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Behavioral and Policy Responses to COVID-19: Evidence from Google Mobility Data on State-Level Stay-at-Home Orders*

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Abstract
In early 2020, many states issued stay-at-home orders to slow the spread of COVID-19. I analyze Google Mobility data to consider the extent to which state-level stay-at-home orders induced people to stay at home. I find that much of the change in residential, retail and recreational, park, workplace, transit station, and, to a lesser extent, grocery and pharmacy activity preceded state-level stay-at-home orders.

JEL Codes: E32, H73, H75, H77, I12, I18
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I. Introduction

In early 2020, many states issued stay-at-home orders to slow the spread of COVID-19. California led the way, with Governor Gavin Newsom imposing a stay-at-home order on March 19. Twenty more states adopted similar measures in the following week.[1] By April 8, all but eight states—Arkansas, Iowa, Nebraska, North Dakota, Oklahoma, South Dakota, Utah, and Wyoming—had issued state-level stay-at-home orders.[2]

The effectiveness of stay-at-home orders as a policy response to slow the spread of a virus depends, at least in part, on the speed at

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[1] The twenty states were Colorado, Connecticut, Delaware, Hawaii, Idaho, Illinois, Indiana, Kentucky, Louisiana, Massachusetts, Michigan, New Jersey, New Mexico, New York, Ohio, Oregon, Vermont, Washington, West Virginia, and Wisconsin.

[2] In an amendment to Executive Order 2020-07 issued on March 24, Oklahoma Governor Kevin Stitt ordered those over sixty-five or suffering from serious underlying medical conditions to stay home. His order was more limited than the general stay-at-home orders considered herein.

which they are adopted.[3] All else equal, stay-at-home orders imposed earlier will tend to be more effective than those imposed later. But democratically elected officials might be reluctant to take such measures before they are supported by a majority of their constituents.[4] If a behavioral response results when an individual decides it is worthwhile while a policy response results when a majority of individuals decides it is worthwhile, widespread behavioral responses will precede the policy response.[5] All else equal, an increase in behavioral responses tends to reduce the marginal effectiveness of a subsequent policy response.

Furthermore, the effectiveness of state-level stay-at-home orders depends on the policies imposed at lower levels. If within-jurisdiction preferences are more similar at the local level than the state level, then, as the risk of a virus rises, elected officials at the local level will tend to reach the relevant threshold of support before elected officials at the state level. Elected officials at the local level will also tend to reach the relevant threshold of support before elected officials at the state level if information about the relevant risks and opportunity costs cascades across jurisdictions. If a policy response results when a majority of individuals in a given jurisdiction agree it is worthwhile, widespread local-level policy responses will precede the state-level policy response. And all else equal, an increase in local-level policy responses tends to reduce the marginal effectiveness of a subsequent state-level policy response.

In what follows, I analyze Google Mobility data to consider the extent to which state-level stay-at-home orders induced people to stay at home. I find that much of the change in activity preceded state-level stay-at-home orders. The most conservative estimates presented below suggest that 76.60 percent of the change in residential (+), 75.61 percent in retail and recreation (−), 75.81 percent in workplace (−), 74.42 percent in transit station (−), and 19.58 percent in grocery and pharmacy (−) activity occurred before

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[3] Bergman and Fishman (2020), Bilgin (2020), and Yilmazkuday (2021) establish a link between mobility and the number of COVID-19 cases and deaths. Milani (2021) considers the role of social networks.

[4] Preliminary evidence suggests that authoritarian regimes were more responsive to increasing local COVID-19 case counts, but also more likely to suppress mobility data (Herren et al. 2020).

[5] The argument presented here and in the following paragraph is a straightforward application of the median voter theorem, where the median is increasing from 0 to $0.5 < n \leq 1$ over time. Congleton (2004) provides a clear summary of the median voter theorem and a brief defense of such a simple approach to political theorizing.

state-level stay-at-home orders were imposed. I also estimate that 67.54 to 86.13 percent of the decline in park activity occurred before state-level stay-at-home orders were imposed. But, as I explain below, estimates for the decline in park activity before and after stay-at-home orders were imposed warrant far less confidence.

The evidence reviewed herein creates a problem for those who would claim state-level stay-at-home orders significantly reduced economic activity or limited the spread of COVID-19.[6] Without evidence to the contrary, it is reasonable to conclude that much of the desirable mitigation in disease spread and undesirable slowdown in economic activity would have occurred without state-level stay-at-home orders.

To the extent that the decline in activity was warranted and driven by individuals pursuing their own ends, it illustrates the effectiveness of self-governance and the private provision of public goods.[7] To the extent that it was driven by policies adopted by local governments, it illustrates their ability to respond to local conditions.[8] More generally, the episode highlights the need to consider overlapping governance structures when estimating the marginal effect of public policies.[9]

II. Data

Google (2020) provides daily, state-level data on the change in visits and length of stay at different types of places from February 15 through April 26, 2020, compared to a baseline. The Google Mobility baseline is calculated by taking the median value of a visits-and-length-of-stay index for the corresponding type of place and day of the week during the five-week period from January 3 through

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[6] Elsewhere, strict policy interventions appear to have had a bigger effect on activity. Hussain (2020a, b, c). However, synthetic interventions estimated by Agarwal et al. (2020) suggest moderate mobility restrictions are sufficient to "effectively flatten the curve." Additionally, Bargain and Aminjonov (2020) show that compliance with containment policies was higher in countries with higher levels of trust in elected officials.

[7] For example, see Ostrom, Walker, and Gardner (1992), Ostrom (2000), Leeson (2006, 2008, 2009, 2011, 2012), Leeson, Coyne, and Boettke (2006), Powell and Stringham (2009), Boettke (2010), Stringham (2011), Leeson and Coyne (2012), and Ostrom and Ostrom (2015).

[8] For example, see Ostrom, Bish, and Ostrom (1988) and Boettke, Coyne, and Leeson (2011).

[9] For example, see Ostrom, Tiebout, and Warren (1961), Aligica and Tarko (2012), Ostrom (2010), and Furton and Martin (2019).

February 6, 2020. Observations are then reported as a percent change from the baseline.

There are six types of locations in the Google Mobility dataset: (1) grocery and pharmacy, (2) parks, (3) residential, (4) retail and recreation, (5) transit stations, and (6) workplaces. Grocery and pharmacy includes grocery markets, food warehouses, farmers markets, specialty food shops, drug stores, and pharmacies. Parks includes local parks, national parks, public beaches, marinas, dog parks, plazas, and public gardens. Transit stations includes public transport hubs such as subway, bus, and train stations. Retail and recreation includes restaurants, cafes, shopping centers, theme parks, museums, libraries, and movie theaters. Residential includes places of residence, like houses and apartments. Workplaces includes places of work.

Presumably in an effort to preserve privacy, Google offers no further details on the types of locations. Google (2020) reports that the location data "included in the calculation depends on user settings, connectivity, and whether it meets our privacy threshold." Specifically, if activity on day X at location type Y in state Z is insufficient to meet Google's privacy threshold, the observation $O_{X,Y,Z}$ is not reported. This policy results in one missing observation.[10] The total possible number of observations is 50 states × 72 days × 6 categories = 21,600.
The *New York Times* reports the effective dates of stay-at-home orders issued by states as of April 20, 2020 (Mervosh et al. 2020).

States are sorted into three categories: statewide order, order in parts of state, and no order. Statewide orders includes all statewide stay-at-home orders, as well as the healthy-at-home order issued in Kentucky and the shelter-in-place orders issued in Delaware and Georgia. It does not include the safer-at-home order issued in Oklahoma, which only required those over sixty-five or with serious under lying medical conditions to stay at home. In total, forty-two states imposed statewide stay-at-home orders from March 19 through April 7.

Along with Oklahoma, Utah and Wyoming are categorized as having issued an order in part of the state. Mervosh et al. (2020) list three county-level orders for Utah: Davis (issued April 1; pop. 352,000), Salt Lake (issued March 30; pop. 1,200,000), and Summit

[10] The missing observation is for the parks location type in Delaware on April 25, 2020.

(issued March 27; pop. 42,000). In Wyoming, the town of Jackson—with an approximate population of 10,000—imposed a stay-at-home order on March 28. I reclassify all three of these states as not having imposed a state-level stay-at-home order.

Five other states are categorized as having no order in place as of April 20, 2020. These states are Arkansas, Iowa, Nebraska, North Dakota, and South Dakota. Taken together, there are eight states without stay-at-home orders in the following analysis. Hence, the total number of observations in states issuing a stay-at-home order at some point over the period considered is 42 states × 72 days × 6 categories − 1 missing observation = 18,143.

III. Analysis

In an effort to consider the extent to which state-level stay-at-home orders induced people to stay at home, I analyze the activity indices described in section 1. The analysis is conducted in two stages. First, I review the activity index over time in all fifty states without consideration of the timing of stay-at-home orders. Then, I limit attention to the forty-two states issuing a stay-at-home order at some point over the period and review the activity index before and after stay-at-home orders were imposed. I repeat this analysis for all six location types.

One minor issue is worth noting at the outset. State-level stay-at-home orders were issued in Missouri and South Carolina on April 6 and April 7, respectively. Since many businesses permitted to be open were nonetheless closed for the Easter holiday on April 12, the seven-day average following stay-at-home orders potentially overestimates the effect of stay-at-home orders on grocery and pharmacy, residential, retail and recreation, transit station, and workplace activity and potentially underestimates the effect for park activity. However, estimates with Missouri and South Carolina excluded suggest the bias is small across all location types. The relatively small effect of excluding Missouri and South Carolina also suggests that the results do not depend to a large extent on two states' relatively late adoption.

A. Residential Activity

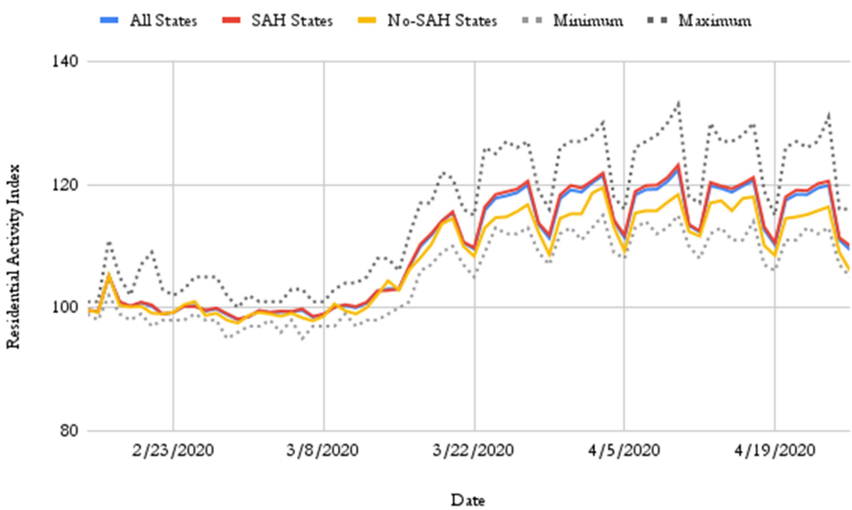
Figure 1 shows the average residential activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020.

Minimum and maximum index values across all states on each date are presented as well.

Residential activity was relatively stable in late February and early March and similar across both groups. Over the seven-day period ending March 1, the residential activity index averaged 99.39 across SAH states and 99.09 across no-SAH states. Over the seven-day period ending March 8, the averages stood at 99.29 and 98.70, respectively.

Then, the index began to climb. The average across all states increased from 98.92 on March 8 to 103.04 on March 15 and 109.54 on March 22. Over the seven-day period beginning on March 22, the residential activity index averaged 116.70 across SAH states and 113.63 across no-SAH states. It increased somewhat more thereafter. Over the seven-day period beginning March 29, it averaged 118.03 and 114.98, respectively.

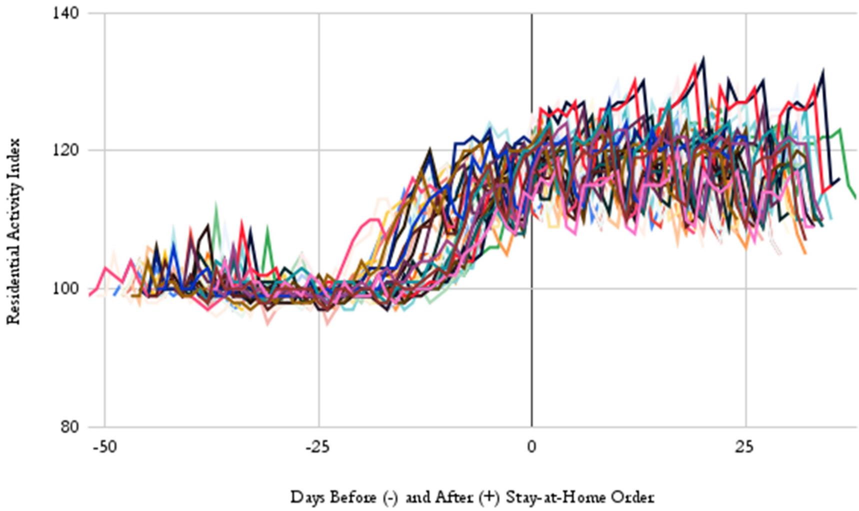
Figure 1. Residential activity by group, February 15–April 26, 2020



The residential activity index remained elevated thereafter. It averaged 118.32 across SAH states and 114.86 across no-SAH states over the seven-day period beginning on April 5. Over the seven-day period beginning April 12, it averaged 118.05 and 115.38. Finally, over the seven-day period beginning April 19, it averaged 116.96 and 113.43.

Figure 2 shows the residential activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. Residential activity index values are measured along the vertical axis. The zero line on the horizontal axis indicates the day the state-level order went into effect in each state. Observations to the left of the zero line occurred on the days leading up to the effective date. Observations to the right of the zero line occurred on the days immediately following the effective date.

Figure 2. Residential activity by state, before and after state-level stay-at-home orders



It is clear from figure 2 that much of the increase in residential activity occurred before the introduction of state-level stay-at-home orders. On the day before the stay-at-home order went into effect, the residential activity index averaged 115.45. The median was 115, with observations ranging from 108 to 122. On the day after the stay-at-home order was imposed, the average, median, minimum, and maximum were 118.86, 119, 110, and 126, respectively.

Over the seven days before the stay-at-home order, residential activity averaged 114.12. Then, over the seven days following the stay-at-home order, it averaged 118.27. Using the baseline from January 3 to February 6, 2020, as the relevant counterfactual suggests that 77.29 percent of the increase in residential activity occurred before the stay-at-home order went into effect.

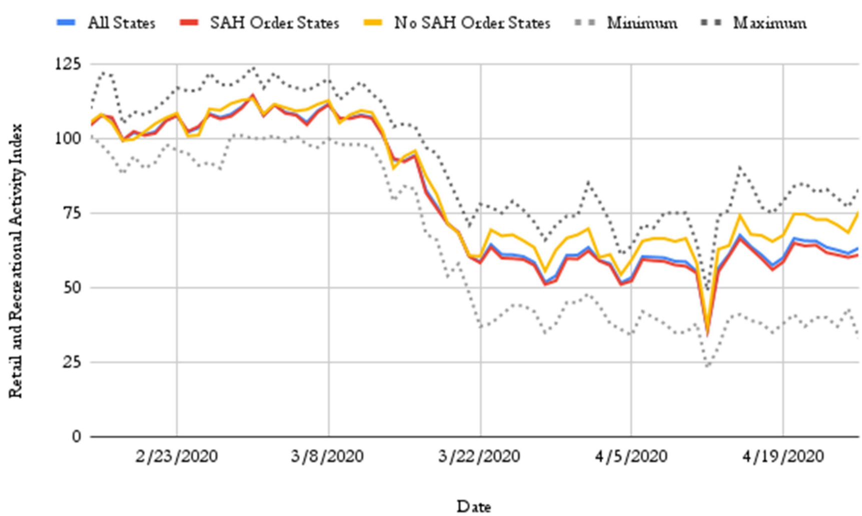
The estimated share of the increase occurring before the stay-at-home order is conservative in two respects. First, the baseline likely falls below the relevant counterfactual. Recall that the residential activity index hovered below 100 in late February and early March. Second, my reliance on seven-day averages tends to increase the difference between the two periods. If, instead, one were to take a +/− one day approach, the share of the effect occurring before the stay-at-home order rises to 81.94 percent.

As noted above, one might worry that the relative proximity to Easter of Missouri and South Carolina's stay-at-home orders biases the analysis. With these two states excluded, the residential activity index averaged 114.10 over the seven days before the stay-at-home order went into effect. It averaged 118.40 over the seven days after. With Missouri and South Carolina excluded, the share of the increase in residential activity occurring before the stay-at-home order is estimated at 76.60 percent.

B. Retail and Recreational Activity

Figures 3 shows the average retail and recreational activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020. Minimum and maximum index values across all states on each date are also presented.

Figure 3. Retail and recreational activity by group, February 15–April 26, 2020



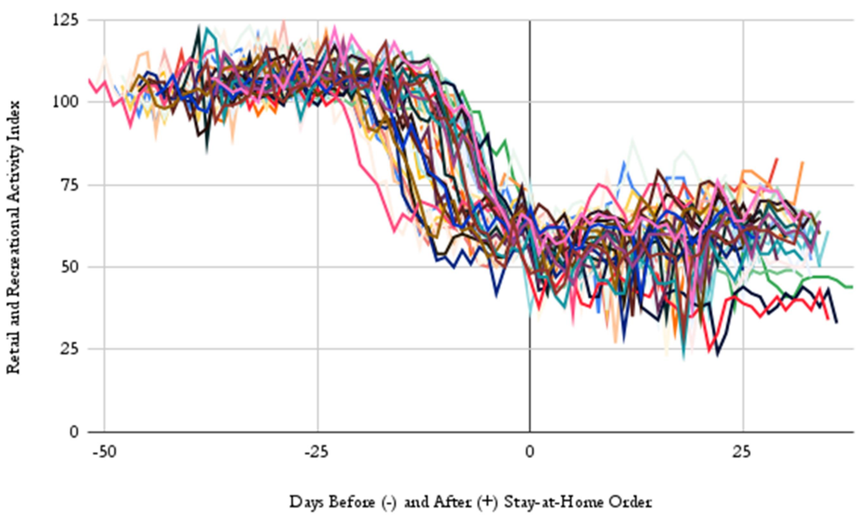
Retail and recreational activity grew slowly in late February and early March. Over the seven-day period ending on February 23, the retail and recreational activity index averaged 103.63 across SAH states and 103.86 across no-SAH states. In the following week, it rose to 107.62 and 108.48, respectively. The averages stood at 108.59 and 110.48, respectively, for the seven-day period ending March 8.

Around March 13, retail and recreational activity began to decline. The average across all states was 92.50 on March 15. By March 22, it was 58.68. Over the seven-day period beginning on March 22, the retail and recreational activity index averaged 58.51 across SAH states and 64.27 across no-SAH states. It averaged 57.37 and 63.20, respectively, over the seven-day period beginning March 29.

By the end of the period, retail and recreational activity had recovered somewhat, but remained well below the baseline. It averaged 57.04 across SAH states and 64.04 across no-SAH states over the seven-day period beginning on April 5. Over the seven-day period beginning April 19, it averaged 62.11 and 71.75, respectively.

Figure 4 shows the retail and recreational activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. The vertical axis marks retail and recreational activity index values. The horizontal axis marks the days leading up to (−) and immediately following (+) the effective date of a state's stay-at-home order.

Figure 4. Retail and recreation activity by state, before and after stay-at-home orders



As with residential activity, it is clear from figure 4 that much of the change in retail and recreation activity occurred before the introduction of state-level stay-at-home orders. On the day before the stay-at-home order went into effect, retail and recreational activity averaged 63.60. The median was 63.50, with observations ranging from 53 to 79. On the day after the stay-at-home order was imposed, the average, median, minimum, and maximum were 53.26, 53, 35, and 69, respectively.

Over the seven days before the stay-at-home order, retail and recreational activity averaged 65.94. Then, over the seven days following the stay-at-home order, it averaged 55.26. Treating the baseline from January 3 to February 6, 2020 as the relevant counterfactual suggests that 76.12 percent of the decrease in retail and recreational activity took place before the stay-at-home order went into effect.

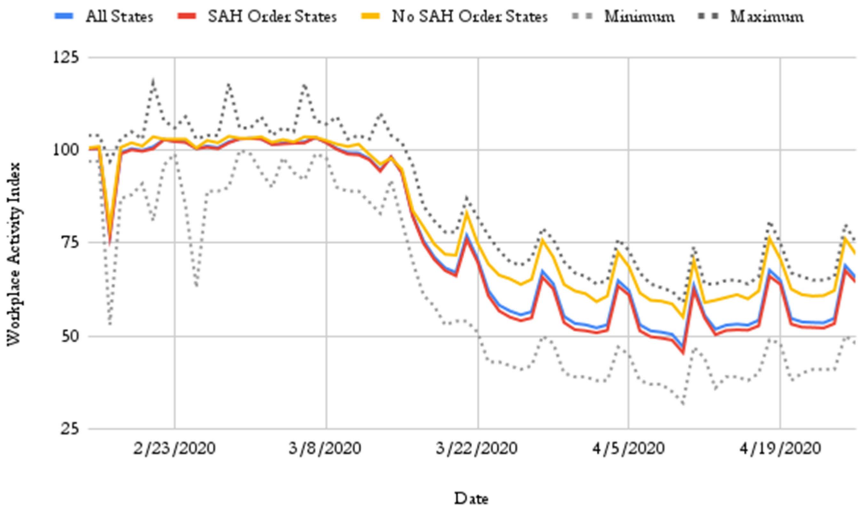
As noted above, the estimated share of the effect occurring before the stay-at-home order is conservatively estimated, which is especially relevant for retail and recreational activity. Retail activity tends to be low in January, which accounts for much of the baseline period. Recall that the retail activity index was 3 to 9 percent above the baseline in late February and early March. Using 103 (109) as the relevant counterfactual instead of 100, the share of the decrease occurring before the stay-at-home order rises to 77.62 (80.12) percent. Using the +/− one day approach and the mostly January baseline, the share of the decrease occurring before the stay-at-home order rises to 77.89 percent. It would rise to 79.22 (81.46) percent assuming a counterfactual of 103 (109) instead.

Excluding Missouri and South Carolina results in a retail and recreational activity index average of 66.03 over the seven days before the stay-at-home order went into effect. It averaged 55.08 over the seven days after. After exclusions, the share of the decrease in retail and recreational activity occurring before the stay-at-home order estimated using the +/− seven days approach is 75.61 (100), 77.14 (103), and 79.68 (109), with assumptions about the relevant counterfactual noted parenthetically.

C. Workplace Activity

Figure 5 shows the average workplace activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020, alongside minimum and maximum index values for each date.

Figure 5. Workplace activity by group, February 15–April 26, 2020



Workplace activity was relatively stable in late February and early March and similar across groups. Over the seven-day period ending March 1, the workplace activity index averaged 101.72 across SAH states and 102.64 across no-SAH states. Over the seven-day period ending March 8, the averages stood at 102.22 and 102.95, respectively.

The workplace activity index began to decline around March 11. On March 15, it averaged 93.90 in SAH states and 94.88 in no-SAH states. It fell further to 69.98 and 75.00, respectively, by March 22.

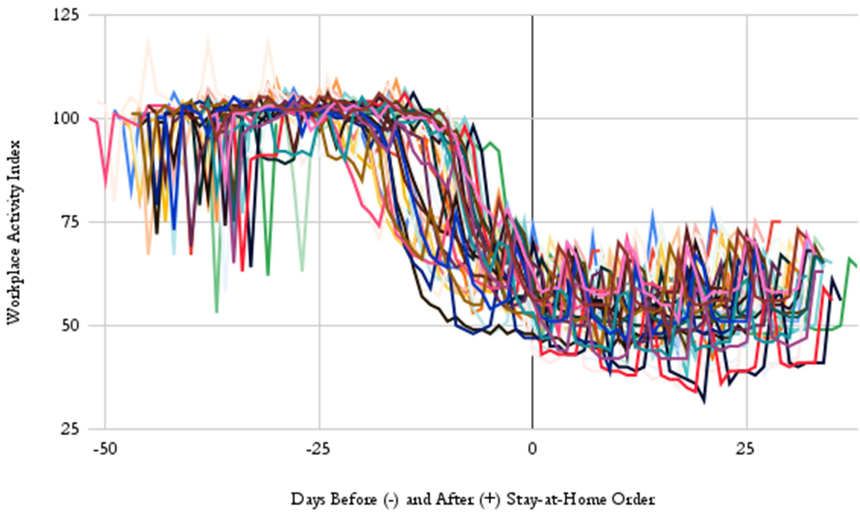
Over the seven-day period beginning on March 22, the workplace activity index averaged 59.63 across SAH states and 68.71 across no-SAH states. It fell further, averaging 55.03 and 64.45, respectively, over the seven-day period beginning March 29.

Workplace activity remained well below the baseline through April, with no-SAH states elevated relative to SAH states. Over the seven-day period beginning April 5, it averaged 52.62 across SAH states and 61.89 across no-SAH states. It averaged 56.41 and 64.93 over the seven-day period beginning on April 19.

Figure 6 shows the workplace activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. The vertical axis marks workplace activity index values. State time series have been shifted to line up on the day each state imposed its stay-at-home order. Days leading up to the effective date of a state's stay-at-home order are negative, while those following the effective date are positive.

Again, it is clear that much of the change occurred before the introduction of state-level stay-at-home orders. On the day before the stay-at-home order went into effect, workplace activity averaged 60.88. The median was 60.5, and observations ranged from 47 to 75. On the day after the stay-at-home order was imposed, the average, median, minimum, and maximum were 54.79, 55, 42, and 69, respectively.

Figure 6. Workplace activity by state, before and after state-level stay-at-home orders



Over the seven days before the stay-at-home order, workplace activity averaged 65.42. Then, over the seven days following the stay-at-home order, it averaged 54.77. Treating the baseline from January 3 to February 6, 2020, as the relevant counterfactual suggests that 76.46 percent of the decrease in retail and recreational activity occurred before the stay-at-home order went into effect. Treating 102 as the relevant counterfactual, which is in line with late February and early March activity, would increase the estimated share of the decrease occurring before the stay-at-home order to 77.46 percent.

Taking a +/− 1 day approach with the mostly January baseline results in an estimated share of the decrease in workplace activity occurring before the stay-at-home order of 86.52 percent. The estimate is 87.09 percent if 102 is assumed to be the relevant counterfactual.

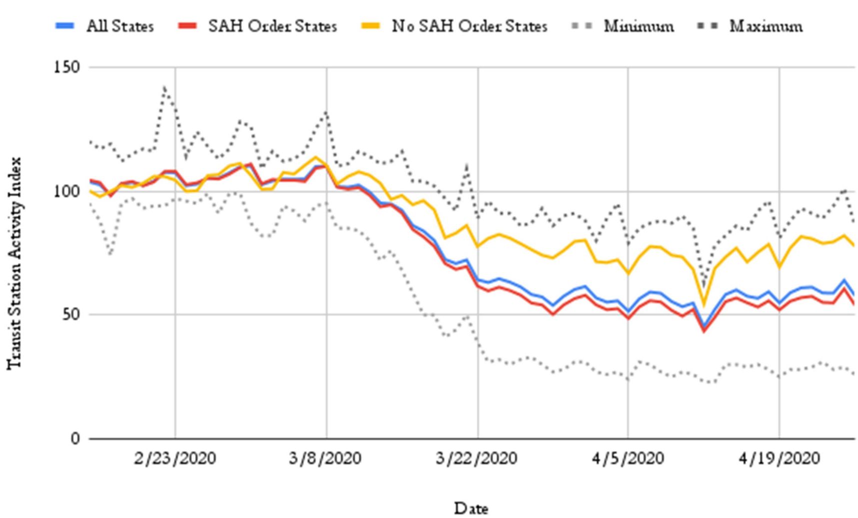
Excluding Missouri and South Carolina has a small effect on the results. With exclusions, the workplace activity index is 65.66 over the seven days prior. It is 54.71 over the seven days following. The share of the decrease in workplace activity occurring before the stay-at-home order estimated with exclusions using the +/− seven days approach is 75.81 percent when using the mostly January counterfactual. It is 76.84 percent when treating 102 as the relevant counterfactual.

D. Transit Station Activity

Figure 7 shows the average transit station activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020,. Minimum and maximum index values for each date are included, as well.

Transit station activity climbed gradually in late February and early March and was similar across groups. Over the seven-day period ending on February 23, the transit station activity index averaged 103.80 across SAH states and 103.27 across no-SAH states. In the following week, it rose to 106.16 and 105.79, respectively. The averages were 105.62 and 107.20 for the seven-day period ending March 8. Then, the transit station activity index began to decline. By March 15, it averaged 91.12 in SAH states and 98.25 in no-SAH states. By March 22, it had fallen to 61.67 and 77.63, respectively.

Figure 7. Transit station activity by group, February 15—April 26, 2020

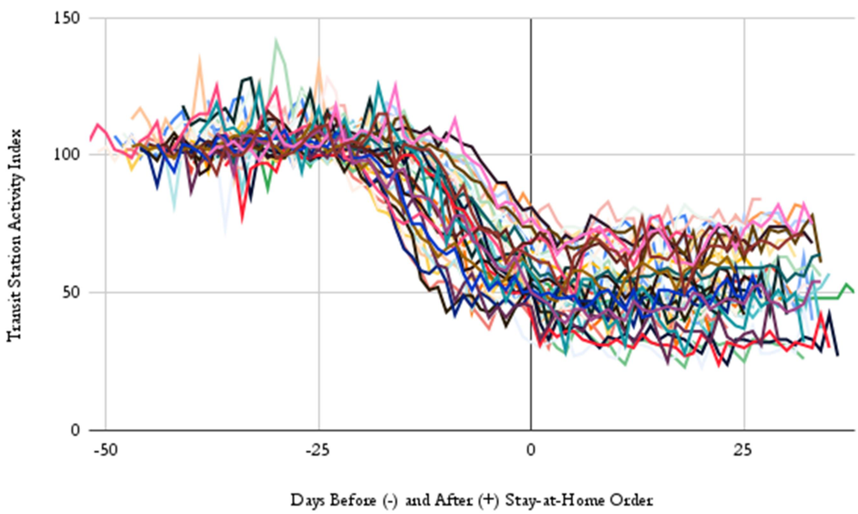


Over the seven-day period beginning on March 22, the transit station activity index averaged 58.48 across SAH states and 78.75 across no-SAH states. Over the seven-day period beginning March 29, it averaged 53.94 and 74.80, respectively.

Transit station activity remained low thereafter, and somewhat more so in SAH states. Over the seven-day period beginning April 5, it averaged 52.34 across SAH states and 72.98 across no-SAH states. Over the seven-day period beginning April 19, it averaged 56.07 and 78.45.

Figure 8 shows the transit station activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. The vertical axis marks transit station activity index values. The horizontal axis marks the days before (−) and after (+) the effective date of each state's stay-at-home order.

Figure 8. Transit station activity by state, before and after state-level stay-at-home orders



As with the other indices of activity considered thus far, it is clear that much of the change in transit station activity occurred before the introduction of state-level stay-at-home orders. On the day before the stay-at-home order went into effect, transit station activity averaged 60.17. The median was 60, while the range was 34 to 86. Two days later, the average, median, minimum, and maximum were 53.90, 53.50, and 30 to 80, respectively.

Over the seven days before the stay-at-home order, transit station activity averaged 64.86. Then, over the seven days following the stay-at-home order, it averaged 53.13. If the baseline from January 3 to February 6, 2020, is treated as the relevant counterfactual and a +/− seven days approach is employed, then 76.98 percent of the decrease in transit station activity occurred before the stay-at-home order went into effect. Using a +/− one day approach increases the estimated share 86.42 percent.

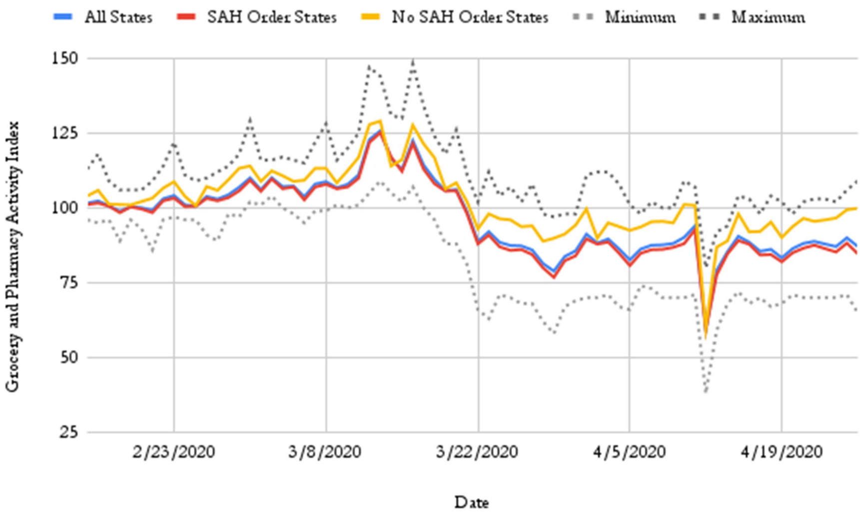
Recall that the transit station activity index grew from around 103 to 106 in late February and early March. If 103 (106) were treated as the relevant counterfactual, the estimated share of the decrease occurring before the stay-at-home order is 76.48 (77.82) percent using the +/− seven days approach and 87.25 (87.98) percent using the +/− one day approach.

The transit station activity index is 64.74 over the seven days prior when Missouri and South Carolina are excluded. It is 52.62 over the seven days following. Excluding Missouri and South Carolina reduces the estimated share of the decrease in transit station activity occurring before the stay-at-home order to 74.42 (100), 75.95 (103), 77.30 (106) percent, with assumptions about the relevant counterfactual noted parenthetically.

E. Grocery and Pharmacy Activity

Figure 9 shows the average grocery and pharmacy activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020, alongside minimum and maximum values.

Figure 9. Grocery and pharmacy activity by group, February 15–April 26, 2020



Grocery and pharmacy activity climbed from late February to mid-March. Over the seven-day period ending February 23, grocery and pharmacy activity averaged 100.44 across SAH states and 103.45 across no-SAH states. It was 103.57 and 107.75 over the seven-day period ending March 1 and 106.60 and 110.95 over the seven-day period ending March 8, respectively.

The average across all states peaked at 125.76 on March 13 and then began to fall. On March 15, it was 112.86. On March 22, it was 88.78. Over the seven-day period beginning March 22, grocery and pharmacy activity averaged 87.34 across all states, 86.02 across SAH states, and 94.29 across no-SAH states.

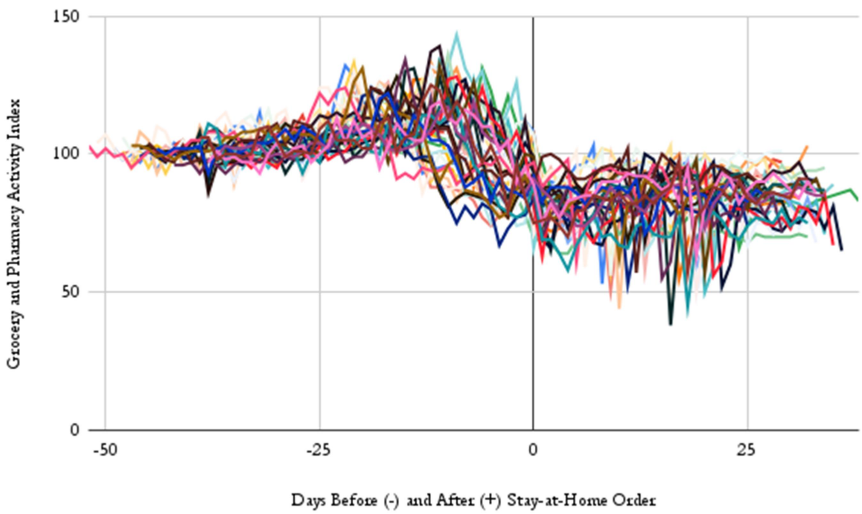
There was a sizeable drop in grocery and pharmacy activity on Easter. While the grocery and pharmacy index averaged 86.16 across all states over the seven days before and after Easter, the average stood at just 59.40 on April 12.

Figure 10 shows the grocery and pharmacy activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. Grocery and pharmacy index values are measured along the vertical axis. The zero line on the horizontal axis indicates the day the state-level order went into effect in each state, with those days preceding (−) and following (+) arranged accordingly.

The increase in grocery and pharmacy activity before March 13 and the smaller overall change in grocery and pharmacy activity relative to residential, retail and recreational, workplace, and transit station activity obscure the effect. Nonetheless, figure 10 shows that a nontrivial share of the decrease in grocery and pharmacy activity occurred before the introduction of state-level stay-at-home orders.

On the day before the stay-at-home order went into effect, the grocery and pharmacy activity index averaged 94.19. The median was 93, with observations ranging from 75 to 112. On the day after the stay-at-home order was imposed, they were 80.02, 80.5, and 62 to 99, respectively. Using the baseline from January 3 to February 6, 2020, as the relevant counterfactual, the +/− one day approach suggests that 29.08 percent of the decrease in grocery and pharmacy activity occurred before the stay-at-home order went into effect.

Figure 10. Grocery and pharmacy activity by state, before and after state-level stay-at-home orders



Over the seven days before the stay-at-home order, grocery and pharmacy activity averaged 96.32. The seven-day average fell to 81.80 following the stay-at-home order. Treating the baseline as the relevant counterfactual, the +/− seven day suggests that 20.20 percent of the increase in residential activity occurred before the stay-at-home order went into effect.

Considering the huge drop in grocery and pharmacy activity at Easter, I repeat the +/− seven days analysis with Missouri and South Carolina excluded. In this case, the grocery and pharmacy activity index averaged 96.38 over the seven days before the stay-at-home order went into effect and 81.49 over the seven days after. The share of the decrease in grocery and pharmacy activity occurring before the stay-at-home order when Missouri and South Carolina are excluded is estimated at 19.58 percent.

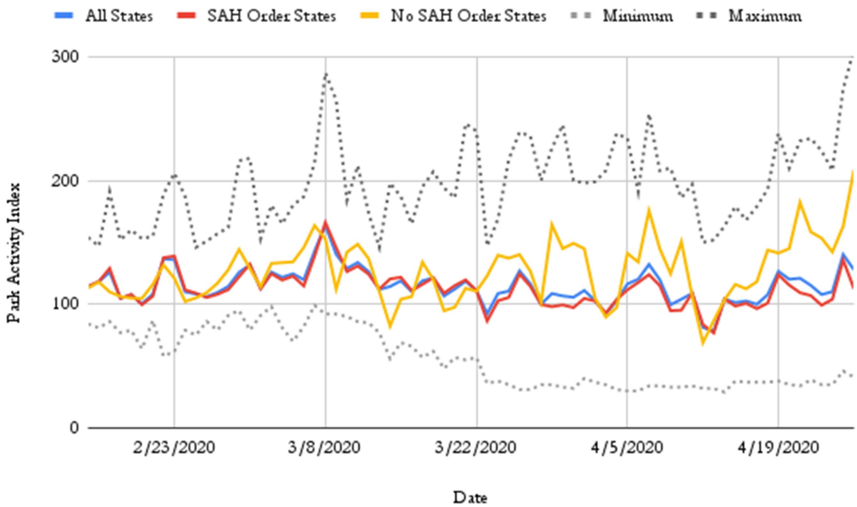
F. Park Activity

Figure 11 shows the average park activity index value for all fifty states, the forty-two states issuing a stay-at-home order at some point over the period (SAH states), and the eight states not issuing a stay-at-home order (no-SAH states) from February 15 to April 26, 2020. Minimum and maximum values across all states for each date are also included.

Park activity grew significantly from late February to mid-March. Over the seven-day period ending February 23, park activity averaged 117.76 across SAH states and 113.54 across no-SAH states. It increased to 128.48 and 139.61 over the seven-day period ending March 8. On March 8, the average across all states was 163.92. The median was 156, while the range extended from a low of 92 to a high of 287.

Average park activity across all states fell to 118.94 on March 15, with a median of 116 and a range of 69 to 187. The seven-day average beginning March 15 was 116.29 across SAH states and 109.93 across no-SAH states. It fell to 106.38 across SAH states over the period beginning March 22 but rose to 125.55 in no-SAH states. Over the seven-day period beginning March 29, park activity averaged 99.83 across SAH states and 127.89 across no-SAH states.

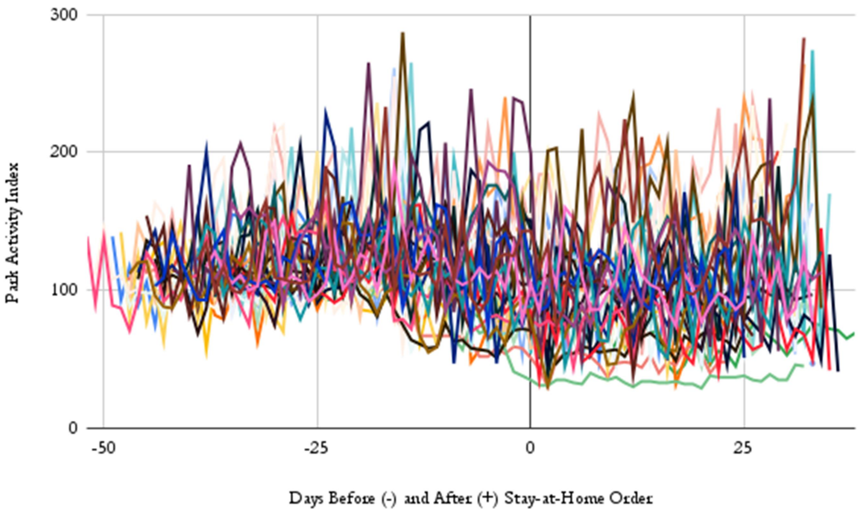
Figure 11. Park activity by group, February 15–April 26, 2020



Park activity remained relatively stable in SAH states over April, while generally growing in no-SAH states. Over the seven-day period beginning April 5, park activity averaged 109.63 in SAH states and 139.68 in no-SAH states. Over the seven-day period beginning April 19, it averaged 113.51 in SAH states and 155.11 in no-SAH states. Somewhat surprisingly, general park activity declined on Easter. In SAH states, park activity averaged 83.55 on April 12; the median was 85.50 and the range extended from 32 to 150. They were 69.00, 66.50, and 43 to 112 in no-SAH states, respectively.

Figure 12 shows the park activity index for the forty-two states issuing a stay-at-home order. Each line traces the time series of a particular state. Park activity index values are measured along the vertical axis. Days preceding (−) and following (+) the effective date of a stay-at-home order are marked along the horizontal axis.

Figure 12. Park activity by state, before and after state-level stay-at-home orders



On the day before the stay-at-home order went into effect, the park activity index averaged 111.86. The median was 105.50, with observations ranging from 38 to 236. Over the seven days before the stay-at-home order, park activity averaged 112.19.

On the day after the stay-at-home order was imposed, the park activity index averaged 93.52. The median was 84, with observations ranging from 31 to 184. The seven-day average was 98.06.

The mostly January counterfactual seems highly implausible for park activity, which would be expected to increase as weather conditions improve in late winter and early spring. It is also the most difficult to account for using the simple techniques employed above, since the change in weather over the period studied is much bigger in some states and more relevant for park activity in states imposing stay-at-home orders later. As such, any estimate of the share of the decrease in park activity occurring before the introduction of state-level stay-at-home orders along these lines is highly suspect.

With the limitations of this approach clearly stated, I estimate the share of the decrease in park activity occurring before the introduction of state-level stay-at-home orders with two counterfactual scenarios in mind. In the first scenario, I assume that park activity would have been 1.5 times greater than the mostly January baseline in the absence of the pandemic when stay-at-home orders were imposed. Park activity was roughly 1.5 times the baseline on March 8. In the second scenario, I assume that park activity would have been two times greater. Park activity was roughly two times the baseline in no-SAH states at the end of the period considered.

Under the first counterfactual scenario, the share of the decrease in park activity occurring before the introduction of state-level stay-at-home orders is estimated at 67.45 (+/− one day) and 72.79 (+/− seven days) percent. Under the second scenario, it is 82.78 (+/− one day) and 86.13 percent (+/− seven days). With Missouri and South Carolina excluded, estimates using the +/− seven days approach fall to 71.73 (150) and 85.61 (200) percent, with assumptions about the relevant counterfactual noted parenthetically.

IV. Conclusion

Conventional wisdom holds that state-level stay-at-home orders inhibited economic activity and/or limited the spread of COVID-19. However, the available evidence indicates that much of the change in activity in early 2020 occurred before the effective dates of state-level stay-at-home orders. The magnitude of change occurring before state-level stay-at-home orders implies that many of the consequences of people staying home would have likely been realized—for better or worse—even if states had not imposed stay-at-home orders. In other words, the marginal effect of state-level stay-at-home orders, at least at the outset, was probably smaller than most people claim.

The available evidence does not indicate that stay-at-home orders were ineffective at inducing people to stay at home. For starters, roughly 20 percent of the observed change in residential, retail and recreational, workplace, transit station, and park activity and 80 percent of the change in grocery and pharmacy activity occurred after state-level stay-at-home orders were imposed. Moreover, the relatively small marginal effect of state-level stay-at-home orders is, in part, a consequence of local-level stay-at-home orders and other restrictions, which had already been adopted in some places. It is also conceivable that the consideration given to imposing stay-at-home orders persuaded individuals that the situation was serious enough for them to make behavioral changes on their own.

Finally, the available evidence does not indicate that the marginal effect of state-level stay-at-home orders remained low in the weeks after they were imposed. To the extent that individuals grew tired of staying at home, the perception of relevant risks (opportunity costs) declined (increased), or local-level stay-at-home orders expired, the marginal effect of state-level stay-at-home orders probably increased.

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