

The Effect of COVID-19 on Retail Market in the U.S.

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Abstract: This paper focus on the effect of COVID-19 on retail market, especially on the food sector, drug sector and grocery sector. We used panel data model with FE estimation to estimate the model. The result shows that the COVID-19 has positive impact on drug and grocery sectors, and negative impact on food sector. Also, our results indicate that retail market sales were highly responsive to COVID-19 media coverage and online content.

Keywords: COVID-19, retail sales, panel data, food, drug

I. INTRODUCTION

Many stores have been closed during the coronavirus pandemic, like drinking places, gym, etc. . Also, governments and company advocate to reduce social distance and work from home in order to decrease the spread of coronavirus in a large extent. Thus, the bevehavior and shopping preference of customers probably changed due to the public rules and environment during the coronavirus pandemic.

In this paper, we focus on the change of retail sales during the pandemic, analyzing the impact of many aspect of Covid-19, like the positive cases and death, on the retail sales. And our empirical study focus on how retail sales responds to the number of COVID-19 cases. We consider not only how the case counts affect the whole retial sales, but also what types of good benefit most from the increase in demand brought about by the pandemic.

II. DATA

we used data from several source to conduct our analysis: we get (1) the data of monthly retail sales from U.S. Census Bureau, (2) COVID-19 case and death counts from Centers for Disease Control and Prevention (CDC), (3) search data from the Google Trends data.

A. Monthly Retail Sales from U.S. Census Bureau

The monthly retail sales from U.S. Census Bureau contains the sales of each products store. This data includes a detailed category about all kinds of stores that customers could go in the daily life, like automobile dealers, home furnishings stores, grocery stores, pharmacies and drug stores, etc. We summary the detailed category into a general category: vehicle, furniture, grocery, drugs, commodity, food.

We constructed a treated sample using monthly retail sales and COVID-19 cases from January 1, 2020 to December 31, 2020. Then, we constucted a control sample using monthly retail sales from 2017, 2018, and 2019 that occurred during the same month range in order to account for seasonality. There are 289 observations in both samples combined.

The dependent variable is retail sales, the control variable is six dummy variables that indicate product category.

B. COVID-19 Case Counts

From CDC in the U.S., we obtained the number of cases of COVID-19 in each month between January 1, 2020 and December 31, 2020. We created measures of the monthly number of total cases and death, and the cumulative number of total cases and death, and merged the associated variables to the retail sales data.

C. COVID-19 Google Searches

Despite the data COVID-19 cases and death tells us the track of spread of coronavirus in the United States, they do not perfectly correlated to customer reaction to the spread of coronavirus. This is because there is a delay between when case/death reported and when customer learn about the infection rate in their local area. Thus, we obtained a variable that can better measure the customer reaction to the coronavirus --- web search activity on Google.com from the Google Trends data. The popularity of web searches "COVID-19", "Coronavirus", and "Coronavirus disease 2019" are used to measure the customers' reaction to coronavirus.

D. Descriptive Statistics

In table 1, we reported month-by-month changes in the number of case and death of COVID-19, and Google COVID-19 searches in US from January 1, 2020 to December 31, 2020. We notice that the number of positive cases and death have dramatically increased from March to April, which increase rate of positive case and death are 310% and 820%. Both monthly positive cases and monthly death claimed to peak in December. However, the trend of Google keyword search index is totally different from COVID-19 cases and death. Google keyword search index up sharply by March and slowly decreased, finally fluctuate between 350 and 480.

Table 1. The number of cases and death of COVID-19, Google COVID-19 searches in US, by month

Date in 2020	Month	COVID-19 cases and death				Google keyword search index
		monthly_death	total_death	monthly_case	total_case	
01/01 - 01/31	1	4	4	1049	1049	23
02/01 - 02/29	2	16	20	1181	2230	39
03/01 - 03/31	3	7096	7116	108420	110650	808
04/01 - 04/30	4	65270	72386	442529	553179	531

05/01 - 05/31	5	38201	110587	493802	1046981	464
06/01 - 06/30	6	17932	128519	854079	1901060	479
07/01 - 07/31	7	31014	159533	1015152	2916212	350
08/01 - 08/31	8	29753	189286	930584	3846796	376
09/01 - 09/30	9	19044	208330	977803	4824599	209
10/01 - 10/31	10	24605	232935	1437625	6262224	198
11/01 - 11/30	11	52677	285612	2764020	9026244	630
12/01 - 12/30	12	96959	382571	3752932	12779176	345

Table 2 shows that the mean and standard deviation for all variables during the COVID-19 period and the control period. We find that the retail sales nearly not change during the COVID-19 period.

Table 2. Sample statistics of analysis variables

Sample	Full sample(288)		COVID-19 period(72)		Non-COVID-19 period(216)	
	Mean	SD	Mean	SD	Mean	SD
Outcome variables						
retail sales	146831	115923.3	147961.3	123123.1	146454.2	113718
Measures of COVID-19 cases, death and information seeking						
monthly_death	7970.2	19416.6	31880.9	27402.8	0	0
total_death	37018.7	86164.9	148074.9	115477.3	0	0
monthly_case	266232.8	714542.8	1064931	1096048	0	0
total_case	901466.7	2490105	3605867	3895565	0	0
Google_keyword_search_index	92.8	195.7	371	223.8	0	0
Control variables						
food	0.17	0.4	0.17	0.4	0.17	0.4
drugs	0.17	0.4	0.17	0.4	0.17	0.4
grocery	0.17	0.4	0.17	0.4	0.17	0.4
vehicle	0.17	0.4	0.17	0.4	0.17	0.4
furniture	0.17	0.4	0.17	0.4	0.17	0.4
commodity	0.17	0.4	0.17	0.4	0.17	0.4

From Fig1., we notice that almost all of the sales of products have a significant change in 40th month which is during the coronavirus pandemic.

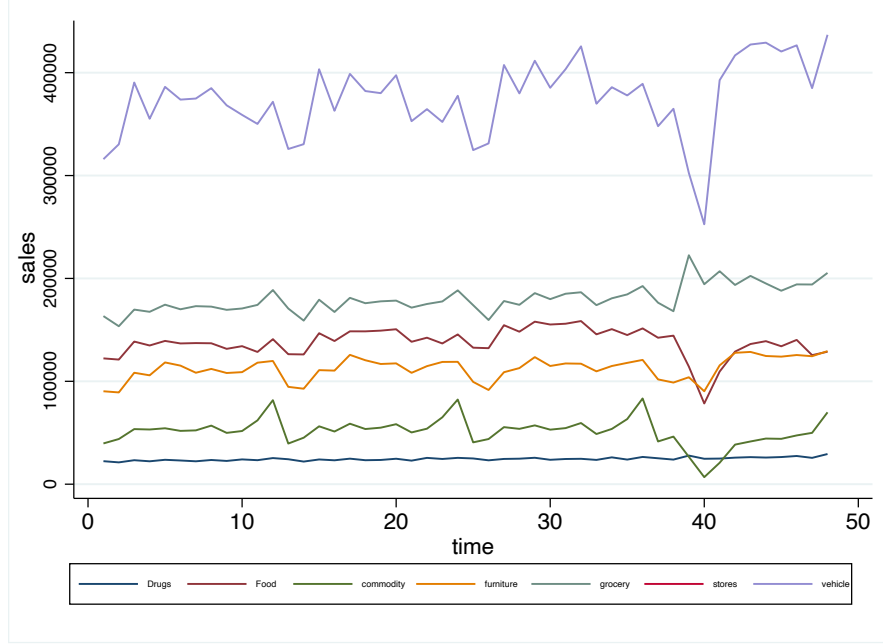


Fig 1. Monthly sales trend among product category

III. EMPIRICAL MODEL

We used panel data model to estimate the impact of COVID-19 on the retail sales in the United States. The ordinary least squares (OLS) estimating equation is:

$$Y_{it} = \alpha + \beta COVID19_{it} + \gamma X_{it} + c_i + \varepsilon_{it}$$

where Y_{it} is outcome variable for the retail sales in product i during month t . $COVID19_{it}$ is a continuous variable measuring one of the following during month t : the monthly number of COVID-19 cases/death, the total number of COVID-19 cases/death, or the Google keyword search index of COVID-19; X_{it} is the indicator variables for product category; c_i is a fixed effect for month; ε_{it} is time-varying unobserved factors. The parameter β estimate the impact on an additional case/death of COVID-19 on the outcome variable.

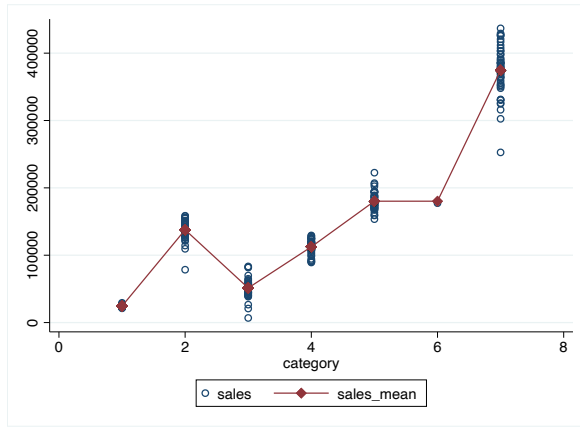
IV. ASSUMPTION

A. Strictly Exogenous

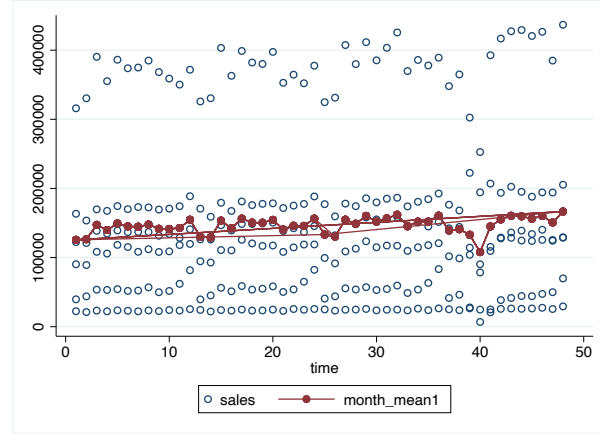
In this paper, the explanatory variables are the number of COVID-19 case/death which are totally uncorrelated with retail sales, so there is impossible that these variables are endogenous.

B. Heterogeneity

Fig 2. tells us that the unobserved variables that do not change over time and product category



(a) Heterogeneity across product category



(b) Heterogeneity across month

Fig 2. Heterogeneity

V. EMPIRICAL RESULTS

A. The effect of COVID-19 on total retail sales

Table 3. contains our fixed effect of the impact of COVID-19 on total retail sales. From the table, we notice that the estimated parameter of monthly death and Google search is not statistically significant, but other coefficients are statistically significant. Thus, an additional case of COVID-19 during a one-month timeframe increased retail sales increases about \$0.005 million per month; an additional case of total COVID-19 death increases about \$0.051 million per month.

Table 3. Effect of COVID-19 on total retail sales

Total retail sales			
	Coeff.	SE	Adj. R2
Monthly case	0.005***	0.001	0.98
Total case	0.002***	0.001	0.98
Monthly death	0.051	0.104	0.98
Total death	0.048***	0.014	0.98
Google search	-3.108	9.662	0.98
N·T		288	

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level.

B. The effect of COVID-19 on retail sales by product category

Food sales. In this paper, food sales includes the sales of food services, drinking places, restaurants and other eating places, which were easily affected by COVID-19. Table 4. contains the impact of COVID-19 on food sales. All coefficients in the table are statistically significant, especially Google search. As a result, we can conclude that, compared the cases and death of COVID-19,

Google search index has the largest impact on the food sales, which means that one additional unit increases in Google search leads to \$42.83 million decrease on food sales.

Drug sales. From table 4. we notice that COVID-19 has a positive impact on the sales of drugs. This is probably because people need to store anti-pandemic products, like mask, medical alcohol.

Grocery sales. In this paper, grocery sales contains the sales of grocery stores, supermarket, and food and beverage stores, which were probably affected by COVID-19. Table 4. tells us that one additional units Google search of COVID-19 during a one-month timeframe increased grocery sales increases about \$99.453 million per month.

In summary, from table 4., we can conclude that the COVID-19 has a positive effect on sales of drugs and grocery, a negative effect on food sales.

Table 4. Effect of COVID-19 on retail sales by product category

		Coeff.	SE	Adj. R2
Food sales	Monthly case	-0.005**	0.002	0.06
	Total case	-0.001**	0.0003	0.03
	Monthly death	-0.377**	0.18	0.28
	Total death	-0.044**	0.0145	0.08
	Google search	-42.830***	11.922	0.36
Drug sales	Monthly case	0.001***	0.0002	0.36
	Total case	0.0003***	0.0001	0.37
	Monthly death	0.045***	0.01	0.31
	Total death	0.011***	0.002	0.39
	Google search	4.456***	0.923	0.31
Grocery sales	Monthly case	0.020***	0.005	0.13
	Total case	0.006***	0.001	0.12
	Monthly death	0.836***	0.175	0.16
	Total death	0.188***	0.03	0.16
	Google search	99.453***	11.812	0.23
N·T			48	

Note: ***, **, * indicate significance at the 1%, 5%, and 10% level.

VI. CONCLUSION

By analyzing the retail sales performance, we find that COVID-19 pandemic has significantly impact on it. Specifically, one additional COVID-19 case/death increases lead to the retail sales in the United Stated increases about \$0.01 million.

The performance of sale of each product types are different from each other. In detail, drugs and grocery products experienced a large surge in demand, but the sales in resturant and drinking place plunged, which could be due to people's response to the coronavirus. Many food and drinking were

closed during COVID-19, and almost all people stay at home, and work from home, so people prefer to store more food and anti-pandemic product.

Our estimate of the effect of Google searchers mentions COVID-19 on the retail sales is larger than the change of COVID-19 cases and death, which consists with what we mentioned previously.

Our study probably has important implications to retail market. For food stores, the store owners can increase their revenues through delivery service or pick-up service to fight against the business environment changes by COVID-19.

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