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The Impact of COVID-19 on US Consumer Spending: Quantitative Analysis Using High-Frequency State-Level Data

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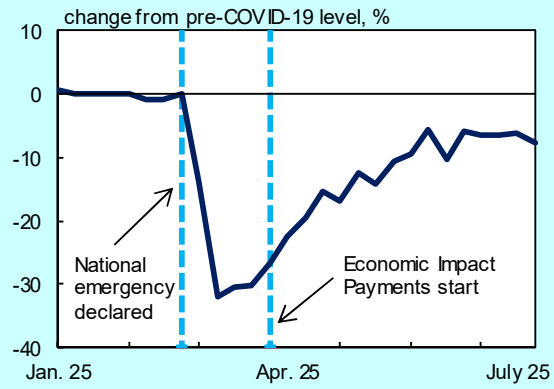
According to macroeconomic statistics, consumer spending in the United States, after falling sharply due to the COVID-19 pandemic along with the strict public health measures, has started to increase again since May. However, a closer look at high-frequency data shows that the pace of recovery in consumer spending has slowed since the latter half of June, when new infections began to increase again. Using weekly state-level panel data, this study quantitatively examines the impact of various factors that have affected US consumer spending during the pandemic. The empirical results suggest that US consumer spending has been (1) strongly affected by the strict public health measures such as the stay-at-home orders put in place, (2) pushed down by the renewed increase in new infections since the latter half of June, and (3) boosted to some extent by fiscal measures such as the Economic Impact Payments.

Introduction

Consumer spending in the United States fell sharply from March to April due to the spread of the novel coronavirus along with the strict public health measures. While monthly macroeconomic statistics suggest that consumer spending has been on an increasing trend again since May, weekly credit and debit card spending data, which make it possible to examine spending trends in a more detailed and timely manner, indicate that the pace of recovery has slowed since the latter half of June (Chart 1).

[Chart 1] Credit and Debit Card Spending



Note: Figures are seasonally adjusted. The pre-COVID-19 level is the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).
Source: Opportunity Insights.

In a situation such as the current one, where economic activity fluctuates substantially over a short period of time, it is useful to employ non-conventional high-frequency data in addition to conventional macroeconomic statistics in order to grasp the current state of the economy in a timely manner. In fact, the Federal Reserve also assesses the current situation referring to high-frequency data. For example, Chairman Powell stated at the press conference after the Federal Open Market Committee meeting held in July that "some measures of consumer spending based on debit card and credit card use ha[d] moved down since late June." Against this background, this study examines recent developments in US consumer spending using weekly credit and debit card data as a proxy indicator. Furthermore, using detailed weekly panel data by state and merchant category, the study examines differences in consumer spending across states and merchant categories to empirically investigate the impact of the strict public health measures introduced since March, the large-scale income compensation policies (Economic Impact Payments [1]), and increases in the number of new infections on consumption.

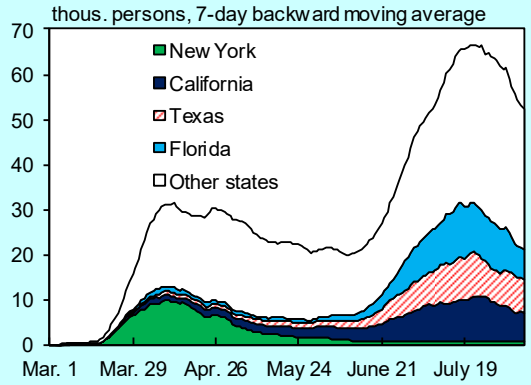
US Consumer Spending Trends Based on Weekly Data

Impact of the pandemic on consumer spending

The number of COVID-19 infections in the United States rose sharply from mid-March and then started to decline at the beginning of April due to the impact of strict public health measures such as stay-at-home

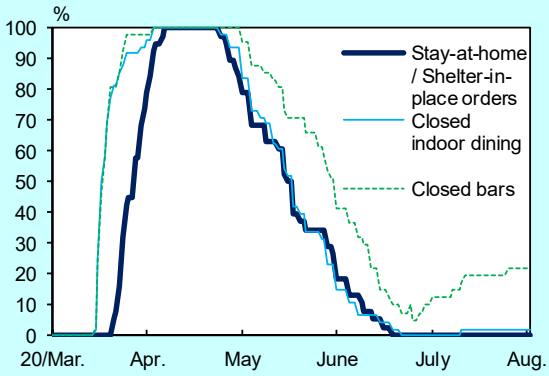
orders (Charts 2 and 3). However, as the strict public health measures were gradually lifted on a state-by-state basis, new COVID-19 cases increased sharply again, especially in the south and the west of the country. For the United States as a whole, they reached a new peak in late June, although recently (as of writing) they have started to decrease again.

[Chart 2] New COVID-19 Cases



Source: CEIC.

[Chart 3] Implementation of Public Health Measures

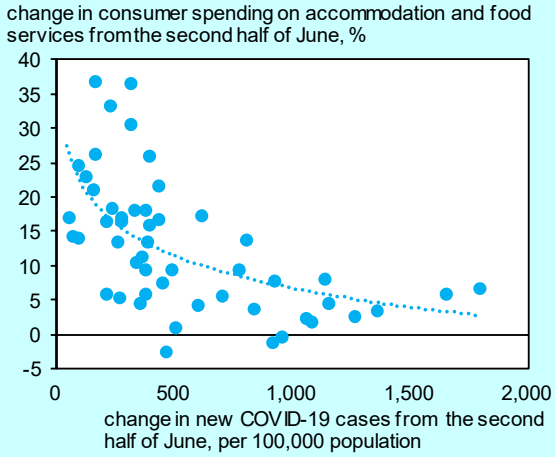


Note: The chart shows the share of states implementing each policy in the US. The figures are the aggregate share of states in which a particular measure was ordered by the state government.

Source: Raifman, Julia, Kristen Nocka, David Jones, Jacob Bor, Sarah Lipson, Jonathan Jay, and Philip Chan, "COVID-19 US State Policy Database," Available at: www.tinyurl.com/statepolicies, 2020.

Regarding the impact of the pandemic on consumer spending, Chart 1 suggests that the introduction and subsequent lifting of strict public health measures have had a substantial impact. In addition, the slowdown in consumer spending since the latter half of June suggests that even without strict measures such as stay-at-home orders the renewed increase in new infections is pushing down consumer spending. In fact, weekly data by state show that the larger the increase in infections since the latter half of June, the weaker consumer spending -- especially on face-to-face services -- tends to be (Chart 4). Likely reasons for this include that, in response to the renewed surge in infections, (1) a number of states have reintroduced targeted public health measures (Chart 3), and (2) households have become more cautious and have voluntarily refrained from buying goods and services (Chart 5).

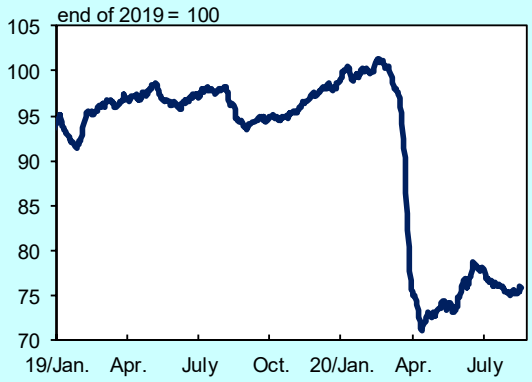
[Chart 4] New COVID-19 Cases by State and Consumer Spending



Note: Figures for consumer spending on accommodation and food services are calculated based on credit and debit card spending.

Source: Opportunity Insights.

[Chart 5] Daily Consumer Confidence Data

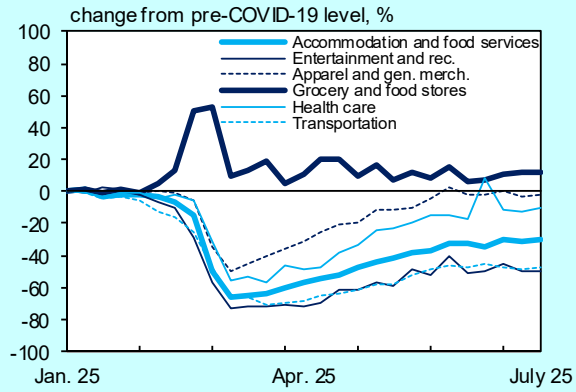


Note: The latest figure is for August 11.

Source: Morning Consult.

The pandemic and the associated public health measures have led to a large drop in sales in many merchant categories. In particular, spending on accommodation and food services, transportation, and entertainment and recreation has decreased significantly (Chart 6). One possible reason for this is that as infections spread, people tended to refrain from discretionary spending and spending on face-to-face services.

[Chart 6] Credit and Debit Card Spending by Merchant Category



Note: Figures are seasonally adjusted. The pre-COVID-19 level is the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).

Source: Opportunity Insights.

Thus, trends in consumer spending as the pandemic spread differ greatly by state and merchant category. Therefore, when examining the impacts of the pandemic and the public health measures as well as that of fiscal policies such as the Economic Impact Payments, the state- and merchant category-level data is helpful to identify the quantitative effects and their transmission channels.

Understanding the quantitative effects through econometric analysis

Therefore, using a panel dataset consisting of weekly data by state and merchant category, this study attempts to quantitatively grasp the features of recent developments in consumer spending. [2] Specifically, in addition to analyzing overall consumer spending by state, data on spending by merchant category is used to examine the variation in the impact of the pandemic on different merchant categories. The independent variables in the econometric analysis are (1) variables representing the strict public health measures (a dummy for the state of emergency and a dummy for stay-at-home/shelter-in-place orders), (2) the number of new infections, and (3) the amount of the Economic Impact Payments. Details of the econometric analysis are provided in the box.

Decomposition of consumer spending

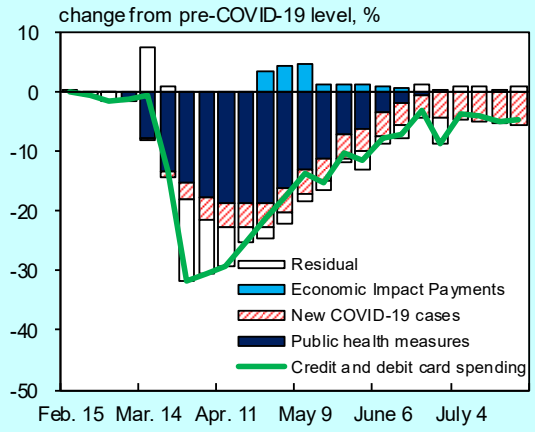
Based on the results of the empirical analysis, changes in consumer spending are decomposed into the above three factors. The results of this decomposition show the following (Chart 7):

(1) The strict public health measures pushed down consumer spending substantially. In particular, the stay-at-home orders pushed down consumer spending by about 20 percent.

(2) Moreover, even without strict public health measures, the increase in new infections reduced consumer spending considerably. In particular, even without the reintroduction of strict public health measures, the increase in the number of infections since the latter half of June has slowed the pace of pickup in consumer spending.

(3) Furthermore, the Economic Impact Payments pushed up consumer spending by up to 5 percent for some time after the start of the payments. In particular, the results suggest that the payments played a major role in the pickup of consumer spending since the end of April.

[Chart 7] Decomposition of US Consumer Spending



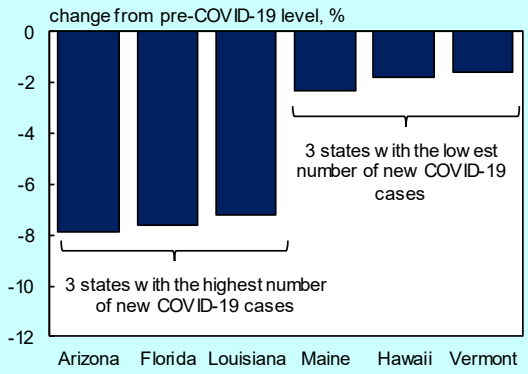
Notes: 1. Figures are seasonally adjusted. The pre-COVID-19 level is the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).
2. Figures are the averages of the contribution of each factor in individual states after missing data mainly due to the lack of data on public health measures in some states are excluded.

Sources: Opportunity Insights; Internal Revenue Service; Raifman, Julia, Kristen Nocka, David Jones, Jacob Bor, Sarah Lipson, Jonathan Jay, and Philip Chan, "COVID-19 US State Policy Database," Available at: www.tinyurl.com/statepolicies, 2020.

Impact by state

According to the estimation results, the variation in the decline in consumer spending by state can to a large extent be explained by differences in the number of new infections. For example, in southern and western regions (Arizona, Florida, etc.), where the number of new infections was high in the observation period, consumer spending seems to have been pushed down by up to 8 percent (Chart 8). On the other hand, in some states (such as Hawaii and Vermont), where the pandemic had subsided, consumer spending seems to have been pushed down by only around 2 percent.

[Chart 8] Impact of New COVID-19 Cases by State



Notes: 1. Figures are the change from the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).
2. Figures are obtained by multiplying the average of new COVID-19 cases (per 100,000) for the period from the second half of June to the end of July with the estimated regression coefficients in order to quantify the effect of new COVID-19 cases on consumer spending by state.

Sources: Opportunity Insights, etc.

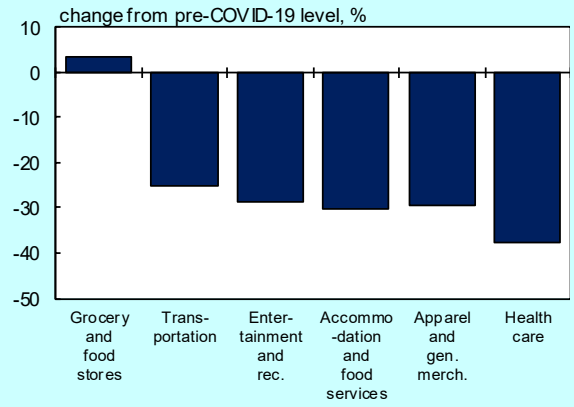
While these estimation results do not allow specifying the mechanism by which the increase in new infections reduces consumer spending, the decline, as mentioned above, is likely the result of the fact that (1) states that saw an increase in infections reintroduced targeted public health measures, and (2) in regions with a large number of infections, the recovery in consumer confidence tended to be weaker and hence people voluntarily refrained from leaving home. [3]

Impact by merchant category

Finally, the two major findings of examining the impact on consumer spending by merchant category are as follows. First, while the strict public health measures such as the stay-at-home orders helped to curb the spread of infections, the impact on consumer spending, as expected, has been substantial. Specifically, the estimates suggest that, except for grocery and food stores, consumer spending in many merchant categories was pushed down by 20 to 40 percent (Chart 9).

Second, the impact of the increase in new infections differs substantially across merchant categories. This is quite different from the impact of the stay-at-home orders, which had a large impact on all merchant categories except for grocery and food stores. Specifically, in merchant categories that involve face-to-face services, such as accommodation and food services, entertainment and recreation, and transportation, an increase in the number of new infections had a large impact in terms of pushing down sales. The exceptions were grocery and food stores, apparel and general merchandise stores, and health care (hospitals, etc.), where the impact was much smaller than in the other merchant categories (Chart 10).

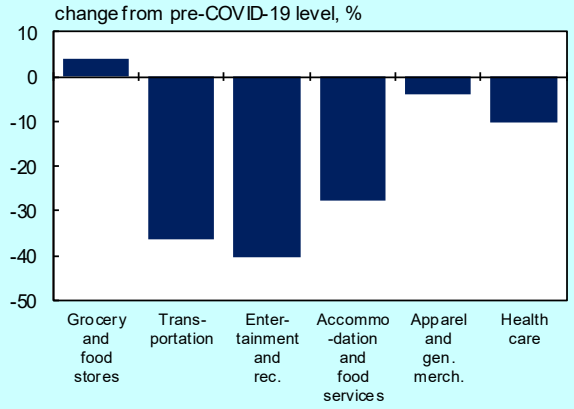
[Chart 9] Impact of Stay-at-Home/Shelter-in-Place Orders by Merchant Category



Notes: 1. The chart shows the estimated regression coefficients for the stay-at-home/shelter-in-place order dummy by merchant category as the effects of the stay-at-home/shelter-in-place orders on consumer spending by merchant category.
2. Figures are the change from the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).

Sources: Opportunity Insights, etc.

[Chart 10] Impact of New COVID-19 Cases by Merchant Category



Notes: 1. Figures are the change from the average for the period from January 4 to 31 (i.e., before the outbreak of COVID-19).
2. Figures are obtained by multiplying the average of new COVID-19 cases (per 100,000) for the period from the second half of June to the end of July with the estimated regression coefficients in order to quantify the effect of new COVID-19 cases on consumer spending by merchant category.

Sources: Opportunity Insights, etc.

BOX　Framework of the Empirical Analysis and Estimation Results

The empirical analysis in this study quantitatively examines the impact of the pandemic, the strict public health measures, and the Economic Impact Payments using weekly panel data by state and merchant category (Box Chart 1). In the analysis, a fixed effect model is used to control for state individual effects such as their economic structure.

【Box Chart 1】Framework

Observation period	January 18 - July 25
Dependent variable	Credit and debit card spending (Change from the average for the period from January 4 to 31)[1] (1) by state (2) by state and by merchant category
Independent variables	Four variables at the state level (1) Emergency declaration dummy[2] — The dummy for the emergency declaration takes 1 for the period from the declaration of a state of emergency until the issuance of stay-at-home/shelter-in-place orders in each state, and 0 for other periods. (2) Stay-at-home/Shelter-in-place order dummy — The dummy for stay-at-home/shelter-in-place orders takes 1 when such an order applied to a state, and 0 for other periods. (3) New COVID-19 cases — The variable is calculated as the log of the number of new COVID-19 cases per 100,000 population plus 1 in order to estimate the elasticity of consumer spending with regard to new COVID-19 cases. (4) Economic Impact Payments[3] — The variable is the total amount of the Economic Impact Payments in each state divided by the annualized value of total household nominal income in each state in 2019/Q4. In addition, each regression includes one-, two-, and three-week lags of the variable to allow for lags in policy transmission.

Notes: 1. Obtained from Opportunity Insights. The data capture nearly 10 percent of all credit and debit card spending in the United States, which makes up approximately 50 percent of the total personal consumption expenditure recorded in national accounts. Chetty *et al*. (2020) show that the credit and debit card data closely tracks patterns in personal spending data in national accounts. Comparison with nationally representative statistics, however, shows that certain goods categories where payment by credit or debit card is common are overrepresented. For instance, in the credit and debit card data, accommodation and food services as well as clothing account for larger spending shares and motor vehicles for a smaller share than in nationally representative consumption statistics. The data for new COVID-19 cases is also obtained from Opportunity Insights.
2. Information on public health measures implemented in each state in response to COVID-19 is obtained from https://github.com/KristenNocka/COVID-19-US-State-Policy-Database.
3. Figures are converted into weekly data through linear interpolation using Internal Revenue Service data.

The empirical results for the state-level data show that the coefficients on (1) the emergency declaration dummy and the stay-at-home/shelter-in-place order dummy, (2) new COVID-19 cases, and (3) the Economic Impacts Payments are statistically and economically significant (Box Chart 2). In addition, they are very similar to those obtained in other studies such as Chetty *et al*. (2020) and Baker *et al*. (2020a, 2020b). While not shown here, the estimation results by merchant category are similarly statistically and economically significant.

BOX　Framework of the Empirical Analysis and Estimation Results (cont'd)

【Box Chart 2】Estimation Results

Independent variables			
(1) Strict public health measures			
Emergency declaration dummy	-0.129 ***	-0.139 ***	-0.133 ***
	(0.009)	(0.009)	(0.010)
Stay-at-home/Shelter-in-place order dummy	-0.195 ***	-0.173 ***	-0.188 ***
	(0.007)	(0.007)	(0.006)
(2) New COVID-19 cases			
Log (1+number of new COVID-19 cases per 100,000 population)		-0.022 ***	-0.022 ***
		(0.003)	(0.004)
(3) Economic Impact Payments (ratio to the annualized value of nominal income)			
1-week lag			3.894 ***
			(0.775)
2-week lag			4.243 ***
			(1.372)
3-week lag			4.147 **
			(1.575)
Individual effect			
State dummies	yes	yes	yes
Number of observations	1083	1003	923
Adjusted-R^2	0.588	0.617	0.613

Note: *** and ** denote statistical significance at the 1 and 5 percent level, respectively. Figures in parentheses are robust standard errors clustered at the state level.

Conclusion

This study examined recent developments in US consumer spending using high-frequency and high-granularity data. Specifically, it sought to quantitatively grasp the impact of the COVID-19 pandemic on consumer spending.

The results suggest that, in addition to the introduction of strict public health measures such as the stay-at-home orders, the increase in the number of new infections itself substantially reduced consumer spending. The increase in new infections resulted not only in the introduction of targeted public health measures but also raised people's sense of caution with regard to the risk of infection, and voluntary efforts to avoid infection appear to have restrained economic activities. In fact, this mechanism appears to be a major reason for the slowdown in the pace of recovery in consumer spending since the latter half of June. The results presented in this study further indicate that fiscal measures such as the Economic Impact Payments likely had the effect of supporting consumer spending.

Finally, two caveats should be noted when interpreting the results of the empirical analysis in this study. The first caveat is that due to the limited availability of high-frequency data, the analysis here potentially did not fully control for various other factors that may affect consumer spending. In particular, the analysis included neither the decline in the compensation of employees nor the expansion of unemployment insurance benefits, which likely had a major impact on personal income during this period.[4] In addition, if weekly data by state for consumer confidence were available, this would have made it possible to refine the analysis, for example, by specifying the mechanism through which the pandemic affects consumer spending. The second caveat concerns the interpretation of the dependent and independent variables. The dependent variable, "consumer spending," covers only credit and debit card spending, so that it does not fully capture consumer spending at the macroeconomic level, such as developments in certain goods (e.g., automobiles). In addition, the "public health measures" used as independent variables consist only of strict measures such as the stay-at-home/shelter-in-place orders. Furthermore, it is possible that the meaning of the "number of new infections" changed within the observation period. Increased testing and the strengthening of medical care provision may have changed the way households view the risk of infection and the availability of medical services. Therefore, for the same number of new infections, the impact of new infections on consumer spending after the increase in testing and improved medical care provision may differ from the initial period before these changes. Moreover, looking ahead, the impact of a decrease in the number

of new infections on consumer spending may differ depending on whether the decrease is due to medical solutions such as the development and dissemination of vaccines and treatments, or whether it is due to the spread of voluntary efforts to prevent infections.

In the current situation, it is important to grasp economic activity by relying on a combination of analyses using conventional macroeconomic statistics and analyses using non-conventional high-frequency data while recognizing these limitations.

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* Currently at the Monetary Affairs Department.

[1] Specifically, as part of the Coronavirus Aid, Relief, and Economic Security Act passed in late March, the US government decided to support individuals and households through direct stimulus payments amounting to US$1,200 for adults and US$500 for each qualifying child, with the total of the package, according to estimates by the Congressional Budget Office, amounting to US$290 billion. See Swagel, Phillip L., "Preliminary Estimate of the Effects of H.R. 748, the CARES Act, Public Law 116-136, Revised, with Corrections to the Revenue Effect of the Employee Retention Credit and to the Modification of a Limitation on Losses for Taxpayers Other Than Corporations," Congressional Budget Office, letter to Mike Enzi, revised April 27, 2020.

[2] There is a still developing but rapidly growing body of research that, like this study, examines US consumer spending during the pandemic using high-frequency data.

A frequently cited study in this context is Chetty *et al*. (2020). The main contribution of Chetty *et al*. (2020) is to clarify the features of US consumer spending during the pandemic, and the free-of-charge publication of high-frequency data such as credit and debit card spending data. This study also utilizes their database. Other studies in this field include Baker *et al*. (2020a, 2020b), Cox *et al*. (2020), and Dunn, Hood, and Driessen (2020), which examine the impact of the pandemic on US consumer spending, etc., using other data sources.

What sets this study apart from these preceding studies is that it quantifies and differentiates the impact of the strict public health measures, the increase in the number of new infections, and the Economic Impact Payments on consumer spending in a unified framework. Therefore, the approach employed in this study is likely to be useful in the sense that it contributes to the broad understanding of US consumer spending while taking various factors into account.

Chetty, Raj, John N. Friedman, Nathaniel Hendren, Michael Stepner, and the Opportunity Insights Team, "How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data," Working Paper 27431, National Bureau of Economic Research, 2020.

Baker, Scott R., Robert A. Farrokhnia, Steffen Meyer, Michaela Pagel, and Constantine Yannelis, "Income, Liquidity, and the Consumption Response to the 2020 Economic Stimulus Payments," Working Paper 2020-55, Becker Friedman Institute for Economics, 2020a.

Baker, Scott R., Robert A. Farrokhnia, Steffen Meyer, Michaela Pagel, and Constantine Yannelis, "How Does Household Spending Respond to an Epidemic? Consumption during the 2020 COVID-19 Pandemic," The Review of Asset Pricing Studies, raaa009, https://doi.org/10.1093/rapstu/raaa009, 2020b.

Cox, Natalie, Peter Ganong, Pascal Noel, Joseph Vavra, Arlene Wong, Diana Farrell, and Fiona Greig, "Initial Impacts of the Pandemic on Consumer Behavior: Evidence from Linked Income, Spending, and Savings Data," Brookings Papers on Economic Activity, 2020.

Dunn, Abe, Kyle Hood, and Alexander Driessen, "Measuring the Effects of the COVID-19 Pandemic on Consumer Spending Using Card Transaction Data," BEA Working Paper Series, WP2020-5, 2020.

[3] Specifying the mechanism would require high-frequency data on consumer confidence by state; however, since such data, to the authors' knowledge, is not available, this study does not examine the impact of new infections on consumer spending through consumer confidence.

[4] That said, at least from a macroeconomic perspective, the decline in the compensation of employees during this period has been largely offset by the expansion of unemployment insurance benefits.

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