

The Economic Impacts of COVID-19 Real-Time Evidence From Private Sector Data

PRINCETON
UNIVERSITY



Webinar



Raj Chetty (Harvard)

Introductory
remarks by
Markus
Brunnermeier

PAST AND FUTURE SPEAKERS

■ Last



Ken Rogoff
"Sovereign debt and the Dollar"

■ Today



Raj Chetty
"Tracking real time impact of COVID"

■ Next webinars



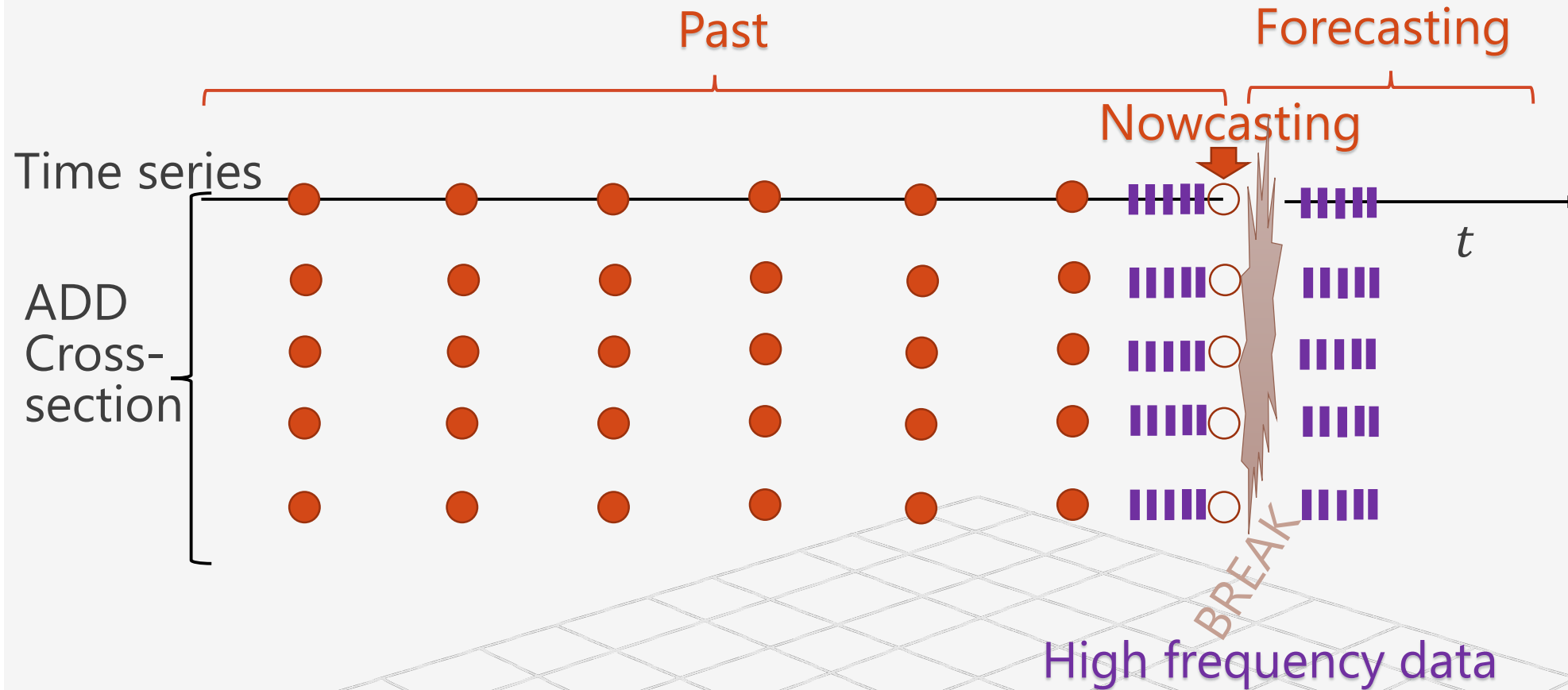
Veronica Guerrieri
"Can supply shocks cause demand shortage"



Philip Lane
ECB's Pandemic Emergency Purchase Program

DATA ANALYSIS IN MACROECONOMICS

■ The evolution



Do we need models when projecting into future after structural break?

CROSS SECTION: "ROOMBA EFFECT"

- GE: "your spending is my income"
- **Previous recession**, esp. GFC 2008:
 - HH response: **cut back on durable goods**
 - like cars, washing machines, ...
 - Policy response:
 - Cash for clunkers
 - Temporary VAT/sales tax reduction
 - Germany 2020,. ...
- **This recession:**
 - **Substitute services for durables**,
 - Like robots: Roomba instead of cleaning person
 - Permanent implications

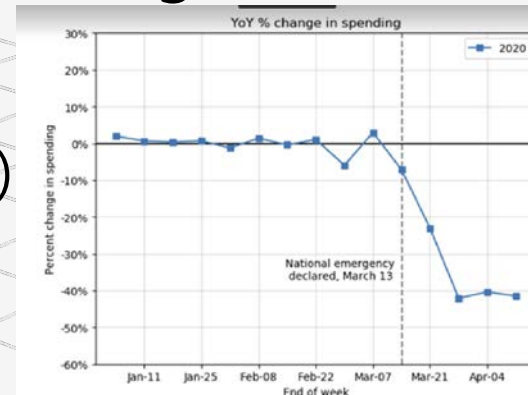


TIME SERIES: FREQUENCY

- What's the optimal frequency?
 - Weekly, daily, ... nano-second (high-frequency trading)
 - Consumption, payments, trading
 - Pricing of internet congestion vs. milk
 - Can you store good (how long)? Battery technology?
 - How volatile and how costly is volatility?
- How to aggregate over time?
- Does high frequency lead to more asymmetric info?
 - Akerlof's Lemon's problem
 - High-frequency trading

OTHER PRIVATE HIGH-FREQUENCY DATA STUDIES

- **Roberto Rigobon's** daily online prices
<http://www.thebillionpricesproject.com/>
- **Erik Hurst:** Cajner et al. 2020 (next Friday)
[Administrative payroll data (ADP)]
 - unemployment
- **Cox et al. 2020** (forthcoming Brookings paper)
(JP Morgan Institute)
[8M credit card users + 4M savings/checking accounts]
 - Large spending drop ($\approx 40\%$)
 - Not necessarily income effect – uncertainty?
 - "Liquid balances" have increased 35% (yoy)
 - For high and low income HHs

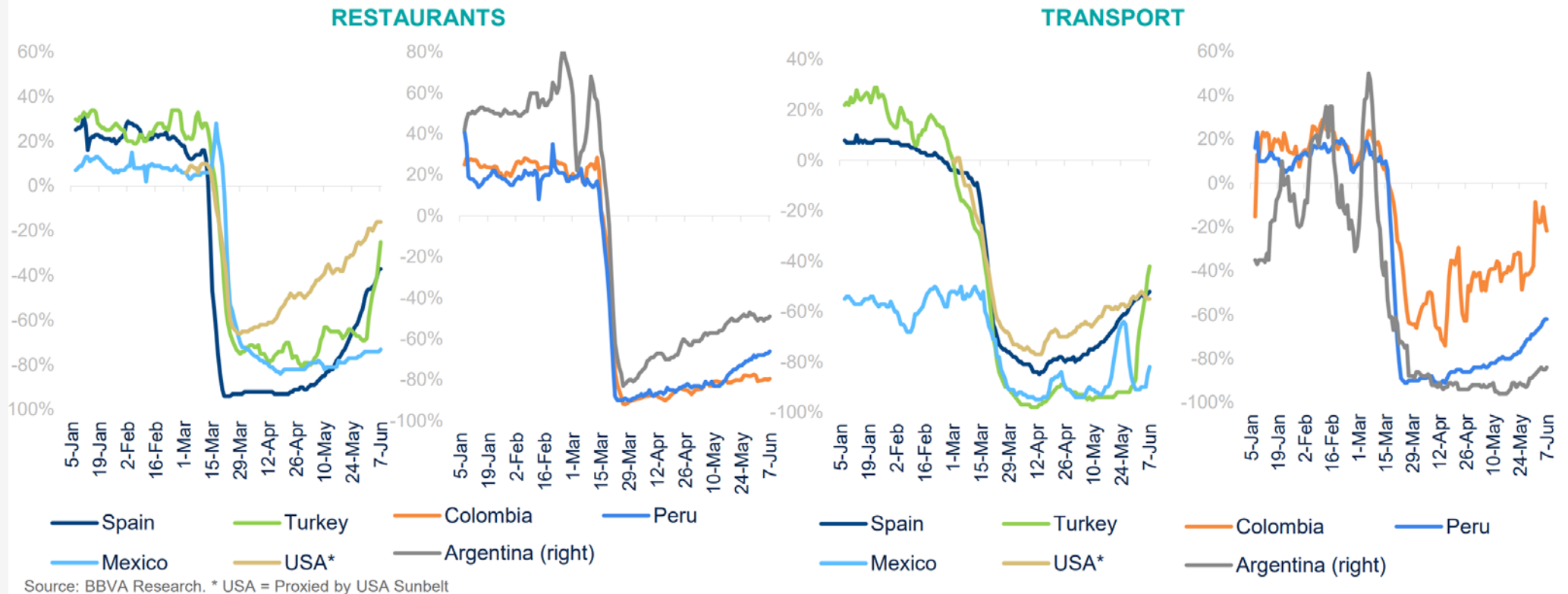


PRIVATE DATA REPORTS

■ BBVA

BBVA RESEARCH BIG DATA CONSUMPTION INDICES

(Consumption by card, % YoY, 7D cumulative)



■ Luohan Academy global pandemic tracker: Alibaba

<https://www.luohanacademy.com/PET>

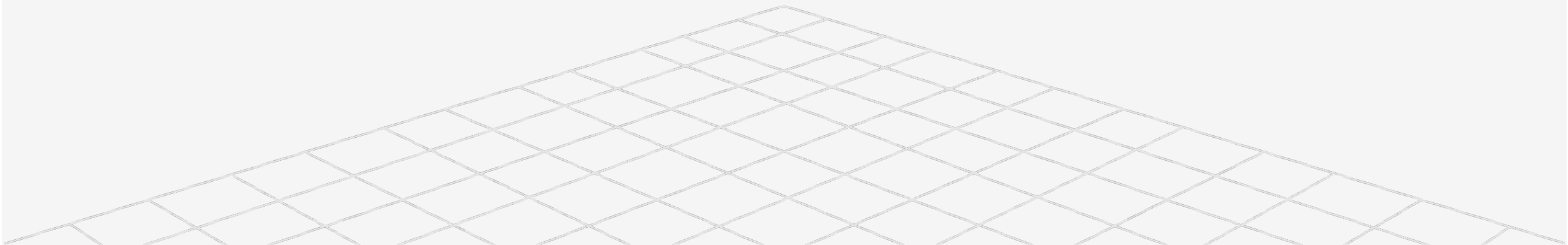
BIG DATA

- Economics of scale

- Concave production function – “perfect forecast is upper bound”

- Economics of scope

- One doesn't need structure, use e.g. textual analysis,
 - machine learning more generally (black box approach)



POLL

1. Do you think private sector data will become more important than official data sources?
 - a. Yes
 - b. No
2. Machine learning analysis (with less focus on causality) will become more important than traditional econometric analysis/tools
 - a. Yes
 - b. No
3. Do you think non-structural data, like textual, analysis will dominate data analysis?
 - a. Yes
 - b. No
 - c. Roughly equal weight
 - d. It will be fully integrated

How Did COVID-19 and Stabilization Policies Affect Spending and Employment?

A New Real-Time Economic Tracker Based on Private Sector Data

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

Outline

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

Data Partners

Consumer Spending

affinity
solutions

Small Business Revenues

WOMPLY

Employment

 **earnin**[™]

intuit[®]

homebase

Job Postings

 **burningglass**[®]
TECHNOLOGIES

Education

2EARN

Constructing Economic Indices Based on Private-Sector Data

- 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
 2. Smooth seasonal fluctuations
 3. Index to January 2020 values and exclude small cells to protect privacy
 4. Benchmark to national statistics to characterize what 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

Data

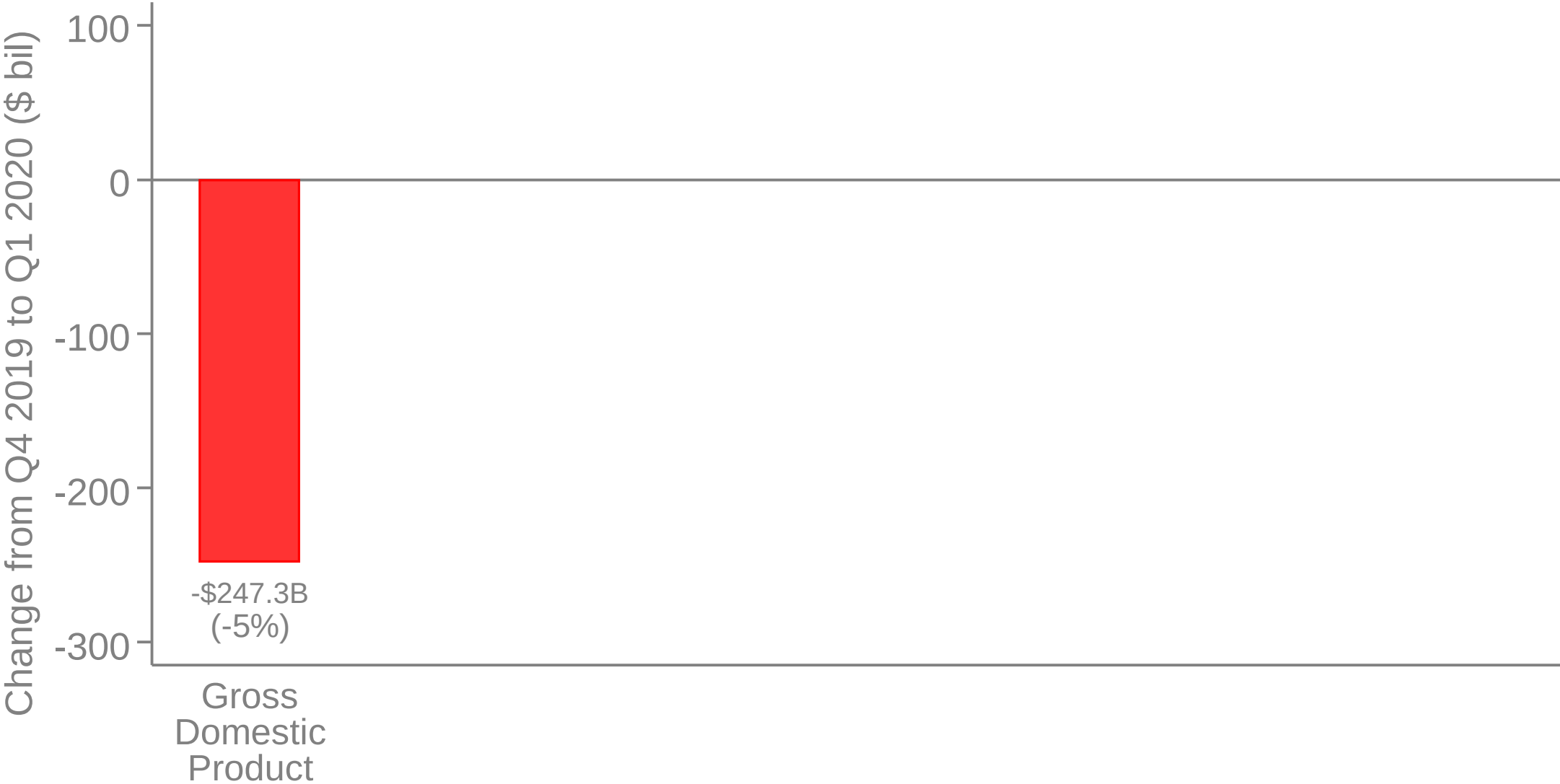
Impacts of
COVID-19

Impacts of
Stabilization
Policies

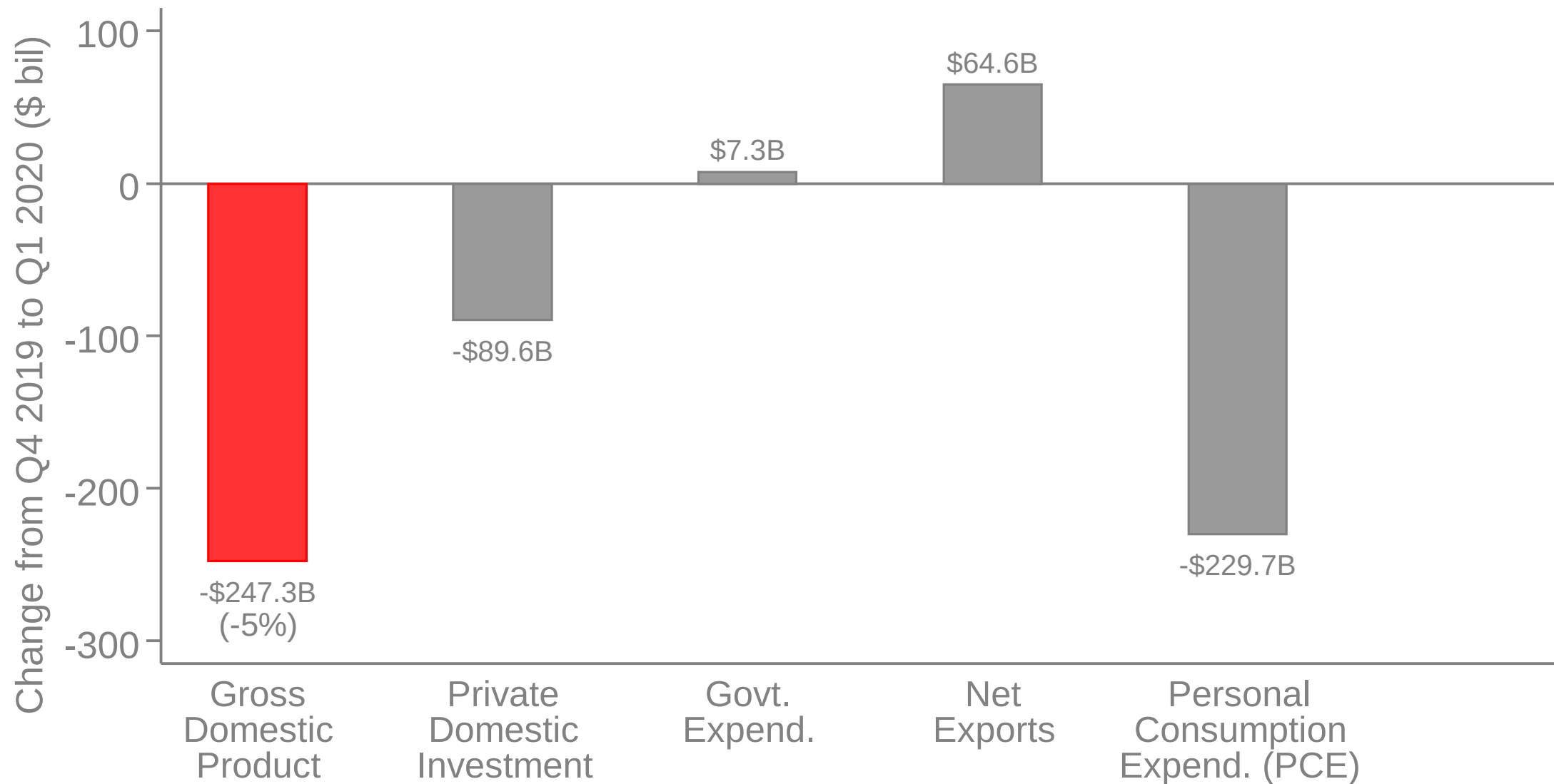
Policy
Implications

Impacts of COVID-19

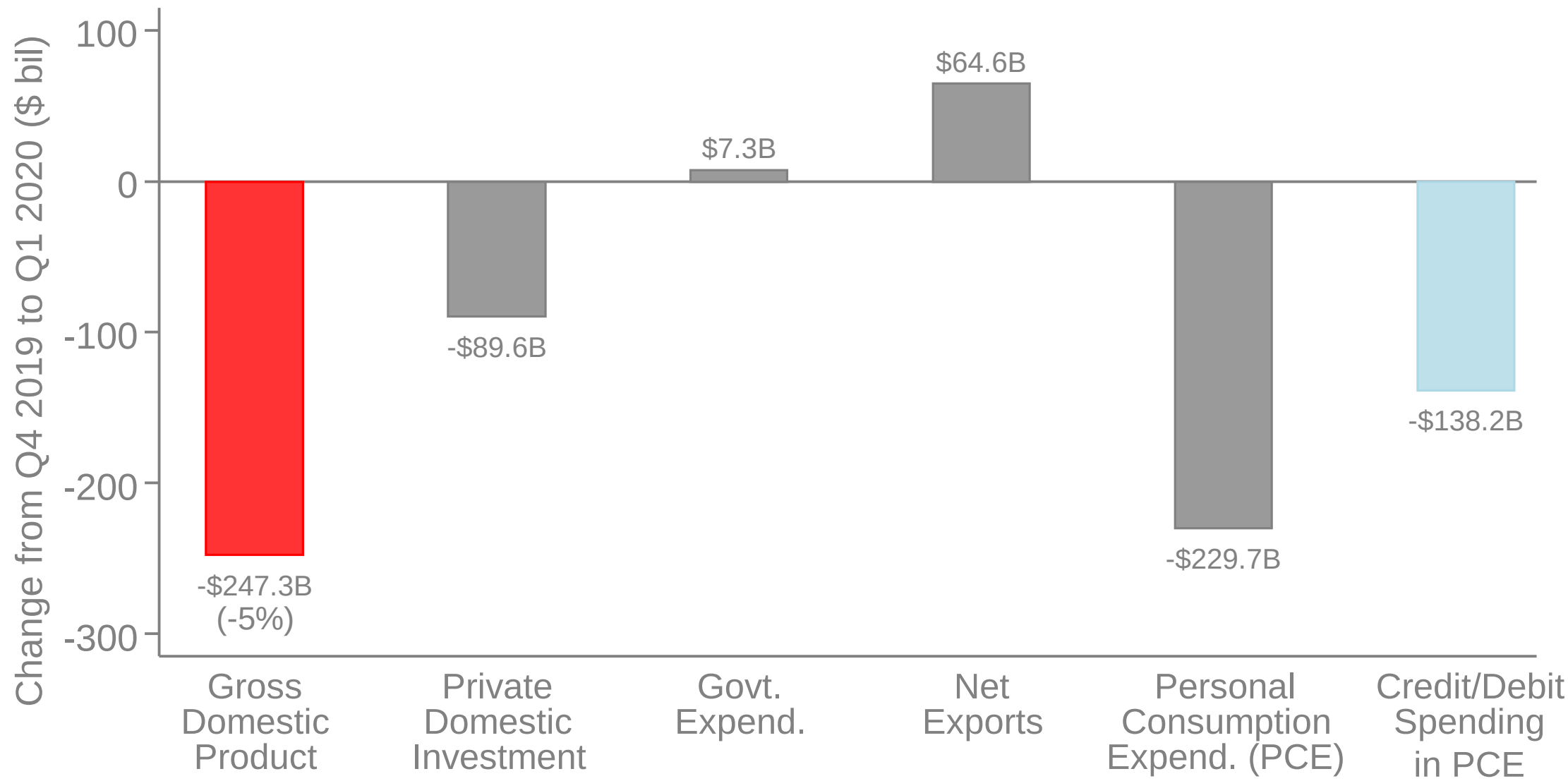
National Accounts Data: Changes in GDP and its Components



National Accounts Data: Changes in GDP and its Components

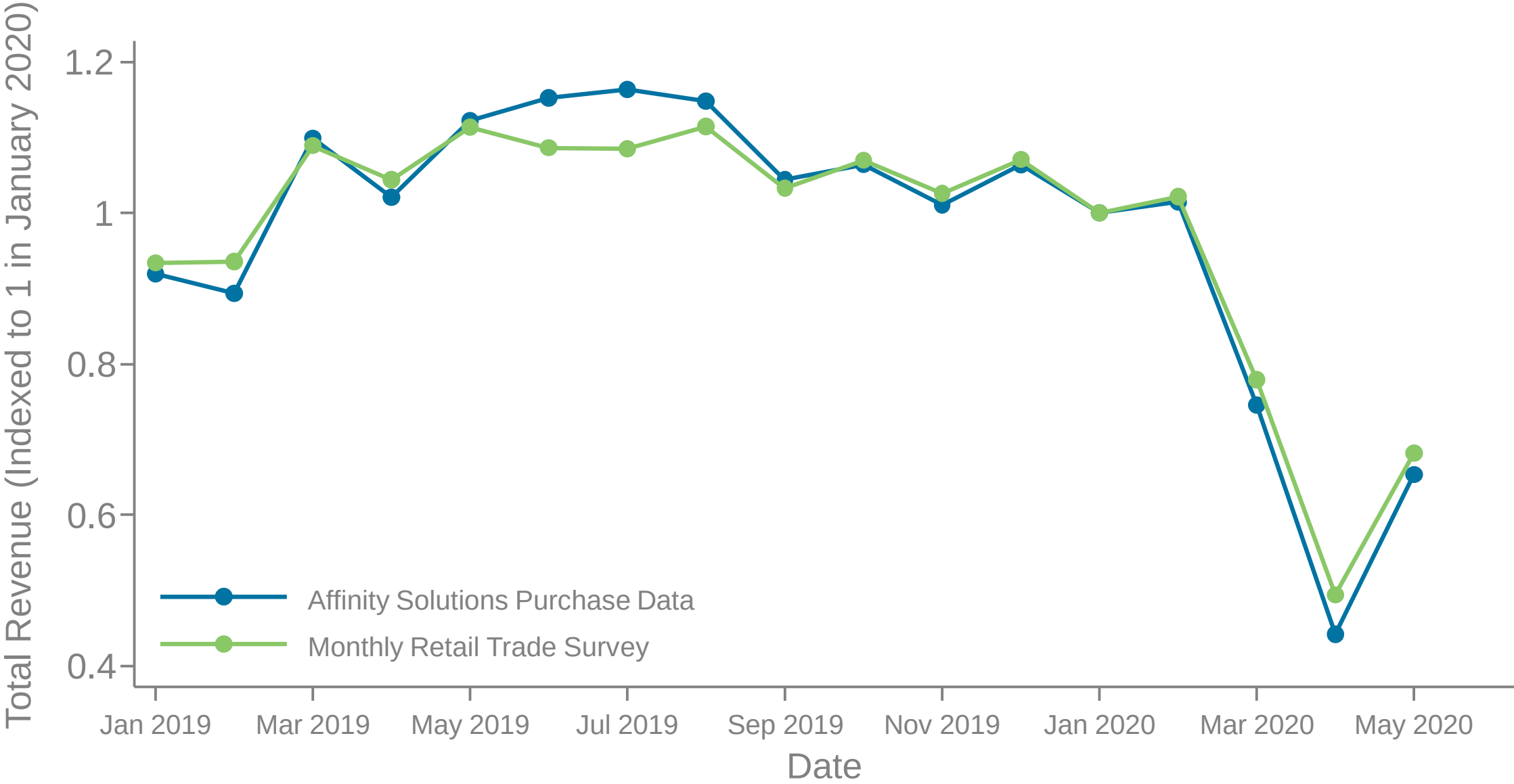


National Accounts Data: Changes in GDP and its Components



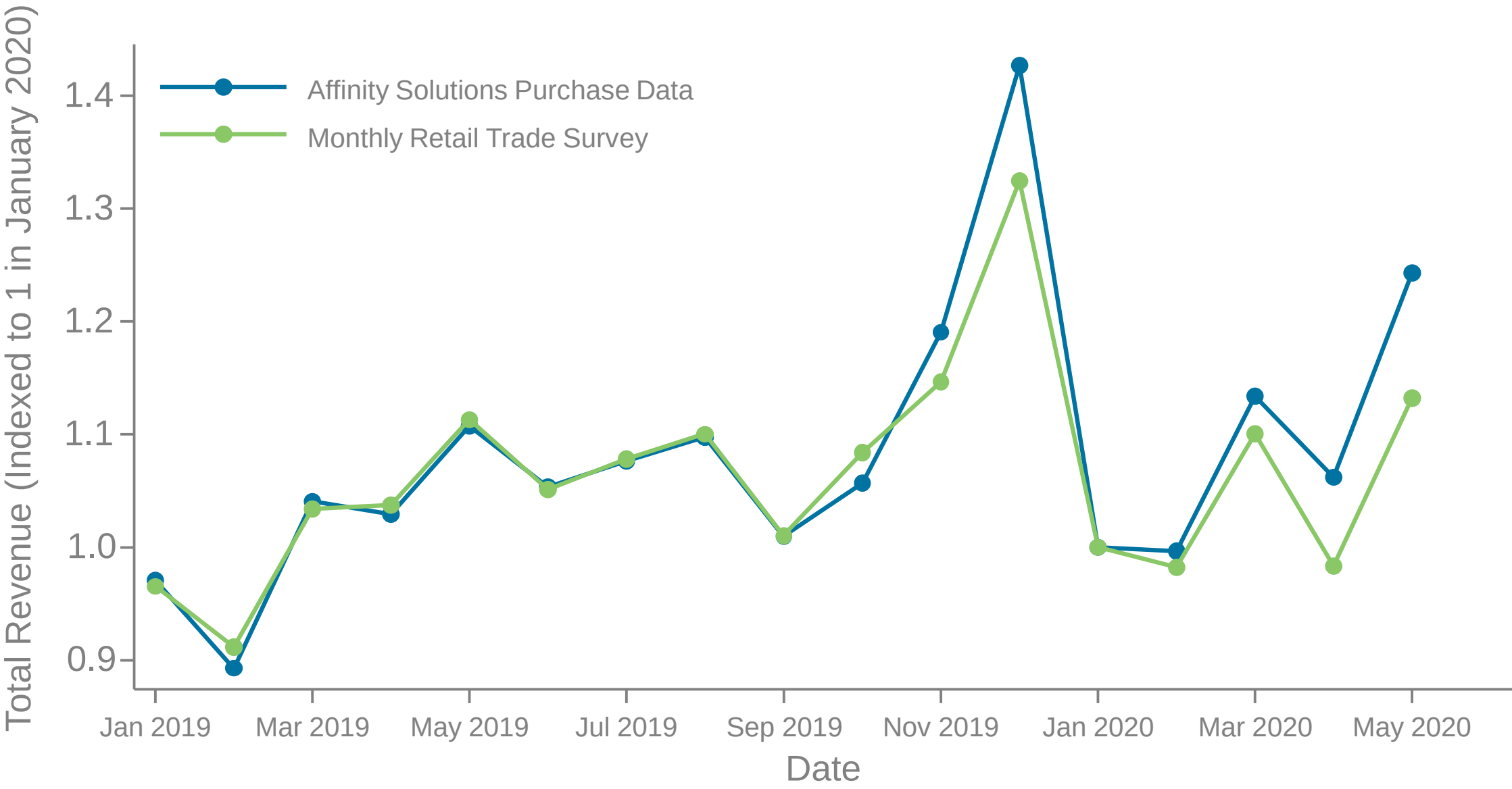
Changes in Consumer Spending: National Accounts vs. Credit/Debit Card Data

Food Services in Affinity Solutions Purchase Data vs. Monthly Retail Trade Survey



Changes in Consumer Spending: National Accounts vs. Credit/Debit Card Data

Retail Services in Affinity Solutions Purchase Data vs. Monthly Retail Trade Survey

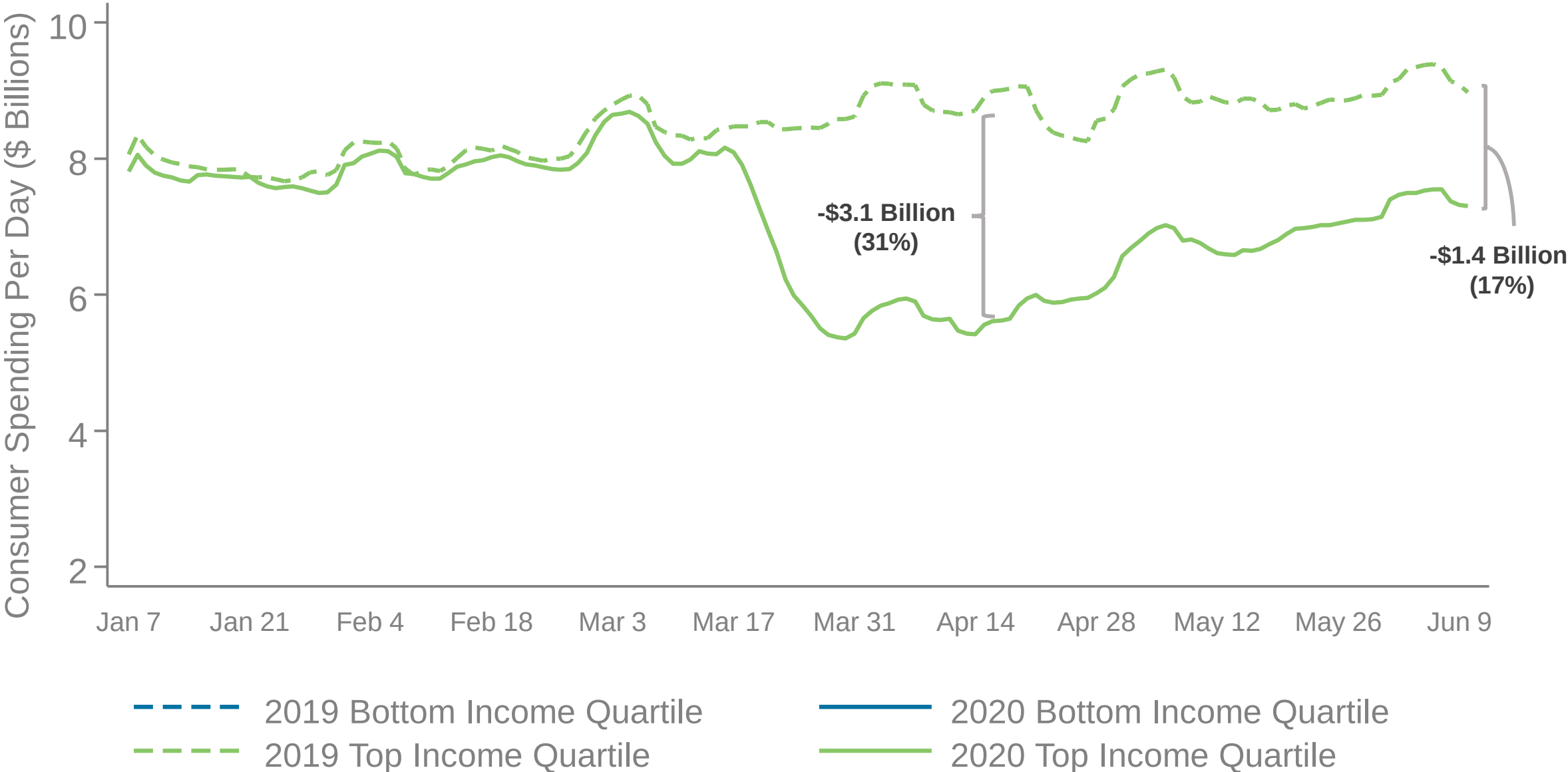


Consumer Spending

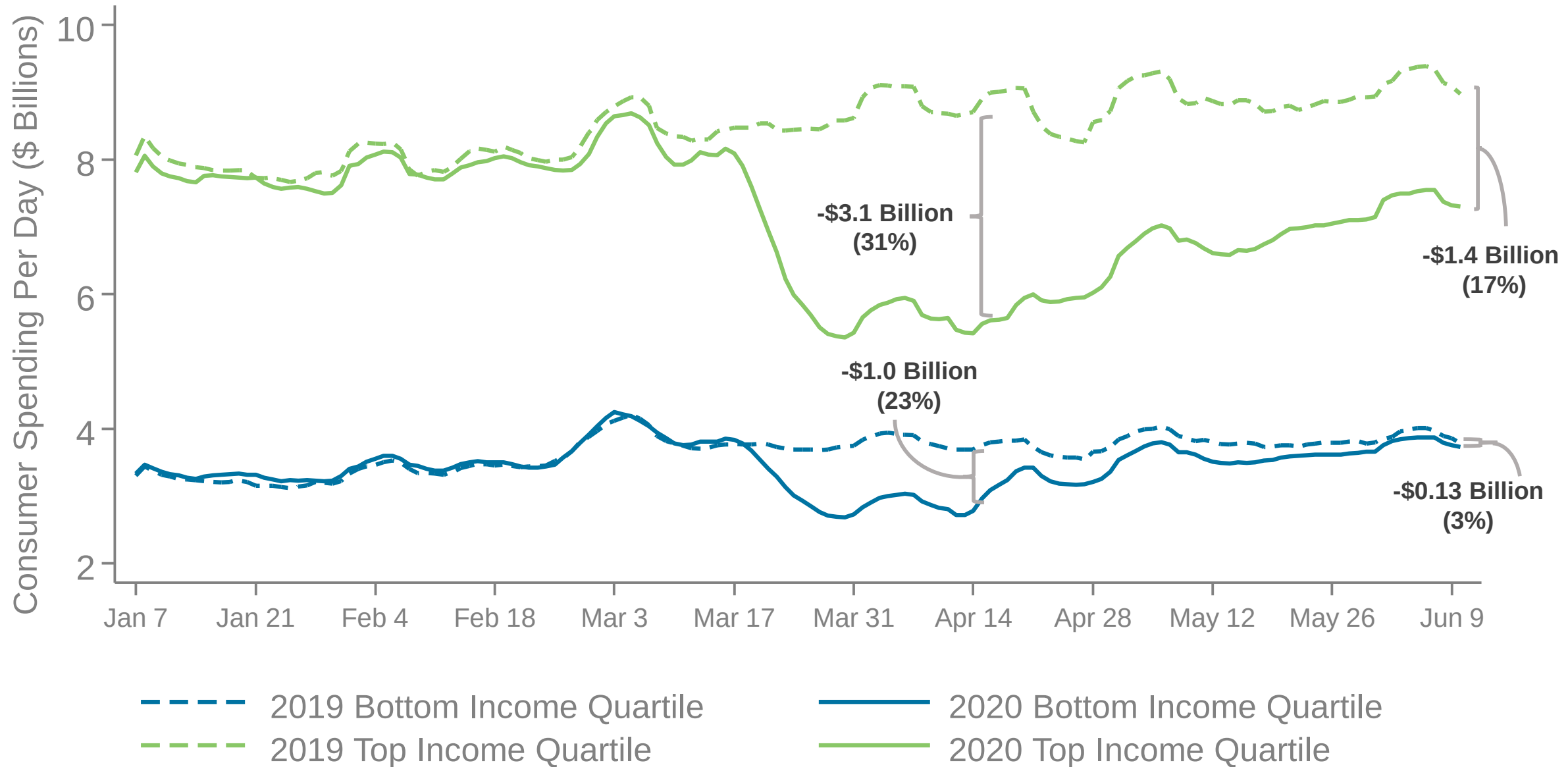
Impacts of COVID-19 on Consumer Spending

- 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 obtained from JPMorgan Chase individual-level income data as of April 15, 2020
[Farrell, Greig, Cox, Ganong, Noel 2020]

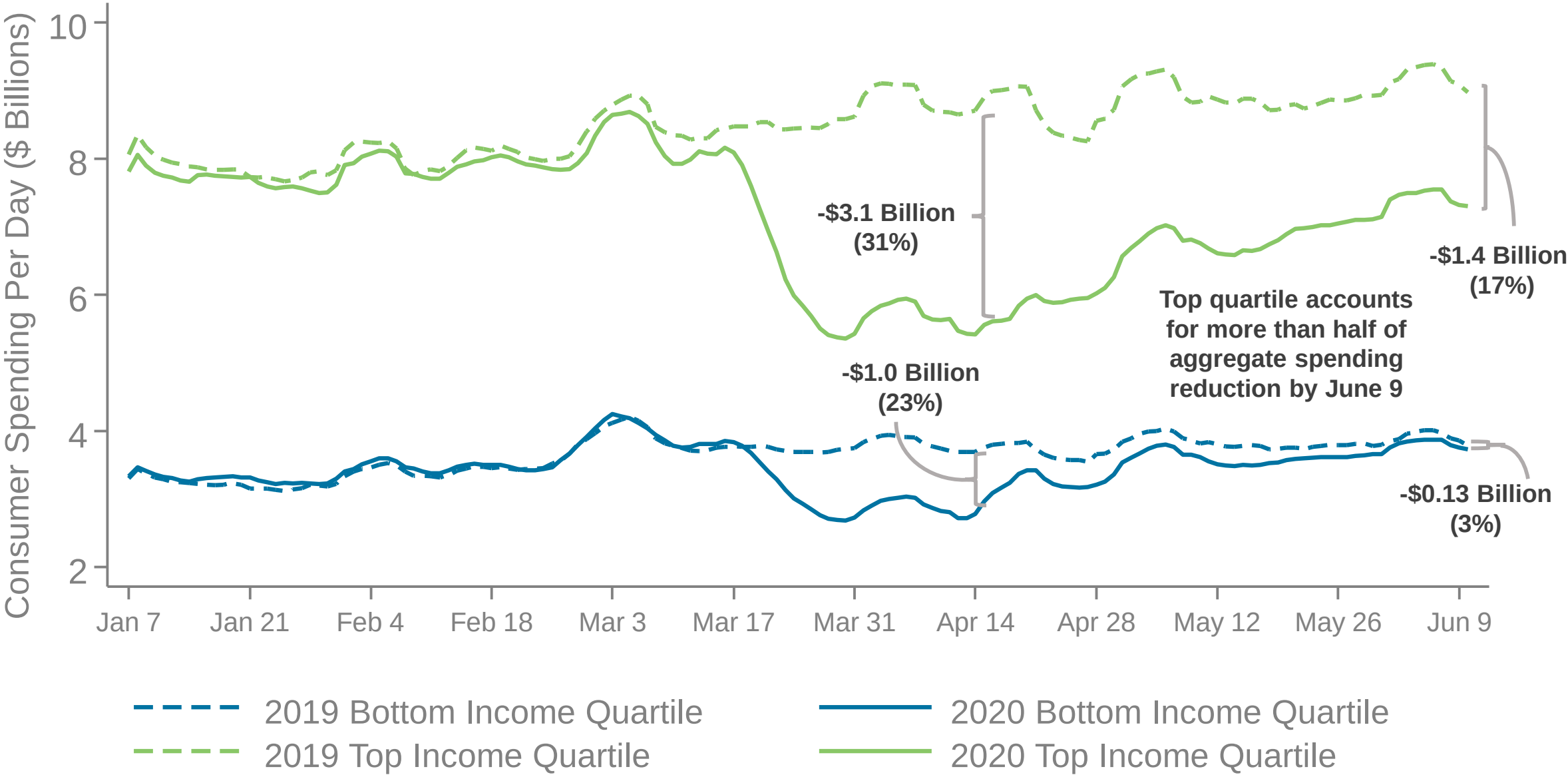
Consumer Spending by Income Quartile



Consumer Spending by Income Quartile



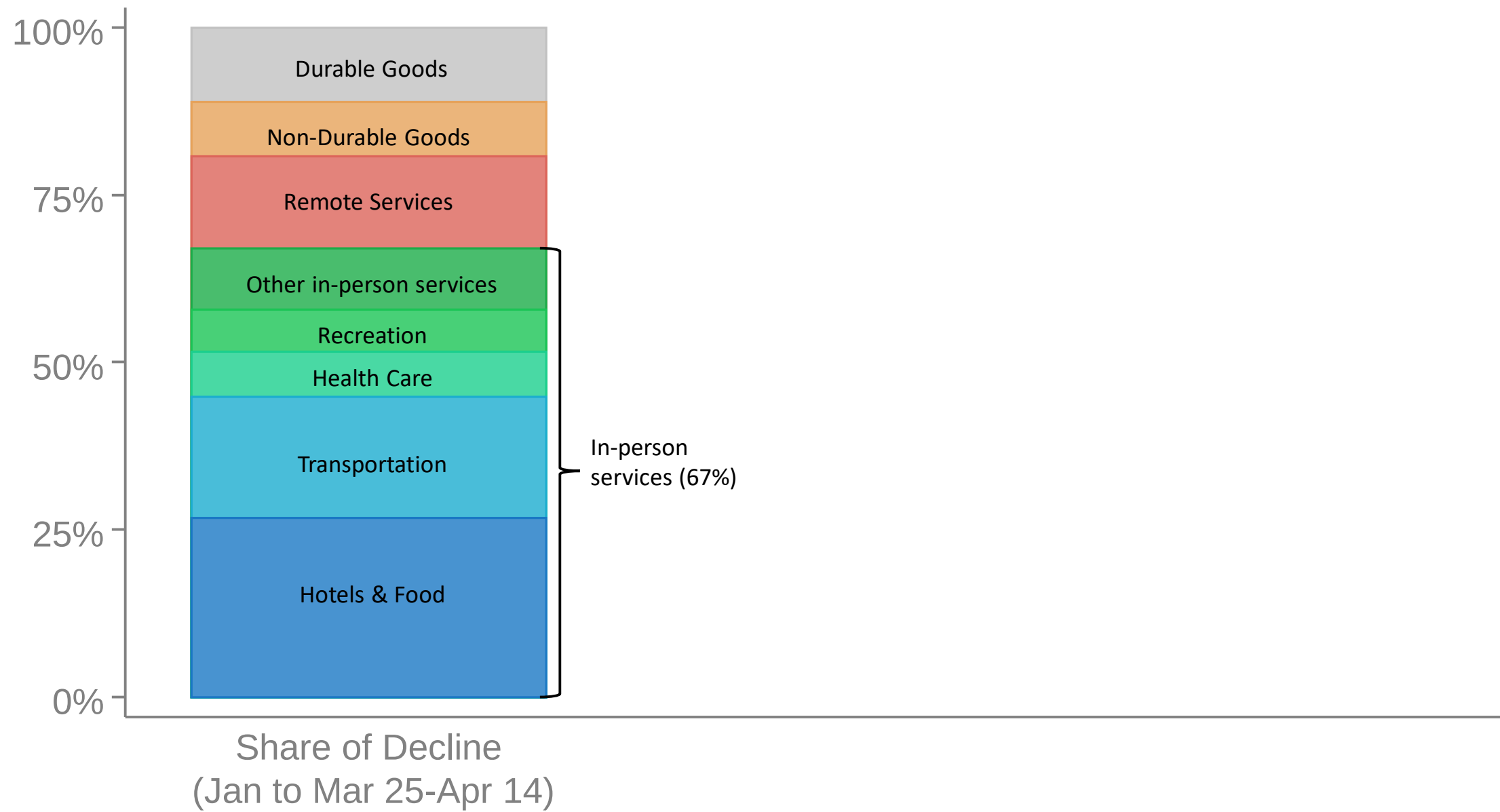
Consumer Spending by Income Quartile



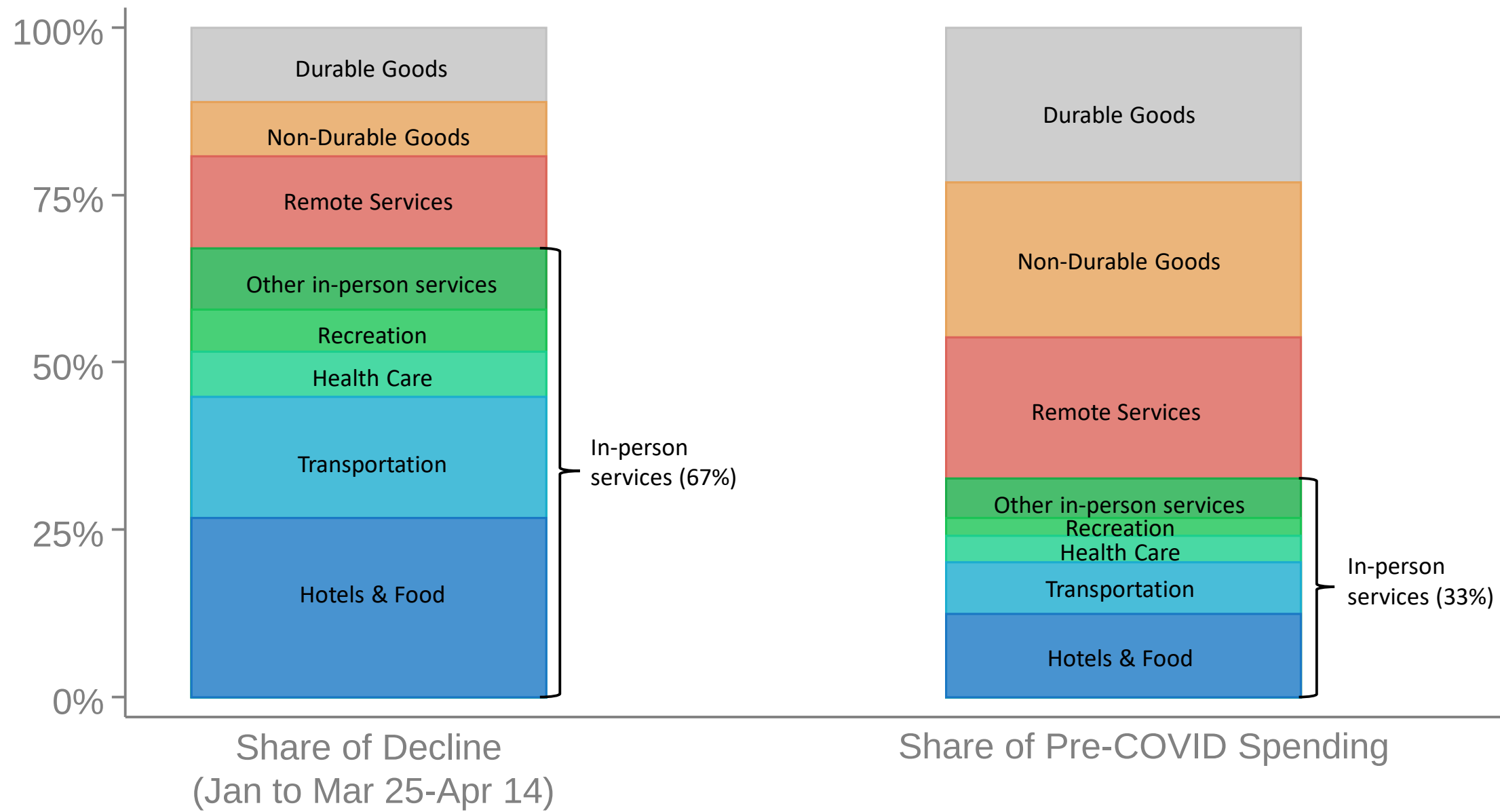
Impacts of COVID-19 on Consumer Spending

- Next, disaggregate by sector
 - Why did spending fall? Because of a reduction in purchasing power/expected income or health concerns about COVID-19?

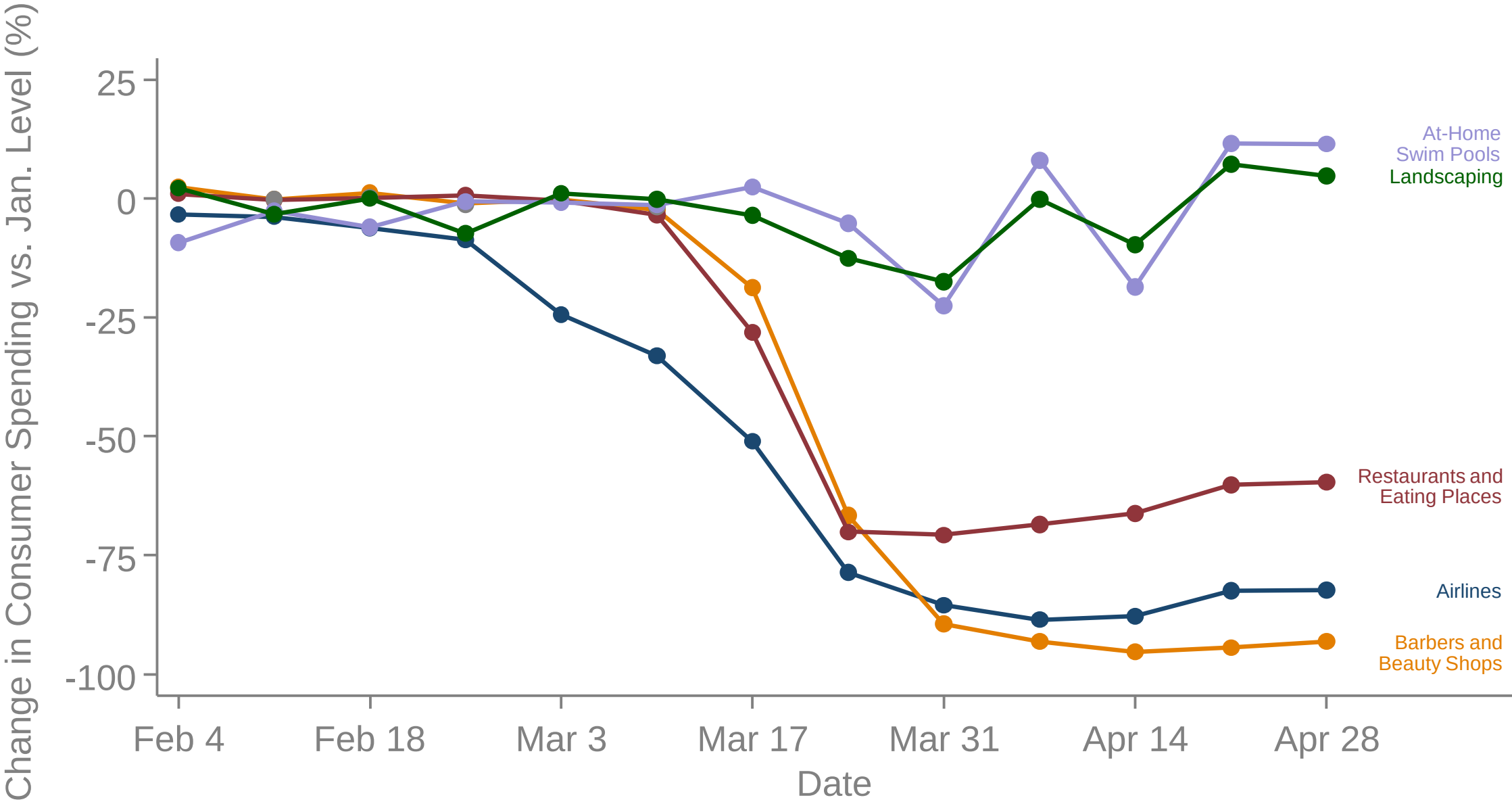
Changes in Consumer Spending by Sector



Changes in Consumer Spending by Sector

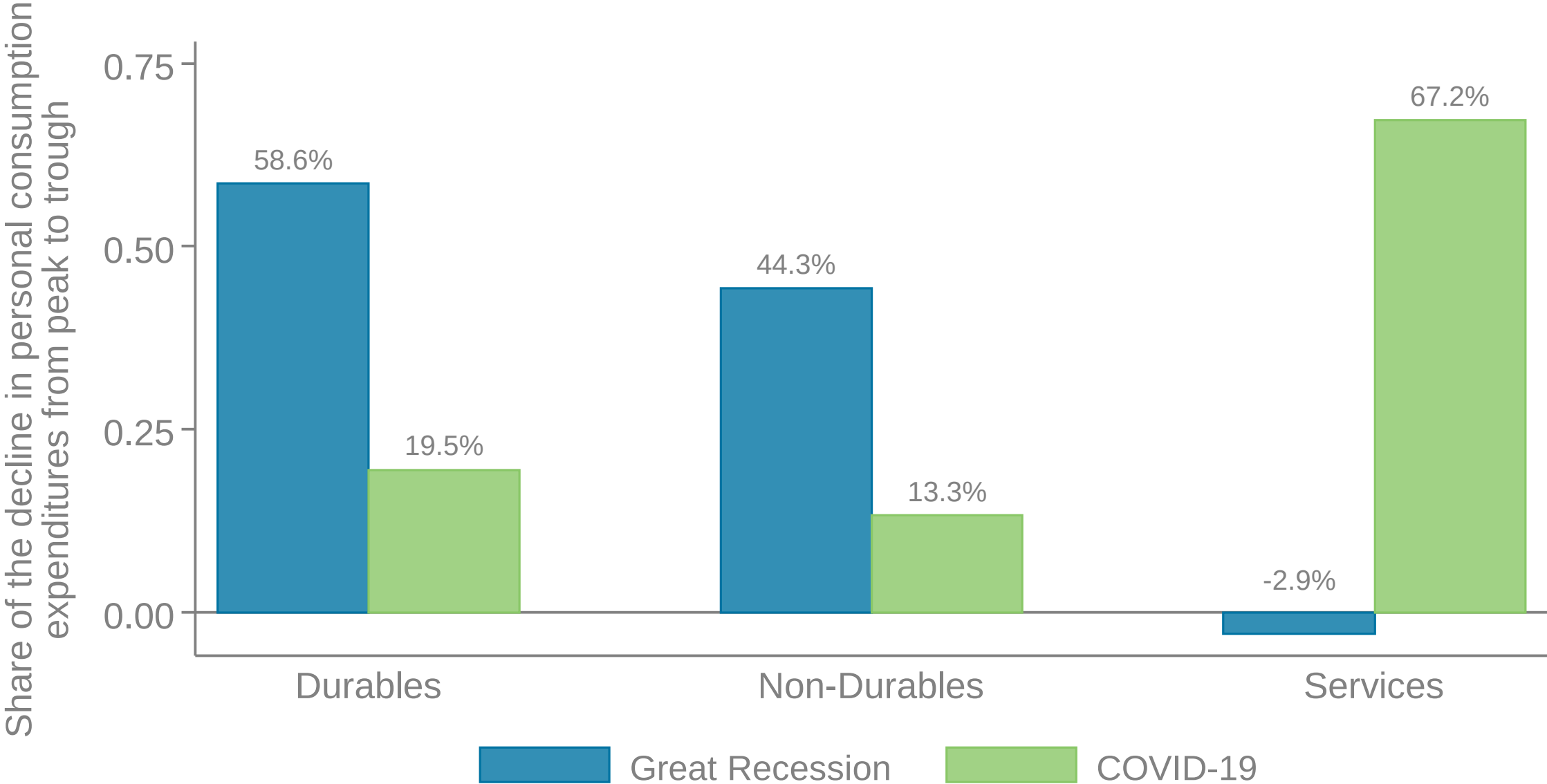


Changes in Consumer Spending by Sub-Category



Changes in Consumer Spending by Sector

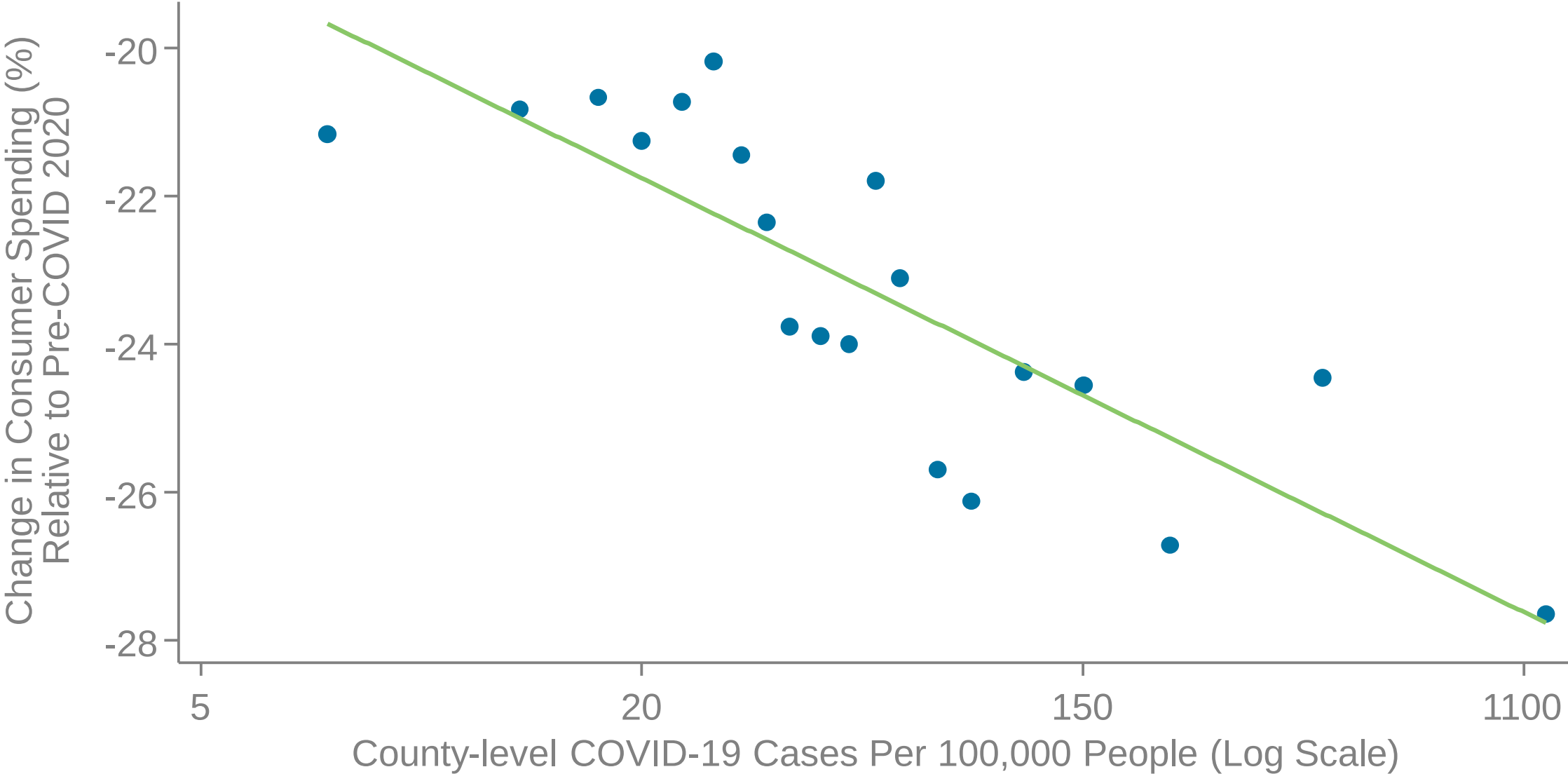
COVID vs Great Recession



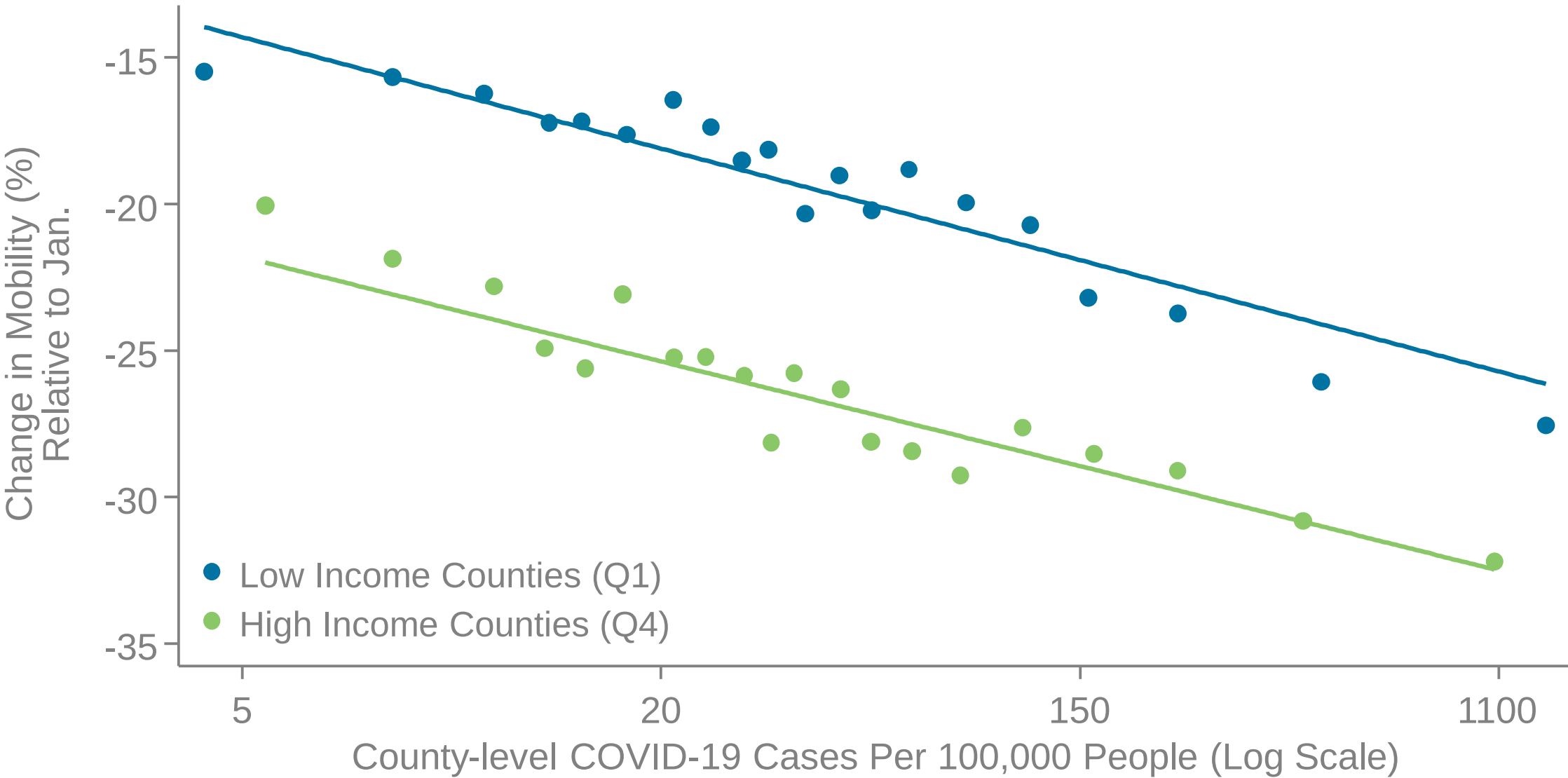
Impacts of COVID-19 on Consumer Spending

- Next, disaggregate by COVID incidence rates to examine effects of health concerns more directly

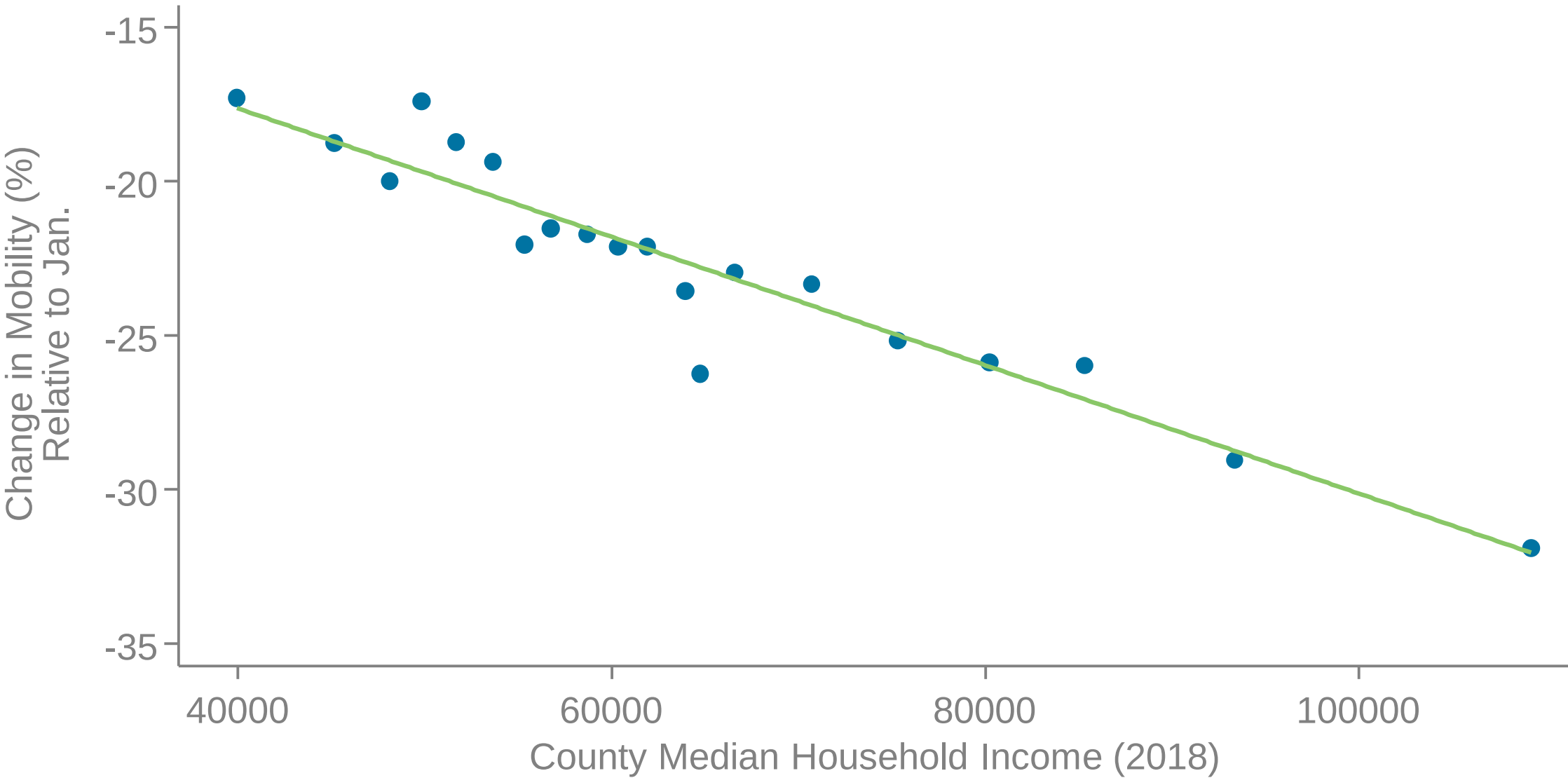
Consumer Spending Changes vs. COVID-19 Cases, by County



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



Time Spent Outside Home vs. Median Income, by County



Impacts of COVID-19 on Consumer Spending: Summary

- Consumer spending fell primarily because of health concerns rather than lost income
- Income losses were relatively small for the rich (Cajner et al. 2020) and low-income households had lost income more than fully replaced by unemployment insurance (Ganong, Noel, Vavra 2020)
- In current policy environment, 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)
- Now examine downstream impacts of this novel spending shock on businesses and employees

Data

Impacts of
COVID-19

Impacts of
Stabilization
Policies

Policy
Implications

Business Revenues

Impacts of COVID-19 on Businesses

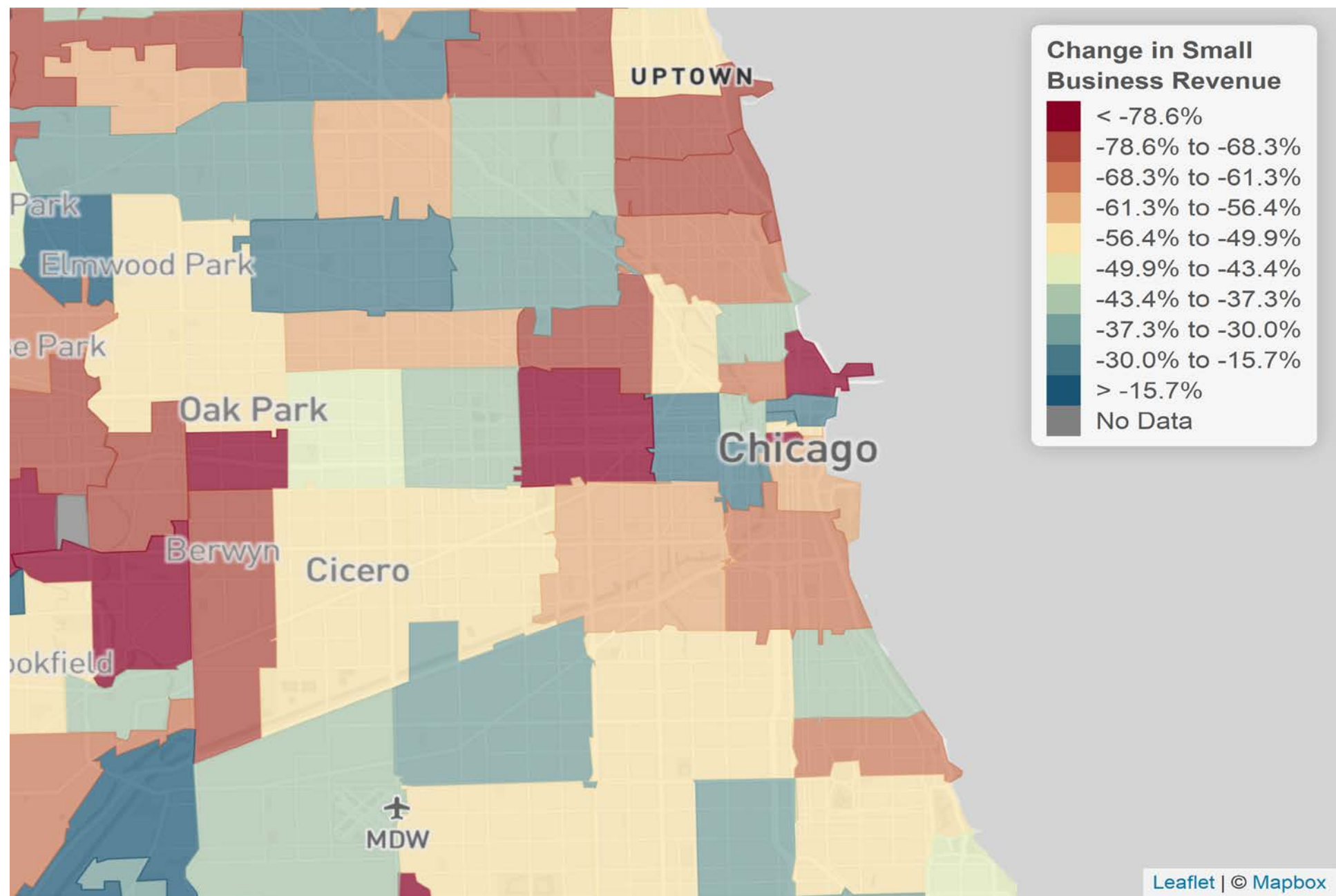
- How did fall in consumer spending and business revenue affect business decisions: decision to remain open, employment, new job postings, etc.?
- To answer this question, use variation in size of spending shocks across ZIP codes
 - Spending fell primarily among high-income households for in-person services 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

New York



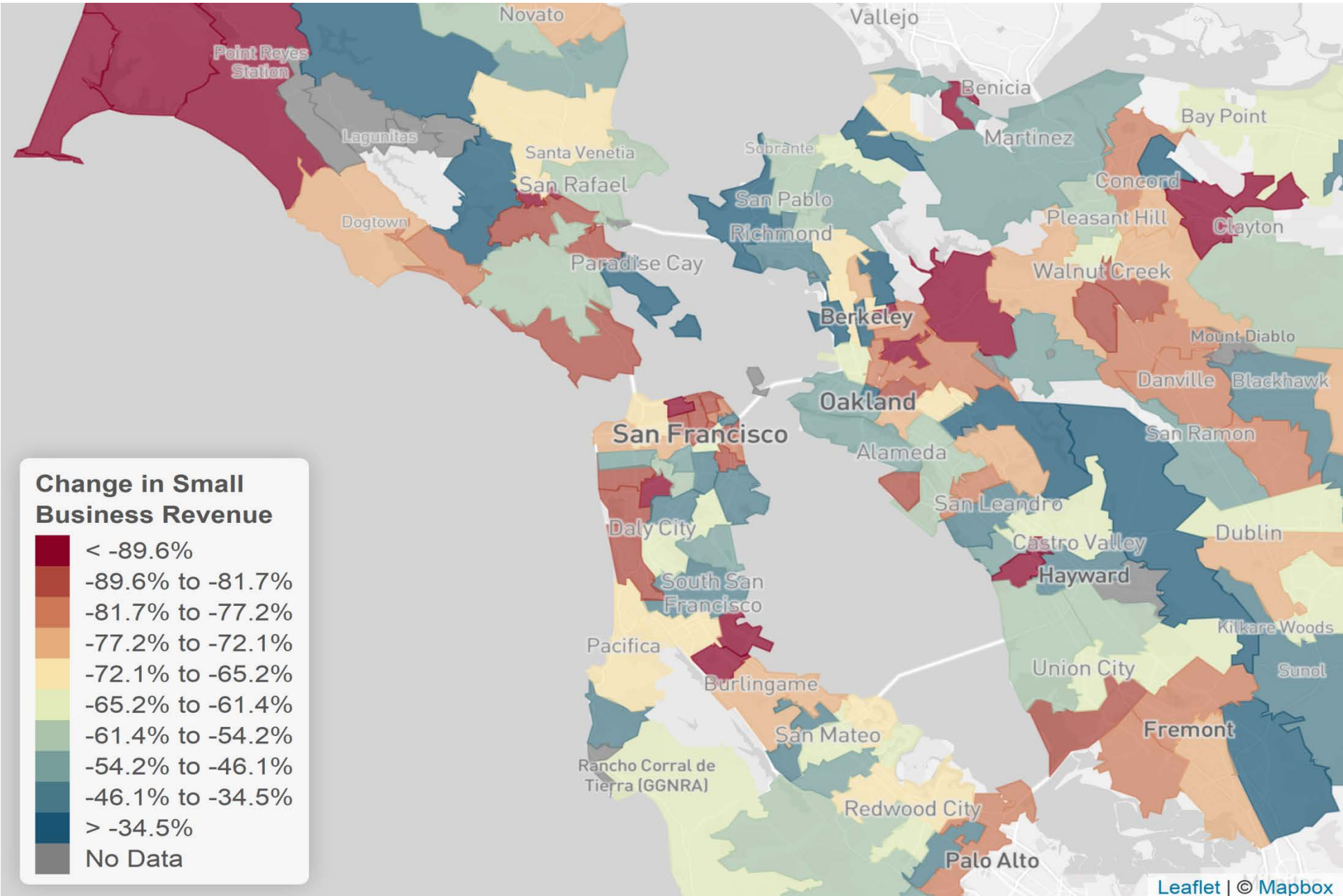
Changes in Small Business Revenues from January to April by ZIP Code

Chicago



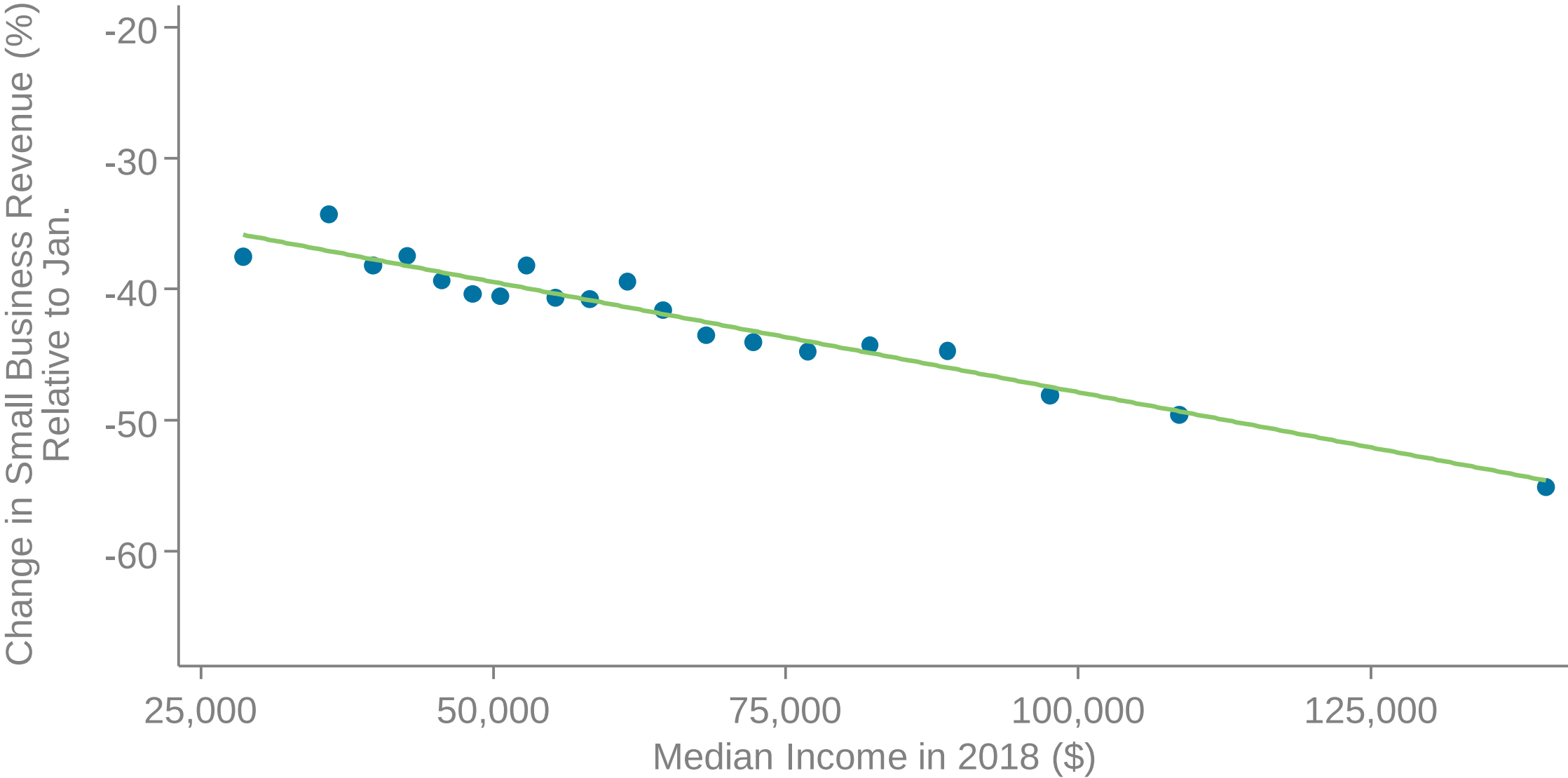
Changes in Small Business Revenues from January to April by ZIP Code

San Francisco



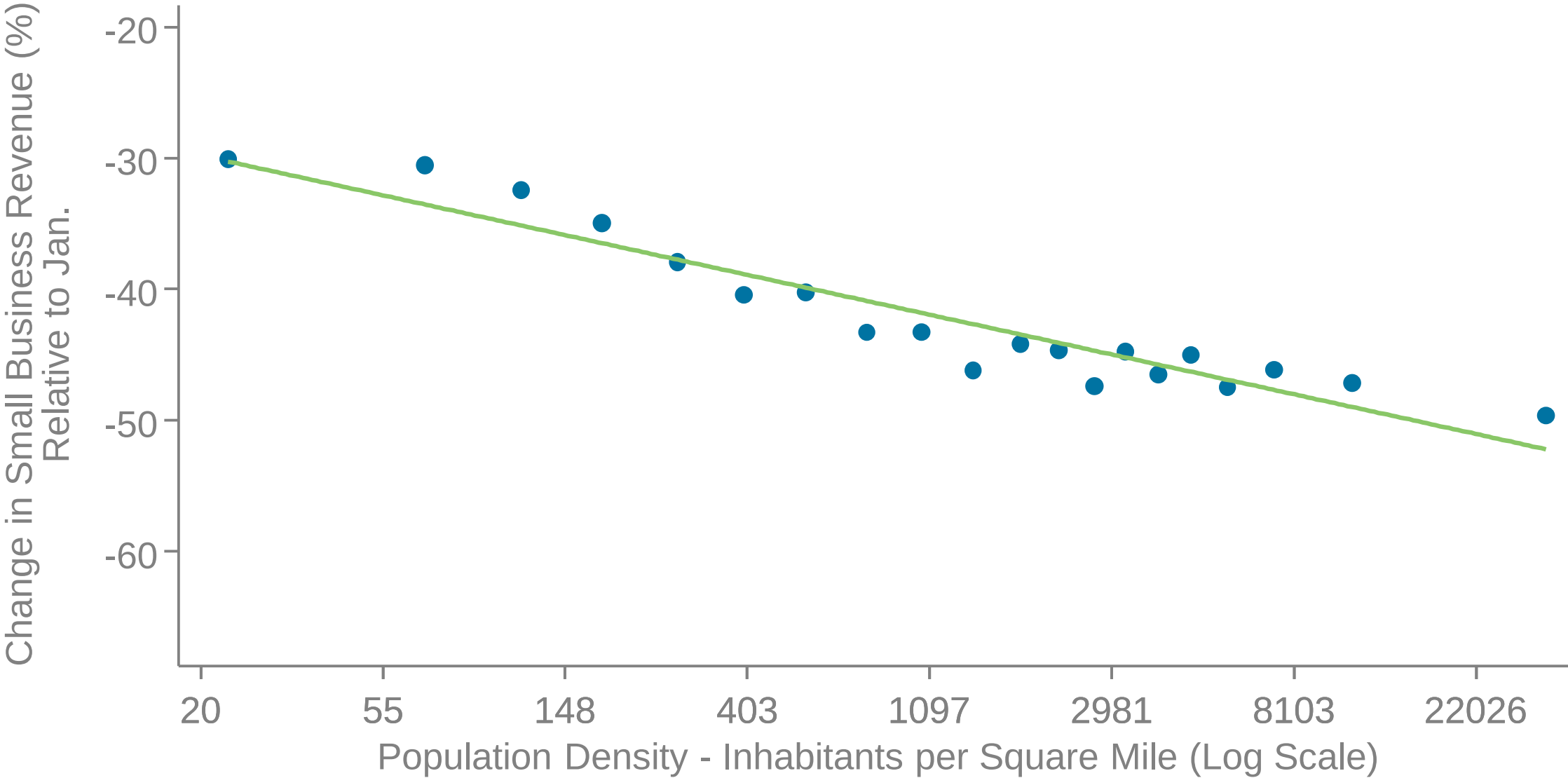
Changes in Small Business Revenues vs. ZIP Code Characteristics

Median Income



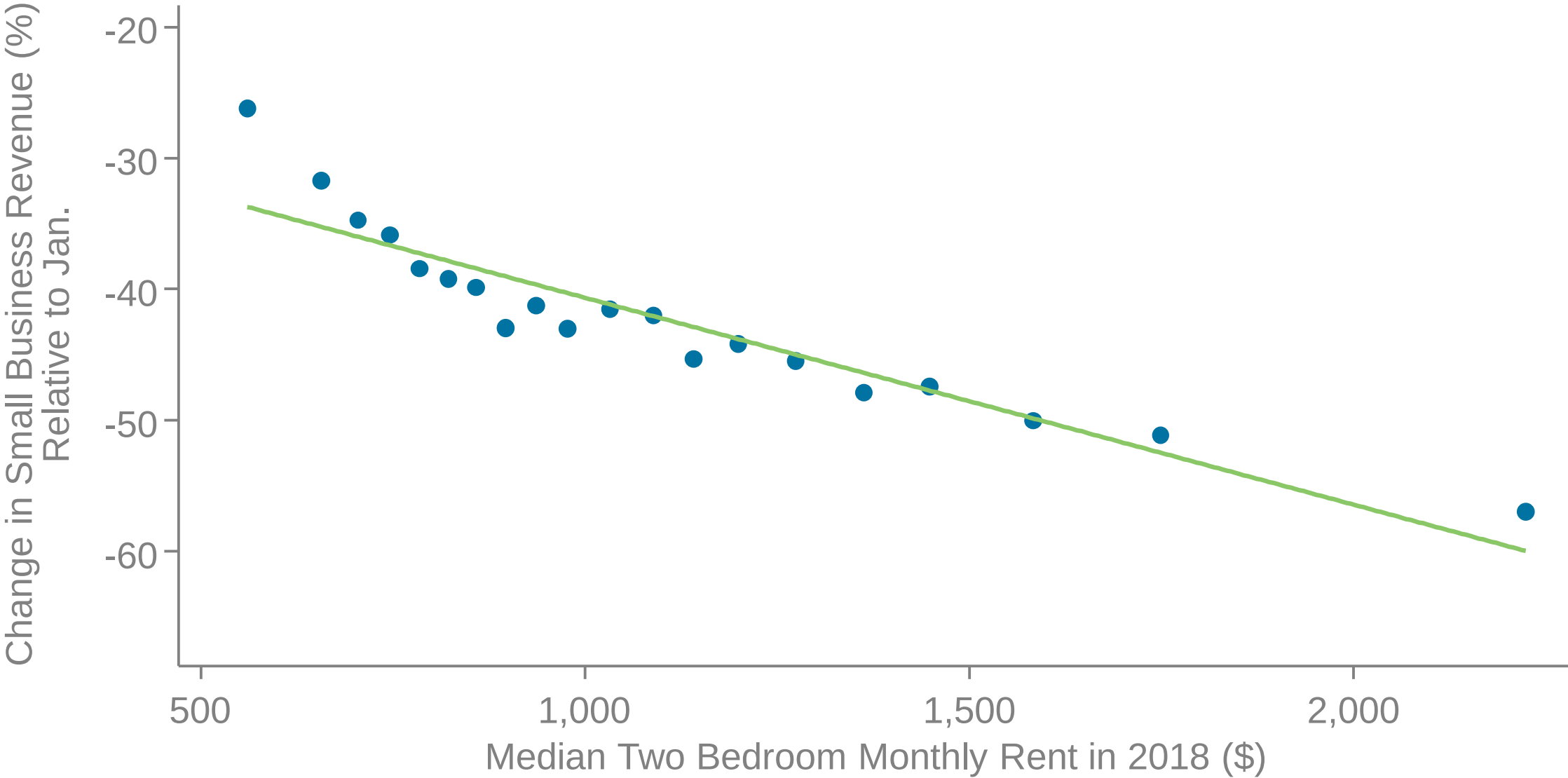
Changes in Small Business Revenues vs. ZIP Code Characteristics

Population Density



Changes in Small Business Revenues vs. ZIP Code Characteristics

Median Two Bedroom Rent



Changes in Small Business Revenues vs. ZIP Code Characteristics

Median Two Bedroom Rent: Non-Tradable vs. Teleworkable



Impacts of COVID-19 on Businesses: Summary

- Impacts of COVID shock on business are highly heterogeneous across areas
- More than half of aggregate loss in small business revenues came from business located in the top-quartile of ZIP codes by rent; only 8% from bottom-quartile

Data

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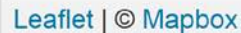
Policy
Implications

Employment

Impacts of COVID-19 on Employment

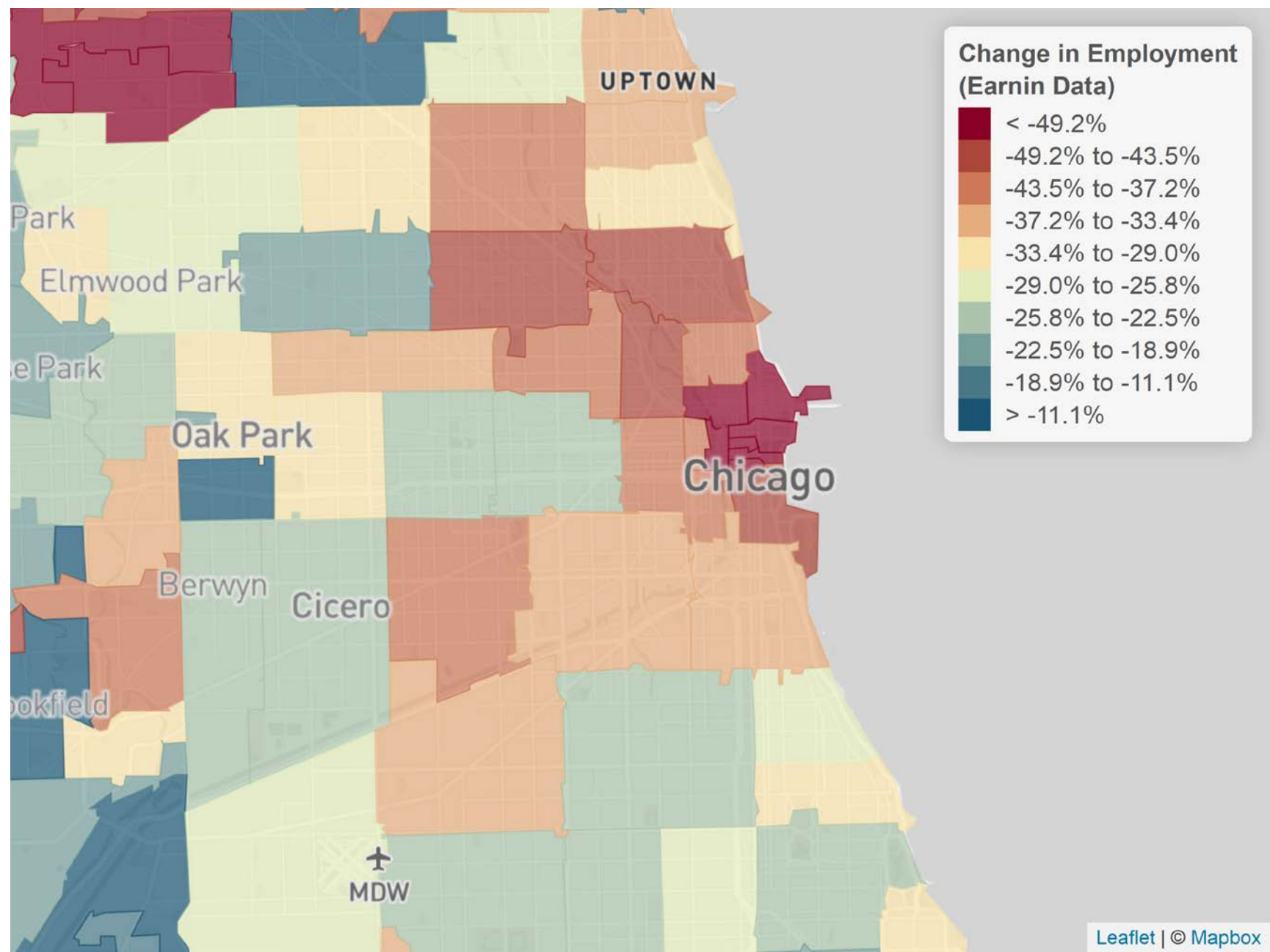
- How did loss in business revenues affect employees?
- Employment losses have been concentrated at the low end of the income distribution (Cajner et al. 2020)
- Analyze employment of low-wage workers primarily using data from Earnin, which closely tracks overall employment for bottom-quintile workers in other data sources
 - Similar results obtained using other data sources: Homebase, Intuit

New York



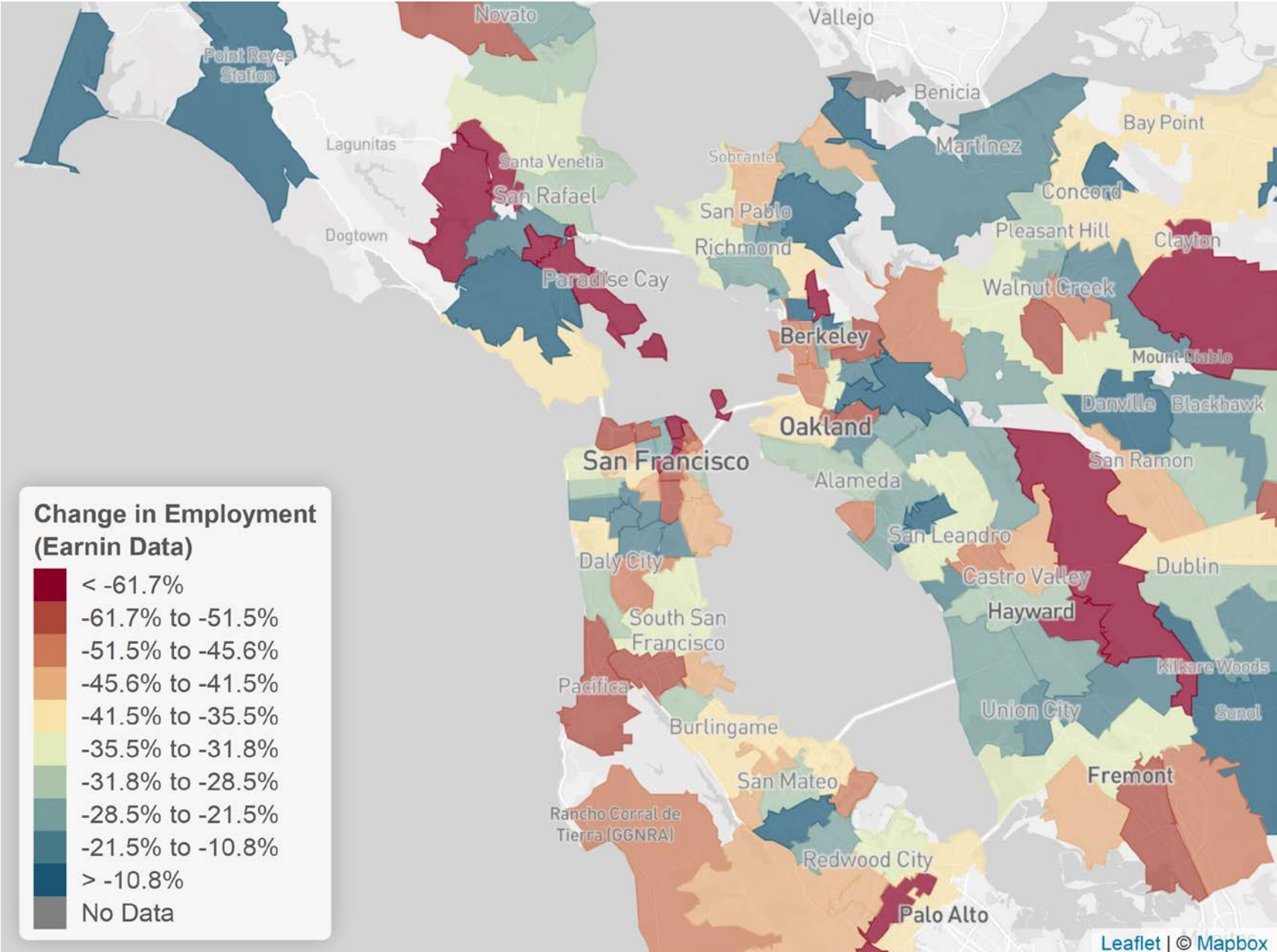
Changes in Employment Rates by ZIP Code

Chicago



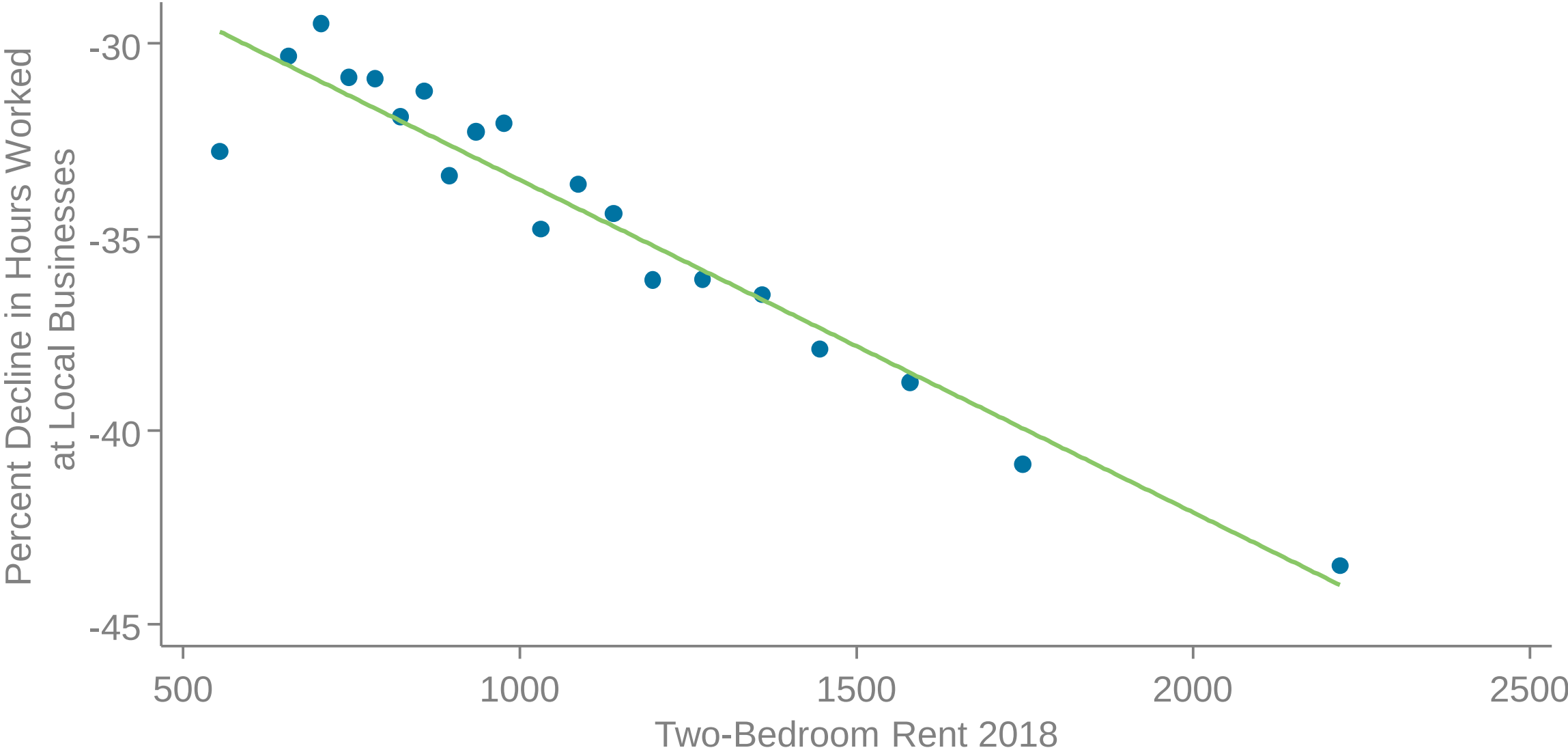
Changes in Employment Rates by ZIP Code

San Francisco



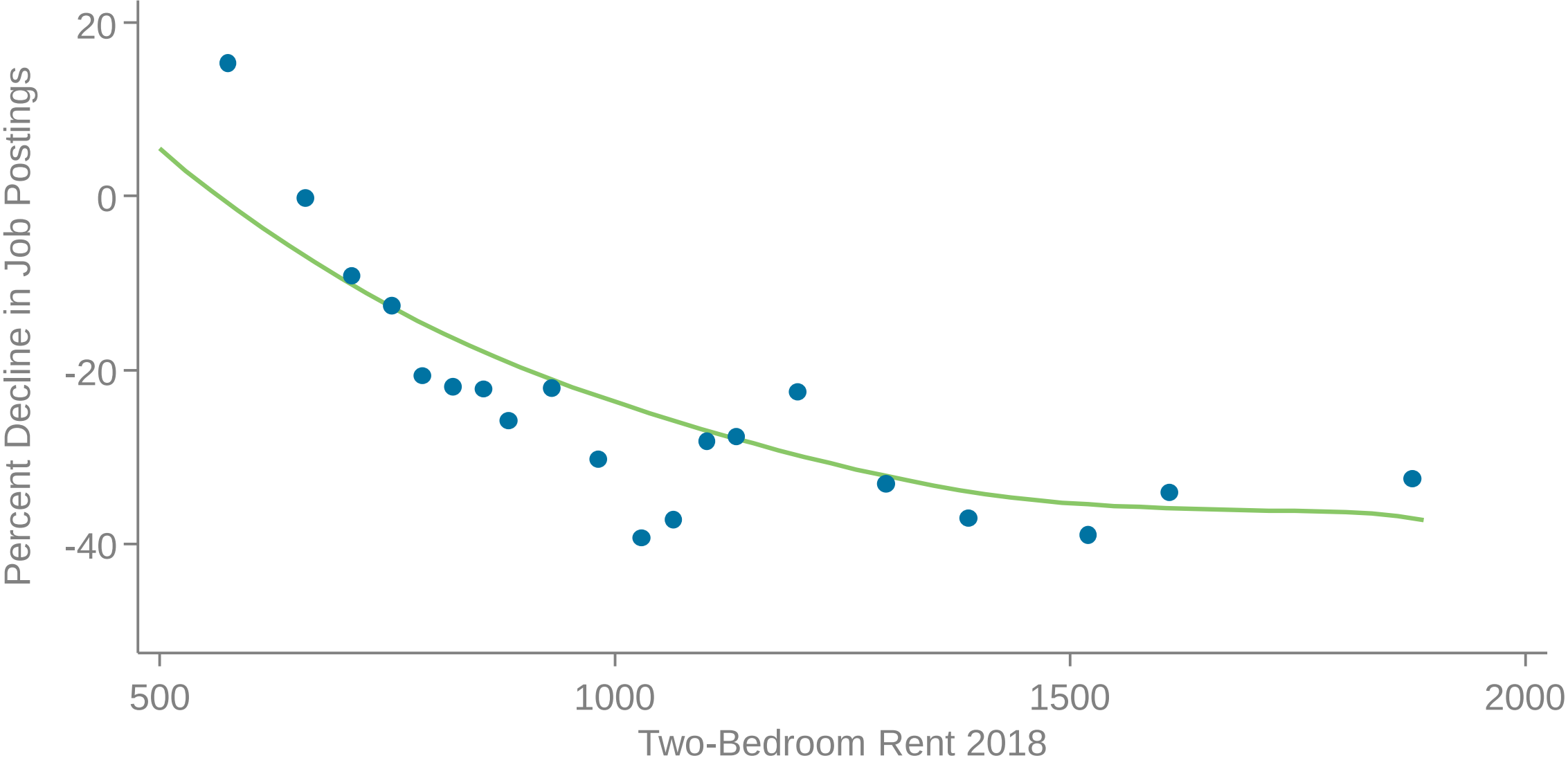
Changes in Employment and Job Postings vs. Rent

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



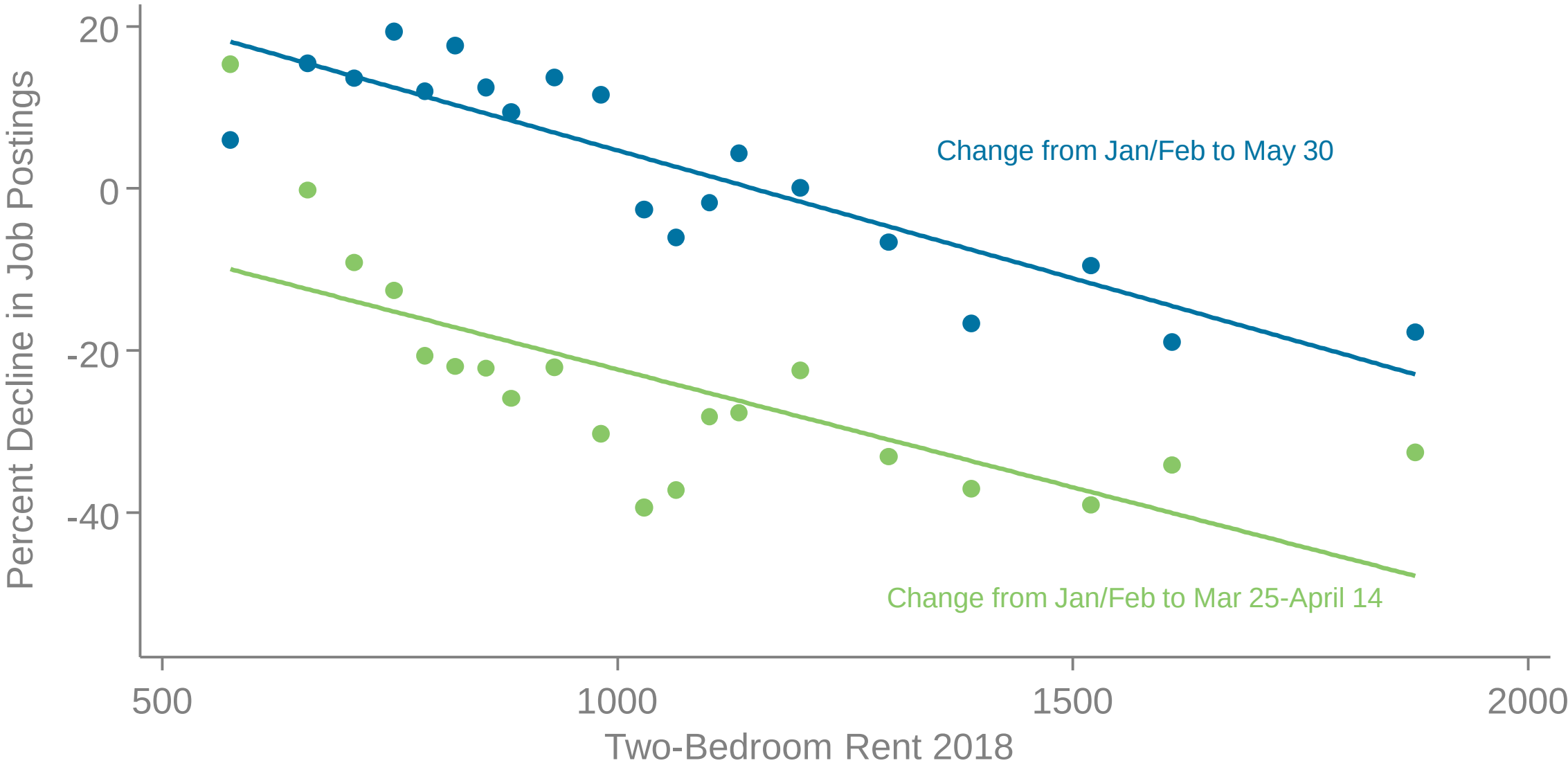
Changes in Employment and Job Postings vs. Rent

Job Postings for Low-Education Workers and County Median Rent (Burning Glass)



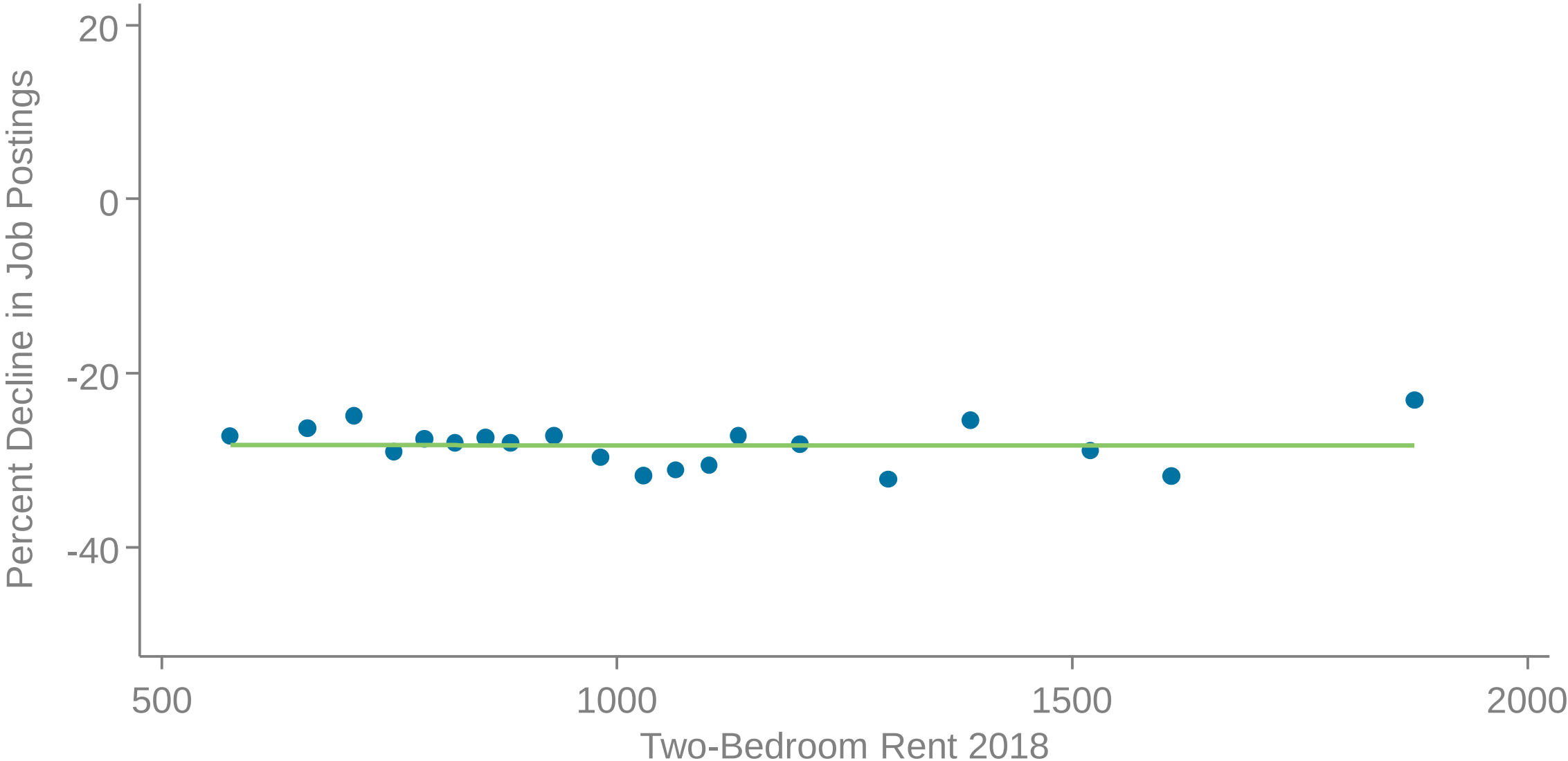
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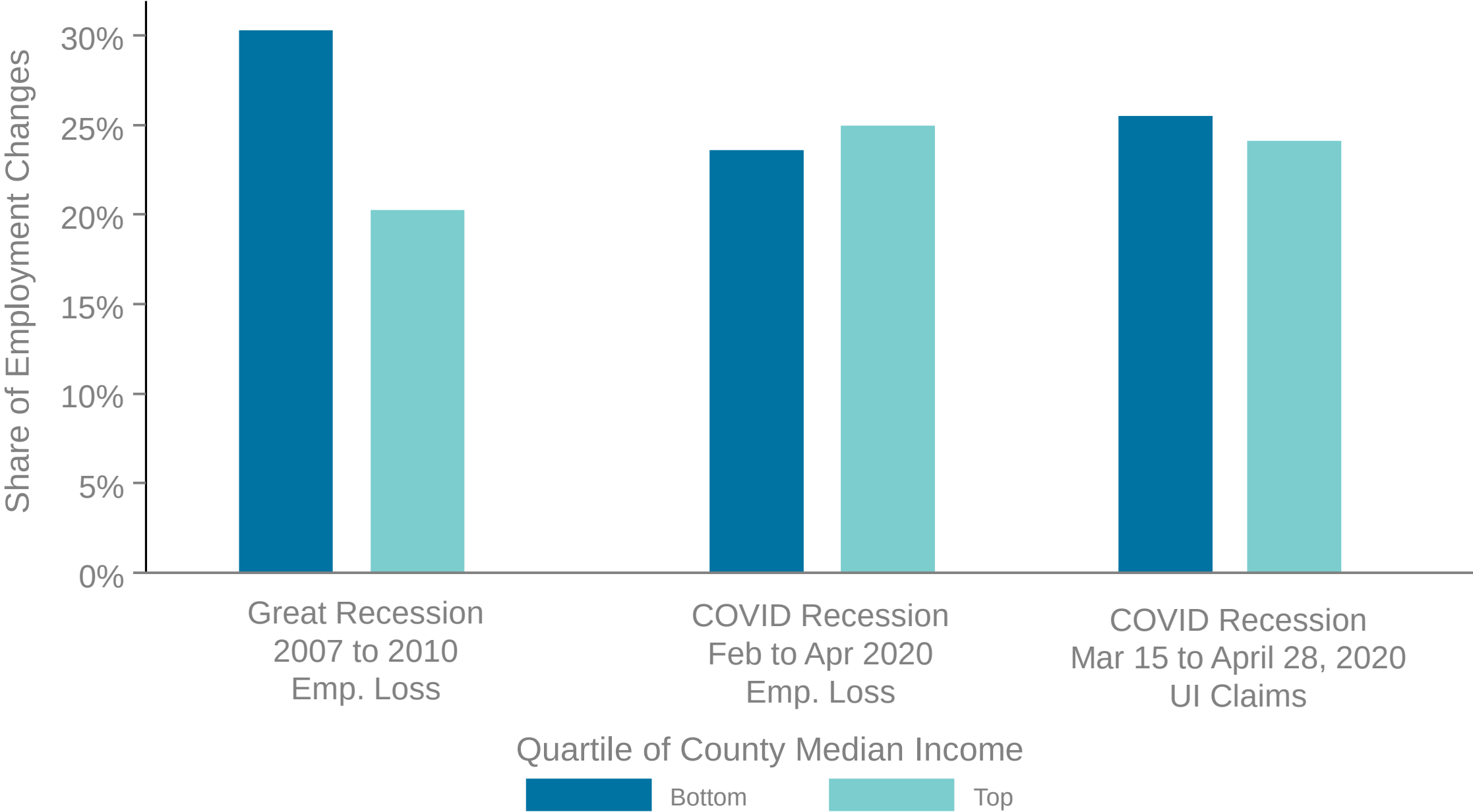


Changes in Employment and Job Postings vs. Rent

Job Postings for High-Education Workers and County Median Rent (Burning Glass)



Geography of Unemployment in the Great Recession vs. COVID Recession



Impacts of COVID-19 on Employment: Summary

- 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

Data

Impacts of
COVID-19

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Impacts of Stabilization Policies

Impacts of COVID-19 on Employment: Summary

- 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

Data

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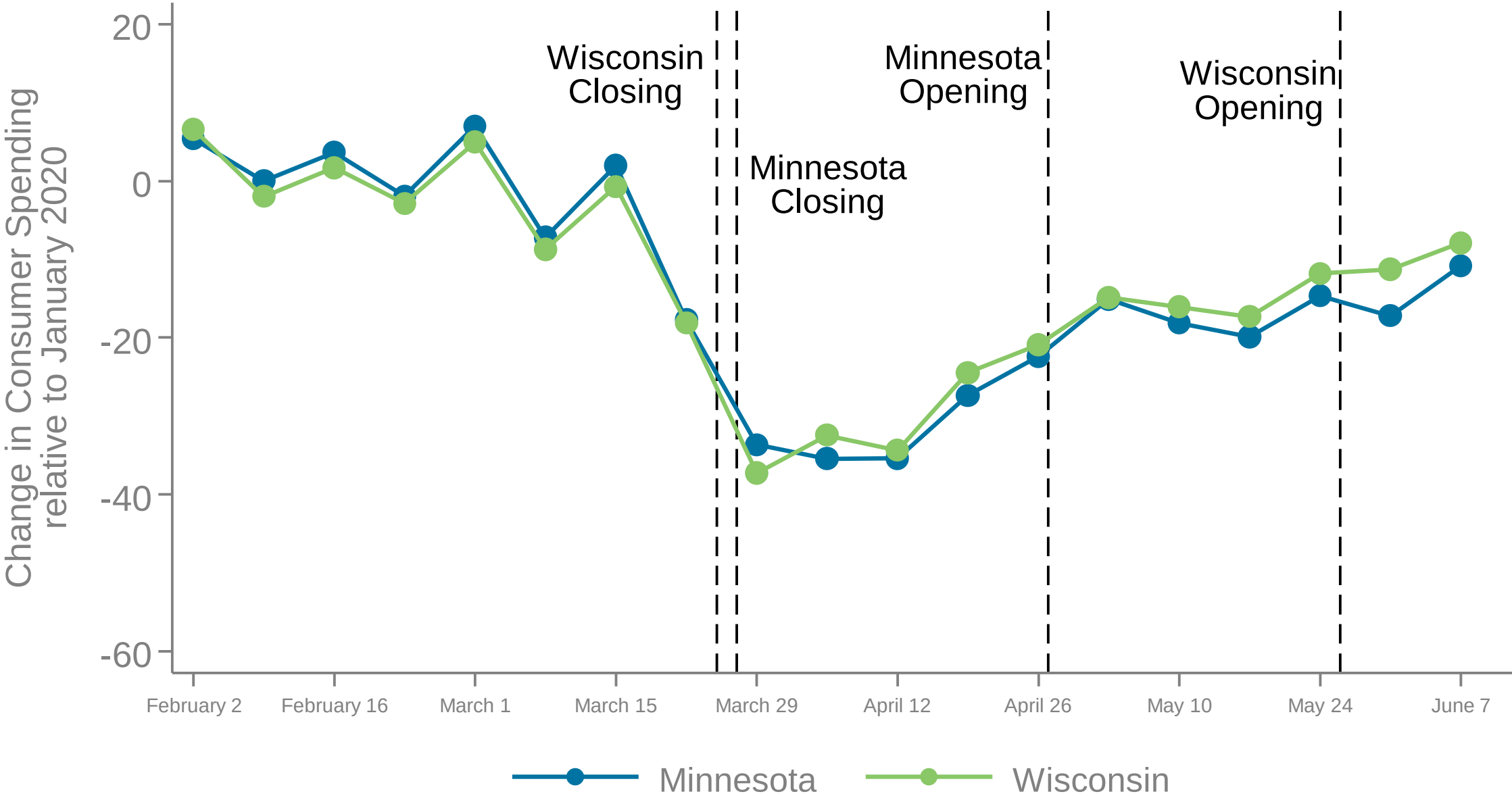
State-Ordered Reopenings

State-Ordered Reopenings

- Can executive orders restore economic activity?
- Compare trends in spending and employment in states that reopened earlier vs. later to assess

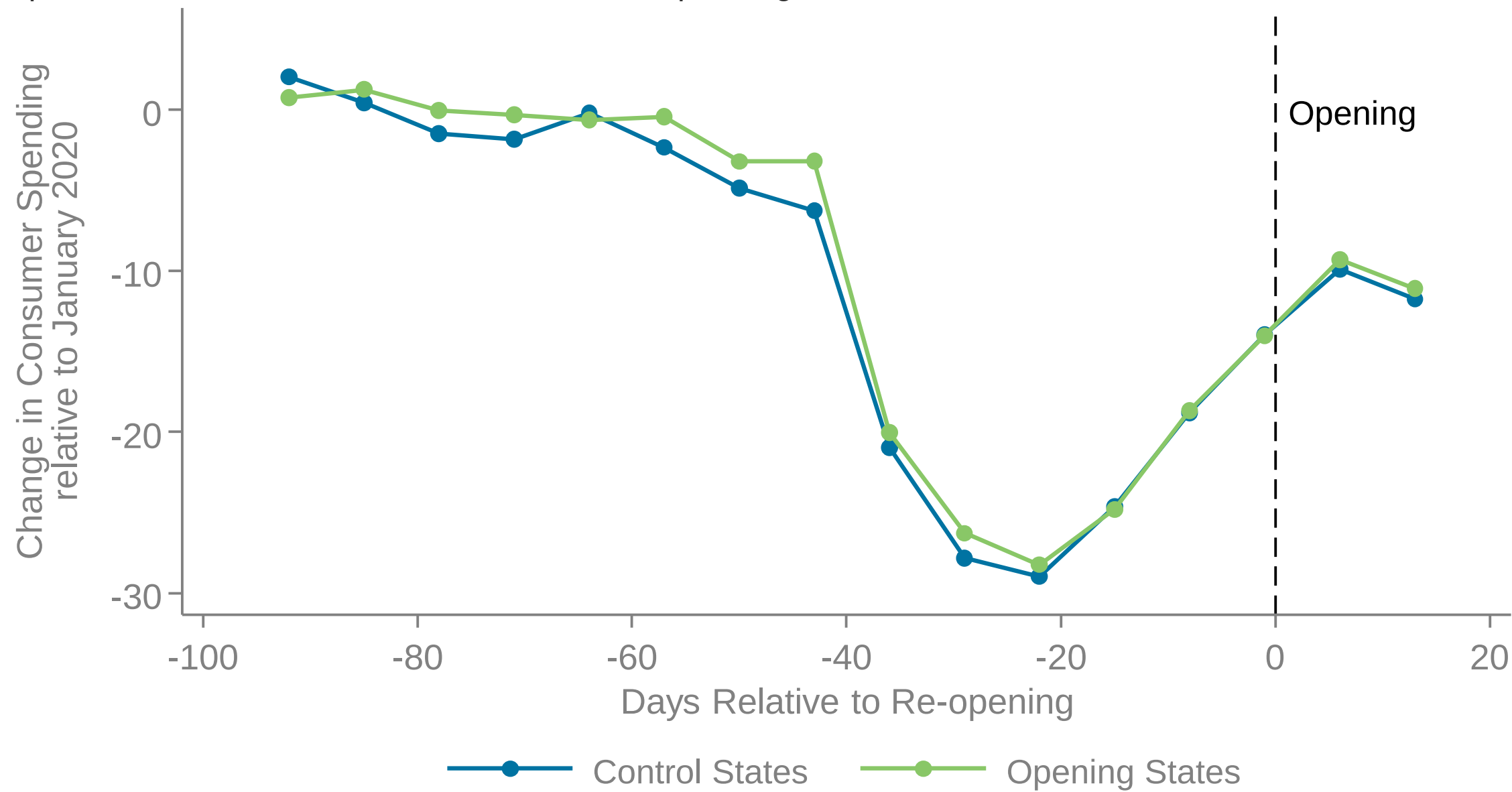
Causal Effects of Re-Openings on Economic Activity: Event Studies

Case Study on Business Re-Openings: Minnesota vs Wisconsin



Causal Effects of Re-Openings on Economic Activity: Event Studies

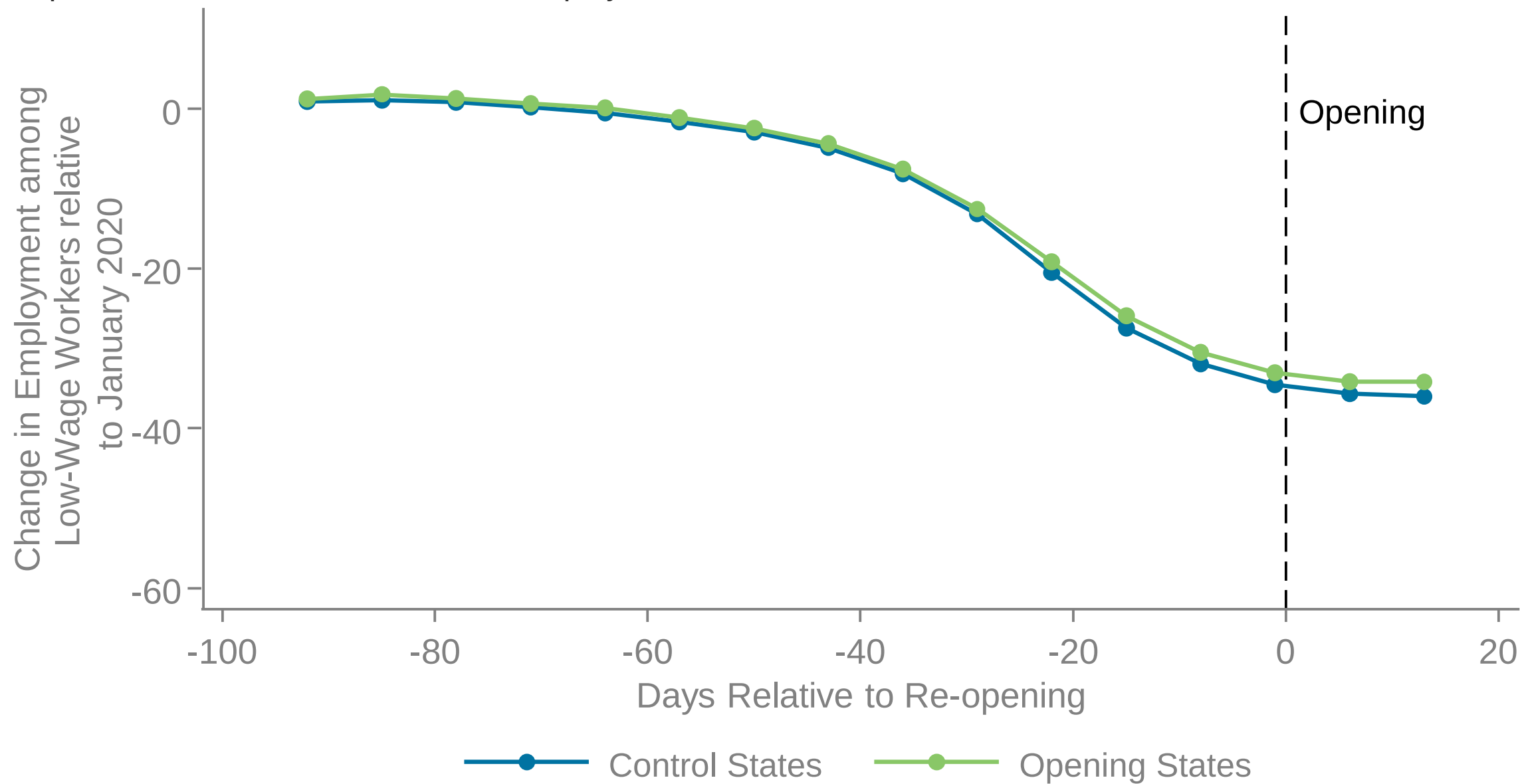
Re-Opened States vs. Control States: Consumer Spending



Diff-in-diff Estimate: +.505p.p. (s.e. = 3.036)

Causal Effects of Re-Openings on Economic Activity: Event Studies

Re-Opened States vs. Control States: Employment



Diff-in-diff Estimate: +.197p.p. (s.e. = 1.533)

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

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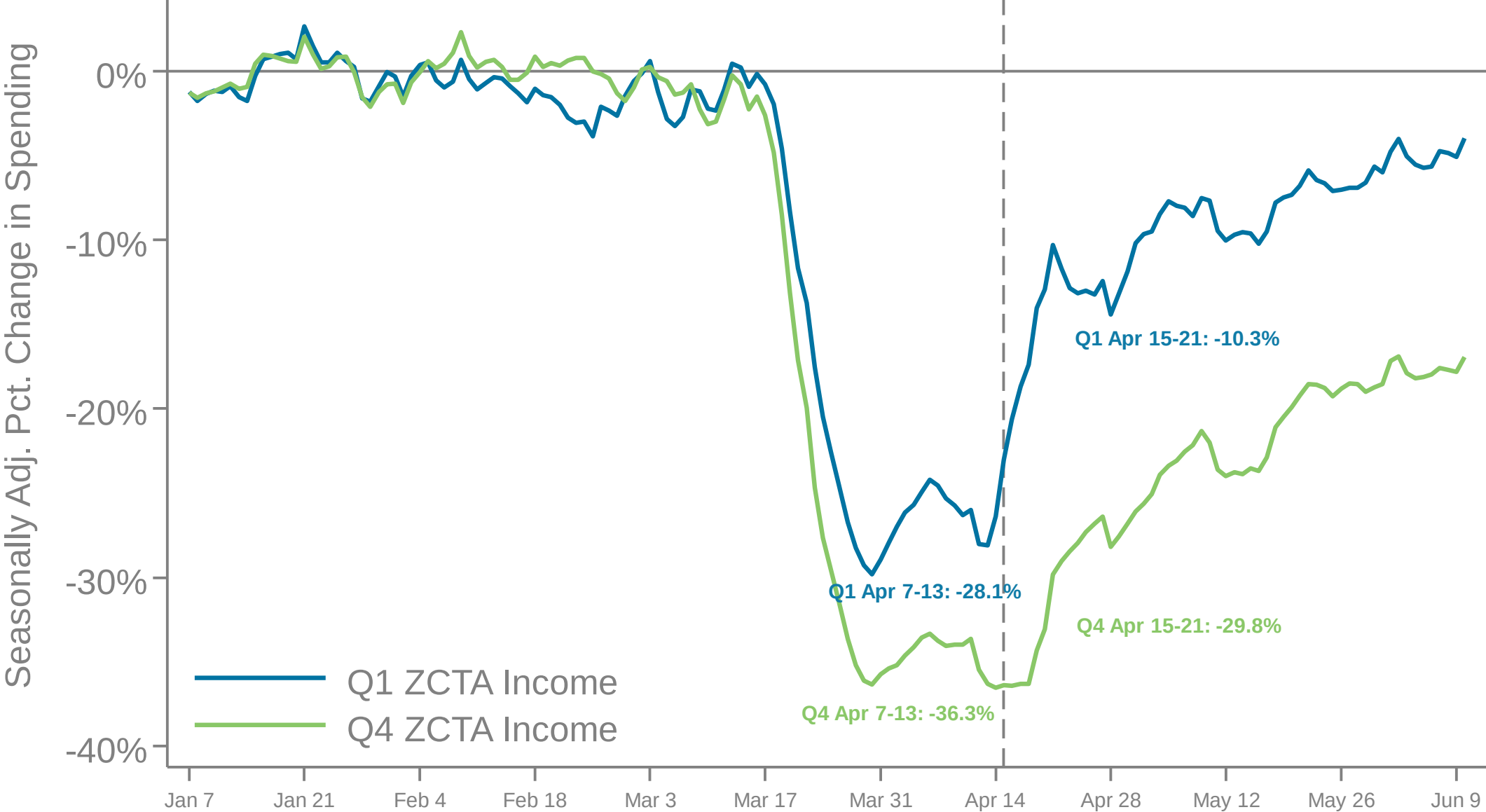
Stimulus Payments

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

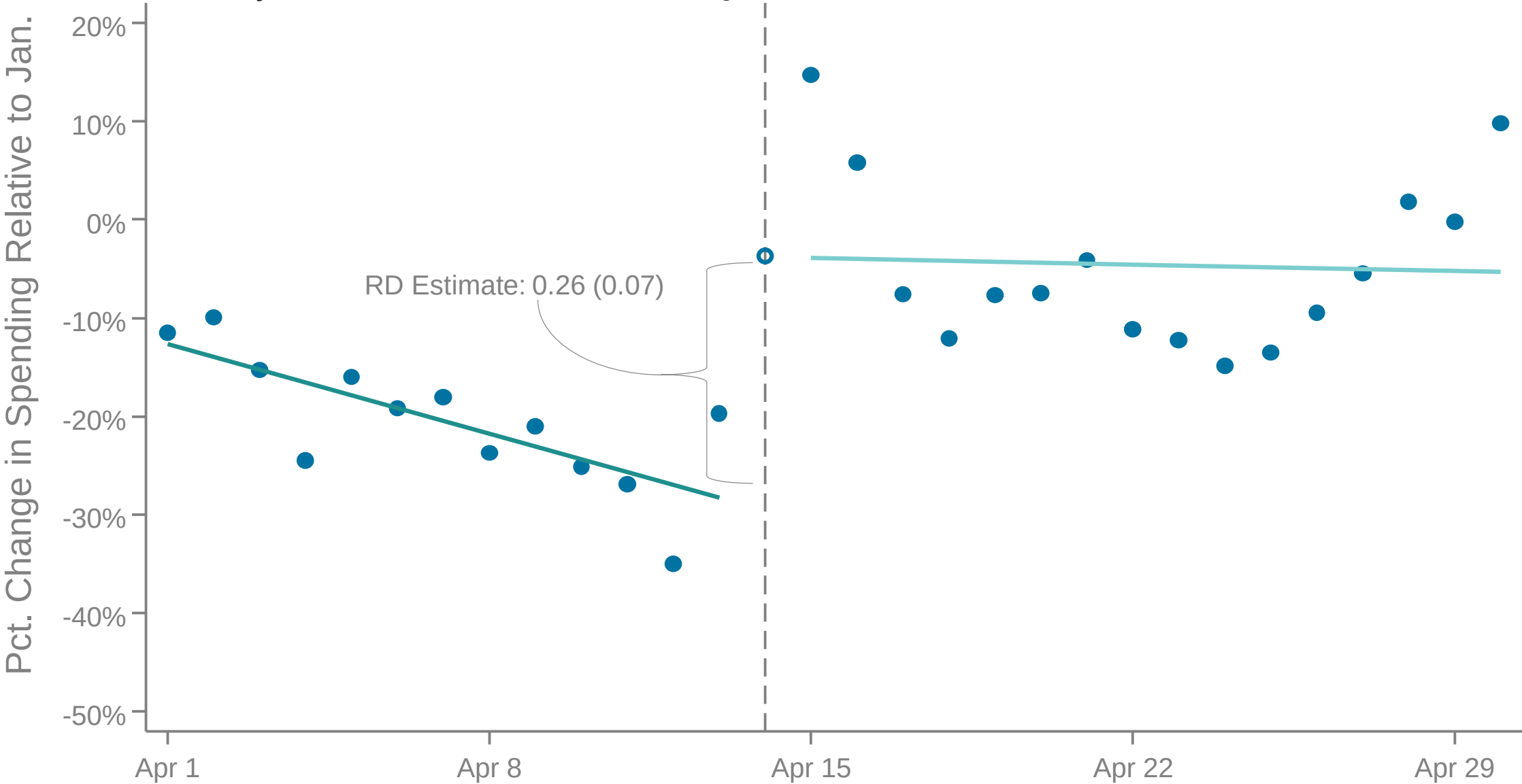
Impact of Stimulus Payments on Consumer Spending

Seasonally Adjusted Spending Changes by Income Quartile



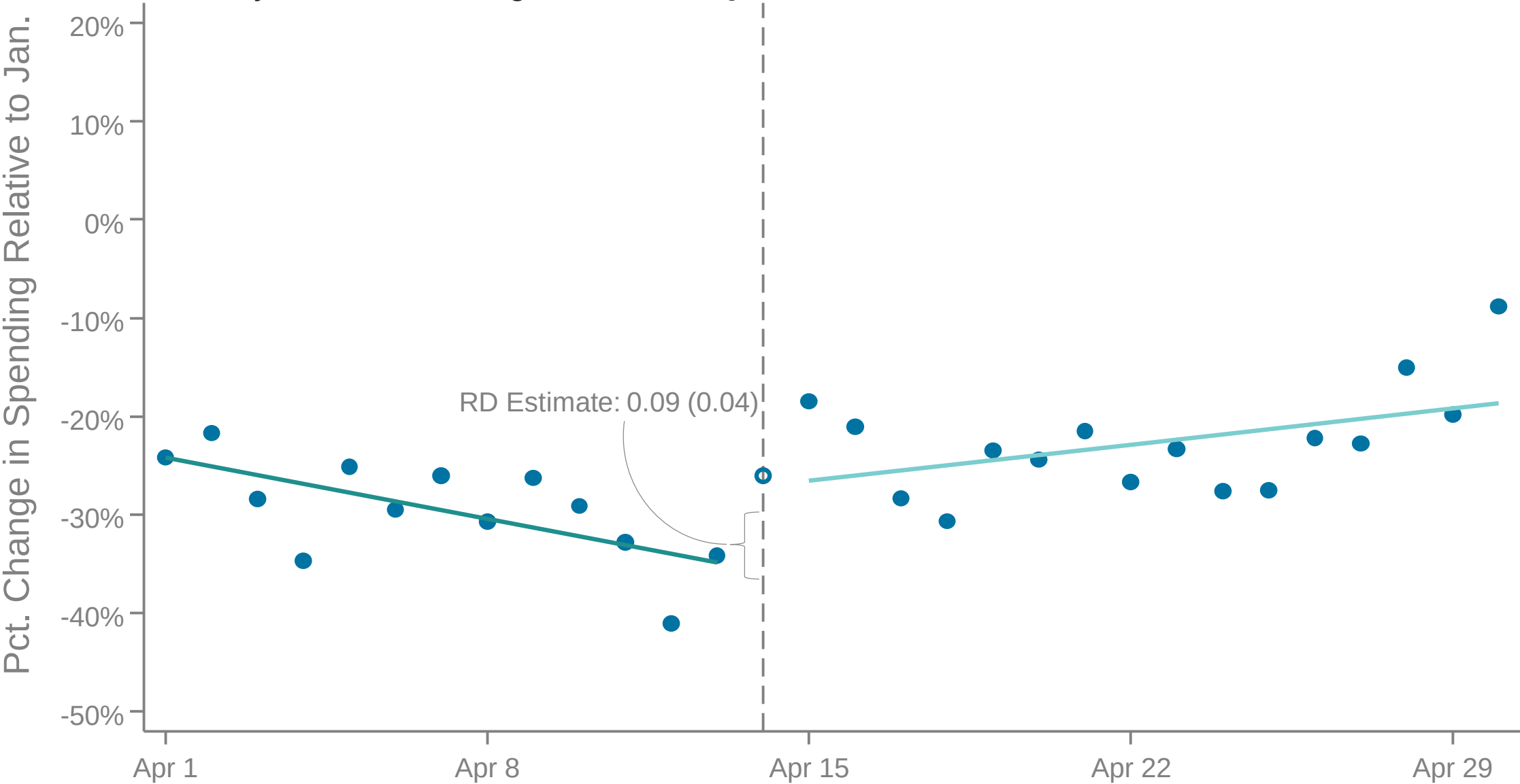
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for Bottom Income Quartile Households



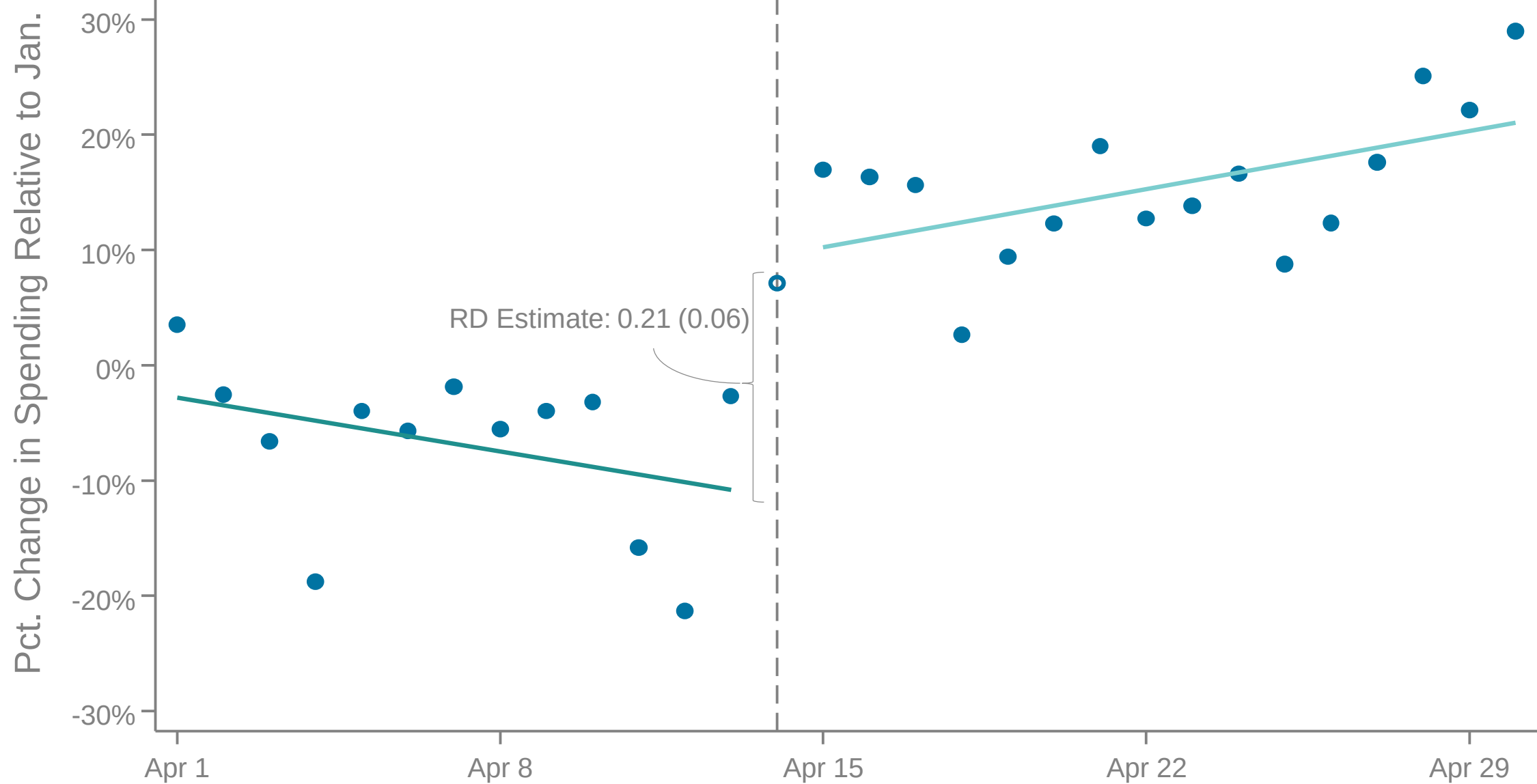
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for Highest Income Quartile Households



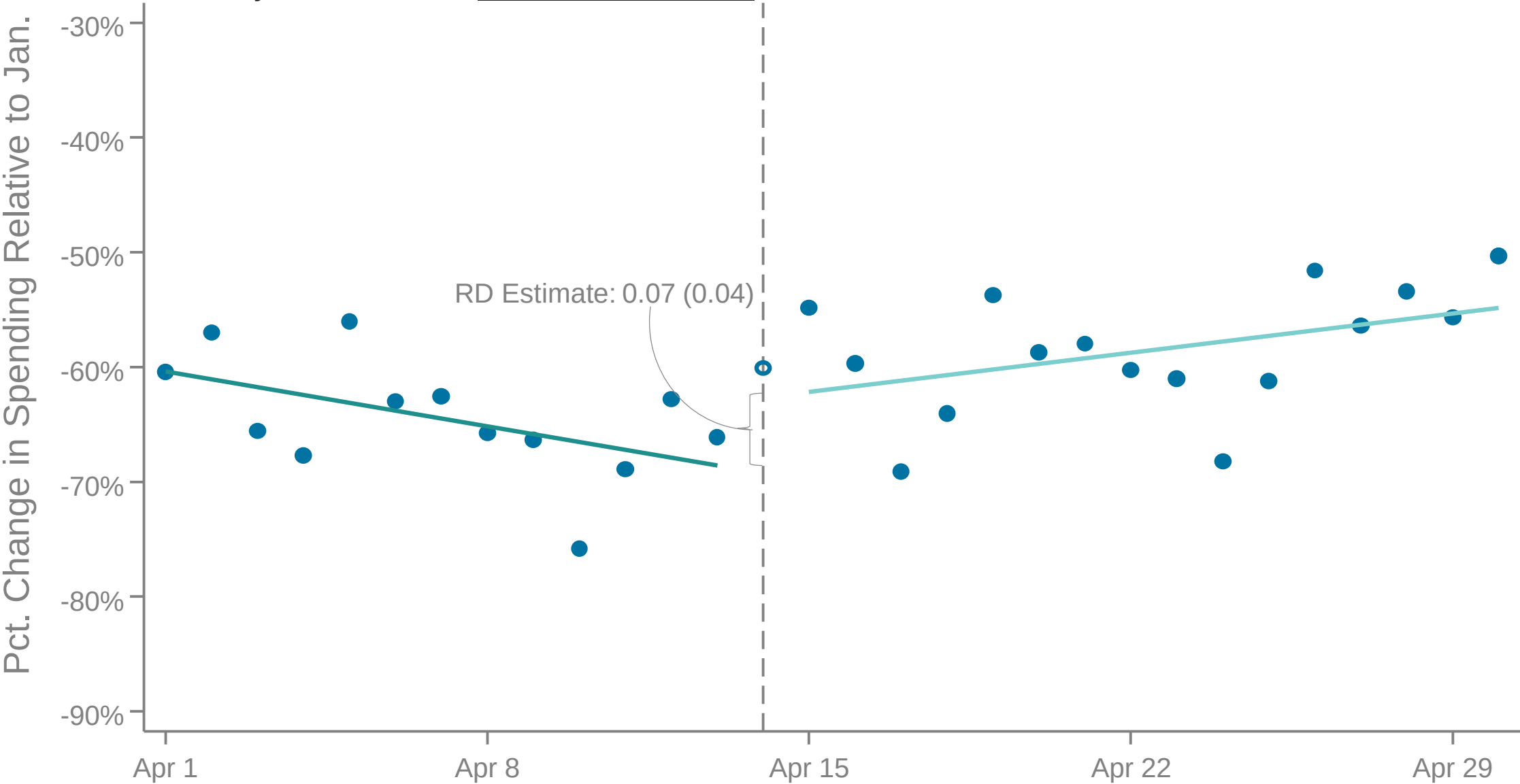
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for Durable Goods



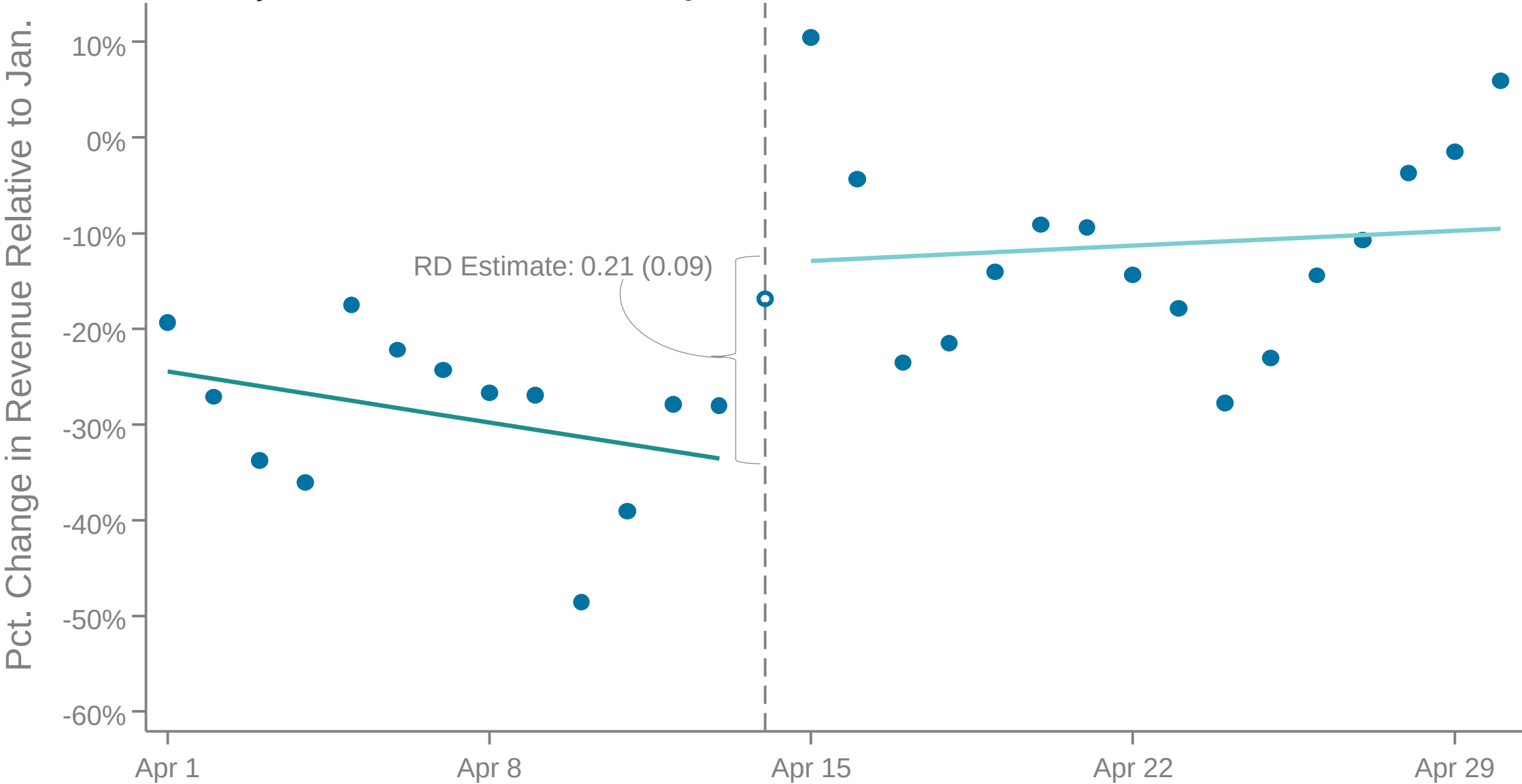
Impact of Stimulus Payments on Consumer Spending

Regression Discontinuity Estimates for In-Person Services



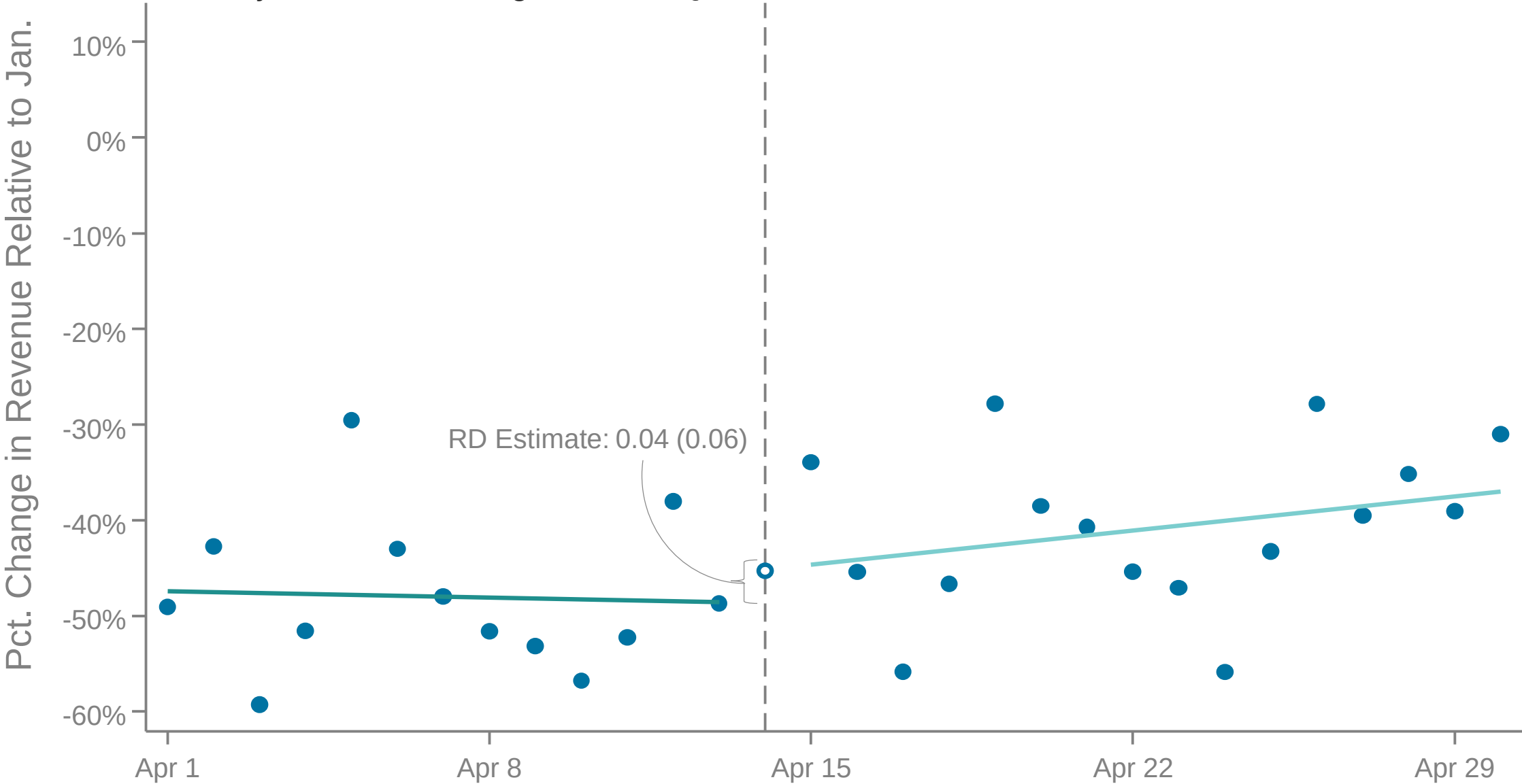
Impact of Stimulus Payments on Business Revenue

Regression Discontinuity Estimates for Lowest Rent Quartile ZIP Codes



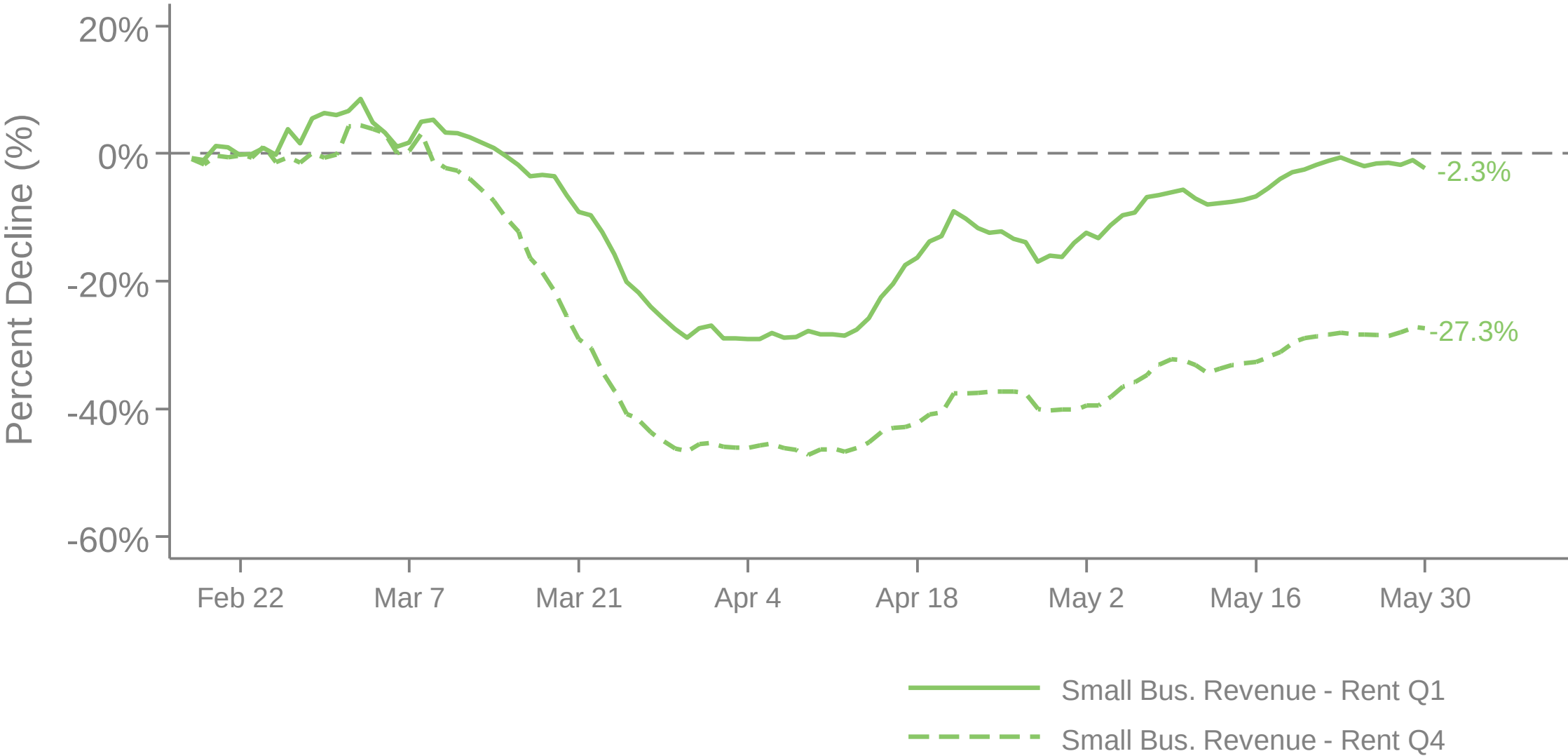
Impact of Stimulus Payments on Business Revenue

Regression Discontinuity Estimates for Highest Rent Quartile ZIP Codes



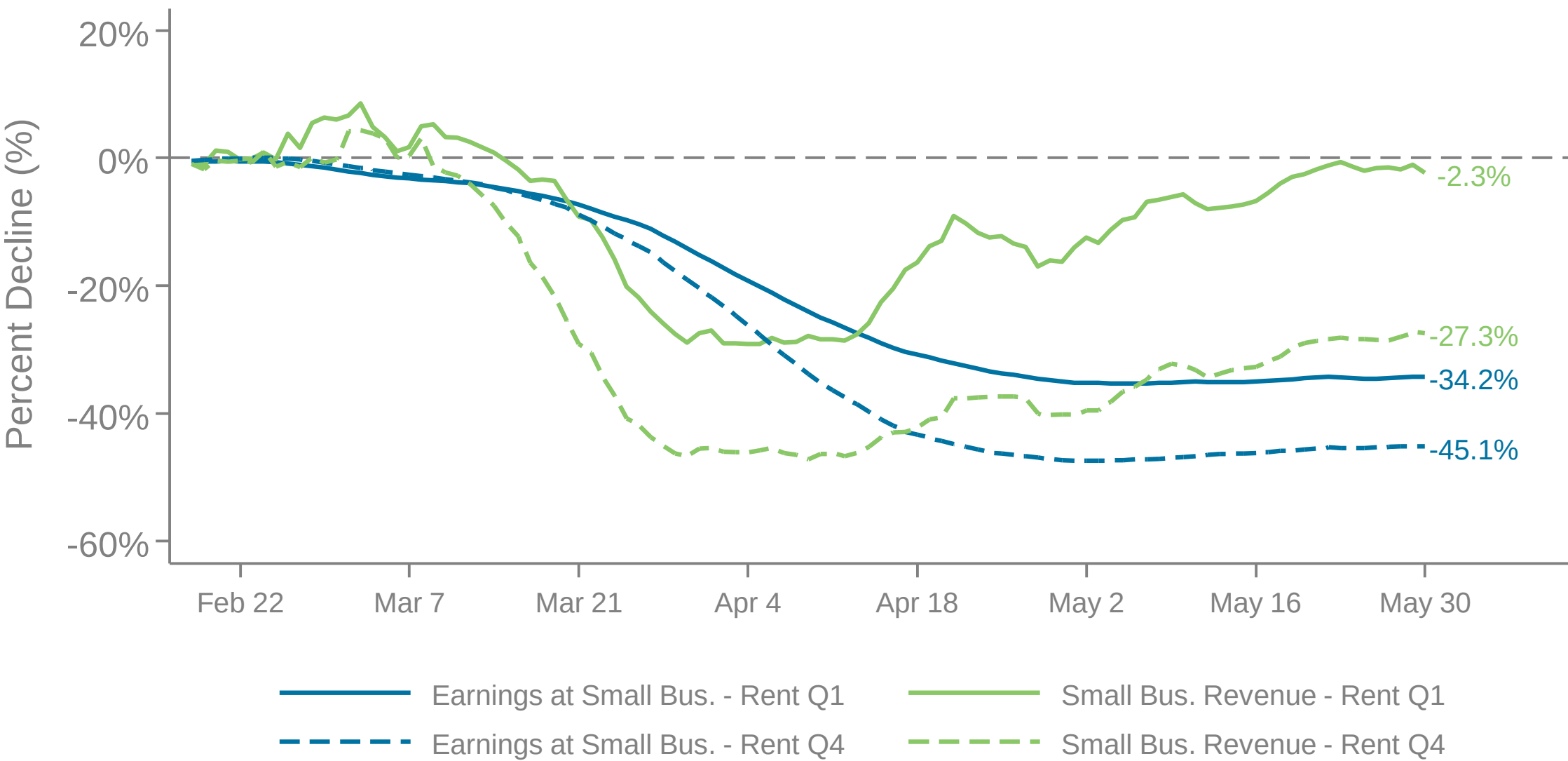
Impact of Stimulus Payments on Business Revenue and Employee Hours

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



Impact of Stimulus Payments on Business Revenue and Employee Hours

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



Impacts of Stimulus Payments

- 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

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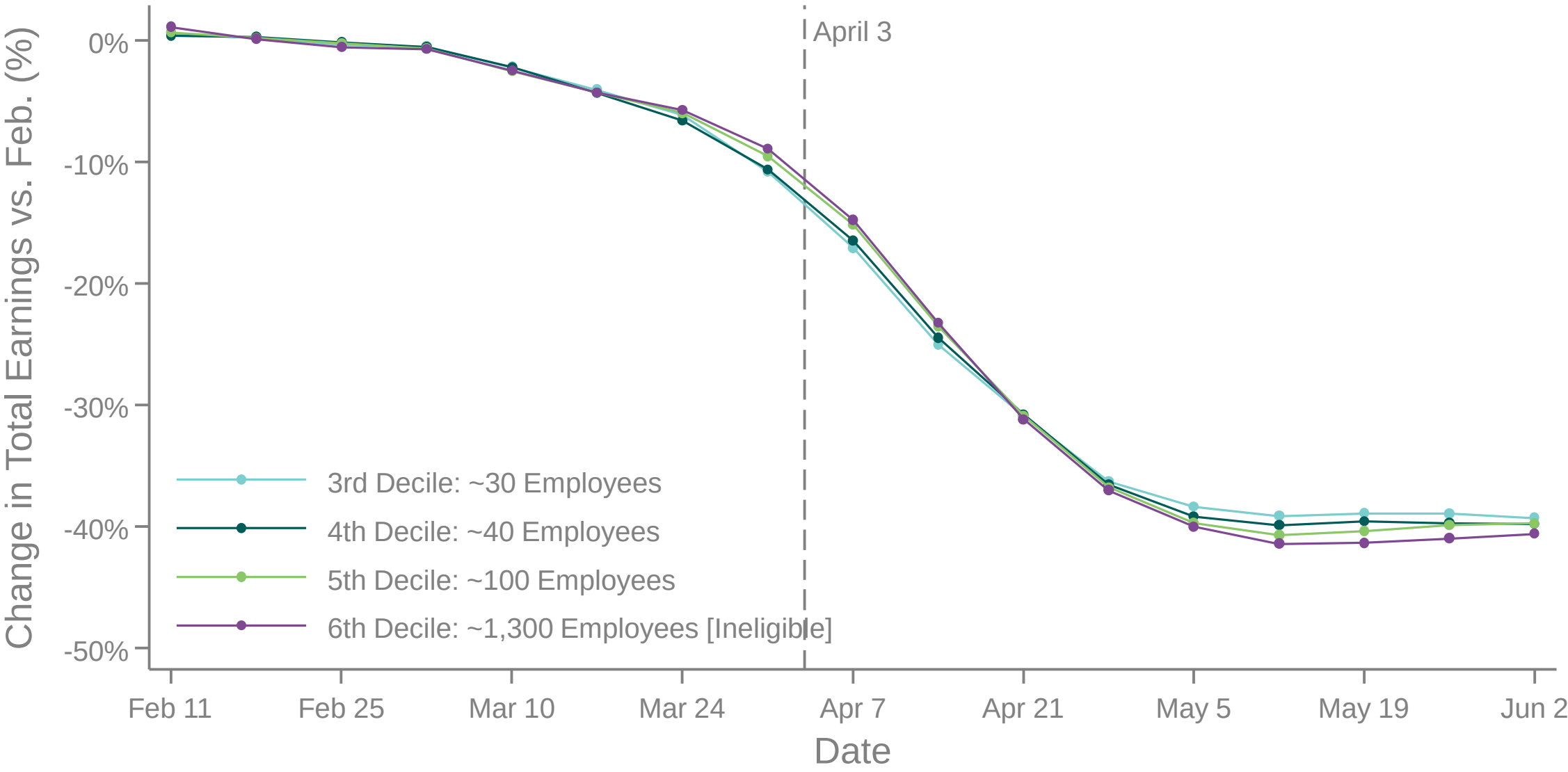
Loans to Small Businesses

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

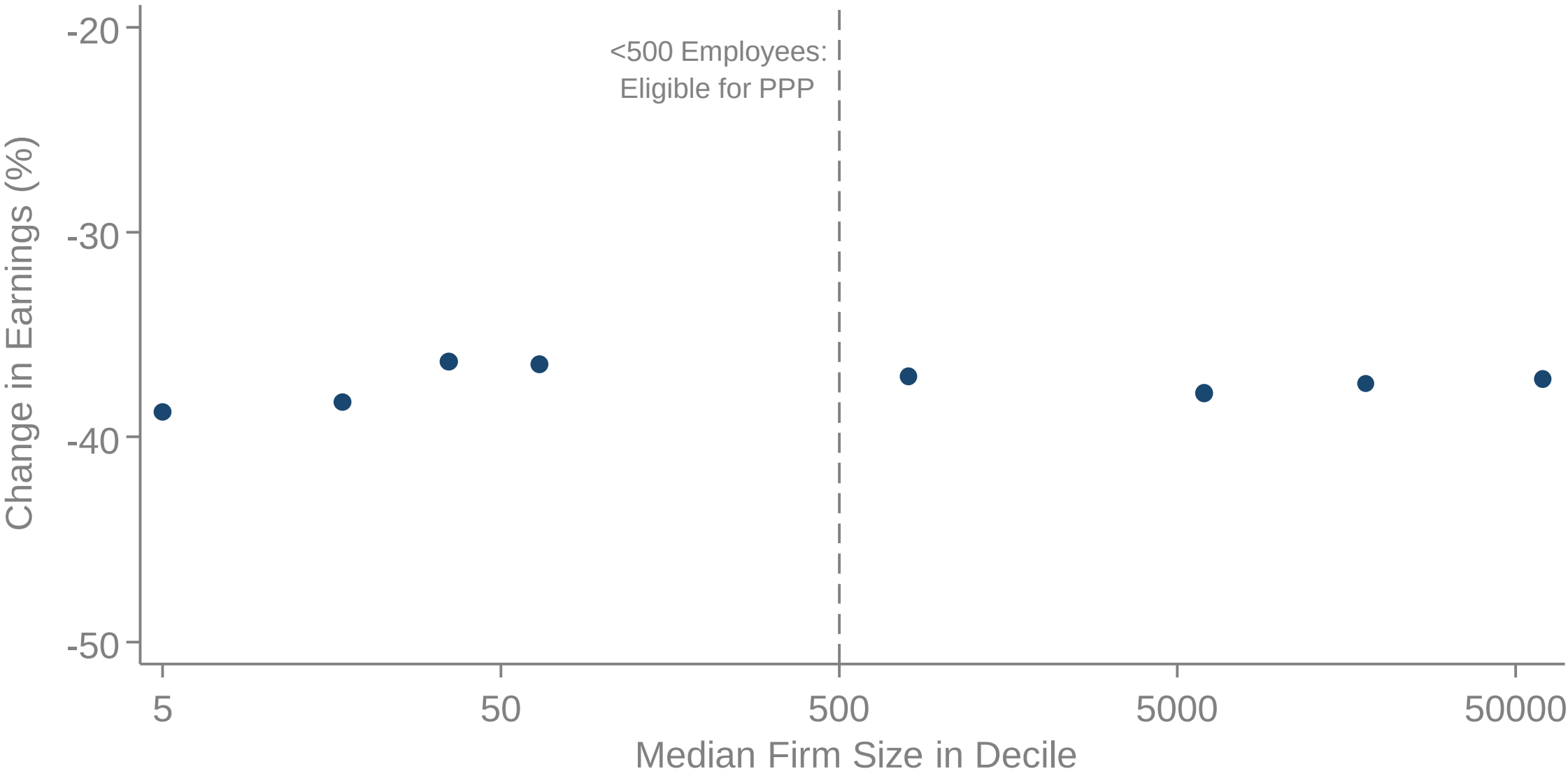
Impact of Paycheck Protection Program on Hours Worked

Change in Hours Worked by Decile of Firm Size, All Industries Excl. Food Services



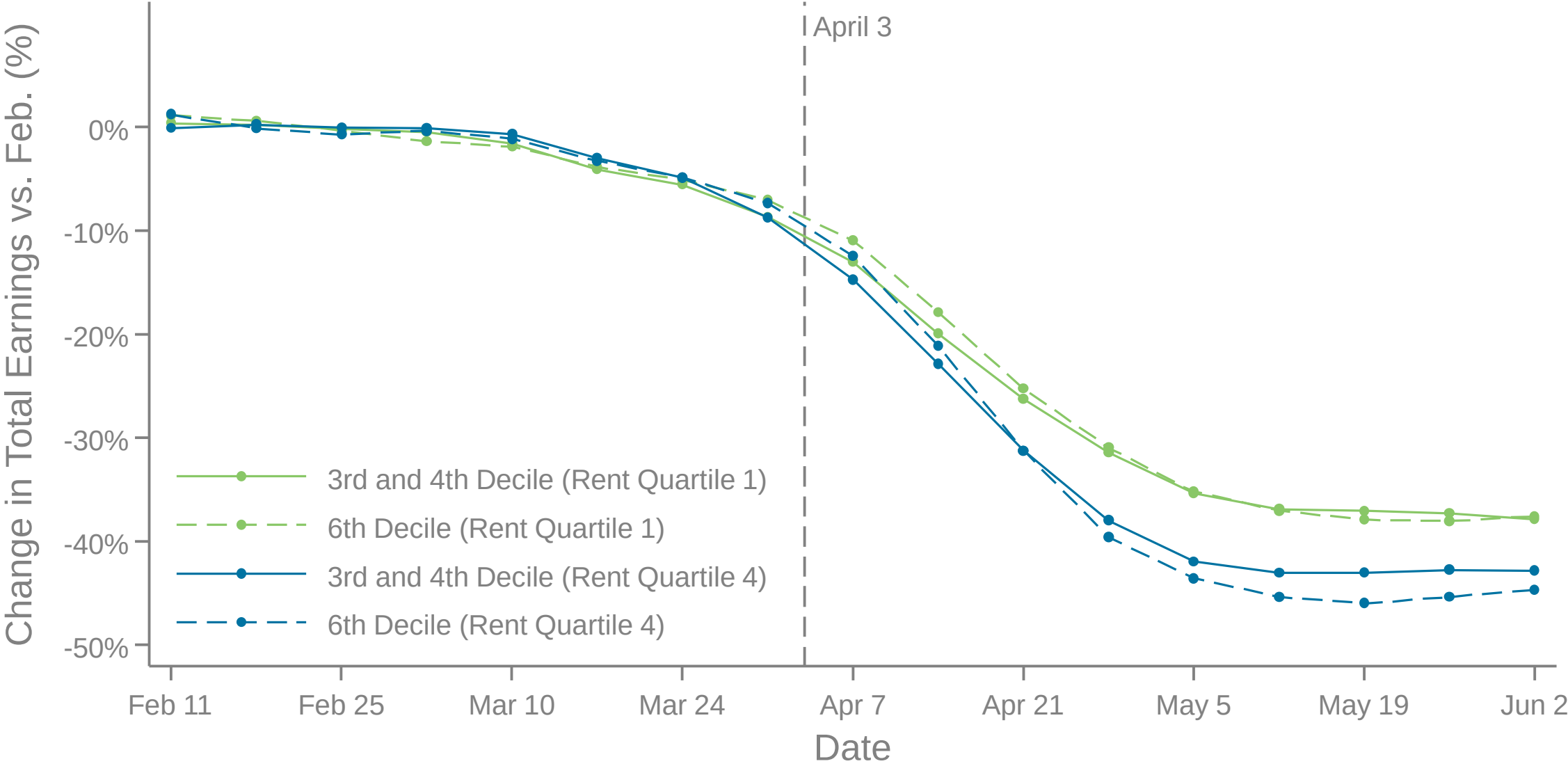
Impact of Paycheck Protection Program on Hours Worked

Change in Hours Worked vs. Decile of Firm Size, All Industries Excl. Food Services



Impact of Paycheck Protection Program on Hours Worked

Change in Hours Worked by Firm Size and Employer ZCTA Rent Quartile



Paycheck Protection Program

- Paycheck Protection Program has had little impact on employment rates at small business to date
- Why have program impacts been modest 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]

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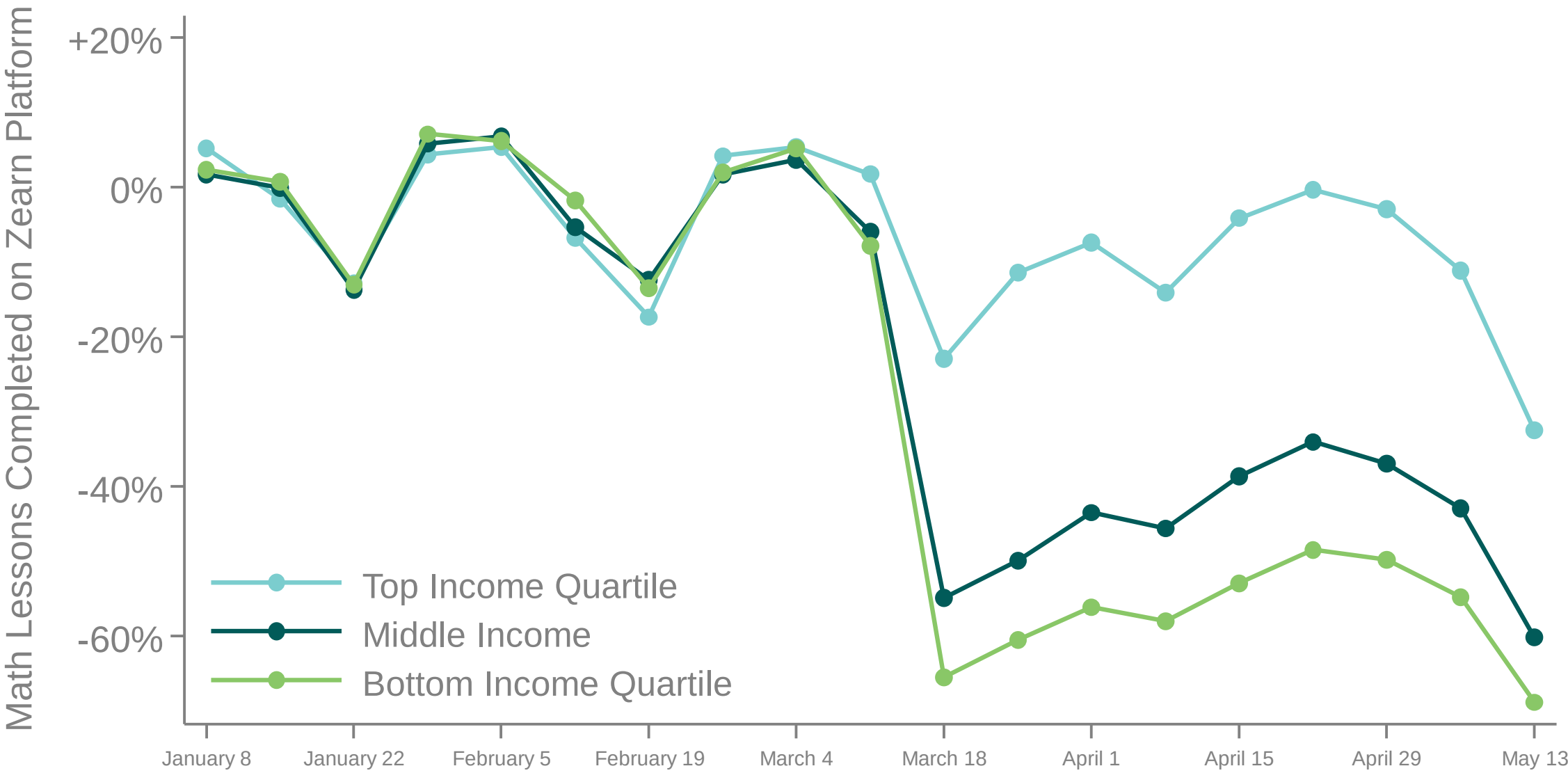
Policy
Implications

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.

Effects of COVID on Educational Progress by Income Group



Data

Impacts of
COVID-19

Impacts of
Stabilization
Policies

Policy
Implications

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

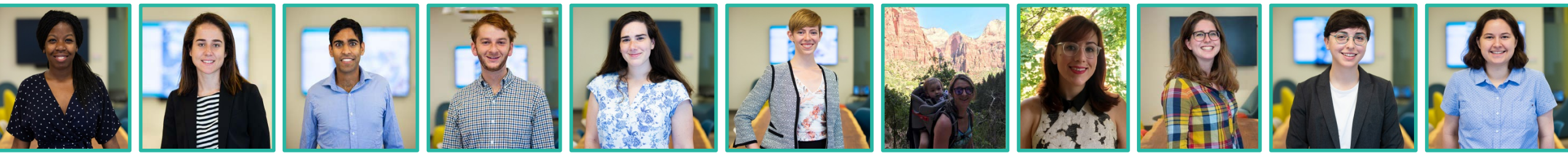
Conclusion

- Broader lesson: 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

Opportunity Insights Economic Tracker Team



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Data

Impacts of
COVID-19

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Policies

Policy
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Questions & Discussion

Changes in Employment Rates Over Time

All Industries



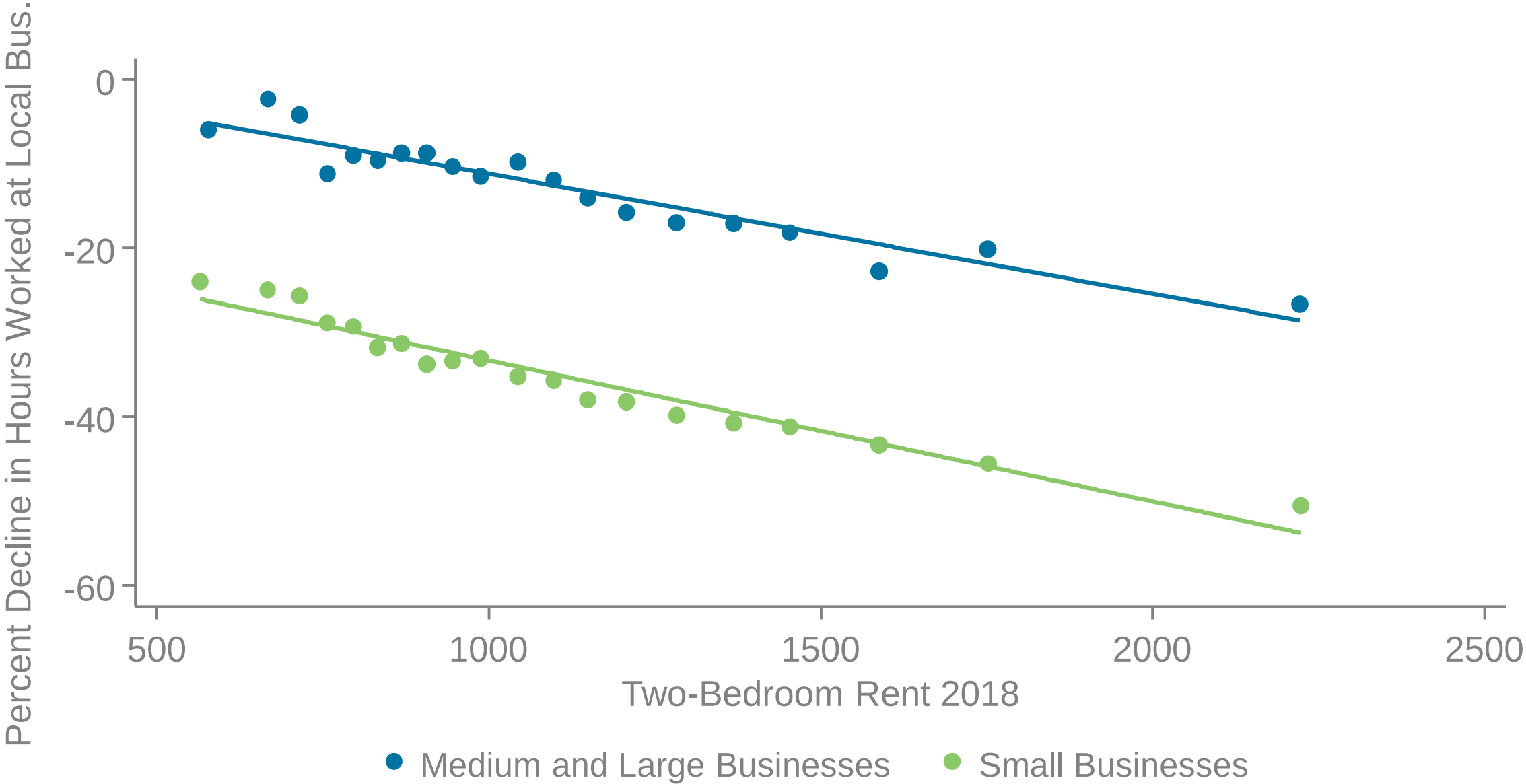
Changes in Employment Rates Over Time

Accommodations and Food Services



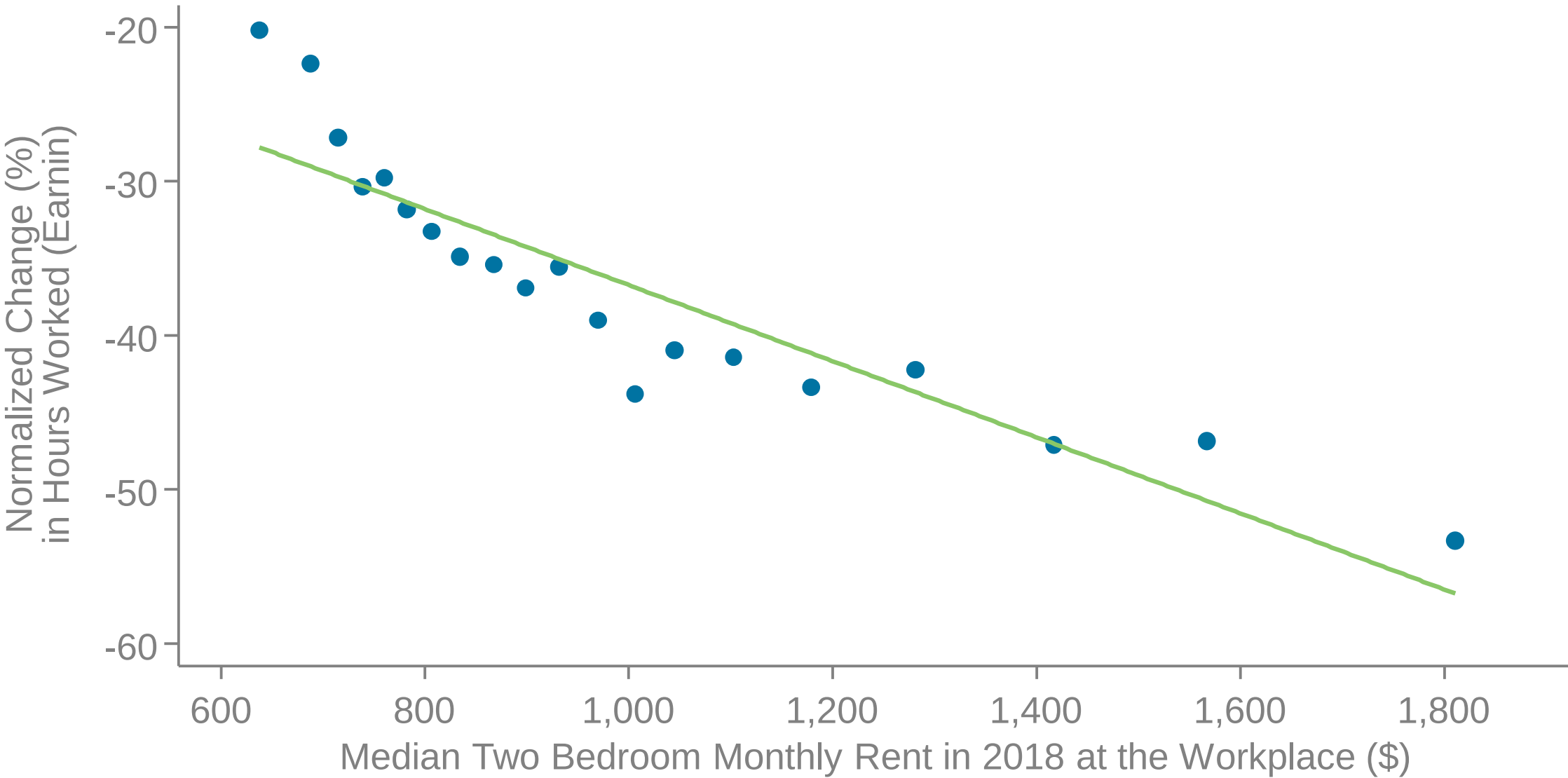
Changes in Employment and Job Postings vs. Rent

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



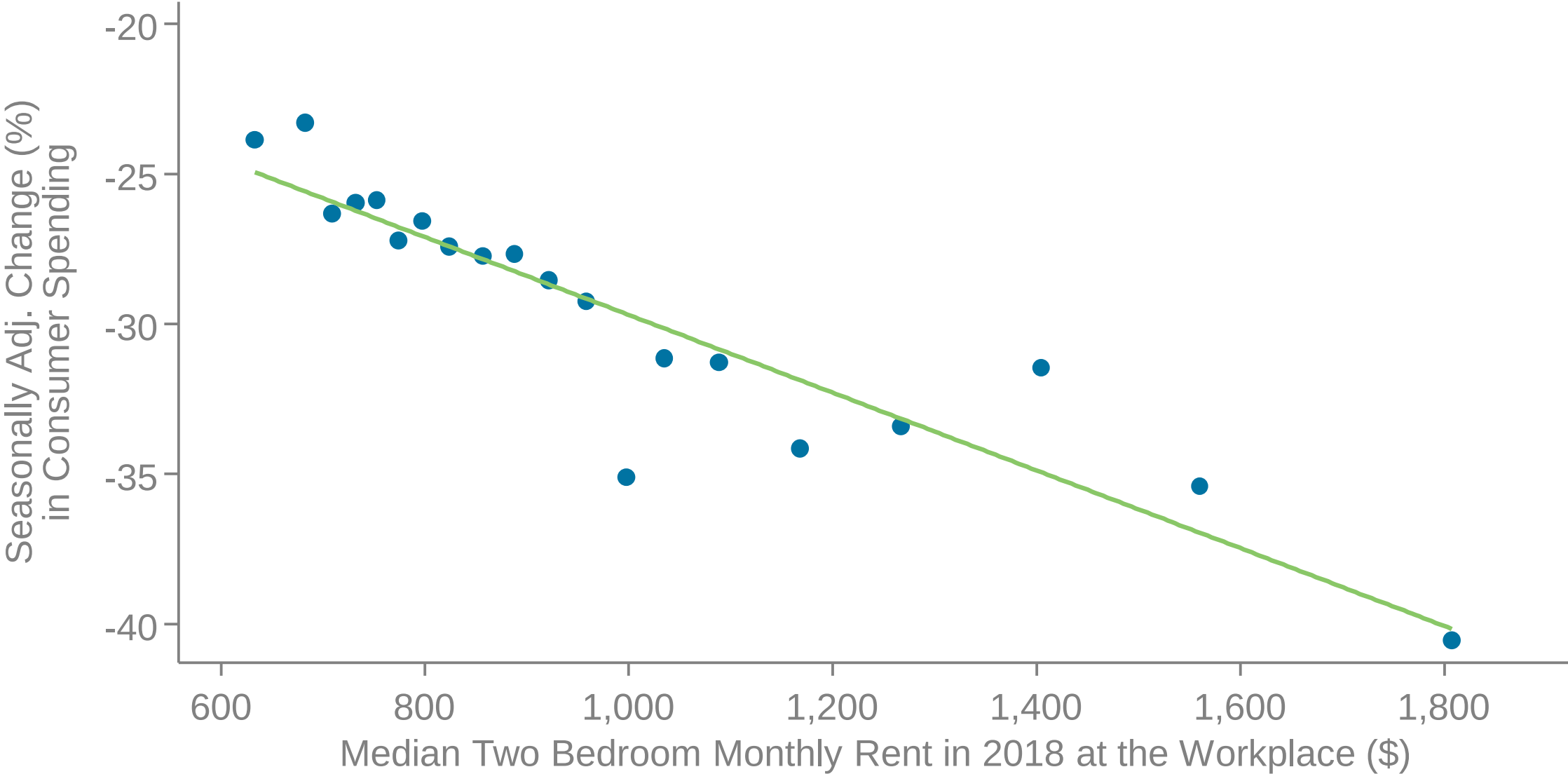
Changes in Consumer Spending vs. Workplace Rent for Low-Income Households

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



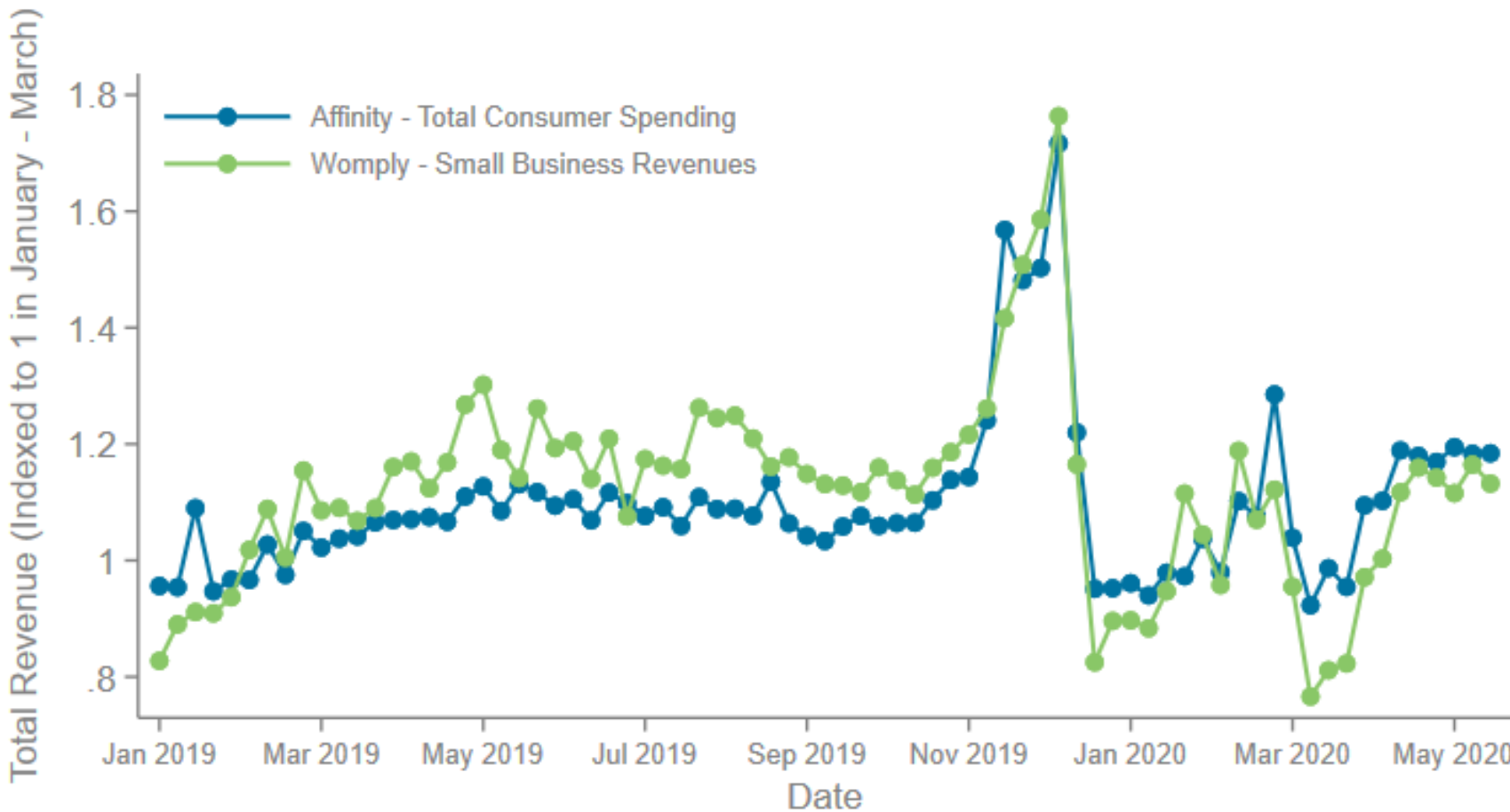
Changes in Consumer Spending vs. Workplace Rent for Low-Income Households

Change in Spending vs Workplace Rent among Low-Income Households



Small Business Revenue Changes vs. Local Income Distribution

Retail Services (Excluding Auto and Gas)



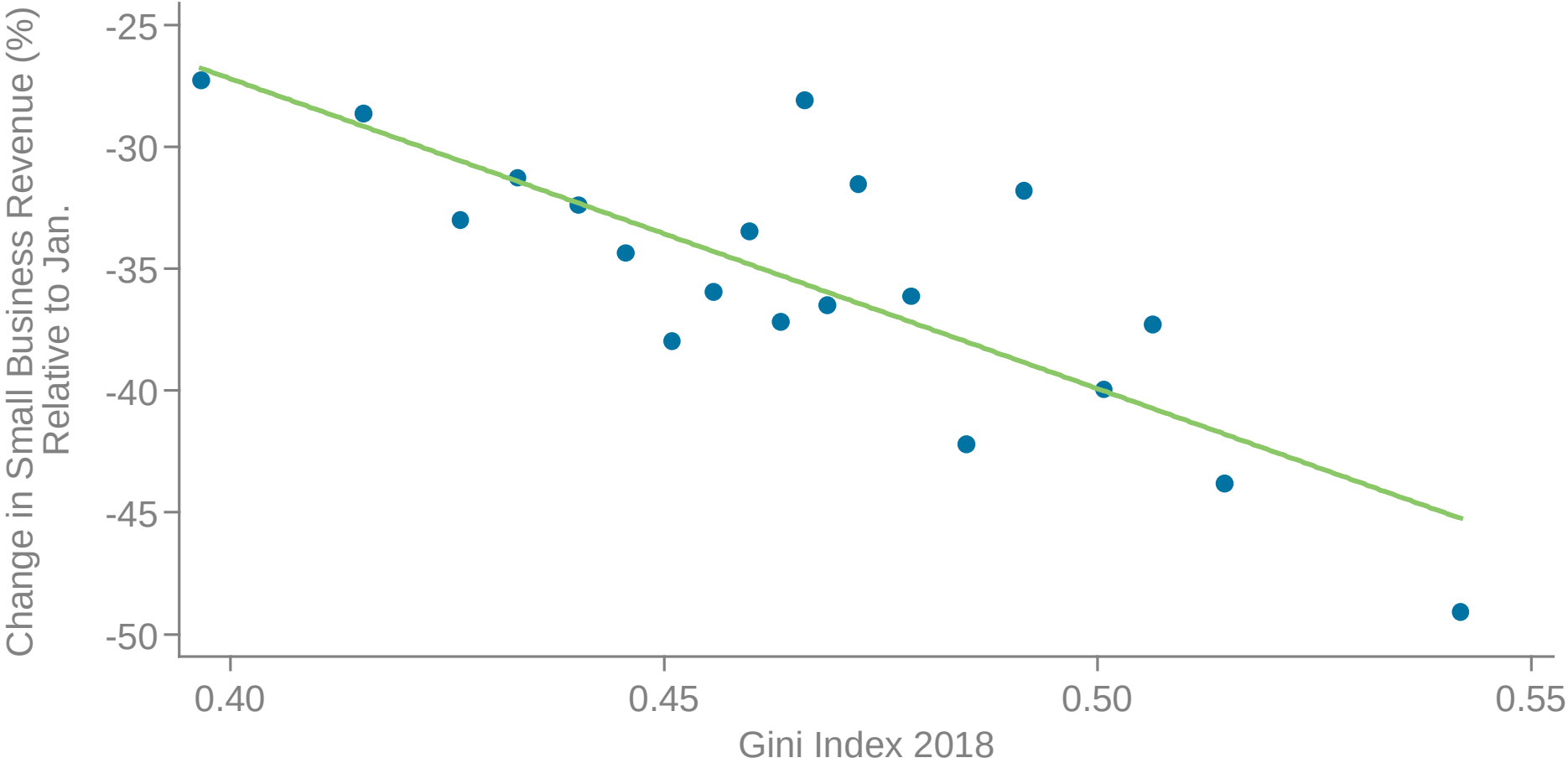
Small Business Revenue Changes vs. Local Income Distribution

Food Services and Accommodations



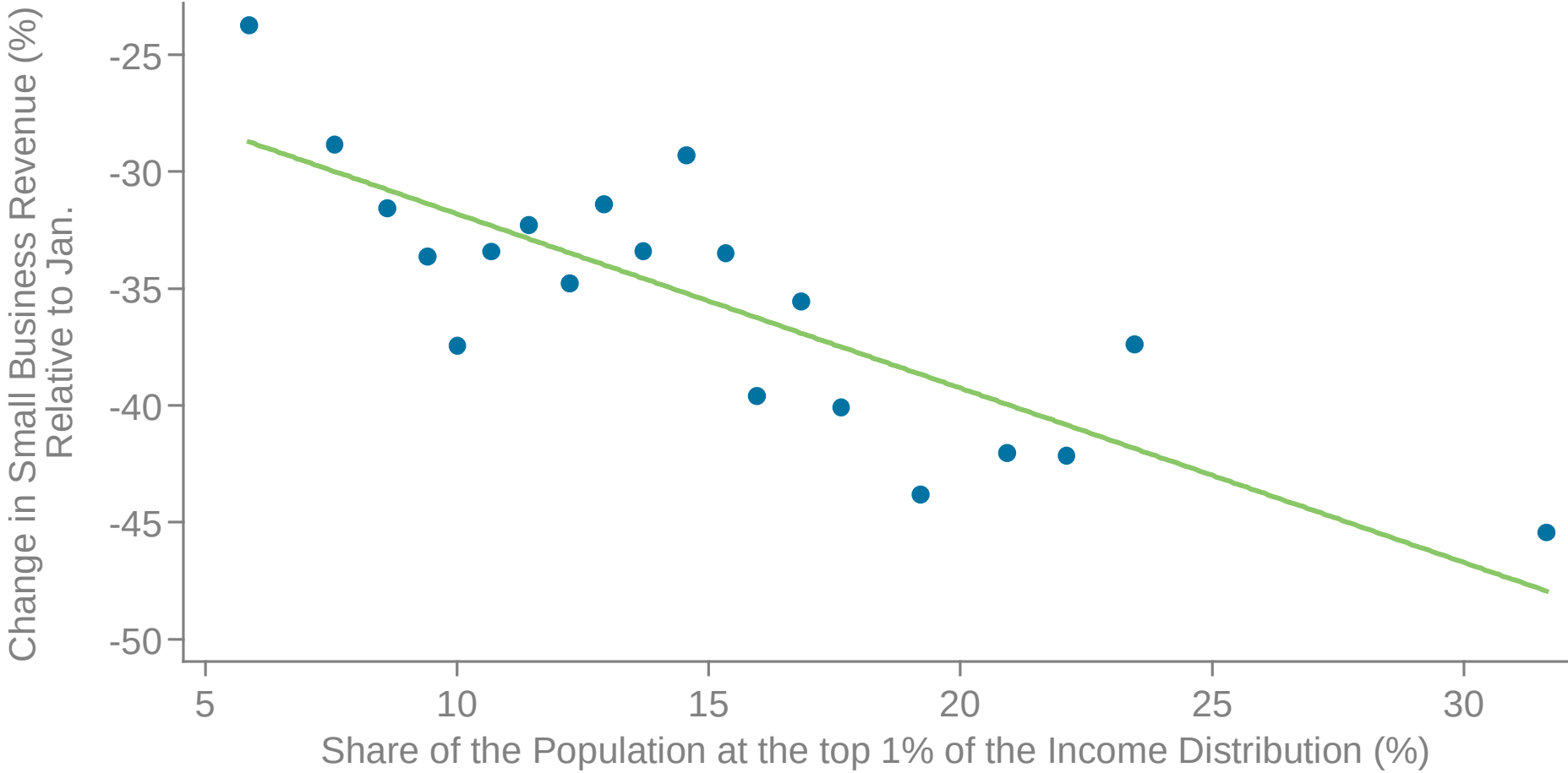
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Gini Index



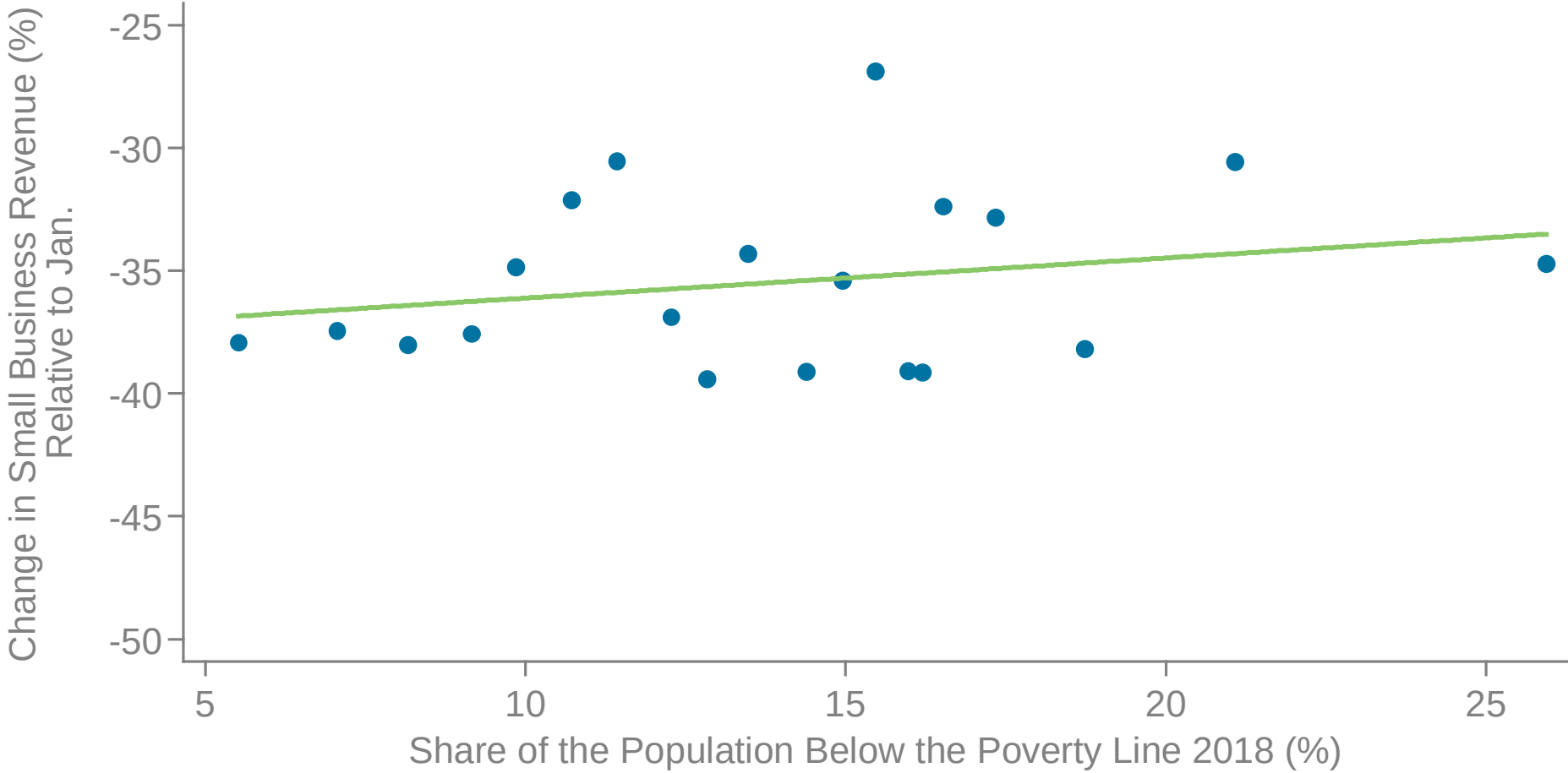
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Share of Population in Top 1% of Income Distribution



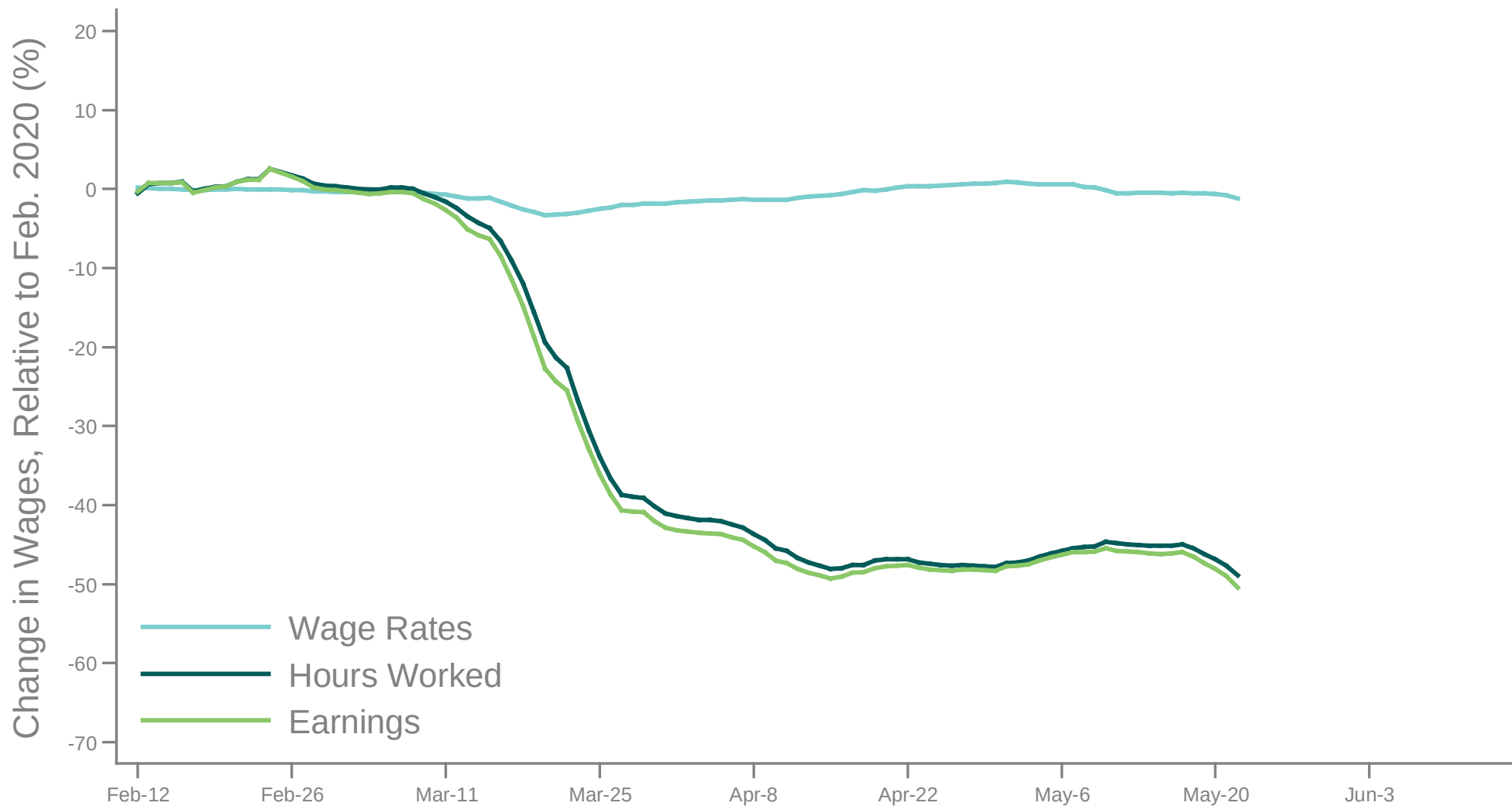
Womply Business Revenue vs. Poverty Share, Top 1% Share, and Gini by County

Share of Population below Poverty Line



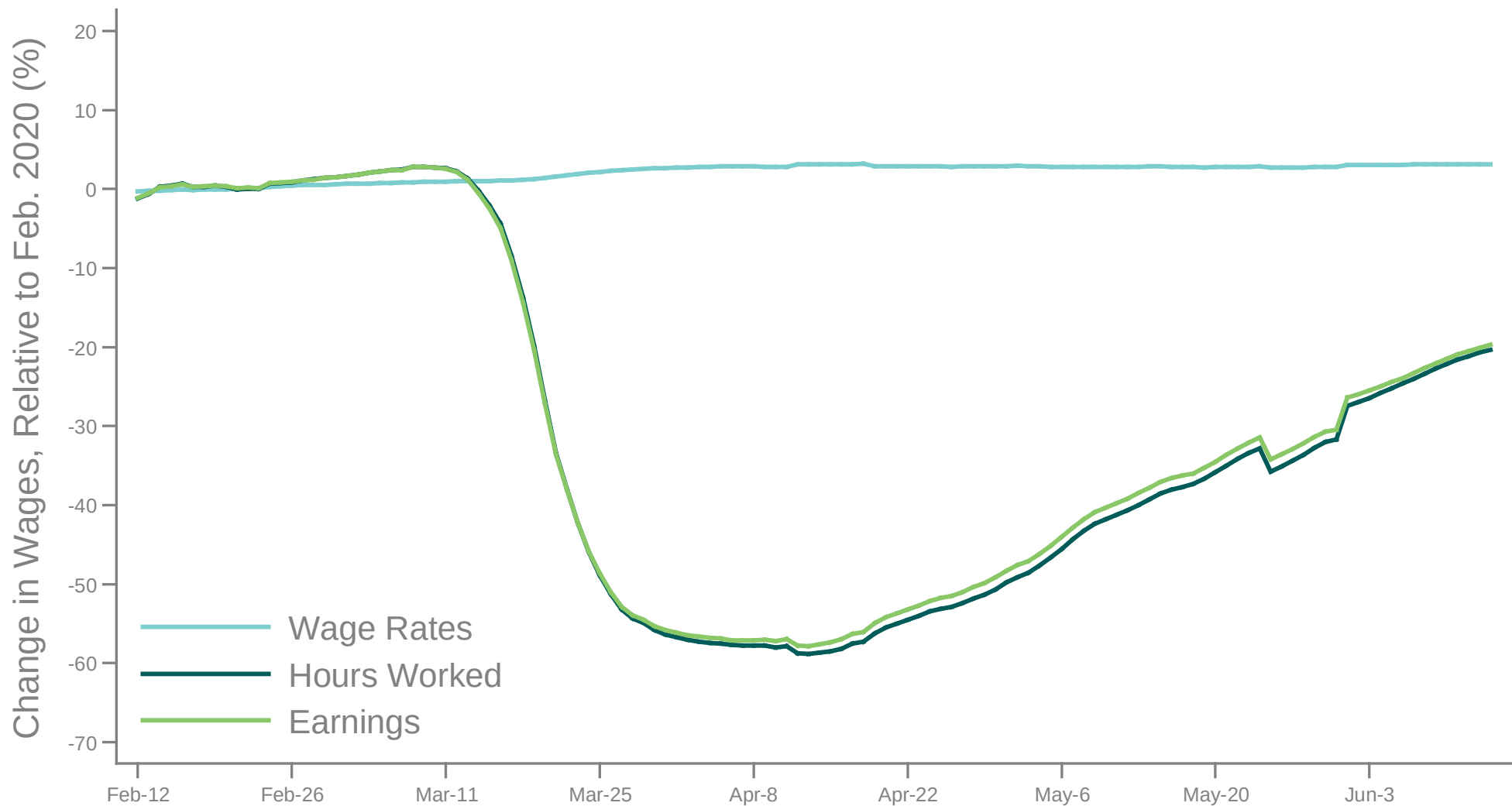
Changes in Wages, Hours Worked and Earnings Over Time

Earnin

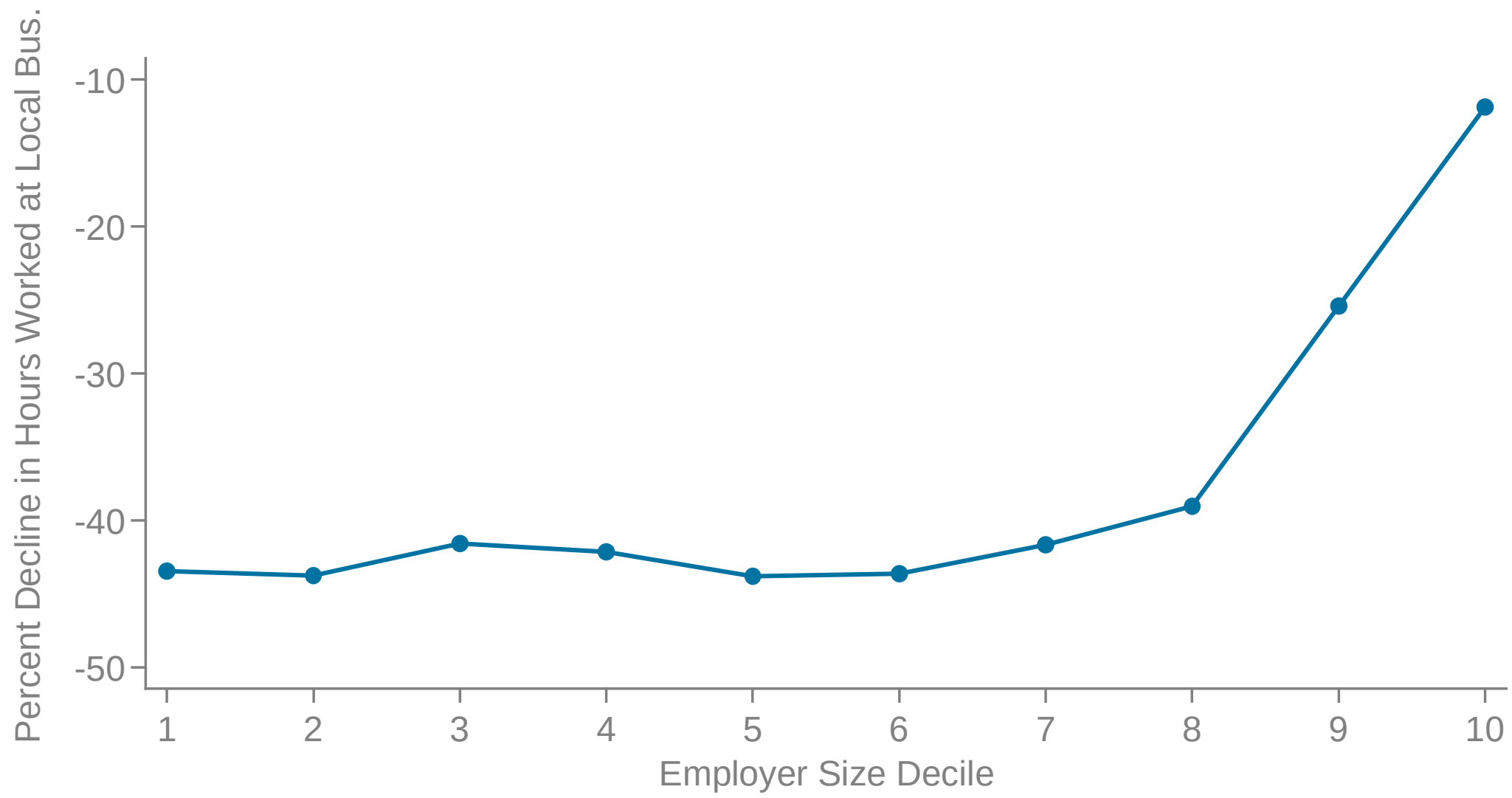


Changes in Wages, Hours Worked and Earnings Over Time

HomeBase

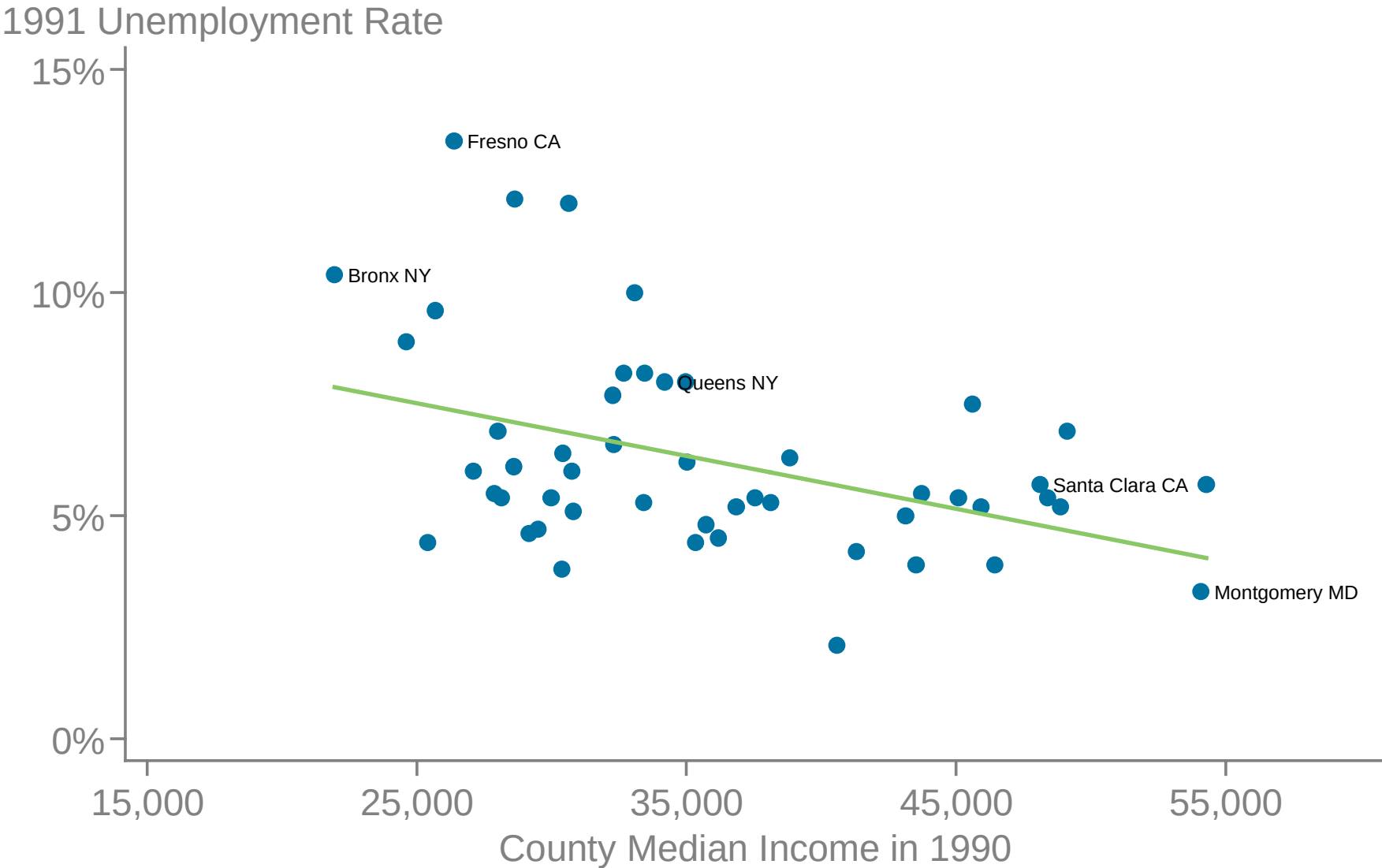


Changes in Total Employment by Firm Size



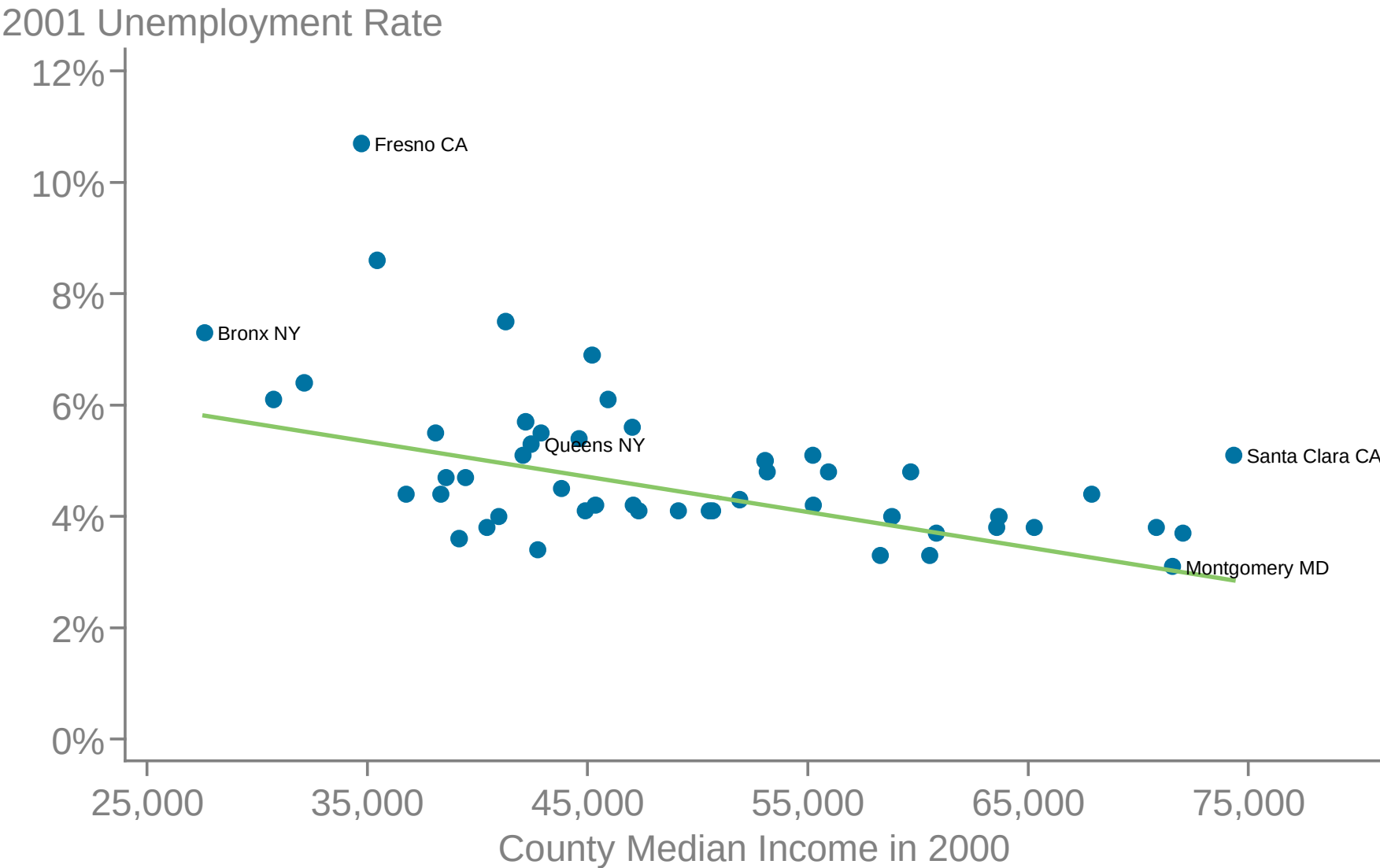
Unemployment Rates vs County Income in Four Recessions

1991 Recession



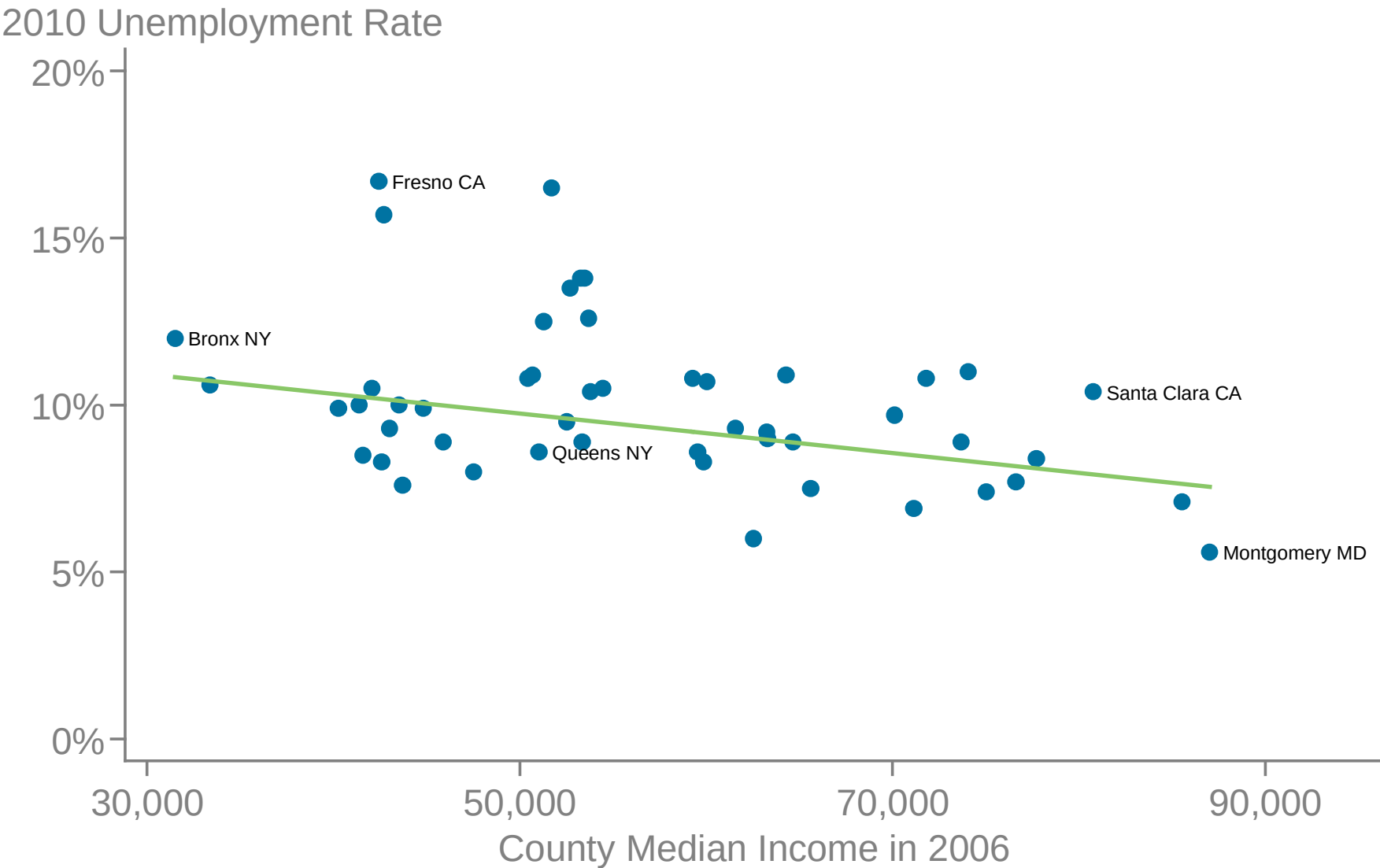
Unemployment Rates vs County Income in Four Recessions

2001 Recession



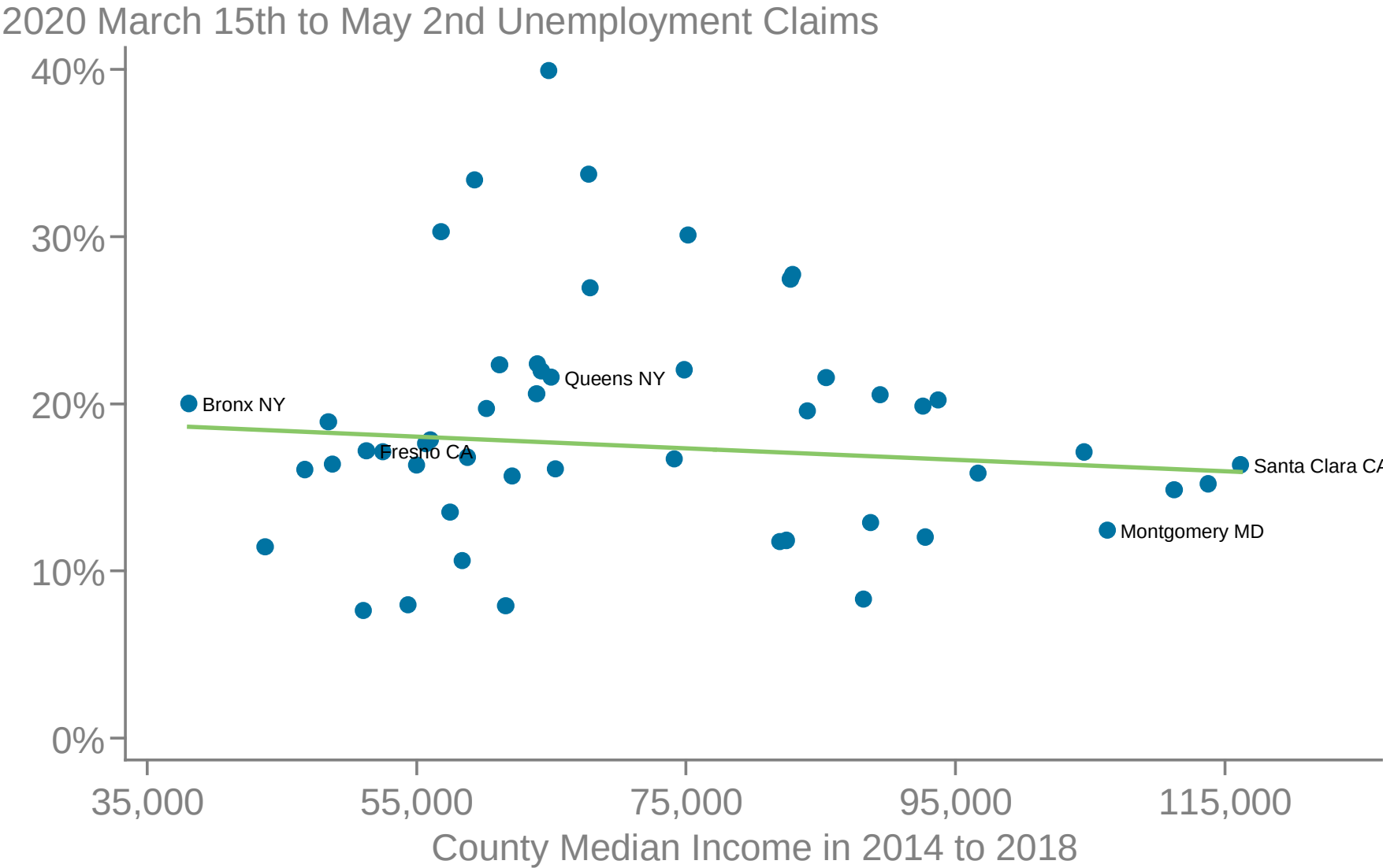
Unemployment Rates vs County Income in Four Recessions

2010 Recession



Unemployment Rates vs County Income in Four Recessions

2020 Recession



Impact of Stimulus on the Composition of Consumer Spending

