | 0.003*<br>(0.002) | -0.002<br>(0.002) | 0.004**<br>(0.002) |
| Close public transport DV | 0.038**<br>(0.005) | 0.047**<br>(0.003) | 0.046**<br>(0.004) | 0.044**<br>(0.003) |
| Stay at home requirement DV | -0.023**<br>(0.003) | -0.021**<br>(0.002) | -0.007**<br>(0.002) | -0.018**<br>(0.002) |
| Restrict internal movement DV | 0.004<br>(0.003) | -0.002<br>(0.002) | -0.030**<br>(0.002) | -0.010**<br>(0.002) |
| International travel control DV | 0.039**<br>(0.003) | 0.023**<br>(0.002) | 0.013**<br>(0.003) | 0.026**<br>(0.002) |
| monthdum1-7 | Yes | Yes | Yes | Yes |
| statefips | Yes | Yes | Yes | Yes |
| # of obs. | 11,936 | 11,936 | 11,936 | 11,936 |
| Adj. R-squared | 0.735 | 0.819 | 0.755 | 0.833 |

Standard error follows coefficient in parentheses
Month and state fixed effects included
*Significant at the 5 percent level

| |
|---|
| **Significant at the 1 percent level |

## Works Cited


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