CEPOS A First Literature Review: Lockdowns Only Had a Small Effect on COVID-19

06-01-2021 By Jonas Herby, P: +45 2728 2748, M: herby@cepos.dk

Abstract

How important was the economic lockdowns in the spring of 2020 in curbing the COVID-19 pandemic and how important was the lockdown in comparison to voluntary changes in behavior? In the spring, the overall social response to the COVID-19 pandemic consisted of a mix of voluntary and government mandated behavior changes. Voluntary behavior changes occurred on the basis of information, such as the number of people infected, the number of COVID-19-deaths and on the basis of the signal value associated with the official lockdown combined with appeals to the population to change its behavior. Mandated behavior changes took place as a result of the banning of certain activities deemed non-essential. Studies which differentiate between the two types of behavioral change find that, on average, mandated behavior changes accounts for only 9% (median: 0%) of the total effect on the growth of the pandemic stemming from behavioral changes. The remaining 91% (median: 100%) of the effect was due to voluntary behavior changes. This is excluding the effect of curfew and facemasks, which was not employed in all countries.

Background

In the spring of 2020, the social response to the COVID-19 pandemic in general consisted of two parts, both of which may have had a greater or lesser effect on the spread of infection:

1. **Voluntary behavior.** Any social interaction between people involves costs and benefits for the participants. Therefore, people will respond to changes in the risk of meeting with others. When the media report infection and death rates for the COVID-19 pandemic, when governments appeal to the population to change its behavior, and when governments – e.g. through lockdowns – signal the severity of the pandemic, people will voluntarily modify their behavior to match their own experience of the risk of infection. This may be done by reducing the number of social interactions but also by maintaining more distance, using hand sanitizer, wearing masks etc.
2. **Mandated behavior** When the government shuts the economy down, it makes it more difficult for the population to have selected social interactions. The government thereby forces citizens to change their behavior in specific respects, as well as change the number and type of social interactions.

A pandemic is an unfamiliar situation for most people. Therefore, they are uncertain about which behavioral adjustments to make to protect themselves and their relatives from the virus, especially at the beginning of the pandemic. During spring 2020 the government may therefore have had better opportunities than usual to influence the behavior of the population through signals.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

An economic lockdown can act as a signal that encourages the population to change its behavior (more strongly) in the direction wanted by the politicians. From a behavioral economic viewpoint, the lockdown can be interpreted as a way to change the default. When possible, I distinguish between this "signaling effect" of the lockdown, which encourage voluntary behavior changes, and the more direct regulatory effect of the lockdown. E.g. Bonardi et al. (2020) finds no effect of harder lockdowns compared to softer lockdowns among 108 countries. Hence, the softest lockdown among the 108 countries works just as well as the hardest to prevent COVID-19-deaths. This clearly indicate that the signal (inducing voluntary behavior changes) is important in contrast to the actual regulation (mandated behavior changes), which do not affect the number of COVID-19-deaths in the study.

This distinction is important because the policy implications are remarkably different. If the encouraged voluntary behavior – as a consequence of a signal from the government – is important, then the policy implication is that the government should send the cheapest signals possible. If you can obtain the same effect by recommending working from home at a well attended press conference as you can by closing all non-essential activities, then that is clearly preferable from an economic and a societal perspective.

In this paper I provide an overview of studies of how important the voluntary and mandated behavior changes were in the spring of 2020. It gradually becomes clear that many exogenous variables impact the development of the pandemic in individual countries, of course including the seasonal pattern of coronavirus (see for example Nickbakhsh et al. (2020)) and factors such as population density and demographics (see for example, Allcott et al. (2020)), but also less obvious factors such as holiday times as highlighted by Klein et al. (2020). However, the focus of this paper is on the total behavioral response of society to the pandemic and how this response affects the growth rate of the pandemic.

The rest of the paper is structured as follows: I start with a review of the overall results of my literature review and put forward a possible theoretical explanation of the results. I then review the literature systematically before concluding and describing the questions that remain open and should be answered.

Voluntary changes in behavior were remarkably more important than mandated behavior changes

I have reviewed 22 studies that can illuminate the importance of voluntary and mandated changes in behavior in relation to how societies handled the COVID-19 pandemic in the spring of 2020. All 22 studies show or indicate that **voluntary behavior** changes were a very important part of the total social response. For example, Courtemanche et al. (2020) find that approximately half of the effect on the spread of the infection since the peak can be attributed to voluntary behavior.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

However, if we disregard the effect of curfews, voluntary behavior represented approximately 5/6 of the effect. Farboodi et al. (2020) find that the desire to not fall ill yourself can explain 70% of the effect of the total social response, while altruistic voluntary behavior can explain up to 23%. Chetty et al. (2020) find that people significantly reduced their consumption in areas with high numbers of infected cases and within industries that require physical contact, while Goolsbee and Syverson (2020) show that consumer traffic dropped before lockdown was initiated and was closely linked to the number of COVID-19 deaths in the region. At the same time, consumers switched from large/busy businesses to those that were smaller/less busy. Some of the studies indicate that encouraging voluntary behavior – via government signals – was important. Chaudhry et al. (2020) find, for example, that an early lockdown (of any kind) can flatten the infection curve. Allcott et al. (2020) find very little effect from lifting the curfew again, so the effect of the curfew lasts longer than the actual lockdown because the citizens voluntarily choose to stay home. Bjørnskov (2020) and Bonardi et al. (2020) finds no effect of harder lockdowns relative to a soft lockdown, such as in Sweden. These studies indicate that the signal value – and not the hardness of the lockdown – is decisive.

All studies find relatively little or no effect of **mandated behavior** changes in the form of an economic lockdown. However, there is a lot to suggest that curfews, such as those used in several states and counties in the United States, have significantly contributed to limiting development of the COVID-19 pandemic. Courtemanche et al. (2020) for example, find greater effects of curfew (corresponding to approximately 3/5 of the effect of voluntary behavior) but only relatively little effect of closing entertainment-related businesses and schools (approximately 1/6 of the voluntary behavior). They find no effect of closing schools or banning larger public gatherings. Chaudhry et al. (2020) find no effect on the number of deaths as a result of early closure of the borders, lockdown and widespread testing. Goolsbee and Syverson (2020) show that one of the effects of the lockdown is that it shifts consumption activities from "non-essential" activities to "essential" activities.

The overall conclusions drawn on the basis of the overall literature review are presented in the table below. A more in-depth and systematic literature review is available in the "Literature review" section.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Table 1 Summary of results in the literature	
Voluntary behavior	All 22 studies show that behavioral change took place in the populations through voluntary behavior as a result of the pandemic and government information and signaling and appeals. 8 of the studies looked only at behavioral changes and find that all significant behavioral changes were driven by the voluntary behavior changes and independent of the lockdown. 10 studies differentiate between types of behavior and find that voluntary behavior represent 91% on average (median: 100%) of the total effect on the pandemic growth rates stemming from social response to the pandemic. The last 4 studies differentiate between the types of behavior without stating so explicitly. However, they paint a similar picture.
Mandated behavior	14 of the studies look at the effects of lockdowns. The 10 studies that quantify the effects estimate that a (stricter) lockdown represents from 9% on average (median: 0%) of the effect of the total social response to the pandemic. Five of the 14 studies also find an effect of curfews. The effect of curfews is not investigated in detail as curfews were not part of the response to the pandemic by the Danish Government in the spring of 2020.

Why did government lockdowns only have little effect on reducing the growth rate of the pandemic?

It may come as a surprise to some that the lockdown instituted by the government had only little importance in reducing the growth rate of the pandemic, and that the citizens' voluntary behavior changes are correspondingly more important. However, there are a number of theoretical reasons to believe that lockdowns do not have much effect.

1. **People circumvent the restrictions.** If the population does not back the restrictions, they will try to circumvent them. This can happen through either the rules being directly broken or through circumvention of the rules. For example, earlier closing times for bars can lead to some people holding illegal pirate parties, while others will simply meet at bars earlier or move the parties to private homes. Even if the rules are broken or circumvented, they still carry a cost to the individual and therefore the restrictions will have an immediate effect on the spread of infection but not necessarily an overall effect, cf. point 3 below.
2. **The restrictions can have unintended consequences.** When the government shuts down certain activities, to some extent such activities will be replaced by other activities (as Goolsbee and Syverson (2020) and others show). Depending on how many people participate in the replacement activity and how close the contact is during this activity, the shutting down of some activities can lead to a higher spreading of infection. For example, in the spring many municipalities in Denmark closed their tennis facilities. If tennis players met indoors instead of playing tennis – and perhaps even in larger groups – all other things being equal, the closure of the tennis facilities would increase the community spread of the infection.
3. **People react to the world (and the infection) outside.** People react to the infection out in the community and adjust their behavior. This means that if the community infection is widespread, people will take extra care but will relax in terms of their vigilance if there are very few cases of infection in the community. These behavioral changes counteract any effects of points 1 and 2 above.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

4. **The lockdown includes few social relationships.** People have many different relationships at work, in the family, for leisure activities, etc. Only some of these relationships were banned by governments in the spring. In many countries, many social interactions were still permitted. If the states regulate only a small part of the social interactions in a population, the effect of the governmental regulation will be relatively small.

Many studies do not differentiate between voluntary and mandated behavior

In connection with my literature review, I have come across a number of studies that do not differentiate between voluntary and mandated behavior. Therefore, the studies do not contribute to answering the central question of whether it is the governmental economic lockdown or the voluntary behavior of the citizens that is most important to the growth rate of the pandemic. I have reviewed several of these studies and present a few examples of studies of this type below, along with what their researchers have written about the interpretation of their results:

- Flaxman et al. (2020) write that *"our model [...] assumes that changes in Rt are an immediate response to interventions rather than gradual changes in behavior"*.
- Balmford et al. (2020) write that *"we caution against overinterpreting the result: it is likely that even without a formal lockdown, people would have socially distanced and engaged in other behavior s to limit Covid-19 deaths"*.
- Davies et al. (2020) write that *"we assumed these interventions would affect the rate of contact between individuals, as well as the relative infectiousness of clinically infected individuals (but not preclinically or subclinically infected individuals) in the case of self-isolation of symptomatic individuals"*.
- Li et al. (2020) write that *"our analysis was based on data on control policy rather than on actual population behavior. In particular, we were unable to account for the growing awareness of personal hygiene (including wearing face coverings) among the public in response to the pandemic. These behavioral changes lead to a further reduction of transmission and are likely to vary over time. We were also unable to examine compliance with these NPIs due to the scarcity of suitable data that were reliable across countries over time"*.

Not all studies specifically highlight the fact that they do not differentiate between voluntary and mandated behavior. Nevertheless, it is essential to understand that a study can easily find a marked effect of the overall efforts of society in facing the pandemic without necessarily showing that the government lockdown had a notable impact. In fact, this is what the above mentioned studies do, but by design they assign the total effect to the lockdown and thus give a wrong understanding of the effect of lockdowns while ignoring the effect of behavior changes (for a critique of much cited Flaxman et al. (2020), see Stefan Homburg and Christof Kuhbandner (2020)).

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Literature review

I have found that a total of 14 studies were useful in illuminating how much voluntary changes in behavior in the spring meant to the overall social response to the COVID-19 pandemic. In addition, I have reviewed 8 studies that look at, inter alia, voluntary changes in behavior as a result of the pandemic but do not assess the importance of these behavioral changes in relation to the mandated changes in behavior.

The studies were found in October 2020 by searching for "covid lockdown effect" on scholar.google.com for 2020. This search results in approximately 20,000 hits, so to limit the scope, only the first 15 pages of results have been reviewed, and those studies for which the headline and the first line of the abstract indicated that the study was relevant to my study have been looked at more closely. I have also reviewed all studies published at CEPR Covid Economics, where I initially sorted roughly on the basis of the headline and then by reading the abstract. In addition, there are studies that I have come across on an ongoing basis, as I have called for studies in the Danish Facebook group "CUVAK-COVID19 - Videnskabelig, Uvildig Kommunikation" ("CUVAK-COVID19 - Scientific, Impartial Communication"), as well as on my profiles on Facebook and Twitter. I have also included the studies that have been referenced in the studies found. Finally, I have added two studies sent to me by scholars during my research. The authors of all the studies I have used have been sent a draft of this literature review in order for them to be able to comment on my review of their work. Note that my literature search does not follow review guidelines such as PRISMA[1] and thus should be seen as a first literature review which should be elaborated by other scholars.

The studies differ in three key dimensions. First of all, they use different data for the development of the pandemic: confirmed cases, number of registered COVID-19 deaths and overall mortality. There are relatively important design-related issues with using the number of confirmed cases, as it depends on the testing strategies in the individual countries. The number of COVID-19 deaths is a better measure because the definition of a COVID-19 death is more uniform across countries. However, it is my opinion that the best measure is overall mortality, as this measure captures what we are really interested in: that the lockdowns save lives. For example, if the lockdowns simply move the cause of death from COVID-19 to another cause of death, the effect of the lockdown is smaller. Chernozhukov et al. (2020) has in an email stated that "Furthermore, there are some reasons why we may trust the results of case growth regression more than the results of death growth regression. In particular, there is a lot of uncertainty with respect to how long it takes for the policy to affect the death growth rates---some infected persons die within 10 days after being infected while others will die after 3-4 weeks. This makes it very difficult to identify the

[1] See http://prisma-statement.org/

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

effect of policies on the death growth rates. We provide sensitivity analysis to the timing lag. For this reason, we believe that the result of case growth regression is more trust-worthy than the result of death growth regression." Although they clearly have a point when the testing strategy in a country is constant, I disagree when testing strategies develop over time with more testing and differences in who is tested (e.g., many countries started out by only testing symptomatic persons and later shifted to testing both symptomatic as well as asymptomatic persons).

Secondly, the studies use different methods to assess the effect of the lockdown based on data. Some studies are based on models that are calibrated to data, after which the course of the pandemic is projected with and without lockdown. Other studies use differences in lockdown policies introduced across geographic areas to estimate the impact of the policy introduced. It is my assessment that the latter type of studies is the best as they are less dependent on model assumptions.

Thirdly, the studies measure the effects differently. Some studies look at the effect on the Effective Reproduction Number, R(t), and thus the pandemic growth rate, while others look at the overall mortality. As described under point 3 on page 4, in theory it can be expected that people will react to a rising level of infection in society by reducing their social interactions thereby reducing the growth rate of the pandemic. Likewise, a falling level of infection will induce people to increase their social activity thereby increasing the growth rate. Therefore, theoretically, R(t) is expected to stabilize at – or move around – 1 in equilibrium. This means that care must be exercised in interpreting the effects on the R(t) as constant.

Finally, for obvious reasons the studies look at the short-term effects and primarily in countries/regions that were coming into the summer season, when coronavirus typically does not thrive.

A key issue for all studies is the differentiation of the two types of behavior (voluntary and mandated). If increasing infections in a country cause both citizens to change their behavior and governments to enforce economic lockdown, the precise calculation of the subsequent effect on the development of infection can be problematic. Most studies attempt to address this endogeneity problem by exploiting differences in behavior (most often mobility), infection development and lockdowns between countries and regions. The idea is that if two otherwise similar regions have introduced different degrees of lockdown or introduced the lockdowns at different times but still have a uniform development in the spread of infection, it is a sign that the lockdown has limited effect. If, at the same time, it is possible to see that differences in changes in mobility between the regions affects development of the infection – and if this change occurs independently of the time of the lockdown – it is a sign that voluntary behavior is important.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Table 2 below describes for each of the studies reviewed how the measure the effect (column 2) whether the study assesses the effect of the lockdown on the spread of the pandemic (column 3), whether it distinguish between and quantify the relative size of voluntary and mandated behavior changes (column 4), the magnitude of the effect of the lockdown (closure of schools and non-essential businesses and bans on large public gatherings) in relation to the overall social response but disregarding the effect of curfews, which were far from being implemented in all countries (column 5), the effect of curfews relative to the effect of the lockdown as well as an order of magnitude of this effect (column 6) and the overall effect of voluntary behavior (column 7). As far as possible, the effect of ordering the use of masks is taken out of the few studies that look at it, as it was not part of the initial response in most Western societies. Note that the sum of column 5 and 7 is 100%. The columns show the relative meaning of the shutdown relative to voluntary behavior, whereas column 6 shows the absolute effect on the growth rate.

Table 2 Overview of studies that differentiate between voluntary and mandated behavioral changes during the COVID-19 pandemic

1. Study (author, journal: title)	2. Measure of effect	3. Quantifies the effects of the lockdown	4. Distinguish between voluntary and mandated bevavior changes	5. Relative effect of lockdown (excluding facemasks and curfew), share of total effect	6. Effect of curfews/shelter-in-place in relation to lockdown	7. Relative effect of voluntary behavior (excluding curfew and facemasks), share of total effect (=1 – column 5)
Abouk and Heydari (2020), WP: The Immediate Effect of COVID-19 Policies on Social Distancing Behavior in the United States.	Amount of COVID-19 cases	Yes	Yes	0%	(37% decrease in positive tests)	100%
Allcott et al. (2020), WP: What Explains Temporal and Geographic Variation in the Early US Coronavirus Pandemic?	Effective Reproduction Number, R(t)	Yes	Yes	11%	1.8X (2%)	89%
Andersen et al. (2020), WP: Pandemic, Shutdown and Consumer Spending: Lessons from Scandinavian Policy Responses to COVID-19		No	No			
Atkeson et al. (2020), WP: Four Stylized Facts about COVID-19		No	No			
Bartscher et al. (2020) CEPR Covid Economics: Social Capital and the Spread of Covid-19: Insights from European Countries		No	No			
Bjørnskov (2020), WP: Did Lockdown Work? An Economist's Cross-Country Comparison	Total mortality	Yes	Yes	0%		100%
Bonardi et al. (2020), CEPR Covid Economics: Fast and local: How lockdown policies affect the spread and severity of covid-19	Growth rate of COVID-19 cases	Yes	Yes	0%		100%
Borgonovi and Andrieu (2020), CEPR Covid Economics: Bowling together by bowling alone: Social capital and Covid-19		No	No			

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

*Born et al. (2020), WP: The lockdown effect: A counterfactual for Sweden	Amount of COVID-19 deaths	Yes	No	Lockdown = 33% less COVID-19 deaths		
Chaudhry et al. (2020), The Lancet EClinicalMedicine: A countr level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes	Amount of COVID-19 deaths	Yes	Yes	0%		100%
Chernozhukov et al. (2020), CEPR Covid Economics: Causal impact of masks, policies, behavior on early Covid-19 pandemic in the US	Growth rate of COVID-19 deaths	Yes	Yes	43%	1.3X (-5%) Not significant	100%
Chetty et al. (2020), WP: How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data		No	No			
Courtemanche et al. (2020), Health Affairs: Strong Social Distancing Measures In The United States Reduced The COVID-19 Growth Rate	Growth rate of COVID 19 cases	Yes	Yes	19%	2.4X(-8%)	81%
Cowling et al. (2020), The Lancet Public Health: Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study		No	No			
Engle et al. (2020), CEPR Covid Economics: Staying at home: The mobility effects of COVID-19		Yes	No		(7.87% decrease in mobility)	
*Farboodi et al. (2020) , WP: Internal and External Effects of Social Distancing in a Pandemic	Amount of COVID-19 deaths	Yes	Yes	0%-25% less COVID-19 deaths		75%-100% less COVID-19 deaths
Gapen et al. (2020), CEPR Covid Economics: Assessing the effectiveness of alternative measures to slow the spread of COVID-19 in the United States	Effective Reproduction Number, R(t)	Yes	Yes	13%	0.8X(-5%)	93%
Goolsbee and Syverson (2020), WP: Fear, Lockdown and Diversion: Comparing Drivers of Pandemic Economic Decline 2020		Yes	No		7% drop in mobility	53% drop in mobility
Gutierrez et al. (2020), CEPR Covid Economics: Information and behavioral responses during a pandemic: Evidence from delays in Covid-19 death reports		No	No			
Laliotis and Minos (2020), CEPR Covid Economics: Spreading the disease: The role of culture		No	No			
**Meunier (2020), WP: Full lockdown policies in Western Europe countries have no evident impacts on the COVID-19 epidemic	Effective Reproduction Number, R(t)	Yes	Yes	0%		100%
Statens Serum Institut (2020), report: Expert report: Mathematical modelling of COVID-19 spread of infection and hospital burden in scenarios for partial reopening of Denmark		Yes	No			
Average / median		**Yes = 14**	**Yes = 10**	**9%/0%**		**91%/100%**

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Note: In studies looking at both confirmed COVID-19 cases and deaths, the results based on deaths have been used, as they are considered to be most valid. This is because the number and prioritization of testing has a great impact on the number of confirmed cases but is of less significance to the number of deaths from COVID-19. As there is a close connection between the Effective Reproduction Number and the growth rate, results calculated on these have been reported without further processing. When converting the Effective Reproduction Number, R(t), to growth rates, a series interval of 5.40 from (Rai et al. (2020)) is used, meaning that the effect on the growth rate is calculated as ln(1-effect on R(t))/5.40.

**It is not immediately possible to calculate an effect on the growth rate or the Effective Reproduction Number, R (t) based on the results of Born et al. (2020) and Farboodi et al. (2020), which is why the results from here are not included in the calculations of average and median.*

*** Meunier (2020) does not directly show that the total social response to the pandemic (voluntary and mandated behavior changes) is of matter for the development of the pandemic (meaning the drop in R(t) could be the result of other factors such as season and herd immunity). However, to the extent to which the change in behavior matters, it can be 100% attributed to voluntary behavior change.*

In table 3 below, I review the 22 studies and have broken down their results on each of the three forms of behavior; voluntary and mandated behavioral changes.

Table 3 Review of literature that differentiates between voluntary and mandated behavioral changes during the COVID-19 pandemic

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
Abouk and Heydari (2020), WP: The Immediate Effect of COVID-19 Policies on Social Distancing Behavior in the United States.	WP	Mobility data show that people modified their behavior before the lockdowns came into effect. For some states (Idaho, Missouri, Wyoming and District of Columbia) the modifications before the lockdowns were so great that it was flattened out before the lockdown came into effect. *The effect of voluntary modification in relation to the effect of the lockdowns is not assessed.* The lack of effects of other forms of lockdown (other than state curfew) is attributed to the fact that this has already been achieved through voluntary changes in behavior.	They see a 37% decrease in the number of positive tests 10 days after state curfews are introduced. The other forms of lockdown (more restricted versions of curfew, the closure of non-essential businesses, bans on large gatherings, the closing of schools and restrictions on restaurants and bars) have no effect on the number of COVID-19 cases.	**Data analysis of confirmed COVID-19 cases.** Takes advantage of the fact that different policies are being introduced at different times throughout the entire US to estimate the causal effect of six lockdown policies; state curfew, more restricted versions of curfew (e.g. curfews for the elderly and regional curfews within a state), the closure of non-essential businesses, bans on large gatherings, the closing of schools and restrictions on restaurants and bars.
Allcott et al. (2020), WP: What Explains Temporal and Geographic Variation in the Early US Coronavirus Pandemic?	WP	Social distancing is primarily (around 75%) driven by voluntary changes in behavior as a result of the spread of infection. However, disregarding the effect of the curfew, the voluntary behavior represented approximately 91% of the social response to the pandemic. Finds very little effect of lifting the curfew again, so the effect of the curfew lasts longer than the actual lockdown because the citizens voluntarily choose to stay home. *This may potentially indicate a signal effect.*	Curfews explain only an approximate 15% of the total change in the "virus contact rate" from the beginning of March to the middle of April. The economic lockdown reduced the contract rate by 9%. Had curfews been introduced on 17 March, the number of cases would have been reduced by 20% by the end of April.	**SIRD model calibrated on confirmed COVID-19 cases and COVID-19 deaths** Neither curfews nor voluntary social distancing can explain a notable aspect of the differences in the development of the pandemic between different cities. Exogenous variables such as population composition and population density mean more.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
Andersen et al. (2020), PNAS: Pandemic, Shutdown and Consumer Spending: Lessons from Scandinavian Policy Responses to COVID-19	Peer review	Overall, the Swedes reduced private consumption almost as much (25%) as the Danes (29%). In particular the elderly - who are most vulnerable - changed their behavior and those aged 70+ are driving the entire difference between Denmark and Sweden because they are the only group that reduced their consumption more in Sweden than in Denmark.	All other things being equal, the lockdown of the Danish economy reduced private consumption by 4%-points (equivalent to 16%) more than in Sweden. With regard to this, it must be taken into account that the prevalence of infection in Sweden was higher than in Denmark. Youth especially reduced their consumption more in Denmark than in Sweden.	**Data analysis of transaction data** Uses transaction data from Danske Bank to estimate the effect of the lockdown on private consumption (consumption on payment cards, withdrawals from ATM, mobile wallets and online invoice payments).
Atkeson et al. (2020), WP: Four Stylized Facts about COVID-19	WP	The daily number of deaths from COVID-19 decreases from high (and inconsistent) levels to close to zero 20-30 days after the total number of deaths in one region has passed 25. *This may indicate that lockdowns do not have a notable effect on the number of deaths.*	Warns that a failure to take into account the fact that the number of deaths is decreasing in all regions may lead to an overestimation of the effect of lockdowns, irrespective of the policy introduced.	**Data analysis of confirmed COVID-19 deaths** Uses COVID-19 deaths from states in the US and from countries that had more than 1,000 deaths on 22 July. Does not directly investigate the effect of lockdowns but the results point in the direction of the lockdown not having had the expected effect. Believes that the big effect of the economic lockdown that some studies find is due to omitted variables (for example by not including voluntary behavioral changes as an explanatory variable)
Bartscher et al. (2020), CEPR Covid Economics: Social Capital and the Spread of Covid-19: Insights from European Countries	Vetted	How sharply the pandemic develops before people become aware of it and how the population responds to the pandemic depends on the social capital of the regions (measured as the proportion who voted in the 2019 European Parliament elections and the share of blood and organ donors). The higher the social capital in an area, the more COVID-19 cases there are initially, due to more social contacts. However, people with high social capital change behavior relatively stronger compared to those with low social capital when aware of the infection.	Adaptation of behavior happens before the lockdown. However, after the lockdown, the difference between high and low social capital is constant, which may indicate that the role of social capital in dealing with the pandemic is weakened when the lockdown is implemented. Their results may indicate that a hard lockdown from a perspective of the pandemic is more necessary in areas with small social capital.	**Data analysis of confirmed COVID-19 cases and overall mortality** Looks at the importance of social capital (measured as the proportion that voted in the 2019 elections for the European Parliament) for voluntary behavior and the importance of the lockdown. Uses regional, internal differences in seven countries and looks at both the number of COVID-19 cases and overall mortality.
Bjørnskov (2020), WP: Did Lockdown Work? An Economist's Cross-Country Comparison	WP	*When the level of lockdown does not have an effect on excess mortality, it may indicate that it is primarily voluntary behavior or the signal value of the lockdown that is important.*	Finds no correlation between the level of lockdown and development of the pandemic.	**Data analysis of overall mortality** Uses overall mortality in 24 European countries, as well as an index of hardness of the lockdowns to assess the effect of lockdowns in relation to a Swedish approach.
Bonardi et al. (2020), CEPR Covid Economics: Fast and local: How lockdown policies affect the spread and severity of covid-19	Vetted	Finds that hard lockdowns do not work better than softer lockdowns. *This may indicate that the signal effects are the most important.*	On the basis of confirmed cases, finds that an early lockdown works better in relation to maintaining the green curve ("flattening the curve"). This can also indicate that the signal effects are important. *The effect is not found when looking at the number of deaths.*	**Data analysis of the growth of confirmed COVID-19 cases** Uses data from 184 countries, of which 108 have introduced one or another form of lockdown. Uses data from the period between 31 January and 4 May 2020.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
		When the level of lockdown does not have an effect on excess mortality, it may indicate that it is primarily voluntary behavior or the signal value of the lockdown that is important.		
Borgonovi and Andrieu (2020), CEPR Covid Economics: Bowling together by bowling alone: Social capital and Covid-19	Vetted	Societies with a high level of social capital and close social relations change behavior earlier and more strongly than societies with low social capital.		**Data analysis of mobility data** Looks at the importance of social capital on the extent to which people will change their behavior. In this context, social capital is measured on the basis of the "The geography of social capital" project. The change in people's behavior is measured by the people's movement patterns. Cuebiq's Mobility Index is used here for this purpose. Uses differences between counties in the United States and includes a number of control variables.
Born et al. (2020), WP: The lockdown effect: A counterfactual for Sweden	WP	Changes in mobility and social distancing in Sweden are similar to the changes in the doppelganger country (based on Google COVID-19 Community Mobility Reports) and social distancing is also seen, but the effect is greatest in the doppelganger country.	A lockdown approximately equivalent to the lockdown instituted in Denmark would have reduced the number of deaths in Sweden by 1/3 and the number of infected by 1/2. Note that this is in relation to restrictions that go beyond the Swedish approach (ban on gatherings of 500 from 11 March, 50 from 27 March and regulation of restaurants from 24 March).	**Modelling of doppelganger based on confirmed COVID-19 cases and COVID-19 deaths** Constructs a doppelganger for Sweden based on 13 countries (Norway and the western EU countries with more than 1 million inhabitants). The doppelganger goes into lockdown for 8.5 weeks and is compared to the number of COVID-19 deaths in Sweden.
Chaudhry et al. (2020), The Lancet EClinicalMedicine: A country level analysis measuring the impact of government actions, country preparedness and socioeconomic factors on COVID-19 mortality and related health outcomes	Peer review	An early lockdown (of any kind) can flatten the infection curve (number of cases). This may indicate that the signal effect is important but note that there are problems with using COVID-19 cases due to differences between countries in the number tested. *Does not look directly at the behavioral effect but as they don't find any effect of the lockdown on the number of deaths, any effect can be attributed to voluntary behavior.*	Early closing of the borders, lockdown and widespread testing have no effect on COVID-19 mortality. Countries that were poorly prepared in terms of detection and reporting of infection and that had poor health systems, high average age, high proportion of overweight in the population, and high unemployment experienced a higher spread of infection and mortality.	**Data analysis of confirmed COVID-19 cases and COVID-19 deaths** Multivariate negative binomial regression of COVID-19 death rates conducted on a data set consisting of the 50 highest ranked countries according to the number of cases of infection, as well as data on their lockdown policies.
Chernozhukov et al. (2020), Journal of Econometrics: Causal impact of masks, policies, behavior on early Covid-19 pandemic in the US	Peer review	The effect of voluntary behavior is around half of the total effect on the decrease in the growth rate of the pandemic. Mandates of masks, curfews and closure of non-essential businesses represent the remainder (closure of businesses account for 1/14 of this part, corresponding to 4% of the overall effect.	The lockdown reduced the growth rate of the pandemic by 52% overall. Of this the closing of schools (K-12) account for 33%-points, masks 11%-points, curfew 5%-points and the closing of non-essential businesses (restaurants, cinemas etc.) 4%-points. The effect of the curfew is insignificant – the same is true for the closing of non-essential schools in their table 9.	**Data analysis of confirmed COVID-19 cases and COVID-19 deaths** Uses mobility data from Google to estimate the effect of lockdown on behavior and the effect of behavior on the development of the pandemic (calculated by confirmed COVID-19 cases and deaths in American states).

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
		The closing of schools has a big indirect effect on behavior (measured as the number of trips to work, retail and train stations). The same is true for the closing of restaurants, cinemas, and other non-essential businesses (but only in their table 7, where the information signals from the national number of infected and deaths is excluded). Ordering masks for employees has no indirect effect on behavior. The effects of individual aspects are uncertain, but overall, the policy has reduced mobility by approximately 50%-points.	As all schools close almost simultaneously, it is difficult to separate the effect of the closing of schools from the effect of information. For this reason, the effect varies between 47% and 18%.	Their result is highly dependent on whether they include the number of cases/deaths on a national level. This is because the closing of schools was implemented almost simultaneously in all states. For this reason, it is difficult to separate the causal effect of the closing of schools from the effect of the information of cases and deaths. Here and in table 2 an average of their table 7 and table 9 is used.
Chetty et al. (2020), WP: How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data	WP	At the beginning of the process, people significantly and notably reduced their consumption in areas with higher numbers of infected cases and in industries that require physical contact. The effect is strongest in the high-income group.		**Data analysis of transaction data** Uses real-time data from a wide range of private companies, including payment card transaction and payroll payment data.
Courtemanche et al. (2020), Health Affairs: Strong Social Distancing Measures in The United States Reduced The COVID-19 Growth Rate	Peer review	Even without lockdowns, development of the pandemic would have decreased significantly and notably. Without lockdown, the growth rate decreases by 14.3%-points from the peak in mid-March (approximately 28%) to the end of April. Disregarding the effect of curfews, this decrease represented approximately 5/6 of the total decrease in the growth rate (14.3% out of approximately 17.7%). This decrease cannot necessarily be attributed to voluntary behavior but may also be due to other factors (e.g. local restrictions that are not included in the study).	The closing of the entertainment industry reduced the growth rate by approximately 3.4%-points (read from exhibit 4) from the peak in mid-March (approximately 28%) to end of April. The imposition of curfews further reduced the growth rate by 8.1%-points. They find no effect of the closing of schools and the ban on public gatherings.	**Data analysis of confirmed COVID-19 cases** Focuses on four parts of the lockdown: curfew (shelter-in-place orders), the closing of schools, ban on large public gatherings and the closing of industries related to the entertainment industry (restaurants, bars and the entertainment industry).
Cowling et al. (2020), The Lancet Public Health: Impact assessment of non-pharmaceutical interventions against coronavirus disease 2019 and influenza in Hong Kong: an observational study	Peer review	The use of masks and hand sanitizer increased as a result of the threat from COVID-19. To a large extent, people also avoided large public gatherings and stayed home more. The greater the spread, the bigger the change in behavior.		**Data analysis of questionnaire data and official press releases from the authorities.** Uses data from telephone interviews in Hong Kong, conducted between 20-30 January, 11-14 February and 10-13 March 2020. Looks at the effect of the measures on the prevalence of influenza.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
Engle et al. (2020), CEPR Covid Economics: Staying at home: The mobility effects of COVID-19	Vetted	Increased infection in one geographical area also reduces the mobility of citizens when taking into account whether a curfew was imposed in the areas concerned. An increase in the rate of infection (cases in relation to the population) from 0% to 0.003% (which was the median for countries with registered infected on 20 March) reduces mobility by 2.13%.	A curfew reduced mobility by 7.87%. Just six days after 20 March, there were approximately five times as many cases in the United States, so the effect of voluntary behavior can potentially be important in relation to the effect of a curfew.	**Data analysis including mobility data and other data** The study also finds that the effects of both infection and curfews are greater in an area with a higher population density, fewer people voting for Trump in 2016 and more people older than the age of 65.
Farboodi et al. (2020), WP: Internal and External Effects of Social Distancing in a Pandemic	WP	Voluntary behavior is far more important than the lockdown. The desire not to fall ill yourself can explain 70%-points of the effect of the lockdown (in relation to a situation without any changes in behavior). Altruistic behavior (along with the lockdown - they do not differentiate between the two) explains 23%-points (77% of the remaining 30%-points after voluntary adjustments in behavior). Changes in mobility took place long before the lockdowns but coincided with the declaration of a state of national emergency by President Trump on 18 March. *This may indicate a significant and notable signal effect.*	The lockdown (along with altruistic behavior - they do not differentiate between the two) explains 23% of the effect of the overall social response to the pandemic.	**SIRD model with behavior calibrated based on number of confirmed COVID-19 cases and COVID-19 deaths** The article builds a theoretical model based on "optimal control theory". Through this, two differential equations are derived, which are fitted according to data from the US on the outbreak of COVID-19 after 13 March 2020.
Gapen et al. (2020), CEPR Covid Economics: Assessing the effectiveness of alternative measures to slow the spread of COVID-19 in the United States	Vetted	Mobility fell sharply, both in states with curfew and states without curfew. The decrease contributes to halving R(t), cf. Model 1-9 (finds an effect of 40% -60% reduction in R(t)). States that lifted curfews early did not see an increase in mobility because people were afraid of being infected. Changes in mobility have a particularly high effect - "*especially high degree of leverage*" - on the Effective Reproduction Number, R(t), in all their specifications. In some states the mobility effect halved the Effective Reproduction Number. Finds a relatively low R0=1.6 on average across states, which is attributed to the population having become aware of COVID-19.	All other things being equal, curfews reduce the Effective Reproduction Number R(t) by about 5%, while the effect of the mask mandate is almost 10%. behavior The effect of closing restaurant is not directly observable, but in a model with mask mandate and a closing of restaurants (model 8+9), the effect is insignificant, if there is a mask mandate at the same time, but about 6% without a mask mandate. Concludes that the pandemic can be brought under control through mass testing (1.75 million tests per day in the US, equivalent to about 30,000 tests per day in Denmark) and introducing an order on the use of masks (which can have the same effect as testing 1.1 million per day).	**SIR model based on COVID-19 deaths** Uses (AI-estimated) data for the number of deaths to populate an SIR model, which can measure the effect of different interventions on the Effective Reproduction Number. Uses mobility data, inter alia, to estimate the effect of voluntary behavior. Some problems with differentiating the effects in their model, which is why the run nine different models. I have given most weight to model 6 and model 8+9, but the different between the relevant models is not that big.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
Goolsbee and Syverson (2020), WP: Fear, Lockdown and Diversion: Comparing Drivers of Pandemic Economic Decline 2020	WP	Consumer traffic decreased before the lockdown was initiated and was closely linked to the number of COVID-19 deaths in the region. At the same time, consumers switched from large/busy businesses to those that were smaller/less busy. Consumer behavior was understood symmetrically in such a way that reopening of the states had the greatest impact on the places where the infection was low. Individual choices were far more important than the lockdown (approximately 9 times as important) and appear to be driven by the fear of being infected with COVID-19.	The closing down of non-essential activities only limited consumer traffic by 7%-points out of a total decrease of 60%. One of the effects of the lockdown is that it shifts consumption activities from "non-essential" activities to "essential" activities.	**Data analysis of mobile data** Uses mobile data for customer visits to more than 2.25 million businesses across 110 industries in the period from 1 March to 16 May and COVID-19 deaths by regions in the US. They do not assess the effect of a curfew and closing of non-essential businesses on the mobility in society, nor the effect of a curfew on the effective reproduction number R(t). In the results I assume that the effect of the closing of businesses has the same relative effect on R(t) compared to mobility as curfews have.
Gutierrez et al. (2020), CEPR Covid Economics: Information and behavioral responses during a pandemic: Evidence from delays in Covid-19 death reports	Vetted	People react to information on the number of COVID-19 deaths, but the reaction depends on how accurate data is. If the estimates of the number of deaths are delayed, the response will also be delayed and this could worsen the consequences of the pandemic. Clear communication regarding the spread of the pandemic can be a cost-effective measure.		**Data analysis of questionnaire data** User data from an online survey, in which the type of information provided to respondents is varied by taking (/not taking) into account the delays in reporting COVID-19 deaths in Mexico. Then uses a theoretical model to assess the consequences on the development of the pandemic.
Laliotis and Minos (2020), CEPR Covid Economics: Spreading the disease: The role of culture	Vetted	Finds a clear effect on mobility up to 30 days before lockdown. Although Catholics and non-Catholics reduce mobility just as sharply in response to the pandemic, the number of deaths does not fall as sharply among Catholics, which may be due to Catholics having stronger family networks.		**Data analysis of confirmed COVID-19 cases** Compares development of the pandemic in different regions of Germany (NUTS3) depending on the proportion of Catholics in the region. Culture is important to the importance of the behavior. Cultural differences can potentially help explain the differences between different countries.
Meunier (2020), WP: Full lockdown policies in Western Europe countries have no evident impacts on the COVID-19 epidemic	WP	The Effective Reproduction Number, R(t), decreases across the different countries in a uniform manner before and after the lockdowns. The differences between countries is primarily due to the fact that they start with different R(t) levels. After a period in which R(t) decreases, R(t) stabilizes at around 1 for all countries. This may indicate that people react to the stabilization of the pandemic by paying less attention. The decrease in R(t) may be due to many other things than behavior changes (season, increasing immunity etc.).	Finds that R(t) - the Effective Reproduction Number - decreases more rapidly before the lockdown than after. *In reality, they find a relative increase in R(t) as a result of the lockdown, but the reason is probably that R(t) is approximately 1 when the effect of the lockdown was fed into data, rather than a perverse effect on R(t).*	**Data analysis of R(t) based on COVID-19 deaths** Compares development in R(t) - the Effective Reproduction Number - in a SIR model before and after the lockdowns in France, Italy, Spain, the UK and 10 other countries with at least 1,000 COVID-19 deaths on 15 April 2020 (excluding China).

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study (author, journal: title)	Status *	Voluntary behavior	Mandated behavior	Method/other
Statens Serum Institut (2020), report: Expert report: Mathematical modelling of COVID-19 spread of infection and hospital burden in scenarios for partial reopening of Denmark	WP	The voluntary social distancing is approximately four (= 226%/55%) times more important than a large reopening relative to a small reopening.	A large reopening would result in a burden on intensive care departments that was 154 (55%) higher than a small reopening. A small reopening *without* social distancing would result in a burden on intensive care departments that was 632 (226%) higher than a small reopening *with* social distancing.	**SIR model** Modelling runs of small, medium, large and "small without social distance" reopenings of Denmark. Differentiated from the other studies by being a pure modelling run for a single country. The study is included in order to illustrate that Danish experts were aware of the difference between the government lockdown and voluntary behavior.

Note: Text in the table in italics is my interpretation of the results of the study
Status: WP = Working paper that has still not been peer reviewed. Vetted = peer reviewed, but less thoroughly than in a normal peer review, Peer review = peer reviewed literature published in journals. In many cases, peer review is a slow process, so it can take months - and in some cases years - from the time a study is completed as a working paper until it is published in a journal.

Literature overview from other studies

Some of the studies in table 3 contain an overall review of the existing literature. Gapen et al. (2020) for example, write that *"our research falls within recent threads that have looked at the effects of stay-at-home orders and other policy measures put in place by most states, for varying durations, starting in mid-March. One key area of focus has been the effects of these measures on personal mobility and economic activity more generally. Not surprisingly, these studies generally conclude that the stay-at-home orders coincided with general reductions in mobility (*Goolsbee and Syverson (2020), Alexander and Karger (2020), Nguyen et al. (2020), Barrios et al. (2020), Maloney and Taskin (2020), *and* Chen et al. (2020)) *and various measures of activity (*Gupta, Montenovo, et al. (2020), Gupta, Nguyen, et al. (2020), Jiang et al. (2020), Coibion et al. (2020)*, and* Alexander and Karger (2020)). ***A common finding has been that voluntary behavioral changes induced by the outbreak have been at least as important as, if not more important than, policy measures in terms of explaining reductions in mobility and activity"***, while Bartscher et al. (2020) write (my highlights), that "*Engle et al. (2020) and Painter and Qiu (2020) show that the impact of restriction orders in the US is stronger in democratic-leaning counties. On the macro level, Frey et al. (2020) show that countries with democratically accountable governments introduced less stringent lock-downs, but were more effective in reducing geographic mobility at the same level of policy stringency. Born et al. (2020) show that Sweden – the only European country without a lockdown – did not behave much differently from other European countries in terms of crisis dynamics. They conclude that "**voluntary social restraint goes some way in resolving the lockdown puzzle**" and that "we show that social capital only induces differential mobility responses before the lockdown when controlling for local economic conditions". This finding is in line with evidence by*

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Borgonovi and Andrieu (2020), who show a positive correlation between social capital and early mobility reductions for US counties."

Conclusion and recommendations

Only a few studies differentiate between the effect of the government lockdown (mandated behavior changes) and the voluntary behavior changes of the population. The studies that do differentiate clearly indicate that the voluntary behavioral changes in the population were far more important than the government lockdown. A central estimate is that the state lockdown represented approximately 9% (average) or 0% (median) of the total social response to the pandemic. The remainder – 91% (mean) and 100% (median) – were due to voluntary and encouraged behavior.

The result should really not be surprising. The economic lockdown only regulated a small part of contact among the population. In most countries the majority of companies could remain open, most private events could still be held, cross-sections of citizens could still meet, etc., but the companies voluntarily sent employees home, private events were voluntarily cancelled, and citizens isolated themselves voluntarily or voluntarily restricted themselves to fewer regular contacts. At the same time, corona handshakes, hand sanitizers, etc., were widespread even before governments shut economies down. Therefore, there is little doubt that the effect of the lockdowns in the spring of 2020 was modest.

However, attention must be drawn to the fact that even small effects on the Effective Reproduction Number, R(t), can have a major impact on the development of the pandemic. In a simple SIR model where 0.1% of the population is initially infected, herd immunity occurs in 23%, 9% and 0.1% of those infected, if the respective R(t)'s are 1.3, 1.1 and 0.9. Hence in principle there may be bigger effects from a small reduction in the Effective Reproduction Number.

The question is whether the Effective Reproduction Number can be kept low over the longer term. For obvious reasons the literature reviewed looks at the short-term effects and primarily in countries that were coming into the summer season in which coronavirus typically does not thrive. As described on page 4, people react to the infection outside their doors. This means that they weigh the benefits of meeting family and friends against the risk of becoming infected (and infecting others). Over the longer term, an economic lockdown that effectively limits infections will therefore most often be met by more risky behavior among citizens and, theoretically, it can be expected that a temporary decrease in the infection, due for example to closed bars and restaurants, will be followed by an increase in infections in other parts of society, which is found, inter alia, in Goolsbee and Syverson (2020). We will become smarter about this rational behavioral effect as we move further into the 2020/21 winter season.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

References

Abouk, Rahi, and Babak Heydari. 2020. "The Immediate Effect of COVID-19 Policies on Social Distancing Behavior in the United States." *MedRxiv*, April. https://doi.org/10.1101/2020.04.07.20057356.

Alexander, Diane, and Ezra Karger. 2020. "Do Stay-at-Home Orders Cause People to Stay at Home? Effects of Stay-at-Home Orders on Consumer Behavior." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3583625.

Allcott, Hunt, Levi Boxell, Jacob C Conway, Billy A Ferguson, Matthew Gentzkow, and Benny Goldman. 2020. "What Explains Temporal and Geographic Variation in the Early US Coronavirus Pandemic?" *NBER Working Paper Series*, October. https://doi.org/10.3386/w27965.

Andersen, Asger Lau, Emil Toft Hansen, Niels Johannesen, and Adam Sheridan. 2020. "Pandemic, Shutdown and Consumer Spending: Lessons from Scandinavian Policy Responses to COVID-19." *PNAS* 117 (34). https://doi.org/10.1073/pnas.2010068117.

Atkeson, Andrew, Karen Kopecky, and Tao Zha. 2020. "Four Stylized Facts about COVID-19." *NBER Working Paper Series*, August. https://doi.org/10.3386/w27719.

Balmford, Ben, James D. Annan, Julia C. Hargreaves, Marina Altoè, and Ian J. Bateman. 2020. "Cross-Country Comparisons of Covid-19: Policy, Politics and the Price of Life." *Environmental and Resource Economics* 76 (4):525–51. https://doi.org/10.1007/s10640-020-00466-5.

Barrios, John, Efraim Benmelech, Yael Hochberg, Paola Sapienza, and Luigi Zingales. 2020. "Civic Capital and Social Distancing during the Covid-19 Pandemic." *NBER Working Paper Series*, June. https://doi.org/10.3386/w27320.

Bartscher, Alina K., Sebastian Seitz, Sebastian Siegloch, Michaela Slotwinski, and Nils Wehrhöfer. 2020. "Social Capital and the Spread of Covid-19: Insights from European Countries." *CEPR Covid Economics (Updated Version)*, September. https://doi.org/10.2139/ssrn.3616714.

Bjørnskov, Christian. 2020. "Did Lockdown Work? An Economist's Cross-Country Comparison." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3665588.

Bonardi, Jean-Philippe, Quentin Gallea, Dimtrija Kalanoski, and Rafael Lalive. 2020. "Fast and Local: How Lockdown Policies Affect the Spread and Severity of Covid-19." *CEPR Covid Economics*, 27. https://cepr.org/sites/default/files/CovidEconomics23.pdf.

Borgonovi, Francesca, and Elodie Andrieu. 2020. "Bowling Together by Bowling Alone: Social Capital and Covid-19." *CEPR Covid Economics*, May. https://cepr.org/sites/default/files/news/CovidEconomics17.pdf.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Born, Benjamin, Alexander Dietrich, and Gernot J Mueller. 2020. "The Lockdown Effect: A Counterfactual for Sweden." *CEPR Discussion Paper*, July, 32. https://cepr.org/active/publications/discussion_papers/dp.php?dpno=14744.

Chaudhry, Rabail, George Dranitsaris, Talha Mubashir, Justyna Bartoszko, and Sheila Riazi. 2020. "A Country Level Analysis Measuring the Impact of Government Actions, Country Preparedness and Socioeconomic Factors on COVID-19 Mortality and Related Health Outcomes." *The Lancet EClinicalMedicine*, July, 100464. https://doi.org/10.1016/j.eclinm.2020.100464.

Chen, M. Keith, Yilin Zhuo, Malena de la Fuente, Ryne Rohla, and Elisa F. Long. 2020. "Causal Estimation of Stay-at-Home Orders on SARS-CoV-2 Transmission." *ArXiv:2005.05469 [Physics, q-Bio, q-Fin]*, May. http://arxiv.org/abs/2005.05469.

Chernozhukov, Victor, Hiroyuki Kasahara, and Paul Schrimpf. 2020. "Causal Impact of Masks, Policies, Behavior on Early Covid-19 Pandemic in the US." *CEPR Covid Economics*, 60.

Chetty, Raj, John Friedman, Nathaniel Hendren, Michael Stepner, and The Opportunity Insights Team. 2020. "How Did COVID-19 and Stabilization Policies Affect Spending and Employment? A New Real-Time Economic Tracker Based on Private Sector Data." *NBER Working Paper Series*, June. https://doi.org/10.3386/w27431.

Coibion, Olivier, Yuriy Gorodnichenko, and Michael Weber. 2020. "The Cost of the Covid-19 Crisis: Lockdowns, Macroeconomic Expectations, and Consumer Spending." w27141. Cambridge, MA: National Bureau of Economic Research. https://doi.org/10.3386/w27141.

Courtemanche, Charles, Joseph Garuccio, Anh Le, Joshua Pinkston, and Aaron Yelowitz. 2020. "Strong Social Distancing Measures In The United States Reduced The COVID-19 Growth Rate." *Health Affairs* 39 (7):1237–46. https://doi.org/10.1377/hlthaff.2020.00608.

Cowling, Benjamin J, Sheikh Taslim Ali, Tiffany W Y Ng, Tim K Tsang, Julian C M Li, Min Whui Fong, Qiuyan Liao, et al. 2020. "Impact Assessment of Non-Pharmaceutical Interventions against Coronavirus Disease 2019 and Influenza in Hong Kong: An Observational Study." *The Lancet Public Health* 5 (5):e279–88. https://doi.org/10.1016/S2468-2667(20)30090-6.

Davies, Nicholas G, Adam J Kucharski, Rosalind M Eggo, Amy Gimma, W John Edmunds, Thibaut Jombart, Kathleen O'Reilly, et al. 2020. "Effects of Non-Pharmaceutical Interventions on COVID-19 Cases, Deaths, and Demand for Hospital Services in the UK: A Modelling Study." *The Lancet Public Health* 5 (7):e375–85. https://doi.org/10.1016/S2468-2667(20)30133-X.

Engle, Sam, John Stromme, and Anson Zhou. 2020. "Staying at Home: The Mobility Effects of COVID-19." *CEPR Covid Economics*, May. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3565703.

Farboodi, Maryam, Gregor Jarosch, and Robert Shimer. 2020. "Internal and External Effects of Social Distancing in a Pandemic." *NBER Working Paper Series*, April. https://doi.org/10.3386/w27059.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Flaxman, Seth, Swapnil Mishra, Axel Gandy, H. Juliette T. Unwin, Thomas A. Mellan, Helen Coupland, Charles Whittaker, et al. 2020. "Estimating the Effects of Non-Pharmaceutical Interventions on COVID-19 in Europe." *Nature* 584 (7820):257–61. https://doi.org/10.1038/s41586-020-2405-7.

Frey, Carl Benedikt, Chinchih Chen, and Giorgio Presidente. 2020. "Democracy, Culture, and Contagion: Political Regimes and Countries' Responsiveness to Covid-19." *CEPR Covid Economics*. https://cepr.org/sites/default/files/CovidEconomics18.pdf.

Gapen, Michael, Jonathan Millar, Blerina Uruçi, and Pooja Sriram. 2020. "Assessing the Effectiveness of Alternative Measures to Slow the Spread of COVID-19 in the United States." *CEPR Covid Economics*, 30. https://cepr.org/file/9426/download?token=S7jOm6aO.

Goolsbee, Austan, and Chad Syverson. 2020. "Fear, Lockdown, and Diversion: Comparing Drivers of Pandemic Economic Decline 2020." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3631180.

Gupta, Sumedha, Laura Montenovo, Thuy Nguyen, Felipe Lozano Rojas, Ian Schmutte, Kosali Simon, Bruce Weinberg, and Coady Wing. 2020. "Effects of Social Distancing Policy on Labor Market Outcomes." *NBER Working Paper Series*, May. https://doi.org/10.3386/w27280.

Gupta, Sumedha, Thuy Nguyen, Felipe Lozano Rojas, Shyam Raman, Byungkyu Lee, Ana Bento, Kosali Simon, and Coady Wing. 2020. "Tracking Public and Private Responses to the COVID-19 Epidemic: Evidence from State and Local Government Actions." *NBER Working Paper Series*, April. https://doi.org/10.3386/w27027.

Gutierrez, Emilio, Adrian Rubli, and Tiago Tavares. 2020. "Information and Behavioral Responses during a Pandemic: Evidence from Delays in COVID-19 Death Reports." *CEPR Covid Economics*. https://doi.org/10.2139/ssrn.3645317.

Jiang, Xuan, Felipe Lozano Rojas, Laura Montenovo, Kosali Simon, Bruce Weinberg, and Coady Wing. 2020. "Is the Cure Worse than the Problem Itself? Immediate Labor Market Effects of COVID-19 Case Rates and School Closures in the U.S." *NBER Working Paper Series*, May. https://doi.org/10.3386/w27127.

Klein, Daniel B, Joakim Book, and Christian Bjørnskov. 2020. "16 Possible Factors for Sweden's High COVID Death Rate among the Nordics." *SSRN Electronic Journal*, 26. https://doi.org/10.2139/ssrn.3674138.

Laliotis, Ioannis, and Dimitrios Minos. 2020. "Spreading the Disease: The Role of Culture." *CEPR Covid Economics*, June. https://doi.org/10.31235/osf.io/z4ndc.

Li, You, Harry Campbell, Durga Kulkarni, Alice Harpur, Madhurima Nundy, Xin Wang, and Harish Nair. 2020. "The Temporal Association of Introducing and Lifting Non-Pharmaceutical Interventions with the Time-Varying Reproduction Number (R) of SARS-CoV-2: A Modelling

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553

Study across 131 Countries." *The Lancet Infectious Diseases*, October, S1473309920307854. https://doi.org/10.1016/S1473-3099(20)30785-4.

Maloney, William F., and Temel Taskin. 2020. "Determinants of Social Distancing and Economic Activity During COVID-19: A Global View." *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3599572.

Meunier, Thomas A. J. 2020. "Full Lockdown Policies in Western Europe Countries Have No Evident Impacts on the COVID-19 Epidemic." *MedRxiv*, May. https://doi.org/10.1101/2020.04.24.20078717.

Nguyen, Thuy, Sumedha Gupta, Martin Andersen, Ana Bento, Kosali Simon, and Coady Wing. 2020. "Impacts of State Reopening Policy on Human Mobility." *NBER Working Paper Series*, May. https://doi.org/10.3386/w27235.

Nickbakhsh, Sema, Antonia Ho, Diogo F P Marques, Jim McMenamin, Rory N Gunson, and Pablo R Murcia. 2020. "Epidemiology of Seasonal Coronaviruses: Establishing the Context for the Emergence of Coronavirus Disease 2019." *The Journal of Infectious Diseases* 222 (1):17–25. https://doi.org/10.1093/infdis/jiaa185.

Painter, Marcus, and Tian Qiu. 2020. "Political Beliefs Affect Compliance with COVID-19 Social Distancing Orders." *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3569098.

Rai, Balram, Anandi Shukla, and Laxmi Kant Dwivedi. 2020. "Estimates of Serial Interval for COVID-19: A Systematic Review and Meta-Analysis." *Clinical Epidemiology and Global Health*, August, S2213398420301895. https://doi.org/10.1016/j.cegh.2020.08.007.

Statens Serum Institut. 2020. "Ekspertrapport - Matematisk Modellering Af COVID19, Den 2. April 2020." https://files.ssi.dk/ekspertrapport--matematisk-modellering-af-covid19-den-2-april-2020.

Stefan Homburg and Christof Kuhbandner. 2020. "Comment on Flaxman et al. (2020, Nature: The Illusory Effects of Non-Pharmaceutical Interventions on COVID-19 in Europe." *Nature* 584 (7820):257–61. https://doi.org/10.1038/s41586-020-2405-7.

This preprint research paper has not been peer reviewed. Electronic copy available at: https://ssrn.com/abstract=3764553