
Raj Chetty, Harvard
John N. Friedman, Brown
Nathaniel Hendren, Harvard
Michael Stepner, Univ. of Toronto
and the Opportunity Insights Team

June 17, 2020
Motivation: Measuring the Impacts of COVID-19

- How has COVID-19 affected the American economy and what policies can best mitigate its adverse impacts going forward?

- Macroeconomic policy decisions are typically based on data from surveys of households and businesses

- These data provide vital aggregate information (GDP, unemployment rates), but have two key limitations

  1. Available only with significant time lags at low frequencies

  2. Cannot be disaggregated to examine variation across areas or subgroups
This Project

- We build a real-time, publicly available economic tracker using transaction data from several private companies to measure economic activity by ZIP code by day.

- Study differences by income group, geography, and industry to analyze:
  1. [Mechanisms] Why has COVID-19 led to unprecedented job losses?
  2. [Policy Responses] Causal effects of major stabilization policies enacted to date.

- Findings build on and relate to a growing number of papers using novel sources of data to analyze economic activity [e.g., Alexander and Karger 2020, Bartik et al. 2020, Kurman et al. 2020, Kahn et al. 2020, Allcott et al. 2020, Mongey et al. 2020]
1. Data
2. Impacts of COVID-19
3. Impacts of Stabilization Policies
4. Policy Implications
Data

Impacts of COVID-19

Impacts of Stabilization Policies

Policy Implications
Data Partners

Consumer Spending

Small Business Revenues

Employment

Job Postings

Education
Data sources are raw transactional data that reflect each business’s clients, not necessarily national population.

Starting from raw data, construct series suitable for economic analysis as follows:

1. Clean series to remove artifacts that arise in transaction data and smooth seasonal fluctuations.
2. Index to January 2020 values and exclude small cells to protect privacy.
3. Benchmark to national statistics to characterize the group each dataset represents.

Combine these series in a public platform (www.tracktherecovery.org) that eliminates need for researchers and policymakers to obtain specific contracts to use these data.
National Accounts Data: Changes in GDP and its Components

Change from Q4 2019 to Q1 2020 ($ bil)

- $247.3B (-5%)

Gross Domestic Product
National Accounts Data: Changes in GDP and its Components

<table>
<thead>
<tr>
<th>Component</th>
<th>Change from Q4 2019 to Q1 2020 ($ bil)</th>
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<tbody>
<tr>
<td>Gross Domestic Product</td>
<td>-$247.3B (-5%)</td>
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<tr>
<td>Private Domestic Investment</td>
<td>-$89.6B</td>
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<td>Govt. Expend.</td>
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<td>Net Exports</td>
<td>$64.6B</td>
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<td>Personal Consumption Expend. (PCE)</td>
<td>-$229.7B</td>
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National Accounts Data: Changes in GDP and its Components

Change from Q4 2019 to Q1 2020 ($ bil)

- Gross Domestic Product: -$247.3B (-5%)
- Private Domestic Investment: -$89.6B
- Govt. Expend.: $7.3B
- Net Exports: $64.6B
- Personal Consumption Expend. (PCE): -$229.7B
- Credit/Debit Spending in PCE: -$138.2B
Changes in Consumer Spending: National Accounts vs. Credit/Debit Card Data
Food Services in Affinity Solutions Purchase Data vs. Monthly Retail Trade Survey

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<th>Monthly Retail Trade Survey</th>
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<td>Mar 2020</td>
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<tr>
<td>May 2020</td>
<td>0.6</td>
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Impacts of COVID-19 on Consumer Spending

- Begin by disaggregating spending changes by household income
  - Who cut spending more – the rich or the poor?
- Impute income based on median household income in cardholder ZIP code
  - Matches estimates in JPMorgan Chase individual-level income data as of April 15, 2020 [Farrell, Greig, Cox, Ganong, Noel 2020]
Consumer Spending by Income Quartile

- $3.1 Billion (31%)
- $1.4 Billion (17%)
Consumer Spending by Income Quartile

- $3.1 Billion (31%)
- $1.0 Billion (23%)
- $1.4 Billion (17%)
- $0.13 Billion (3%)

Top quartile accounts for more than half of aggregate spending reduction by June 9.
Impacts of COVID-19 on Consumer Spending

- Next, disaggregate by sector

- Why did spending fall? Because of a reduction in purchasing power/expected income or health concerns about COVID-19?
Changes in Consumer Spending by Sector

- In-person services (67%)
- Remote Services
- Other in-person services
- Recreation
- Health Care
- Transportation
- Hotels & Food
Changes in Consumer Spending by Sector

In-person services (67%) at 75%

Remote Services at 50%

Other in-person services at 25%

Hotels & Food at 0%
Changes in Consumer Spending by Sub-Category

- At-Home Swim Pools
- Landscaping
- Restaurants and Eating Places
- Barbers and Beauty Shops
- Airlines

Change in Consumer Spending vs. Jan. Level (%)

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<th>Date</th>
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<tr>
<td>Feb 4</td>
<td>20%</td>
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<td>Feb 18</td>
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<td>Mar 3</td>
<td>10%</td>
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<td>Mar 17</td>
<td>5%</td>
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<tr>
<td>Mar 31</td>
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<td>Apr 14</td>
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<tr>
<td>Apr 28</td>
<td>-75%</td>
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Date: Feb 4, Feb 18, Mar 3, Mar 17, Mar 31, Apr 14, Apr 28
Changes in Consumer Spending by Sector
COVID vs Great Recession

- Durables: 19.5% (Great Recession), 58.6% (COVID-19)
- Non-Durables: 13.3% (Great Recession), 44.3% (COVID-19)
- Services: -2.9% (Great Recession), 67.2% (COVID-19)

Pct. of decline in personal consumption expenditures from peak to trough.
Impacts of COVID-19 on Consumer Spending: Summary

- Consumer spending reduction is not due to a lack of purchasing power, but rather a supply shock (firms unable to supply services without health risks)

- Income losses were relatively small for the rich (Cajner et al. 2020) and low-income households’ lost income was fully replaced by unemp. insurance (Ganong, Noel, Vavra 2020)

- Now examine downstream impacts of this novel spending shock on businesses and employees
Business Revenues
Impacts of COVID-19 on Businesses

- How did the fall in consumer spending and business revenue affect business decisions: decision to remain open, employment, new job postings, etc.?

- To answer this question, use variation in size of spending shocks across ZIP codes

  - Spending fell primarily among high-income households for in-person services such as restaurants

  - Such services are mostly produced by small businesses that serve customers in their local area

  - Differences across ZIP codes in average household income → variation in size of spending shock that local businesses face

- Begin by analyzing impacts on small business revenue using data from Womply
Changes in Small Business Revenues from January to April by ZIP Code
New York
Changes in Small Business Revenues from January to April by ZIP Code
San Francisco
Changes in Small Business Revenues vs. Median Income, by ZIP Code

Change in Small Business Revenue (%) Relative to Jan.

Median Income in 2018 ($)

25,000 50,000 75,000 100,000 125,000

<table>
<thead>
<tr>
<th>Population Density</th>
<th>Change in Small Business Revenue (%) Relative to Jan.</th>
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Graph showing the relationship between change in small business revenue and population density.
Changes in Small Business Revenues vs. Rent, by ZIP Code

Change in Small Business Revenue (\%) Relative to Jan.

Median Two Bedroom Monthly Rent in 2018 ($)
Changes in Small Business Revenues vs. Rent, by ZIP Code
In-Person Services vs. Teleworkable Services

Change in Small Business Revenue (%)
Relative to Jan.

Food and Accommodation Services and Retail Trade
Finance and Professional Services

Median Two Bedroom Monthly Rent in 2018 ($)
Employment
How did loss in business revenues affect employees?

Employment losses have been concentrated at the low end of the income distribution (Cajner et al. 2020)

Analyze employment of low-wage workers primarily using data from Earnin, which closely tracks overall employment for bottom-quintile workers in other data sources

Similar results obtained using other data sources: Homebase, Intuit
Changes in Employment Rates by ZIP Code

New York
Changes in Employment and Job Postings vs. Rent
Employment at Small Businesses and ZIP Median Rent (Earnin)
Changes in Employment and Job Postings vs. Rent

Job Postings for Low-Education Workers and County Median Rent (Burning Glass)
Changes in Employment and Job Postings vs. Rent
Job Postings for High-Education Workers and County Median Rent (Burning Glass)
Job Losses in the Great Recession vs. COVID Recession by County: BLS Statistics

- **Great Recession 2007 to 2010 Emp. Loss**
- **COVID Recession Feb to Apr 2020 Emp. Loss**
- **COVID Recession Mar 15 to April 28, 2020 UI Claims**

**Quartile of County Median Income**
- **Bottom**
- **Top**
Reduction in spending by the rich has led to loss of jobs for low-income individuals working in affluent areas

Evidence from Great Recession suggests that disparate job losses across regions can have persistent effects for nearly a decade because workers do not move to find jobs [Yagan 2019]

Job postings more depressed in affluent areas → early signs of a long road to recovery for low-income households in affluent counties in this recession as well
Impacts of Stabilization Policies
In rest of talk, examine what policies can mitigate impacts of pandemic, focusing in particular on employment of low-income workers

Focus on three major policies that target chain of events (consumer spending → business revenue → employment) at different points

1. State-ordered re-openings
2. Stimulus payments to households
3. Loans to small businesses
State-Ordered Reopenings
Can executive orders restore economic activity?

Compare trends in spending and employment in states that reopened earlier vs. later to assess.
Causal Effect of Re-Opening on Consumer Spending
Case Study of Colorado vs. New Mexico

Change in Consumer Spending Relative to January 2020 (%)

-60 -40 -20 0 20

February 1  February 15  February 29  March 14  March 28  April 11  April 25  May 9  May 23  June 6

Colorado Begins Re-Opening
New Mexico Begins Re-Opening
Colorado Closing
New Mexico Closing
Colorado Begins Re-Opening
Causal Effect of Re-Opening on Consumer Spending
Case Study of Colorado vs. New Mexico
Causal Effects of Re-Openings on Consumer Spending

Diff-in-diff Estimate: +.313p.p. (s.e. = 2.928)
Causal Effects of Re-Openings on Consumer Spending

Change in Employment among Low-Wage Workers Relative to January 2020

Days Relative to Re-opening

Diff-in-diff Estimate: +.432 p.p. (s.e. = 2.092)
State-Ordered Reopenings

- Key driver of reduction in spending is fear of virus itself, not restrictions imposed by government.

- Limited capacity for governments to restore spending through re-openings, unless public interprets them as a credible signal of reduced health concerns.
Stimulus Payments
Impacts of Stimulus Payments

- Coronavirus Aid, Relief, and Economic Security (CARES) Act made direct payments to nearly 160 million people, totaling $267 billion as of May 31, 2020
  - Larger payments for lower-income households
  - Vast majority of payments made exactly on April 15, 2020

- Was stimulus effective in increasing consumer spending and restoring employment?
  - Use high-frequency event studies, comparing spending for low vs. high income households, to answer this question
Impact of Stimulus Payments on Consumer Spending, by Income Quartile

Seasonally Adj. Pct. Change in Spending

-40% -30% -20% -10% 0% 10%

Jan 7  Jan 21  Feb 4  Feb 18  Mar 3  Mar 17  Mar 31  Apr 14  Apr 28  May 12  May 26  Jun 9

Stimulus Payments Issued

Q1 Apr 13: -28.1%
Q4 Apr 13: -36.3%
Q1 Apr 21: -10.3%
Q4 Apr 21: -29.8%

Bottom Income Quartile
Top Income Quartile
Impact of Stimulus Payments on Consumer Spending
Regression Discontinuity Estimates for Bottom Income Quartile Households


RD Estimate: 26% (7%)
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for Highest Income Quartile Households


Apr 1  Apr 8  Apr 15  Apr 22  Apr 29

RD Estimate: 9% (4%)
Impact of Stimulus Payments on Consumer Spending
Regression Discontinuity Estimates for Durable Goods

RD Estimate: 21% (6%)
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for In-Person Services


Apr 1  Apr 8  Apr 15  Apr 22  Apr 29

RD Estimate: 7% (4%)

Stimulus Payments Issued
Impact of Stimulus Payments on Business Revenue

Regression Discontinuity Estimates for Lowest Rent Quartile ZIP Codes

Pct. Change in Revenue Relative to Jan.

RD Estimate: 21% (9%)
Impact of Stimulus Payments on Business Revenue and Employee Hours

Revenue and Employment Changes Among Small Businesses, by ZIP Rent Quartile

Stimulus Payments Issued

Percent Decline (%)

Feb 22  Mar 7  Mar 21  Apr 4  Apr 18  May 2  May 16  May 30

Small Bus. Revenue - Rent Q1
Small Bus. Revenue - Rent Q4

-2.3%
-27.3%
Impact of Stimulus Payments on Business Revenue and Employee Hours
Revenue and Employment Changes Among Small Businesses, by ZIP Rent Quartile

Stimulus Payments Issued

-2.3%
-27.3%
-36.4%
-47.4%
Stimulus payments increased spending by low-income consumers substantially, consistent with Baker et al. (2020)

But did not undo the initial spending reductions by returning money back to the businesses that lost the most revenue

If workers' ability to switch jobs is constrained – e.g. because of job-specific skills or geographical constraints – impacts of stimulus on employment may be dampened
Loans to Small Businesses
Paycheck Protection Program

- CARES Act also provided $500 billion in loans to small businesses starting on April 3

- Loans were forgivable if payroll was not reduced significantly relative to pre-COVID levels

- Firms with fewer than 500 employees were eligible for these loans (with some exceptions)

- Compare trends in employment for firms with less than 500 employees vs. more than 500 employees around April 3 to identify causal effects of the program
Impact of Paycheck Protection Program on Low-Income Employment

Change in Employment Since January

Date

Feb 12  Feb 26  Mar 11  Mar 25  Apr 8  Apr 22  May 6  May 20  Jun 3  Jun 17  Jul 1

PPP Program Begins

125-475 Employees (Eligible for PPP)
Impact of Paycheck Protection Program on Low-Income Employment

Change in Employment Since January

PPP Program Begins

- 125-475 Employees (Eligible for PPP)
- 525-875 Employees (Ineligible for PPP)
PPP Employment Impact: +3%

PPP Program Begins

Change in Employment Since January

125-475 Employees (Eligible for PPP)

525-875 Employees (Ineligible for PPP)

Impact of Paycheck Protection Program on Low-Income Employment
Impact of Paycheck Protection Program on Low-Income Employment

PPP Employment Impact: +3%

Cost Per Job Saved = $340,000

PPP Program Begins

Change in Employment Since January

Date

Feb 12  Feb 26  Mar 11  Mar 25  Apr 8  Apr 22  May 6  May 20  Jun 3  Jun 17  Jul 1

125-475 Employees (Eligible for PPP)

525-875 Employees (Ineligible for PPP)
Paycheck Protection Program

- Why has PPP had limited impact on employment despite substantial expenditure?
  - Businesses who took up loans may not have intended to lay off their workers to begin with
  - Ex: very high takeup rate among firms providing professional and scientific services despite low job losses in that sector
  - Consistent with evidence that loans flowed to areas with smaller employment losses in March [Granja, Makridis, Yannelis, Zwick 2020]
Long-Term Impacts
Long-Term Impacts

- We have focused primarily on short-term impacts of COVID crisis on spending and employment.

- But this shock may have lasting impacts going forward on inequality and social mobility.

- To illustrate, turn to data on educational progress on an online math platform used as part of school curriculum by 1,000,000 students in the U.S.
Math Lessons Completed on Zearn Platform

Effects of COVID on Educational Progress by Income Group

- Top Income Quartile
- Bottom Income Quartile

January 8 | January 22 | February 5 | February 19 | March 4 | March 18 | April 1 | April 15 | April 29 | May 13
Policy Implications
Implications for Policy Going Forward

- Results suggest that there is limited capacity to restore consumer spending via traditional economic tools in the midst of the pandemic
  - Impacts of stimulus and loans to small businesses may be blunted when spending is constrained by health concerns
  - Long-term solution lies in addressing virus itself and public health efforts [Allen 2020, Romer 2020]
Implications for Policy Going Forward

- In the meantime, may be most fruitful to use economic policy to limit hardship among low-income workers who have lost their jobs.
  - Extending unemployment benefits and social safety net may be a more impactful use of scarce resources than stimulus checks to all households or loans to all businesses.
  - May be a role for place-based policies targeting recovery in hardest hit areas (e.g., low-income workers in affluent counties).
  - Important to take potential long-term impacts on children into account, e.g. in decisions on when to re-open schools vs. businesses.
Conclusion

- More broadly, private sector data can provide a new tool to support economic policy in the age of big data
  - Can target aid more effectively
  - And diagnose what the root causes of economic failure are rapidly

- Tracker constructed here is a prototype for a system of “real time” national accounts, building on the vision of Kuznets (1941) in constructing current national accounts
  - All data used to produce results shown here are freely downloadable at www.tracktherecovery.org
Appendix Slides
Small Business Revenue Changes vs. Local Income Distribution
Food Services and Accommodations
Changes in Employment Rates Over Time

All Industries

<table>
<thead>
<tr>
<th>Month</th>
<th>CES - All Workers</th>
<th>ADP NER - All Workers</th>
<th>Earnin Earnings - Low-Wage Workers, All Firms</th>
<th>ADP FRB - All Workers</th>
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Changes in Employment Rates Over Time

Accommodations and Food Services

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<th>ADP FRB - All Workers</th>
<th>ADP NER - All Workers (71-72)</th>
<th>ADP NER - All Workers (71-72)</th>
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Changes in Employment and Job Postings vs. Rent

Hours Worked at Small Businesses and ZIP Median Rent (Earnings)

Percent Decline in Hours Worked at Local Bus.

Two-Bedroom Rent 2018

- Blue dots: Medium and Large Businesses
- Green dots: Small Businesses
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Gini Index

Change in Small Business Revenue (%)
Relative to Jan.

Gini Index 2018
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Share of Population in Top 1% of Income Distribution

Change in Small Business Revenue (%)
Relative to Jan.

5 10 15 20 25 30

Share of the Population at the top 1% of the Income Distribution (%)
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Share of Population below Poverty Line

Change in Small Business Revenue (%)

Relative to Jan.

-50
-45
-40
-35
-30
-25
-20
-15
-10
-5
0
5
10
15
20
25

Share of the Population Below the Poverty Line 2018 (%)
Changes in Consumer Spending vs. Workplace Rent for Low-Income Households

Change in Hours Worked vs Workplace Rent among Low-Income Households

Normalized Change (%)
in Hours Worked (Earnings)

Median Two Bedroom Monthly Rent in 2018 at the Workplace ($)

Diagram showing the relationship between median two-bedroom monthly rent and normalized change in hours worked for low-income households.
Changes in Consumer Spending vs. Workplace Rent for Low-Income Households

Change in Spending vs Workplace Rent among Low-Income Households

Seasonally Adj. Change (%)
in Consumer Spending

Median Two Bedroom Monthly Rent in 2018 at the Workplace ($)
Changes in Wages and Employment Over Time

Earnin
Changes in Wages, Hours Worked and Earnings Over Time
Homebase
Changes in Total Employment by Firm Size

Employer Size Decile

Percent Decline in Employment

Employer Size Decile

Changes in Total Employment by Firm Size
Unemployment Rates vs County Income in Four Recessions

2001 Recession

County Median Income in 2000 vs 2001 Unemployment Rate

- Queens NY
- Santa Clara CA
- Bronx NY
- Montgomery MD
- Fresno CA

0% - 12%
25,000 - 75,000

Graph showing the relationship between county median income in 2000 and unemployment rate in 2001.
Unemployment Rates vs County Income in Four Recessions

2010 Recession

- Queens NY
- Santa Clara CA
- Bronx NY
- Montgomery MD
- Fresno CA

2010 Unemployment Rate

County Median Income in 2006
Unemployment Rates vs County Income in Four Recessions

2020 Recession

2020 March 15th to May 2nd Unemployment Claims

County Median Income in 2014 to 2018
Impact of Stimulus on the Composition of Consumer Spending

January
- In-person Services: 32%
- Remote Services: 21%
- Non-Durable Goods: 23%
- Durable Goods: 23%

Pre-Stimulus
- In-person Services: 18%
- Remote Services: 24%
- Non-Durable Goods: 29%
- Durable Goods: 29%

Post-Stimulus
- In-person Services: 20%
- Remote Services: 23%
- Non-Durable Goods: 27%
- Durable Goods: 30%

Composition of Recovery
- In-person Services: 18%
- Remote Services: 19%
- Non-Durable Goods: 19%
- Durable Goods: 44%
Change in Mobility (%)

Relative to Jan.

County-level COVID-19 Cases Per 100,000 People (Log Scale)

Time Spent Outside Home vs. COVID-19 Cases, by County

- Low Income Counties (Q1)
- High Income Counties (Q4)
Changes in Employment and Job Postings vs. Rent
Job Postings for Low-Education Workers and County Median Rent (Burning Glass)

- Change from Jan/Feb to May 30
- Change from Jan/Feb to Mar 25-April 14

Percent Decline in Job Postings vs. Two-Bedroom Rent 2018
Changes in Employment Rates by ZIP Code

Chicago
Changes in Employment Rates by ZIP Code
San Francisco