

INTERDEPENDENCE AND THE COST OF UNCOORDINATED RESPONSES TO COVID-19

By David Holtz, Michael Zhao, Seth G. Benzell, Cathy Y. Cao, M. Amin Rahimian, Jeremy Yang, Jennifer Allen, Avinash Collis, Alex Moehring, Tara Sowrirajan, Dipayan Ghosh, Yunhao Zhang, Paramveer S. Dhillon, Christos Nicolaides, Dean Eckles, Sinan Aral

Social distancing is the core policy response to COVID-19. As of mid-May, federal, state, and local governments worldwide have begun opening businesses and relaxing shelter-in-place orders worldwide. However, there is a lack of quantitative evidence on how policies in one region affect mobility and social distancing in other regions, and the consequences of uncoordinated regional policies adopted in the presence of such spillovers.

To provide these insights, the Social Analytics Lab at the MIT Initiative on the Digital Economy (IDE) released a comprehensive study of the cost of uncoordinated responses to [COVID-19](#). We combined daily, county-level data on shelter-in-place and business closure policies with movement data from more than 27 million mobile devices, social network connections among over 220 million Facebook users, daily temperature and precipitation data from 62,000 weather stations, and county-level census data on population demographics to estimate the geographic and social network spillovers created by regional policies across the United States. We then used our empirical estimates to calibrate a model of what we call the “loss from anarchy” created by states failing to coordinate amid social and geographic spillovers.

One of the most surprising results is that behavior is influenced not just by those in local communities; social connectivity is often as important as geographic proximity. Social networking through mobile phones, video conferencing, and social media can substantially alter perceptions of the effectiveness of local policies. Therefore, it is likely that an individual’s adherence to social distancing is impacted by the policies of neighboring and distant regions where their social network connections reside, not only by local mandates. Put differently, a local government’s social distancing policy may significantly impact the health outcomes of other communities, near and far pointing up the strong need for coordinated governmental responses to COVID-19 across geographic and administrative regions.

SOCIAL NETWORKING THROUGH MOBILE PHONES, VIDEO CONFERENCING, AND SOCIAL MEDIA CAN SUBSTANTIALLY ALTER PERCEPTIONS OF THE EFFECTIVENESS OF LOCAL POLICIES.

METHODOLOGY

In this report, we measure mobility across borders, adherence to social distancing, and high-density interactions among people using population-scale digital trace data from more than 22 million mobile devices. The data, provided by Safegraph and Facebook, record the fraction of mobile devices staying home each day in

IN THIS BRIEF

- Data from more than 27 million mobile devices and over 220 million Facebook users estimates the geographic and social network spillovers created by regional social distancing policies across the United States.
- People are socially as well as geographically connected. Contact among people in a one region is significantly influenced by the policies and behaviors of people in other, sometimes distant, regions known as spillovers.
- Social spillovers are very relevant to the spread of COVID-19 because shelter-in-place orders have increased reliance on digital connections, creating record-breaking usage of social media and video conferencing to maintain ties across geographic distance.
- When one third of states enact shelter-in-place orders, it reduces mobility on par with a state enacting its own shelter-in-place order.
- There is a strong need for coordinated central governmental responses to COVID-19 across geographic and administrative regions. Uncoordinated policies can dramatically increase public health risks of the pandemic.

every U.S. county, and the average number of locations visited by mobile devices each day in every county.

We augmented these mobility data sets with an index of the degree to which different U.S. counties are socially connected on Facebook, daily industry-level visit data for each county from Safegraph, temperature and precipitation data from the National Oceanic and Atmospheric Administration’s (NOAA) global historical climatology network (GHCN) database, census counts of each county’s total population, and a detailed database of the timing of COVID-19-related government interventions in every county.

We analyzed this data using difference-in-difference and instrumental variables approaches, allowing us to causally estimate the direct effect of local social distancing policies on local mobility, as well as the indirect effects of other governments’ social distancing policies on local mobility. We also analyzed the mediation of these effects by social influence and geographic proximity across the entire United States. We focused our analysis on the 2,502 U.S. counties appearing in both the Facebook and

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Safegraph data from March 1, 2020 to April 18, 2020, during which the vast majority of social distancing policies were implemented.

KEY FINDINGS AND RECOMMENDATIONS

The findings clearly showed that 36% of a state's geographic and social peer states implementing shelter-in-place policies were as effective at reducing mobility as the focal state itself implementing its own shelter in place policy. Further, we found that these spillovers are substantially mediated by the social distancing behavior of connections outside of the local community. For instance, a 3% reduction in the number of peer locations visited leads to a 5.6% reduction in the number of physical locations visited. In other words, people in a focal state are significantly influenced by the behavior of their peers in other states when calibrating their own social distancing behaviors and choices.

UNCOORDINATED POLICIES CAN REDUCE TOTAL UTILITY, OR NEGATIVE WELFARE IMPACT, OF UP TO 69% GIVEN THE MAGNITUDES OF THE SPILLOVERS WE EMPIRICALLY ESTIMATED.

These results were also used to estimate the strength of interdependence between each pair of U.S. states. Generally speaking, each state's mobility outcomes are impacted by the policy decisions of not just geographically proximate states, but also socially connected, distant states. Finally, we used our empirical estimates to calibrate an analytical model of the inefficiency created by states failing to coordinate over social and geographic spillovers. According to this model, uncoordinated policies can reduce total utility, or negative welfare impact, of up to 69% given the magnitudes of the spillovers we empirically estimated.

Figure 1

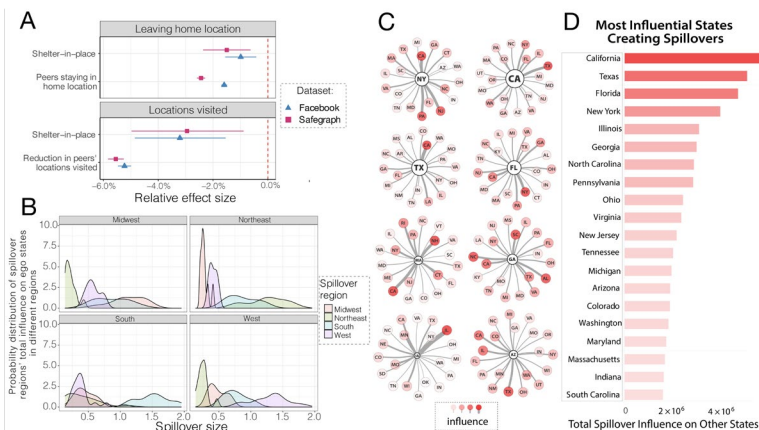


Figure 1: (A) Compares the causal effect of a county's own shelter-in-place policy on mobility, and the causal effect of the social distancing behavior of Facebook friends in other counties on

mobility. (B) Displays the region-level probability distribution functions for the size of the total spillover effect from related or "alter" states in each U.S. region. (C) Displays the 20 most influential alter states for 8 different U.S. states. Both the line thickness and the alter state color correspond to the amount of influence the alter state exerts on the focal, or "ego" state. (D) Displays the 20 states whose shelter-in-place policies cause the greatest reduction in devices leaving home across the U.S., according to empirical analyses.

As government officials around the world begin to calculate the costs and benefits associated with lifting social distancing policies, it is crucial to accurately estimate these policies' effects. Our findings indicate that any given government's decision to lift a social distancing policy will likely affect the behavioral and health outcomes not only of their own citizens, but also the citizens of geographically and socially proximate communities. These results suggest there are significant negative welfare repercussions from uncoordinated government social distancing policies, which suffer from a coordination problem resembling what we call the price of anarchy.

OUR FINDINGS INDICATE THAT ANY GIVEN GOVERNMENT'S DECISION TO LIFT A SOCIAL DISTANCING POLICY WILL LIKELY AFFECT THE BEHAVIORAL AND HEALTH OUTCOMES NOT ONLY OF THEIR OWN CITIZENS, BUT ALSO THE CITIZENS OF GEOGRAPHICALLY AND SOCIALLY PROXIMATE COMMUNITIES.

Our analysis proves that it is important for federal governing bodies (e.g., the United States federal government, the European Union) to coordinate policy action, even in cases where final policy decisions are in the hands of local governments. We hope our work inspires a greater level of coordination between local government officials when determining policies related to social distancing and future research into the indirect effects of these policies.

REPORT

FULL RESEARCH PAPER CAN BE FOUND [HERE](#).

ABOUT THE AUTHORS

All of the authors are affiliated with the MIT Sloan School of Management and/or [The MIT Initiative on the Digital Economy \(IDE\)](#). Tara Sowrirajan is also affiliated with Harvard University; Paramveer S. Dhillon is also affiliated with the School of Information, University of Michigan; Christos Nicolaides is also affiliated with the School of Economics & Management, University of Cyprus.

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