Covid Alone: The Complementarity between Social Capital and Formal Public Health Rules

ABSTRACT The spread of COVID-19 provides a unique opportunity to explore the interactive effect between formal and informal rules. While economists and public health scholars realize the independent effects social capital and stringent public health rules have on prevalence and mortality rates, we advance this literature with a novel framework to analyze the interaction between the two. With state-level data on daily COVID-19 cases, a measure of policy stringency, and various measures of social capital, we find that prevalence rates fall by a larger amount in states where people place a higher value on COVID-19 prevention, where public health measures are more stringent, and where there are higher levels of social capital. We estimate that states with higher values for prevention and higher social capital experienced 74 fewer new daily COVID-19 cases per million. The main results are robust to the inclusion of relevant controls, various specifications, and alternative measures of social capital. These results suggest that individuals and the communities they enter into and exit out of play an important role in the spread and prevention of infectious diseases independent of formal, governmental public health responses.

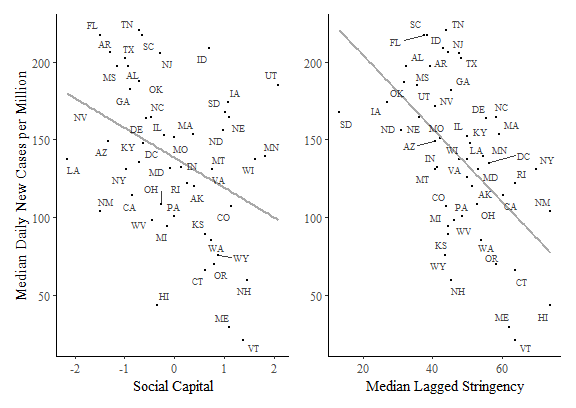
# Introduction

The COVID-19 epidemics and the myriad private and public responses provide a unique opportunity to examine the interplay between formal and informal rules. Many scholars understand how these rules influence economic, social, and political behaviors (North 1990; Baumol 1990; Ostrom 2005; Boettke and Coyne 2007; Heller 2009; C. R. Williamson 2009, 2011; C. Williamson and Kerekes 2011; Storr 2015; Vachris and Isaacs 2017), but the effects rules have on infectious and preventative behaviors—and prevalence rates—are less clear.[[1]](#footnote-20)

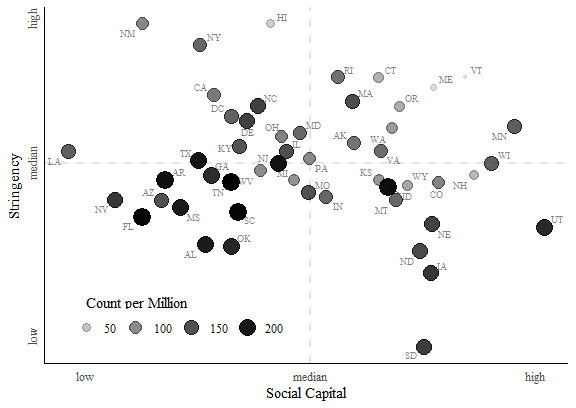
Formal rules can influence the difficulty or ease of developing public health bureaus (Troesken 2015; Olmstead and Rhode 2015), and we expect that people are better able to avoid infectious diseases and/or lessen mortality rates when they live in areas with greater economic freedom (Geloso and Bologna Pavlik 2020; Candela and Geloso 2020). Relatedly, individuals and firms in the private sector are more likely to provide public goods associated with public health when they face incentives to do so; for example, coal mining companies provided sanitation services on par with municipalities (Fishback 1992); groups of workers provided industrial-sickness funds that were effective means of insurance (Murray 2007); private water companies lowered mortality rates in Argentina (Galiani, Gertler, and Schargrodsky 2005); textile mills and railroad companies provided mosquito control services prior to significant public health measures (Carson 2016). Individuals can also alter the incentives and rules they face to provide mosquito-control (Carson 2020a), and to encourage COVID-19 prevention (Carson 2020b).

Whether informal rules influence the spread of disease and whether such rules interact with formal rules to influence the spread of disease, however, are underexplored questions.[[2]](#footnote-21) In response to COVID-19, scholars recognized that formal public health rules, e.g., lockdown orders, might have a dampening effect on disease spread (Brodeur et al. n.d.). Similarly, scholars recognize that social capital—a kind of informal institution—encourages COVID-19 prevention (Imbulana Arachchi and Managi 2021; Makridis and Wu 2021; Brodeur et al. n.d.; Pitas and Ehmer 2020; Wong and Kohler 2020; Borgonovi and Andrieu 2020; Borgonovi, Andrieu, and Subramanian 2020; Wu 2020; Wu et al. 2020; Durante, Guiso, and Gulino 2020).[[3]](#footnote-22) Putnam (2001), p. 19, defines social capital as the “connections among individuals—social networks and the norms of reciprocity and trustworthiness that arise from them.” As it relates to COVID-19, Makridis and Wu (2021) shows that between March and July of 2020 social capital negatively influences the spread of COVID-19. Using state fixed effects that attenuate omitted variable bias and alternative measures of social capital, they report that the spread of COVID-19 falls by 18 percent (and deaths fall by 5.7 percent) as counties increase their social capital from the 25th percentile to the 75th percentile.[[4]](#footnote-23)

We advance this literature by developing a novel framework to 1) assess the conditions under which social capital influences the spread of COVID-19 and 2) compare the effects social capital has on the growth of COVID-19 relative to more formal public health measures. The condition of particular interest is that social capital lowers the spread of COVID-19 when people value COVID-19 prevention and formal public health measures.[[5]](#footnote-24) With one year’s worth of state-level, daily data on COVID-19 cases, social capital, and stringency in the United States, we build a panel model to analyze this interaction effect. We find results similar to Makridis and Wu (2021) in that social capital encourages COVID-19 prevention. More importantly, however, states with stronger social capital (relative to the average) *and* with a higher value of COVID-19 prevention (relative to the average) have about 74 fewer COVID-19 cases whereas states with weaker social capital (relative to the average) *and* a lower value for COVID-19 prevention (relative to the average) have about 60 more cases. While there are potential measurement issues—due to variability in how COVID-19 case data is collected at the local and state level—this does not bias our estimates.[[6]](#footnote-25) Our panel model also attenuates problems related to poor data quality and measurement error because it accounts for jurisdictional and period fixed effects (Stoto et al. 2022). Our results are consistent when we disaggregate social capital based on measured sub-components, and they are robust to the inclusion of standard controls and alternative measures of social capital. Figures 1 and 2 show how our approach differs from the published literature, e.g., Makridis and Wu (2021). Figure 1 replicates the relationships between stringency, social capital, and COVID-19 cases at the state level. Figure 2, however, shows that both social capital and stringency influence COVID-19 cases. That is, states seem to have fewer new daily cases in the upper, right quadrant and states seem to have more new daily cases in the lower, left quadrant.



Cases vs. Social Capital and Stringency



Median Daily New Cases per Million

These results suggest that the values people have for COVID-19 prevention, their formal and informal rules, and their interactions play identifiable roles in how people spread infectious diseases, which should be recognized in subsequent economic and public health research. There are numerous implications of these results. Just as we recognize individuals can influence the formal and informal rules that influence economic, political, and social behaviors, we should recognize individuals influence how diseases spread by the formal and informal rules they create and adapt. For example, economic freedom might play a larger role in developing public health policy as it bolsters social capital (Berggren and Jordahl 2006) and disease prevention (Geloso and Bologna Pavlik 2020; Candela and Geloso 2020). In particular, the formal and informal rules that influence economic freedom are integral components of public health.

A related theme in the economic literature on institutions suggests that the formal rules that facilitate economic development depend on supporting informal rules, and that mimicking formal rules without the underlying cultural values and informal rules or *metis*, following Boettke, Coyne, and Leeson (2008), will likely cause worse outcomes. Evidence on the efficacy of matching formal and informal institutions suggests that areas with higher levels of trust, self-reliance, and civic belief foster economic and political institutions that protect property rights, promote openness, and economic development (Vachris and Isaacs 2017). Furthermore, government-led attempts to foster social capital or create homogeneity—for example, through language laws or the creation of a civil court—create unintended, harmful effects (Carilli, Coyne, and Leeson 2008). Thus, we resist attempts to alter the level and/or kind of social capital via policy so as to influence COVID-19 transmission rates. Social capital is not easily alterable as if it were a lever one person or a large group of people could toggle. Even though social capital supports formal public health rules and might lower the growth rate of COVID-19 cases, this does not necessarily suggest policymakers should target areas with less social capital by increasing stringency measures or by doubling-down along the intensive margin (as suggested by Bartscher et al. 2020).

# Values, Social Capital, and COVID-19

Social capital takes various forms between individuals to encourage cooperation, which then influences health outcomes. Two of the main forms of social capital include *bridging* between people within a social network and *bonding* between people from different social networks. We do not take a stance as to which form of social capital is more or less relevant in the context of COVID-19. We do, however, provide evidence below regarding the measured components of social capital, e.g., categories like family unity and community health. Furthermore, while social capital can be used for legitimate and nefarious activities, we are solely interested in whether social capital influences behaviors related to the spread of disease.

Social capital can influence health outcomes in multiple ways (Putnam 2001): people with greater access to social capital or in a network with stronger social capital might have more tangible assistance from others, e.g., money or health care; they might have more access to organizations that lower the cost of health care; they might have more opportunities to innovate and provide goods and services related to health; they might be in a social network where social norms enforce healthy behaviors, e.g., “don’t take the last bite of food”; they might have more of an ability to advance a political agenda to alter health policy; and there might be a physiological response as social capital can improve immune systems (Putnam 2001). Additional evidence also shows that social capital influences obesity (Kim et al. 2006).

We argue that social capital complements the values people have for prevention and the subsequent formal rules they adopt. That is, people are more likely to limit the spread of COVID-19 when they place a higher value on preventative behaviors and rules and when they live in communities where social capital reinforces such values, behaviors, and rules. People are more likely to encourage the spread of COVID-19 when they place a lesser value on preventative behaviors and rules and when they live in communities where where social capital reinforces such values, behaviors, and rules. Thus, the interaction effect between the value people have for prevention, formal public health rules, and the kind of social capital is our primary interest—rather than each of these factors separately.

We suggest the interaction between social capital, values for prevention, and formal rules has a negative effect on prevalence rates because social capital ultimately raises the private costs to individuals of breaking the rules that a group perceives as legitimate, namely formal and informal public health rules. People with stronger levels of social capital are more likely to interact with each other—which can increase the spread of diseases like COVID-19 due to being physically close to others—but they are also likely to follow the public health rules they value. The more people value disease prevention over other legitimate values they might have and the more they believe public health rules are also legitimate and valuable, breaking those rules is taken as an affront punishable informally by a personal rebuke, a worsening reputation, a refusal of service, or fewer social contacts. More formal measures of enforcement and punishment are also relevant, e.g., calling a public health department, a security guard, or the police.[[7]](#footnote-29) Relatedly, people are better able to monitor the behavior of others in areas with stronger social capital given numerous social ties; this suggests that infractions are more likely to be discovered in areas with stronger social capital. Thus, as strong as values for prevention are and as severe as formal public health rules are, social capital will encourage individuals to engage in preventative behavior. All else equal, this interaction lowers the number of COVID-19 cases.

A person’s normative beliefs and attitudes can raise (or lower) the value of preventative behavior, which can encourage (or discourage) the use of masks, social distancing, etc. People might value disease prevention to improve their own health and the health of their friends and family; and people might legitimately value other goals over disease prevention, e.g., maintaining cultural practices, following religious observances, pursuing economic activity, etc. Given the values people have, then, the community and kind of social capital within which people pursue their individual and cooperative goals becomes relevant. That is, the quality, kind, or strength of social capital influences how well people achieve their goals, whatever those goals might be. Thus, the kinds (and amount) of bonds people form within and between groups vary across school groups, business environments, and familial and social settings. Such bonds give social capital an entrepreneurial quality (Chamlee-Wright 2008; Carilli, Coyne, and Leeson 2008). Recently, Storr and Haeffele (2021) argues that epidemic crises like the COVID-19 crisis influenced people’s social capital by encouraging deeper connections with pre-existing contacts. It remains to be seen, however, how widespread separation might also change, i.e., erode, pre-existing relationships.

Table I depicts a way to visualize our framework on the interaction between social capital and normative values for prevention. The rows characterize groups by their normative beliefs and attitudes regarding prevention; individuals and groups in the top row place a higher value on prevention relative to the average value while those in the bottom row place a lower value on prevention relative to the average value. The columns characterize groups by the strength of their social capital; individuals and groups on the left have stronger social capital relative to the average amount of social capital while those on the right have weaker social capital relative to the average.

1. The Interaction between Social Capital and Values for Disease Prevention

|  |  |  |
| --- | --- | --- |
|  | Strong Social Capital | Weak Social Capital |
| **High Value on Prevention** | I - Lowest Prevalence Rate | II - Higher Prevalence Rate |
| **Low Value on Prevention** | III - Lower Prevalence Rate | IV - Highest Prevalence Rate |

Thus, the interaction between values for prevention and social capital influences the spread of COVID-19 in different ways. We expect the interaction effect between values for prevention and social capital to have the strongest, negative effect on prevalence rates when people place a higher value on prevention, when they adopt more stringent public health rules, and when they have stronger social capital (Quadrant 1). We expect the magnitude of social capital to have the strongest, positive effect on new cases when 1) people place a lower value on preventative behavior and 2) people have weaker social capital (Quadrant IV).

The following testable propositions guide our analysis below:

1. People that place a higher value on COVID-19 prevention will have a larger, negative effect on the growth of COVID-19 cases relative to people that do not value COVID-19 prevention, all else equal.
2. People with stronger social capital will have a larger, positive effect on the growth of COVID-19 cases relative to people with weaker social capital, all else equal.
3. People that place a higher value on COVID-19 prevention *and* have stronger social capital will have the largest, negative effect on the growth of COVID-19 cases, all else equal.

# Model, Data, and Results

This framework is somewhat easy to operationalize in the context of COVID-19, in addition to other epidemiological cases where formal and informal rules are relevant. We measure the columns of Table I with various indices of social capital. We measure the rows of Table I with a measure of policy stringency, which we suggest is indicative—but not a perfect representation—of the values people hold regarding COVID-19 prevention.

Moreover, we specify three panel models. The first model is a one-way, period fixed effects model without controls given by

The second adds a vector of controls to equation 1 and is given by

The third is a two-way fixed effects model given by

where the daily number of new COVID-19 cases per million is a function of 7-day lagged stringency, the square of 7-day lagged stringency, social capital, and an interaction term between the 7-day lagged stringency and social capital. The square of the 7-day lag of the stringency index demonstrates the diminishing impact of stringency on case prevalence. The vector of controls in equation 2 includes time-invariant proxies that control for factors that could possibly influence COVID-19 prevalence and a state’s desire for public health measures. The vector of controls includes the percent of a state with a bachelor’s degree, the percent of a state with poor/fair health, the percent of a state who are black, the percent of a state who live in rural areas, the percent of a state who are older than 65, the average temperature, median income, population density, and the political affiliation of the governor.[[8]](#footnote-31)

These models allow us to investigate our theoretical framework and test our three propositions: do states that have a higher desire for prevention have better prevalence outcomes; do states that have stronger measured social capital scores have worse prevalence rates; finally, do states with higher social capital scores *and* with a higher desire for preventative measures have even better prevalence outcomes? In light of these propositions and our models, we expect to observe the following: the coefficient estimates for the value of public health and stringency will be negative; the coefficient estimates for social capital will be positive; the coefficient estimate for the interaction between values for prevention and stringency and social capital will be negative. The negative interaction term suggests that for a given desire for prevention and a given level of stringency, higher levels of social capital reinforce such desires. Given a level of stringency, thus, higher levels of social capital should decrease the spread of COVID-19 and lower levels of social capital should increase the spread of COVID-19.

We compile state-level data from a variety of sources to systematically measure relevant variables and analyze our framework. Our dependent variable—daily number of new cases per million—and our stringency index that measures the severity of lockdown policies come from Oxford University’s COVID-19 Government Response Tracker (OxCGRT) (Hale et al. 2020) for the United States. The stringency measure is a state-level, ordinal, daily indicator of containment, closure, and informational policies, e.g., school closures and travel restrictions in the United States. The social capital and other control measures are taken from the US Congress Joint Economic Committee’s (JEC) Social Capital Project (*Social Capital Project - United States Joint Economic Committee* n.d.). This project provides us with a state-level social capital index, as well as a set of specific measures in categories such as family unity, family interaction, social support, community health, institutional health, collective efficacy, and philanthropic health. The aggregate measure is calculated as a deviation from a mean score, normalized to 0. The political party of a state’s governor—taken from ballotpedia.org (accessed Nov. 12, 2020)—is used to create the categorical variable shown as *Republican governor*.

The following statistics describe the median values of our sample data, which covers 49 contiguous states and the District of Columbia between March 1, 2020 and April 4, 2021.[[9]](#footnote-32) The median new cases per million is 136; the median 7-day lagged stringency index is 47.7; the mean and median social capital index is about zero by construction; the median percent of people with a bachelor’s degree is 29%; the median percent of people who reported they were in poor or fair health is 16%; the median percent of a state’s black population is 7.8%; the median percent of people in rural areas is 25.8%; the median percent of people over 65 is 14.6%; the median average temperature is 62.8 degrees Fahrenheit; the median of median income is $53,571; and the median population density is 106 people per square mile. There were 25 Republican governors and 24 Democrat governors. Table II presents additional descriptive statistics for our data.

Table 3 presents the results of our three models using our sample data. Column 1 estimates equation 1—the one-way, period fixed effects model. Column 2 estimates equation 2 that adds relevant control variables to equation 1. Column 3 estimates equation 3 that includes both cross-sectional and period fixed effects to account for cross-sectional differences between states. We report clustered errors for all models.

[Insert table 3]

Column 1 in Table III provides the empirical results of equation 1. A one unit increase in the 7-day lagged daily stringency, which we suggest is indicative of the values people have for disease prevention, reduces new, daily cases per million by 5.62. A one unit increase in social capital decreases new, daily cases per million by about 27. More importantly, states with a higher level of social capital and a higher level of daily stringency reduce new, daily cases per million by about 0.9. This multiplicative effect suggests that states with higher levels of social capital *and* higher stringency responded more collectively and slowed daily disease spread at a higher rate than those states with lower levels of social capital but with similar levels of stringency.

These results support our earlier propositions. That is, stringency is statistically significant and negative, supporting Proposition 1, i.e., people who value prevention will see lower prevalence on average. The positive and significant coefficient on social capital supports Proposition 2, i.e., social capital encourages physical interactions, social gatherings, and the spread of COVID-19. Finally, the negative and significant value on the interaction term supports Proposition 3, i.e., states with higher levels of stringency and higher rates of social capital will have an even larger reduction in new cases.

Column 2 replicates the specification found in column 1, but with our vector of time-invariant proxies as discussed above. Column 2 of Table III shows similar results to our first specification. Stringency lowers new, daily cases per million by 5.38, social capital adds to new, daily cases per million by about 31, and the social capital and stringency interaction term lowers new, daily cases per million by 0.641.

Column 3 of Table III—the two-way fixed effects specification—shows similar results. A higher level of stringency decreases new, daily cases per million by 4.26. The social capital and stringency interaction term lowers new, daily cases per million by 0.58. As social capital does not vary across time, unfortunately, it is dropped from the model in column 3.

The sign, magnitude, and statistical significance of our main variables of interest remain remarkably similar across all three specifications. This suggests stringency, social capital, and the interaction between stringency and social capital are important factors that influence the spread of COVID-19. Our results do not qualitatively differ as we control for two-way fixed effects (in specification 3) and relevant, observable proxies (in specification 2). Moreover, these results are not biased because of how COVID-19 case data were collected and reported across myriad local and state level jurisdictions. While such measurement problems pervade all quantitative analyses and especially those related to COVID-19, our use of panel models (Stoto et al. 2022) and the use of case data as a dependent variable mitigates such concerns [Dougherty (2016).[[10]](#footnote-33)

To interpret the meaning of our results—consistent with Table I—Table IV shows the change in daily, new cases per million using specification 3 of Table III. We use specification 3 (over specification 2) to directly show the interdependence between the desire for prevention and social capital plays.[[11]](#footnote-34) Specification 2 is a relevant model as it accounts for the additional, marginal factors that might influence daily new cases, but there is no way to account for the variation in covariates by state in a single, easily interpretable graph. For example, the percentage of a state that reports fair or poor health and greater than 65 years old are covariates that could influence both the value for prevention and the level of social capital. While we find that these are relevant explanatory variables, as shown in specification 2, they cannot be included in a two-by-two matrix following Table I. In any event, Table III shows that stringency, social capital, and the interaction between those two factors are still relevant.

We measure high and low prevention at the first, second, and third quartiles of the stringency index, and we measure strong and weak social capital at two standard deviations above and below the mean of the social capital index. The whole numbers in Table IV represent deviations away from the typical desire for prevention and the typical level of social capital.

[insert table 4]

Table IV—especially the bold numbers in the four corners—allows us to directly examine Proposition 1 and Proposition 3.[[12]](#footnote-35) Table IV suggests that states with a higher value for prevention (relative to the average value of prevention) generally experienced a larger reduction in new cases; states with a lower value for prevention (relative to the average value of prevention) mostly experienced additional new cases. Except for the “weak” social capital column, higher values for prevention leads to a larger reduction in the spread of COVID-19. Such results are consistent with Proposition 1. States with a higher value of prevention *and* a stronger level of social capital experienced the largest reduction in new daily cases per million. That is, these states experienced approximately 74 fewer new, daily cases per million relative to states with an average desire for prevention and the average level of social capital. States with a lower value of prevention and a lower level of social capital experienced 60 additional new, daily cases per million. Such results are consistent with Proposition 3.

To see whether particular components of social capital are more or less relevant, Table V presents the same specification found in column 3 of Table III but accounting for the measured components of social capital. These components include family unity, family interaction, social support, community health, institutional health, collective efficacy, and philanthropic health. Stringency remains negative and statistically significant. All components except family interaction, collective efficacy, and philanthropic health are statistically significant at 1%. The interaction between stringency and family unity, social support, community health, and institutional health, respectively, remains negative. The negative sign indicates that these interactions decrease the spread of COVID-19. The interaction between stringency and institutional health is positive, which suggests the interaction increases the spread of COVID-19.

[insert table 5]

To alleviate concerns about whether the Social Capital Project—and its measurement of social capital—biases our results, we analyze specification 3 of Table III with alternative measures of social capital used in the scholarly literature. Table VI shows the results of specification 3 of Table III using the following measures of social capital: the SCP version of Penn State Index (2014), the Putnam Index (2000), the Alesina & La Ferrara social capital group (2000), and the Family Prosperity index reported in columns 1, 2, 3, 4, respectively. All of these measures were taken from the JEC Social Capital Project. Our main results are consistent in sign and statistical significance across these measures of social capital.

[insert table 6]

# Discussion and Conclusion

Our framework advances literature in economics and in public health by formally analyzing the interaction between formal and informal rules related to infectious diseases in the context of COVID-19 in the United States. As we recognize the beneficial aspects of social capital—and its dark side—we show that people stifle the spread of COVID-19 when they place a higher value on prevention; however, people spread COVID-19 when they place a lesser value on prevention.

Moreover, disease prevention policies focusing primarily on formal, stringent measures are misguided because of diminishing effectiveness and especially when individuals increase their values for prevention and the strength of their social capital.[[13]](#footnote-37) Studies examining the role social capital plays in prevention should also account for individual normative values. There are likely to be relevant interaction effects between the values people have and their formal and informal rules.

While we show the interaction between social capital and the value for prevention lowers the spread of COVID-19, there are no clear policy levers. No one person or group has the ability to alter social capital or maintain the effectiveness of stringent policies given individual values. Social capital emerges when individuals value participating in social interactions; it is not clear how governmental officials, let alone public health officials, can know of or can influence such values and interactions. If officials could alter social capital, our results suggest such policies would be effective only when people already value prevention. Following Besley and Stern (2020), however, there is one policy-related silver lining related to the tradeoff between health and income. Our results suggest that states with stronger values for prevention and stronger social capital face a flatter—and potentially rising—policy mix curve. That is, states might be less stringent and still experience additional reductions in new cases and smaller burdens to economic and social activities. This outcome, however, follows when people value prevention and they have stronger social capital. Alternatively, public health policy can focus on the provision of quality information about COVID-19 transmission, as well as encouraging individuals to seek out relevant tests. Such measures encourage individuals to make decisions and *invest* in existing social ties according to their values.

Future research should study the extent to which social capital erodes over time particularly because of formal rules that prevent interactions. That is, while we find social capital supports the values people have for disease prevention, the related formal rules people also use might begin to extinguish the meaningful parts of social capital given a longer duration or additional severity. This is especially once we recognize the cultural context within which social capital emerges, i.e., human interactions and the norms of proper behavior that develop. Formal rules that make such interactions more costly are likely to alter the costs and benefits people face such that existing social capital erodes (Carilli, Coyne, and Leeson 2008) and alternative kinds of social capital will arise. If formal rules prevent interactions that would have otherwise taken place, individuals realize less of a benefit from maintaining existing social ties.

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1. The *disease versus institutions* debate analyzes some of these issues, i.e., the causal relationships between economic and political institutions, infectious diseases, and economic development, but not the determinants of infectious diseases (Bloom et al. 1998; Gallup and Sachs 2001; Acemoglu and Johnson 2007, 2014; Bloom, Canning, and Fink 2014; Bhattacharyya 2009.) [↑](#footnote-ref-20)
2. See Brennan et al. (2013) and Bicchieri (2017) for general treatments on social norms. For example, informal rules influence behavior via social capital, e.g., pro-environmental behaviors (Farrow, Grolleau, and Ibanez 2017). See Carson (2017) for a description of the informal norms related to HIV prevention in the United States. [↑](#footnote-ref-21)
3. The influence social capital has on health outcomes in general is well-studied (Putnam 2001), and there is even some recognition that social capital influences the spread of infectious diseases by encouraging the use of vaccinations (Nawa and Fujiwara 2019; Palanisamy, Gopichandran, and Kosalram 2018) and other behaviors that spread influenza (Björn Rönnerstrand 2013; B. Rönnerstrand 2014; Chuang et al. 2015). [↑](#footnote-ref-22)
4. Other studies find similar results, but are not as convincing given confounding variables. For example, people living in counties (in the United States) with higher levels of social capital reduced their mobility at a quicker rate than people in counties with lower levels of social capital (Borgonovi and Andrieu 2020; also, see Borgonovi, Andrieu, and Subramanian 2020). Borgonovi, Andrieu, and Subramanian (2020) show that infection rates were initially higher in counties with more social capital, but transmission and mortality rates declined as people learned more about COVID-19. Similarly, Bartscher et al. (2020) suggests that the number of COVID-19 cases across Europe was initially higher in countries with higher social capital, but that cases increased at a slower rate in countries with higher social capital. There is also suggestive evidence that people in areas with more social capital are more likely to follow formal public health rules, e.g., wearing face masks (Wu 2020) and are more likely to have higher rates of testing (Wu et al. 2020). Income also influences the effectiveness of lockdown orders, i.e., whether people are likely to comply with such orders (Wright et al. (2020)). [↑](#footnote-ref-23)
5. We use a measure of policy stringency to represent the variety of formal public health measures *and* as a proxy for the values people within a state have for COVID-19 prevention. [↑](#footnote-ref-24)
6. Following Dougherty (2016), measurement error in a dependent variable leaves estimated coefficients unbiased, but with higher a higher variance and lower t-statistics. [↑](#footnote-ref-25)
7. Whereas formal rules specify a primary directive and secondary qualifiers, a centralized enforcement mechanism, and it is a rule derived from some kind of governing body, informal rules might only specify a primary directive with few secondary qualifiers, enforcement is decentralized, and it is a rule derived from the normative attitudes of the individuals to which the rule applies (Brennan et al. 2013). [↑](#footnote-ref-29)
8. Our choice of the Governor’s political party references the fact that most preventative measures have been enacted by executive order—not by legislative action—which is an additional proxy for the desire citizens have for public health within their state. This choice also follows Adolph et al. (2020) and Baccini and Brodeur (2020) who show that the political affiliation of a governor influences the kind and timing of stringency measures. We expect that Republican Governors would be less likely to implement highly stringent measures in light of other values. We include other control variables, like race, poverty and education level, which follows previous research (Townsend, Kyle, and Stanford 2020; Yancy 2020). [↑](#footnote-ref-31)
9. We ignore Hawaii and Alaska in all models because temperature data is not reported for these states in the data provided by the JEC Social Capital Project. [↑](#footnote-ref-32)
10. Dougherty (2016) shows that measurement error in a dependent variable increases variance of the error term and lowers t-statistics; however, it leaves ordinary-least squares (OLS) coefficient estimates unbiased. [↑](#footnote-ref-33)
11. While model 3 only includes social capital via its interaction with values for prevention—because social capital does not vary over time—it is a more parsimonious model than model 2 as it includes time and place fixed effects. Model 3 accounts for the unobservable cross-sectional variation; specification 2 only accounts for the variables we can observe and included. [↑](#footnote-ref-34)
12. Social capital only enters model 3 via the interaction term, which means we cannot directly analyze Proposition 2 with this table. However, we do see evidence of proposition 2 in Table III, columns (1) and (2). [↑](#footnote-ref-35)
13. Given the lagged-stringency-squared term is consistently positive and statistically significant, lagged-stringency tends to lower daily new cases per million, it does so at a *positive* rate. This indicates that increasing the stringency of public health rules declines in effectiveness beyond a certain point. [↑](#footnote-ref-37)