Trust and compliance to public health policies in times of COVID-19

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ARTICLE INFO

ABSTRACT

While degraded trust and cohesion within a country are often shown to have large socio-economic impacts, they can also have dramatic consequences when compliance is required for collective survival. We illustrate this point in the context of the COVID-19 crisis. Policy responses all over the world aim to reduce social interaction and limit contagion. Using data on human mobility and political trust at regional level in Europe, we examine whether the compliance to these containment policies depends on the level of trust in policy makers prior to the crisis. Using a double difference approach around the time of lockdown announcements, we find that high-trust regions decrease their mobility related to non-necessary activities significantly more than low-trust regions. We also exploit country and time variation in treatment using the daily strictness of national policies. The efficiency of policy stringency in terms of mobility reduction significantly increases with trust. The trust effect is nonlinear and increases with the degree of stringency. We assess how the impact of trust on mobility potentially translates in terms of mortality growth rate.

"*Maybe our biggest strength in Germany is the rational decision-making at the highest level of government combined with the trust the government enjoys in the population.*"(*Professor Hans-Georg, head of virology at University Hospital in Heidelberg*)".[1]

1. Introduction

The COVID-19 pandemic has spread rapidly and globally since February-March 2020. Shelter-in-place and social distancing measures have been enacted or recommended all over the world to slow down transmission and reduce both the load on the healthcare system and overall mortality. In this context, the compliance to health policy rules is crucial and may vary with the local context so that policy measures may not be equally effective in different parts of the globe. In particular, the way people abide to contain-

ment measures may depend on the degree of confidence in the authorities. Yet little is known about the effect of trust on compliance to health and safety rules. Trust has received a lot of attention in the economic literature (see the survey by Algan and Cahuc, 2014) and beyond (e.g., Fukuyama, 1995). Specific forms of trust are investigated, notably citizens' trust in institutions and decision-makers, which are shown to improve regulation efficiency and voluntary compliance to rules and laws.[2] Recent social movements in France (yellow jackets) and elsewhere have also reminded us that a spreading distrust in institutions can harm social cohesion and economic stability. There are very few studies investigating the role of trust and compliance in the face of a massive pandemic.[3]

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[2] This literature highlights the relationship between general trust and many outcomes such as trade or economic development. Political trust and civic norms in particular allow cooperation when large-scale collective action is needed. They improve citizen involvement and governmental performance (Knack, 2002; Helliwell and Putnam, 1995; LaPorta et al., 1997; Knack and Keefer, 1997), tax compliance (e.g. Knack and Keefer, 1997; Scholz and Lubell, 1998) or the decision to report crimes (Tyler, 2006).

[3] Some studies examine trust in the health system (Ozawa and Sripad, 2013) and how it affects vaccine hesitancy or the use of healthcare (e.g. Woskie and Fallah, 2019). Blair et al. (2017) provides an original account of how people who distrusted government were less compliant with Ebola control policies.

Against this background, we exploit regional variation in political trust throughout Europe to test whether confidence in authorities prior to the crisis affects the compliance to lockdown policies, as measured by the change in human mobility. We first provide graphical evidence then adopt a double difference approach around the time of lockdown announcements. We also use the daily intensity of policy stringency as a more continuous source of variation in treatment, both over time and across countries. Most European countries have enacted measures of varying severity, from strict suppression methods (including generalized lockdown, enforced social distancing and the closure of school and non-essential economic activities) to milder mitigation approach (for instance in the UK at first, and in Sweden throughout the period). We check whether trust improves the efficiency of policy stringency. We combine three main data sources: COVID-19 mobility reports from Google, trust data from the European Social Survey (ESS) and policy stringency from the Oxford COVID-19 Government Response Tracker.[4]

We find that the decline in mobility around mid-March 2020 is significantly stronger in high-trust regions. We interpret it as the result of better compliance to national health policies in regions that demonstrated higher levels of trust in policy makers prior to the crisis. The effect is especially strong for non-necessary activities (recreation, work and transport) compared to going to the grocery or to the drugstore, i.e. essential activities allowed by most of the national shelter-in-place policies. The effect of trust is similar whether we adopt a simple difference over the lockdown period of March 2020 or a difference-in-difference approach, and whether we use the ESS data on trust in politicians or alternative measure (ESS satisfaction in governments or Eurobarometer trust in government). Next, we observe a significant impact of the stringency of lockdown measures on mobility in European regions but the diminishing effect is larger in high-trust regions. The overall effect of trust coincides on average with this mediating effect on the efficacy of policy stringency. Using a continuous measure of stringency allows detecting nonlinearities: the effect of trust increases with the degree of stringency and we find no evidence of a sign reversal at very low stringency levels (i.e. as would happen if low-trust regions self-isolated more than the rest because they doubt the ability of the government to respond appropriately). Finally, we assess how the impact of trust on mobility translates in terms of death growth rate.

2. Data sources

To analyze the impact of trust on mobility and, subsequently, on mortality, we mobilize several types of data: the Google mobility index, trust from various sources, the Oxford measure of policy stringency, official information on COVID-related deaths and control variables.

2.1. Mobility

We use the human mobility index by Chan et al. (2020), constructed from the Google COVID-19 mobility reports. These reports aggregate anonymized sets of data from users' mobile device Location History. The mobility index measures how visits to, or length of stay at, different types of location change over time compared to a baseline period corresponding to January 3-February 6, 2020.[5] There are six location categories: (i) retail and recreation, (ii) grocery and pharmacy, (iii) parks (public gardens, dog parks, beaches, etc.), (iv) transit stations (public transport hubs such as subway, bus, train stations), (v) workplaces and (vi) residential areas. For the first five categories, one can expect a significant drop in mobility during the COVID-19 pandemic while the index for private residence, i.e. the length of staying at home, is supposed to increase. Human mobility is tracked by Google daily and in a consistent manner across 131 countries for the period from February 16 to April 5, 2020. For a subset of countries, the information is provided at sub-national level and we combine it with trust data for most of the European regions.

Fig. 1a reports mobility at the country level using the index for "retail and recreation", but very similar patterns are obtained with the other activities. The horizontal axis represents the February 16 - April 5 period with March 1 taken as day 0. Early calls for self-isolation were made in Italy, the first European country affected by COVID-19, and we see a decline in mobility in the first days of March for this country. The first strict official lockdown was enacted on March 9 in Italy. Most European countries tend to follow, with a sharp drop in mobility around mid-March and a lower (containment-level) plateau reached within 10 days. There are a few exception (notably a long hesitation in the UK and the mild mitigation policy in Sweden throughout the period).

Arguably, these mobility patterns reflect both spontaneous behavioral responses to the local gravity of the pandemic and the way people understand, agree and comply with governmental messages and measures: this acceptance/compliance dimension is what may vary with trust levels and what we test hereafter. Finally, note in the graphs that the cross-country variance in mobility is relatively small before lockdown, and increases enormously afterwards due to the variety of country responses. Our approach based on policy stringency will account for such country heterogeneity when attempting to capture the effect of trust.

2.2. Trust and policy stringency

Trust. To measure trust at the regional level, we use the 8th wave of the European Social Survey (ESS). For the year 2016, it asked respondents about their trust in politicians in the country on a scale of 0 to 10 (with 0 meaning "No trust at all" and 10 "Complete trust").[6] For estimations, we aggregate this information at the regional level. A *continuous* measure of trust is calculated as the regional share of respondents whose score is above the country mean score.[7] For convenient interpretations, we also use a *binary* trust measure, distinguishing regions with an average trust score above national average (indicated as the 'trust' group on the graphics presented below) or below (indicated as 'distrust').[8] For robustness

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[4] Focusing on Europe already yields a large enough sample of regions (and exploitable variation in trust and mobility) while it also provides a relatively homogeneous ground to study the impact of civic values. Several papers follow a similar logic by exploiting county variation in the US. Brodeur et al. (2020) proceed as we do with trust data and Google mobility reports: they find that stay-at-home orders reduce mobility more in high-trust counties. Similar results are found in studies using different notions of civic values: Barrios et al. (2020) focus on electoral participation to proxy civic capital (stating that voting is the ultimate example of civic duty) while Engle et al. (2020) show more response to local restriction orders in counties that did not support the Republicans during the last presidential elections. A paper considers very fine (county or municipality) variation in social capital for different European countries, mainly looking at health measures (Bartscher et al. 2020). Other papers use disaggregated variation within specific countries, such as recent evidence on the 'willingness to distance' in Denmark (Olsen and Hjorth, 2020) or variation in civic capital in Italy, also shown to mediate the social distancing process (Durante et al., 2020). Finally, several papers provide cross-country evidence on how lockdown policies can curb the epidemic using mobility patterns (Hale et al., 2020; Askitas et al., 2020).

[5] See https://www.google.com/covid19/mobility/.

[6] The size of ESS datasets ranges from 880 observations (Iceland) to 2852 (Germany).

[7] Note that we could use a cutoff that is common to all the countries, such as a fixed score of 5 on the scale – but our aim is to capture regional variation within country especially, which would not be possible with a common threshold (for instance, most of the individual scores are above 5 in Scandinavian countries). Our conclusions are robust to alternative ways of aggregating trust at regional level, in particular when using the share of scores above the country median or directly the regional average trust score.

[8] Results are very similar whether we use national mean or median.

(a) Mobility Trends

(b) Stringency Trends
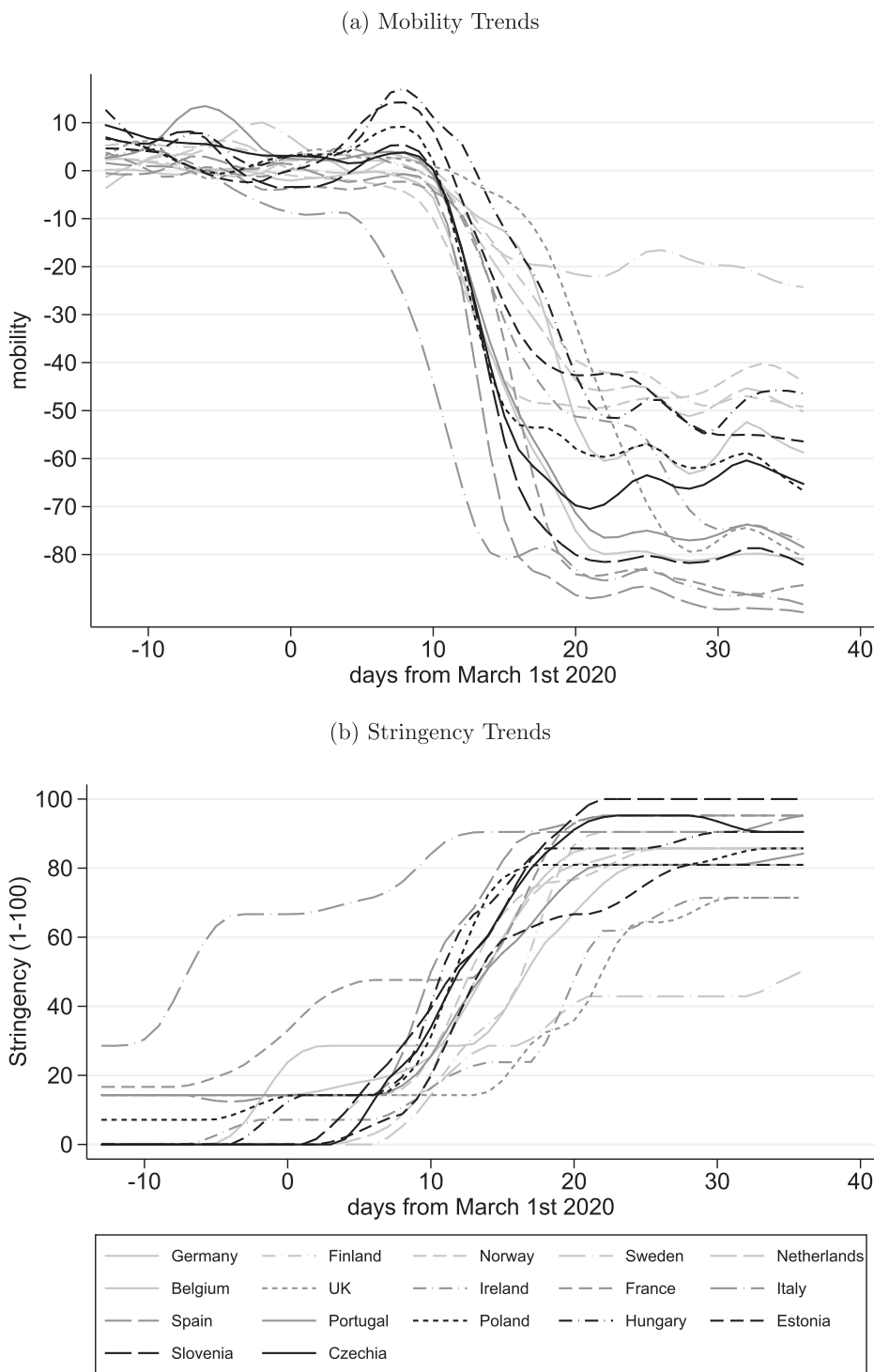
Source: Google mobility data and stringency data from Oxford COVID-19 Government Response Tracker (OxCGRT).

Fig. 1. Daily Mobility and Lockdown Stringency in Europe around March 2020.

checks, we will also use a question from the ESS on individual satisfaction with the work of the national government, as well as the political trust question from the Eurobarometer (the Flash Eurobarometer 472 records the share of those who tend to trust their national government at the regional level).

Note that we use trust measures that are prior to the COVID crisis and hence not affected by the way different governments have managed this crisis.[9] In that sense, we aim to grasp profound differences across European regions in terms of civic norms and trust in

[9] Ongoing research aims to assess how citizens' trust in the government respond to information about the policy response to the pandemic (Khan et al., 2020). Past studies show that effective public intervention to contain Ebola outbreaks might have increased trust in authorities (Flückiger et al., 2019).

the political system. Growing evidence suggest that trust attitudes, like other cultural traits, can persist for surprisingly long periods of time at national and sub-national levels (Bjørnskov, 2007), with regional differences shaped by past political and social developments (Tabellini, 2010). At the same time, we use relatively recent data (2016 for ESS and 2018 for the Eurobarometer) since part of the answer on trust is context-dependent and reflect confidence in the recent governments.

Policy Stringency. We use data on policy stringency from the Oxford COVID-19 Government Response Tracker (OxCGRT). This tracker implemented by the University of Oxford's Blavatnik School of Government systematically collects information on the measures taken by governments to tackle the pandemic since February 2020.[10] OxCGRT is based on publicly available information on 13 indicators of government response (policies such as school closures, bans on public gatherings or travel, etc., and financial indicators such as fiscal or monetary measures). Each indicator is rescaled to get a score between 0 and 100 (100 representing the highest degree of strictness/restriction). The composite stringency index we use is the daily average value of these indices on a 0–100 scale. Hale et al. (2020) describe the data in detail.[11] In Europe, stringency increases as the number of COVID-19 cases rises exponentially around mid-March. Fig. 1b reports country-specific patterns, which mirror national mobility trends and hence indicate the effectiveness of policy measures overall.

2.3. COVID-related deaths and control variables

After combining mobility, ESS trust data and policy stringency, our final sample (with non-missing values in key variables) includes 233 regions in 19 European countries over a period of 50 days starting from February 16, 2020.[12] Our estimations additionally control for the number of COVID-19 related deaths reported on the day before, at the country level, as this may alter individual mobility behavior. The data on COVID-19 deaths is obtained from the daily updates of the European Centre for Disease Prevention and Control (ECDC).[13] We also include regional characteristics, namely the 2019 unemployment rate (taken from EUROSTAT data) and the population density (number of people per square kilometer in the region, taken from EUROSTAT for 2018 and completed by 2016/2017 ESS data when missing).

3. Empirical approaches and results

We opt for a step-by-step presentation where we describe the empirical approach and directly provide the corresponding results. We start with the direct effect of trust on mobility, ultimately using the timing of lockdown policies for a difference-in-difference approach confronting high and low trust regions. We then use policy stringency as a more time-varying treatment variable to examine the effect of trust. While our main outcome is human mobility, we also provide suggestive evidence on the potential impact of trust on the mortality growth rate.

3.1. The direct effect of political trust on mobility

Graphical evidence. We first check the direct role of political trust as a shifter of the overall mobility of European citizens around March 2020. In Fig. 2, we begin with graphical evidence using regional mobility trends for non-essential activities – likely to be impacted by policy responses to the pandemic (recreation, work, transport) – or, symmetrically, the index of time spent at home. In each graph, we use a local polynomial fit of the daily variation across regions of Europe and its 95% confidence interval (CI). The horizontal axis represents dates with March 1 taken as day 0. The vertical dashed line represents the average lockdown date in Europe. Before that point, the variance in mobility across European regions is small while it increases much afterwards, reflecting the diversity of behavior and policy responses across Europe as depicted in Figs. 1a and b.

We see that the relative mobility indices in late February and early March is close to zero, indicating no difference compared to the prior benchmark period (Jan. 3 - Feb. 6). Most importantly, low and high trust groups show very similar trends and only tiny differences in mobility levels at this early stage. We then observe the sharp reduction in mobility (or increase in time spent at home – last graph) following national lockdown measures or recommendations. This drop is more pronounced in the group of regions characterized by higher levels of political trust, and the difference persists until the end of the period of observation. It is also suggestive to see that this pattern mainly concerns non-necessary activities. Indeed, appendix Fig. A.1a shows that for visits to the grocery or pharmacy, mobility declines as well, but not as much, and that there is logically less of a trust and compliance issue so that there is no observable difference between trust groups. Results for visits to the park or other outdoor places are more ambiguous.

A similar pattern is found in a majority of cases when looking at each country separately (see Fig. A.2 in the appendix).[14] It is also confirmed when using alternative measures of appreciation of the political system, including the ESS question on satisfaction with the work of the national government (Fig. A.3) and the question on trust in the national government from the Eurobarometer (Fig. A.4).

Difference-in-difference estimations. We then proceed with difference-in-difference (DD) estimations, using regional data for the period March 1-April 5. The treatment variable is the regional trust level, denoted $Trust_i$ for region i and constructed as a binary or continuous measure as previously discussed. The treatment period is defined as $Post = 1(date > March15)$. National lockdown announcements have taken place in a narrow time window around March 15, as previously seen in Figs. 1a and b.[15] In a classic DD specification ignoring the panel dimension, we regress the mobility of region i at day t as follows:

$$Mobility_{it} = \alpha^T + \beta^T Post \times Trust_i + \rho^T Trust_i + \gamma^T Death_{it-1} \\ + \delta^T X_i + \eta^T Post \times X_i + \theta_t^T + \mu_c^T + \varepsilon_{it}. \tag{1}$$

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[10] https://www.bsg.ox.ac.uk/research/research-projects/coronavirus-government-response-tracker

[11] They show that the positive correlation between stringency and the reported number of COVID-19 cases in early March is driven by Asian countries and tends to disappear as many more countries get infected.

[12] With Eurobarometer trust data, the sample is slightly different, with 171 regions in 18 European countries (it does not contain Estonia and Norway while the ESS data does not include Denmark and Romania).

[13] https://www.ecdc.europa.eu/en/publications-data/download-todays-data-geographic-distribution-covid-19-cases-worldwide.

[14] What the comparison between Figs. 2 and A.2 reveals is that regional variation within a country does not necessarily provides enough power to detect the effect under study: our main, global effect is based on the variation across regions within but also between countries.

[15] Note that our conclusions are unchanged if we rather adopt alternative cutoffs, for instance the pandemic WHO declaration period or country-specific lockdown dates. The latter are the times of official lockdown enactment, when available, or the date of national lockdown recommendation (for Finland, Sweden, Netherlands, Hungary), as reported at: www.bbc.com/news/world-52103747. Below, we show time-heterogeneous effects and indicate that the trust effect becomes significant as soon as the second week of March.

Variation across European Regions (local polynomial fit)
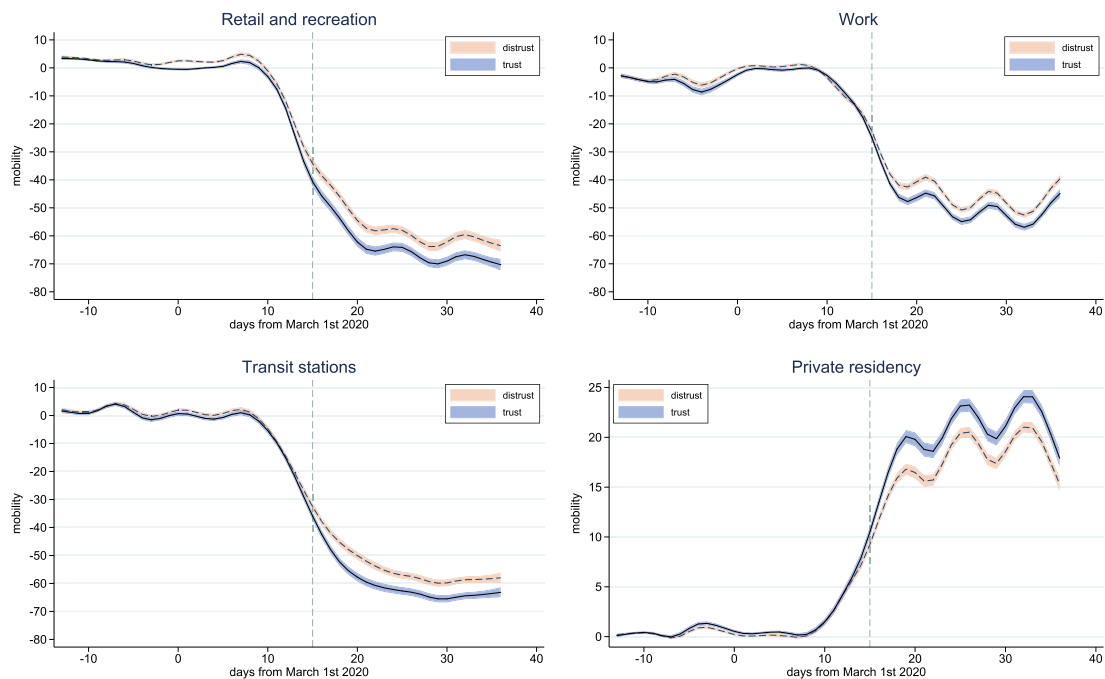
Source: authors' calculations based on Google mobility data and ESS data on trust in politicians. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Distrust indicates regions, within each country, with trust level below country average.

Fig. 2. Daily Mobility and Political Trust (ESS): Variation across European Regions (local polynomial fit).

The coefficient β^T is the double difference estimator while ρ^T represents the long-lasting differences (constant selection bias) between regions.[16] We control for day dummies θ_t^T, which capture common time trends (for instance the information available to all European citizens on the pandemic situation at any point in time) and absorb *Post*. We also include country dummies μ_c^T, which account among other things for national differences in the overall contagion level (e.g. an early start in Italy), for different national healthcare systems or for long-term trends in political trust at the country level (along other cultural differences). We add the number of people deceased from COVID-19 on the previous day, $Death_{it-1}$, which reflects the degree of exposure and the urgency to comply with containment measures.[17] Finally, omitted variables may affect both trust and mobility. For instance, if citizens living in rural areas feel less threatened (and hence comply less) and are traditionally more in confidence with the political system, then our effect would be downward biased. To attenuate this concern, we introduce a vector X_i of local factors comprising the regional urban density (as per our example) and the regional unemployment rate (which mechanically impacts on work-related mobility and may also correlate with trust), as well as their interaction with *Post*. In a second specification, we acknowledge the panel nature of our sample of regions and replace μ_c^T by region fixed effects μ_i^T:

$$Mobility_{it} = \alpha^T + \beta^T Post \times Trust_i + \gamma^T Death_{it-1}$$
$$+ \delta^T X_i + \eta^T Post \times X_i + \theta_t^T + \mu_i^T + \varepsilon_{it}. \quad (2)$$

Time-invariant characteristics of regions, including $Trust_i$ and X_i, are absorbed by these regional effects while $Post \times X_i$ remains in the model. Region fixed effects now capture all the local characteristics that may explain long-lasting differences in both mobility and trust (beyond the mere economic and urban density aspects that we controlled for in the first model). Note that for both models, standard errors are cluster-bootstrapped at regional level to account for multiple observations of each region in the daily panel (1000 replications).

Results are reported in Table 1 for the "retail/recreation" mobility index. All models convey that the mobility of citizens living in high trust regions decreases more than in other regions ($\beta^T < 0$), which we interpret as a higher compliance with national policies encouraging self-isolation. Let us start with the *binary* trust measure. The first two columns (i and ii) present a basic DD estimation using the average regional mobility before and after the time cut-off. We see that high-trust regions decrease mobility more than low-trust region by around 5–6 points on the 100-mobility scale: this is close to what visual inspections of the main graphs convey (cf. Fig. 2). Remark that in column (i), we are pooling regional information from many European countries while the number of regions varies by country. To avoid giving more weight to a country with numerous regions, a variant is suggested in column (ii) whereby each observation is reweighted by the inverse of the number of regions in the corresponding country. The trust effect is very similar in this case.

In the next two columns of Fig. 1, we move to the DD estimations using the whole data. Columns A and B report the results of Eq. (1), without and with reweighting respectively. Columns C and D show the panel DD estimates from Eq. (2), also without and with reweighting. In all cases, we confirm that high-trust regions decrease their mobility significantly more than low-trust regions. The magnitude is similar to the basic DD estimates, with a trust effect around 4.9–5.6 on the mobility scale. This effect appears fairly large if compared to the average drop in

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[16] The parallel trend is verified informally by visual inspections of Fig. 2 for the late February-early March period. Formal tests confirm it using placebo regressions carried out over the whole sample of regions or for each country separately.

[17] Mortality figures are at country level. Data at regional level are not systematically available for all the countries. In alternative unreported estimations, we control for the intensity of Google search for "COVID + death" at regional level to proxy the local intensity of concern regarding the risks associated with the pandemic. Our main estimates are barely changed.

Table 1
Effect of Trust on Mobility.

	Binary trust, basic DD (using average regional mobility before and after lockdown)		Binary trust, panel DD (using daily regional mobility)				Continuous trust, panel DD (using daily regional mobility)			
	(i)	(ii)	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
Post x Trust	−5.766**	−5.083**	−5.570***	−4.940**	−5.560***	−4.925**	−19.973**	−18.753**	−19.910**	−18.671**
	(2.338)	(2.231)	(2.082)	(1.966)	(2.080)	(1.963)	(8.863)	(9.062)	(8.854)	(9.050)
# daily deaths (t-1)	−0.067***	−0.063***	−0.238***	−0.239***	−0.238***	−0.239***	−0.240***	−0.241***	−0.240***	−0.241***
	(0.003)	(0.003)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Observations	440	440	7,899	7,899	7,899	7,899	7,899	7,899	7,899	7,899
R-squared	0.840	0.845	0.888	0.891	0.897	0.900	0.888	0.891	0.896	0.899
Country FE	–	–	Yes	Yes	No	No	Yes	Yes	No	No
Region FE	–	–	No	No	Yes	Yes	No	No	Yes	Yes
Region reweighting	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Elasticities with respect to (continuous) trust										
Mobility							−0.219	−0.206	−0.218	−0.205
Death growth rate							−0.263	−0.247	−0.262	−0.246

Note: authors' difference-in-difference (DD) estimation of Google mobility index (retail and recreation) on trust data (ESS) using regional variation for the period from March 1 to April 5, using either binary trust (1 if regional trust measure above international median, 0 otherwise) or continuous trust (regional trust measure, calculated as the proportion of people with trust scores above national average). Post is a dummy indicating the average lockdown date (mid-March 2020). The first column reports DD estimates using only average regional information before and after the lockdown time cutoff. Columns A to H are based on estimations using daily regional information. Estimations include the lagged daily number of COVID-19 fatalities (cf. European Centre for Disease Prevention and Control), day dummies and regional control variables (unemployment and population density). As indicated, they also account for country fixed effect (in this case, we include both regional controls and their interaction with Post) or region fixed effect (in this case, we include only the interaction term). Region reweighting: observations are weighted by 1 over the # of regions in the corresponding country. Robust standard errors in parentheses, cluster-bootstrapped at region level (1000 replications). Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(recreational) mobility of around 35 on the 100-scale during lockdown: it means that high-trust regions have decreased their mobility by 14%-16% more compared to low-trust regions.[18]

The last four columns present results based on the *continuous* measure of trust. We show estimates based on model (1) (columns E-F) and model (2) (columns G-H) while checking the role of reweighing. Results are consistent and indicate that a 0 to 1 variation in the trust measure (i.e. the proportion of people reporting above national average trust) leads to a reduction of around 18.6–20 on the 100-scale of mobility. An interesting benchmark is a standard deviation in trust (0.10), which represents around a quarter of the average trust level in Europe (.41).[19] Increasing trust by a standard deviation leads to an extra reduction in mobility of 1.9–2, which represents between 5.3% and 5.7% the average change in mobility after lockdown. We can also derive mobility elasticities with respect to trust, which will be used in the last section to evaluate the impact of trust on the COVID growth rate. The elasticity is calculated as the change in mobility (relative to the mean mobility since March 1) for a 100% increase in mean trust. Reported in the penultimate row of Table 1, the elasticities range from -.19 to -.22 across specifications. With this definition, a one standard-deviation increase in regional trust leads to a 5%-5.3% decrease in mobility. While these instantaneous elasticities may seem modest, they can lead to substantial differences after several weeks because of the exponential process of virus diffusion, as illustrated in the last section.

The above results are obtained for mobility related to recreational activities. We replicate the main estimations – namely the panel DD using regional fixed effects – for the other mobility indices. Results in Table A.1 of the appendix convey very similar conclusions: the drop in mobility associated to other non-

necessary activities (work and transport) is significantly larger in high-trust regions. The summary measure indicating an increase in time spent at home during lockdown also shows a significantly higher shift for these regions. In contrast, as expected, the trust effect regarding essential activities (visits to the grocery or pharmacy) is not statistically different from zero. Elasticities are of a similar order of magnitude as what we found for recreational activities (between .16 and .27 in absolute value) and the mobility effect for a standard deviation in trust ranges between 4% and 6.5% (in absolute value).

While these estimates capture the average effect of trust on mobility during lockdown, it is also possible to capture time-heterogeneous effects. Time variation is already visible by comparing the high and low trust curves of Fig. 2 during lockdown, relative to their pre-lockdown trends. To elicit time patterns more precisely, we estimate a version of Eq. (2) where $Post \times Trust_i$ is replaced by interactions between trust and 5-day period dummies. Time-varying effects are interpreted relatively to the first period (March 1–5). These estimates and confidence intervals are reported in Fig. A.5 for both binary and continuous trust. They confirm that the drop in mobility was more pronounced in high-trust regions and additionally show that the divergence between regions appeared during March 16–20 and became statistically significant during March 21–25. Note that in both these results and Fig. 2, global estimates of the trust effect are derived at each point in time and, hence, should be less affected by region autocorrelation in the daily panel. This is illustrated in Fig. A.5 where estimates depend very little on whether standard errors are clustered at region level.

3.2. Policy stringency and trust

Graphical evidence. We now explore a more time-continuous variation in the intensity of lockdown policies using daily stringency measures at country level. We start with graphical evidence. Fig. 3 reports the negative relationship between mobility and policy stringency, derived from time and regional variation in Europe (as represented by 95% CI). It suggests that for all non-essential activities, stricter lockdown regulations have contributed to drasti-

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[18] Other, more minor results are in line with intuition. In particular, the number of COVID-related deaths on the previous day is significantly associated with reduced mobility.

[19] Such a standard deviation across European regions is not overrepresenting trust variation within countries. Indeed, the within-country standard deviation is often large. It varies between.05 and.20 across countries, which is between 10% and 50% the national mean trust level. Note also that similar dispersions are obtained using regional trust scores rather than the share of citizens above country mean.
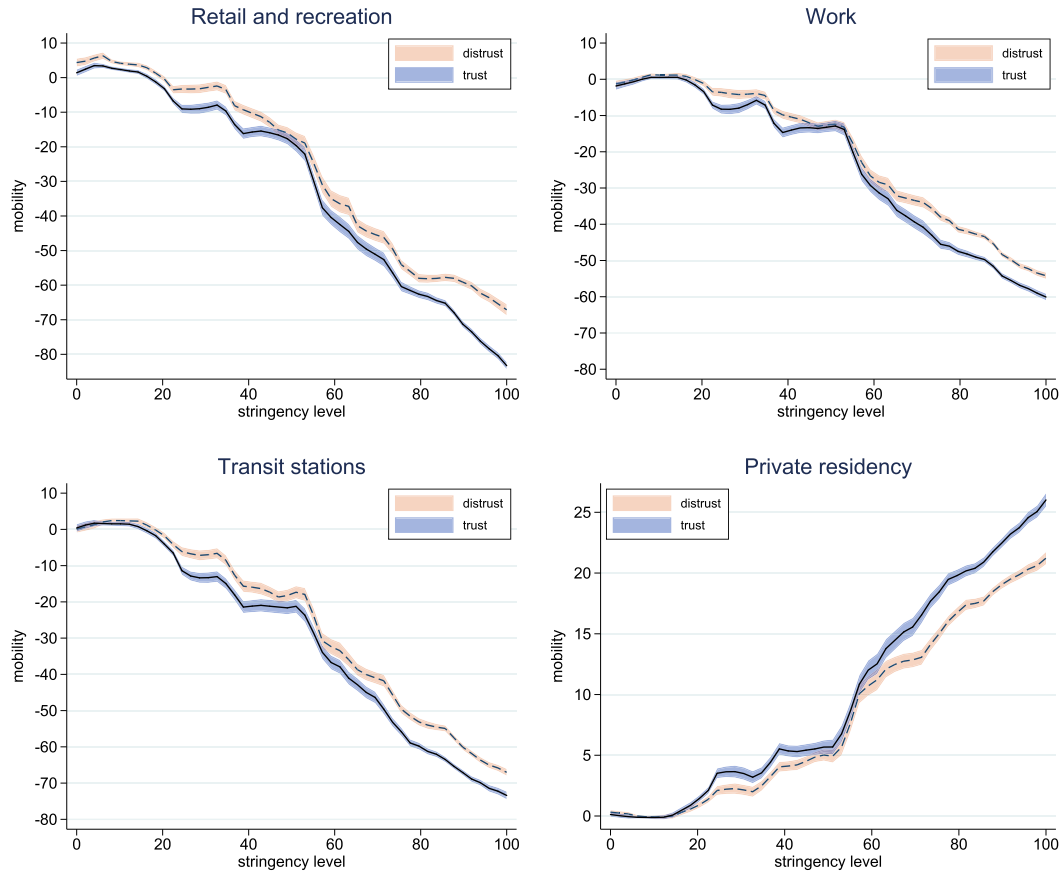
Source: authors' calculations based on Google mobility data, stringency level from Oxford COVID-19 Government Response Tracker (OxCGRT), and ESS data on trust in politicians. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Distrust indicates regions, within each country, with trust level below country average.

Fig. 3. Daily Mobility, Lockdown Stringency and Trust around March 2020.

cally reduce human movements and, hopefully, to limit contagion. In high-trust regions, the mobility trends are shifted downward by a significant margin while, symmetrical, time at home (last graph) is shifted upward. The role of trust is nonlinear: the gap between trust groups increase with the stringency degree.[20] Finally, these patterns are not so pronounced for necessary activities (see Fig. A.1b in the online Appendix), even though policy-defying attitudes by low-trust regions are detected also for these activities at very high stringency levels (especially for visits to the park, which are more restricted than grocery/drugstore visits in some countries).

Empirical approach and results. The double difference approach used pre and post-lockdown time variation and assumed an average policy pressure. We now exploit a time-continuous change in policies using the daily index of stringency, which also captures country heterogeneity in the strictness of lockdown measures across Europe. Estimations are carried out as before on daily regional mobility from March 1 to April 5 and using the same control variables. Different specifications are written as:

$$Mobility_{it} = \alpha^S + Z + \gamma^S Death_{it-1} + \delta^S X_i + \theta^S_t + \mu^S_c + \varepsilon_{it} \qquad (3)$$

with $Z = \beta^S_0 Stringency_{it}$

$$Z = (\beta^S_0 + \beta^S_1 Trust_i) Stringency_{it} + \beta^S_2 Trust_i \qquad (4)$$

$$Z = (\beta^S_0 + \beta^S_{1i} Trust_i) Stringency_{it} + \beta^S_2 Trust_i \qquad (5)$$

with $\beta^S_{1i} = \beta^{HS}_1 HighStringency_{it} + \beta^{LS}_1 LowStringency_{it}$.

In all models, standard errors are cluster-bootstrapped at regional level. The first model, in Eq. (3), simply aims to gauge the average effect of stringency. Results are presented in Table 2. As expected, higher stringency is associated with less mobility (column a) and this result is not sensitive to region reweighting (column b).

Eq. (4) captures how political trust may increase the stringency impact on mobility. Results in Table 2 go as follows. Trust significantly increases the diminishing effect of stringency (column c): high trust regions tend to comply more to policy stringency on average. This effect holds with region reweighting (column d). Replacing $Trust_i$ and country fixed effects μ^S_c by region fixed effects μ^S_i, the model leads to very similar results without or with reweighting (columns e and f respectively).

The elasticity of mobility with respect to trust, calculated around mean stringency and mean trust level, ranges between -.11 and -.13 across models (c)-(f).[21] We also replicate estimations for all types of activities using the most complete model with region fixed effects. As can be seen in Table A.2, the mediating effect of trust on the efficacy of stringency is significant for the decrease in non-essential activities (recreation, work and transport), for the increase in time spent at home, but not for the shift in necessary activities (visits to grocery and pharmacy).

Finally, Eq. (5) aims to test the nonlinearity observed in Fig. 3. In Table 2, specifications without or with region reweighting both convey that the impact of trust is larger at high stringency level

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[20] The recent literature on compliance disentangles the role of trust (which increases voluntary compliance) and that of power (which increases enforced compliance), while noting that they are not necessarily complementary (Batrancea et al., 2019).

[21] In the last specification, the average elasticity mediates around 70% of the direct effect of trust obtained by the corresponding DD model with region fixed effects and reweighting.

Table 2
Effect of Stringency and Trust on Mobility.

	Effect of policy stringency on mobility		Mediating effect of continuous trust on the stringency effect				Mediating effect of continuous trust on the stringency effect, by stringency level			
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Stringency	−0.730***	−0.715***	−0.642***	−0.620***	−0.632***	−0.610***	−0.629***	−0.613***	−0.616***	−0.600***
	(0.0344)	(0.0361)	(0.0543)	(0.0581)	(0.0552)	(0.0596)	(0.0520)	(0.0557)	(0.0527)	(0.0571)
Stringency x trust			−0.164**	−0.174**	−0.184**	−0.195**				
			(0.0765)	(0.0862)	(0.0821)	(0.0931)				
Stringency (high) x trust							−0.162**	−0.174**	−0.187**	−0.198**
							(0.0773)	(0.0865)	(0.0828)	(0.0934)
Stringency (low) x trust							−0.0833	−0.127	−0.0993	−0.145
							(0.0914)	(0.100)	(0.0952)	(0.105)
Observations	7,649	7,649	7,649	7,649	7,649	7,649	7,649	7,649	7,649	7,649
R-squared	0.920	0.920	0.928	0.927	0.936	0.936	0.928	0.927	0.936	0.936
Country FE	Yes	Yes	**Yes**	**Yes**	No	No	**Yes**	**Yes**	No	No
Region FE	No	No	No	No	**Yes**	**Yes**	No	No	**Yes**	**Yes**
Region reweighting	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**	No	**Yes**
Elasticities with respect to (continuous) trust:										
Mobility			−0.112	−0.119	−0.125	−0.133				
Death growth rate			−0.134	−0.142	−0.150	−0.159				

Note: Authors' estimation of Google mobility index (retail and recreation) on stringency index (Oxford COVID-19 Government Response Tracker) and trust data (ESS) for the period from March 1 to April 5, 2020. Estimations include the lagged daily number of COVID-19 fatalities (cf. European Centre for Disease Prevention and Control), day dummies and regional control variables (unemployment and population density). As indicated, they also account for country fixed effect (in this case, we include both regional controls and their interaction with stringency) or region fixed effect (in this case, we include only the interaction term). Region reweighting: observations are weighted by (1/# of regions in the corresponding country). Robust standard errors in parentheses, cluster-bootstrapped at region level (1000 replications). Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.1
Effect of Trust on Alternative Mobility Measures.

| Panel Difference-in-difference estimates of Post x Trust	Retail and recreation (i)	Work (ii)	Transit stations (iii)	Grocery stores and pharmacies (iv)	Private residence (v)
Binary trust	−5.560***	−3.820**	−3.387*	−2.628	1.764**
	(2.080)	(1.737)	(2.037)	(1.724)	(0.752)
R-squared	0.897	0.917	0.928	0.840	0.921
Continuous trust	−19.910**	−12.980*	−14.429*	−10.164	7.271**
	(8.854)	(7.086)	(8.707)	(7.639)	(3.002)
R-squared	0.896	0.916	0.928	0.839	0.921
Observations	7,899	7,899	7,899	7,899	7,899
Mean mobility index	−37.4	−27.6	−36.2		11.1
Elasticities with respect to (continuous) trust					
Elasticity mobility	−0.218	−0.193	−0.163		0.268
Elasticity death growth	−0.262	−0.231	−0.196		0.322

Note: Authors' difference-in-difference (DD) estimation of Google mobility index (for different types of activity as indicated) or index of time spent in private residence on trust data (ESS) using daily regional variation for the period from March 1 to April 5, with either binary trust (1 if regional trust measure above international median, 0 otherwise) or continuous trust (regional trust measure, calculated as the proportion of people with trust scores above national average). We report the coefficient on Post x Trust, with Post a dummy indicating the average lockdown date (mid-March 2020). Estimations include the lagged daily number of COVID-19 fatalities (cf. European Centre for Disease Prevention and Control), day dummies, region fixed effects and Post interacted with regional control variables (unemployment and population density). Robust standard errors in parentheses, cluster-bootstrapped at region level (1000 replications). Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A.2
Effect of Stringency and Trust on Alternative Mobility Measures.

|	Retail and recreation (i)	Work (ii)	Transit stations (iv)	Grocery stores and pharmacies (iii)	Private residence (v)
Stringency	−0.632***	−0.338***	−0.396***	−0.483***	0.131***
	(0.0552)	(0.042)	(0.047)	(0.041)	(0.018)
Stringency x trust	−0.184**	−0.113**	−0.126*	−0.060	0.056**
	(0.0821)	(0.057)	(0.075)	(0.072)	(0.026)
Observations	7,649	7,649	7,649	7,649	7,649
R-squared	0.936	0.918	0.936	0.832	0.925
Mean mobility index	−37.4	−27.6	−36.2		11.1
Elasticity mobility/trust	−0.124	−0.103	−0.088		0.127
Elasticity death growth/trust	−0.149	−0.124	−0.105		0.153

Note: Authors' estimations of Google mobility index (for different types of activity as indicated) or index of time spent in private residence on stringency index (Oxford COVID-19 Government Response Tracker) and trust data (ESS) for the period from March 1 to April 5, 2020. Estimations include the lagged daily number of COVID-19 fatalities (cf. European Centre for Disease Prevention and Control), day dummies, region fixed effects and stringency interacted with regional control variables (unemployment and population density). Robust standard errors in parentheses, cluster-bootstrapped at region level (1000 replications). Significance level: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(a) Mobility Trends.
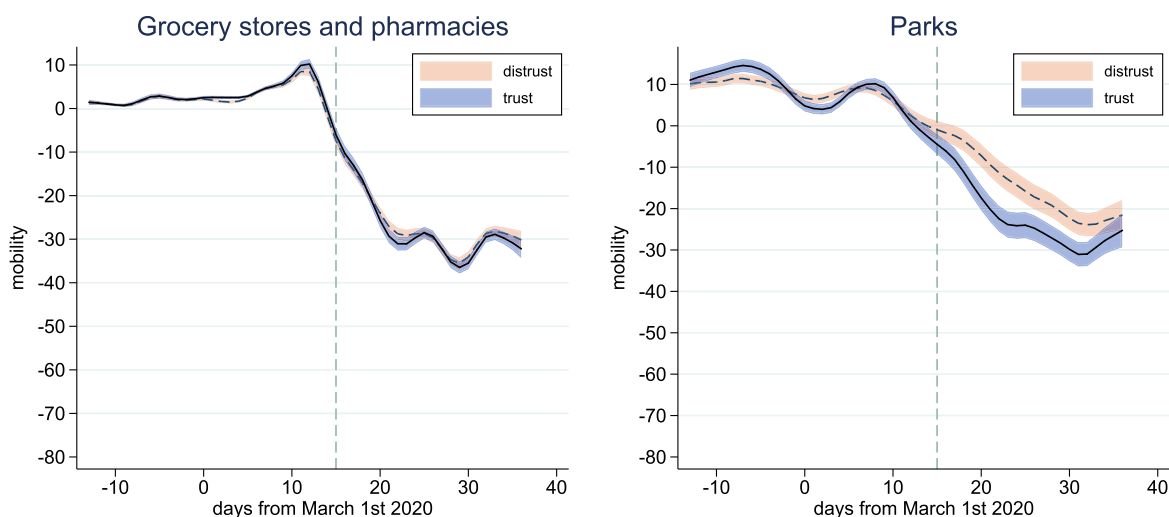
Source: authors' calculations based on Google mobility data and ESS data on trust in politicians. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Distrust indicates regions, within each country, with trust level below country average.

(b) Stringency Trends.
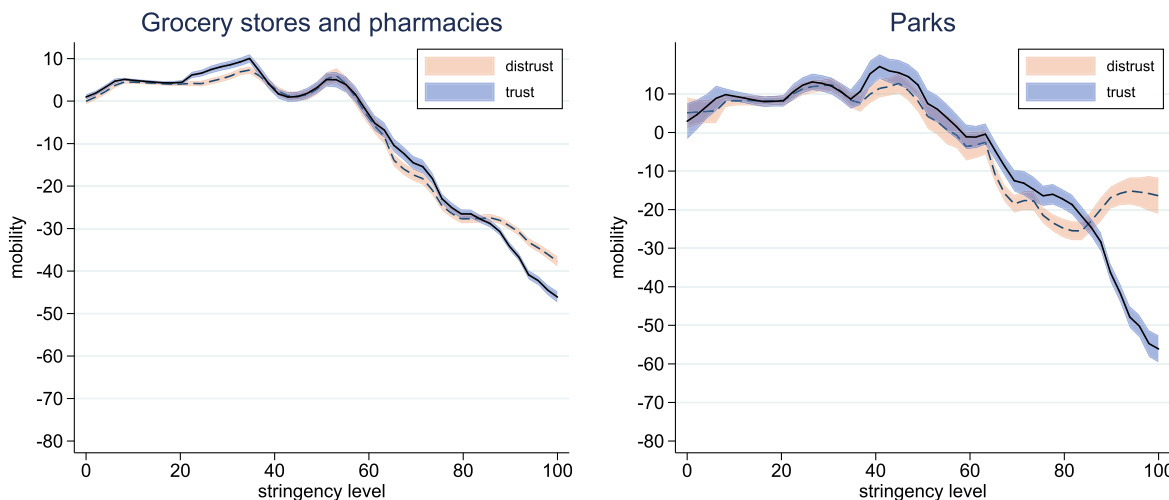
Source: authors' calculations based on Google mobility data, stringency level from Oxford COVID-19 Government Response Tracker (OxCGRT), and ESS data on trust in politicians. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Distrust indicates regions, within each country, with trust level below country average.

Fig. A.1. Daily Mobility, Lockdown Stringency and Trust (Necessary Activities).

(columns g and h respectively). Again, very similar results are obtained using region fixed effects (columns i and j). Equality tests reject the null with a p-value below 5% in models without reweighting. This result tend to confirm the increasing gap between high and low trust groups seen in Fig. 3. We also formally test that there is no sign reversal at very low stringency levels. This could happen in situations where low-trust regions self-isolate more than the rest because they doubt the ability of the government to respond appropriately to the crisis.[22]

Potential limitations. A number of papers have studied the role of trust with respect to policy design and the degree of law-abidingness of the citizens (Algan and Cahuc, 2009). In our context, the endogeneity of policy stringency to the country level of political trust can be questioned. As a merely suggestive check, we regress stringency on trust and standard controls (unemployment, population density) at country level and find no effect of trust on stringency (p-value:.98). Most importantly, even if national policy stringency was endogenous to trust, our approach above relies primarily on region-time variation in trust (models c-d), with country fixed effect controlling for differences in overall levels of stringency and trust across countries, or just on time variation within regions (models e-f). Another potential limitation is the fact that stringency is measured at national level. Given the emergency, lockdown policies have been implemented nationwide in most
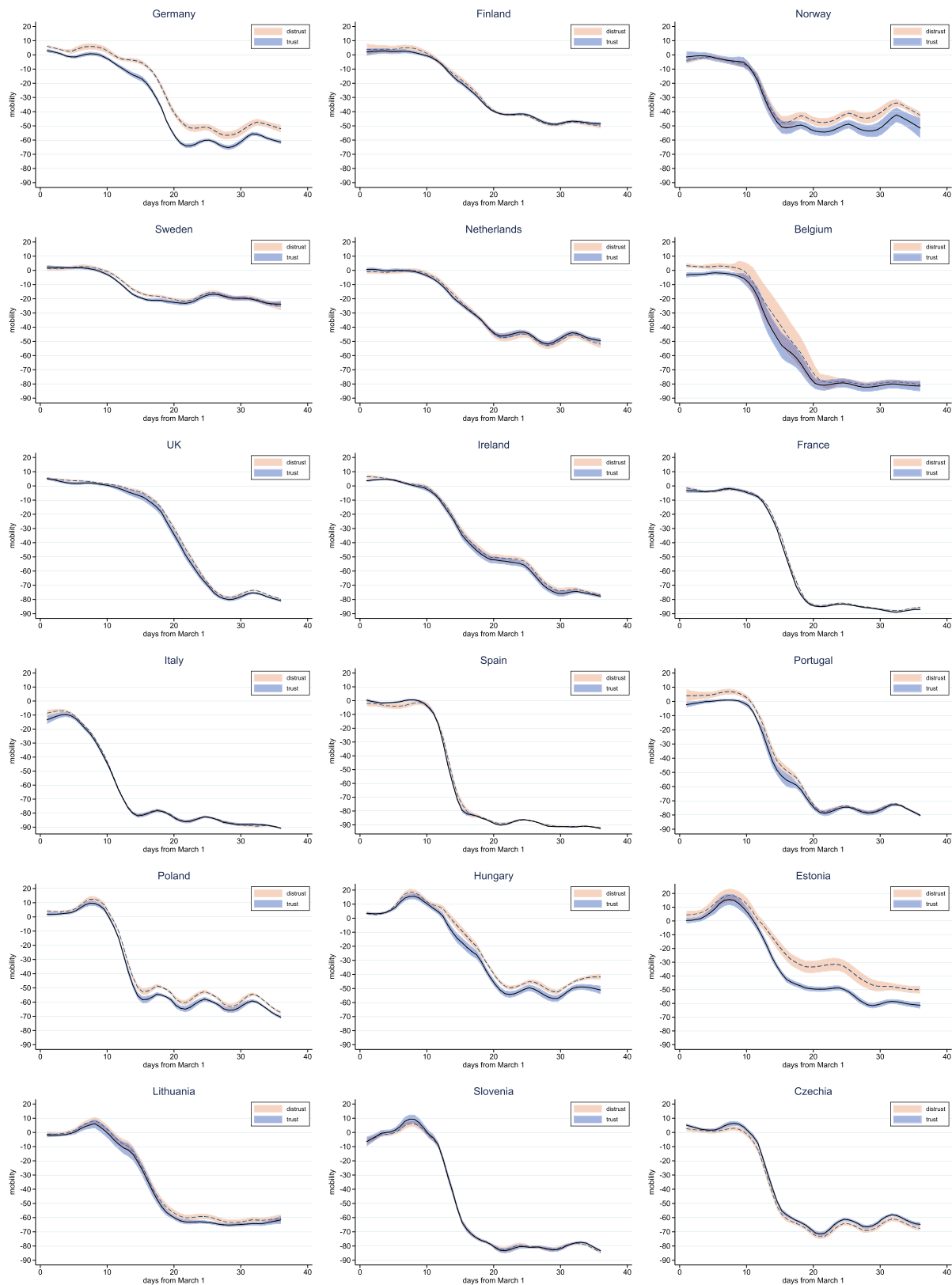
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[22] This interpretation is actually related to very recent studies on political orientation in the US, showing that Democrats tend not to follow the President's directive and exert more social distancing than Republicans (e.g. Allcott et al., 2020 or Painter and Qiu, 2020).

Fig. A.2. Daily Mobility (Retail and Recreational) and Trust within Countries.

countries, even in federal states such as Austria, Belgium or Germany. Stringency may however vary locally (e.g. severe restrictions in Bavaria). Further work could explore regional policy measures

but more disaggregated trust data would be required for identification. Finally, endogenous policy stringency may increase with the number of positive known cases on the days before, which also
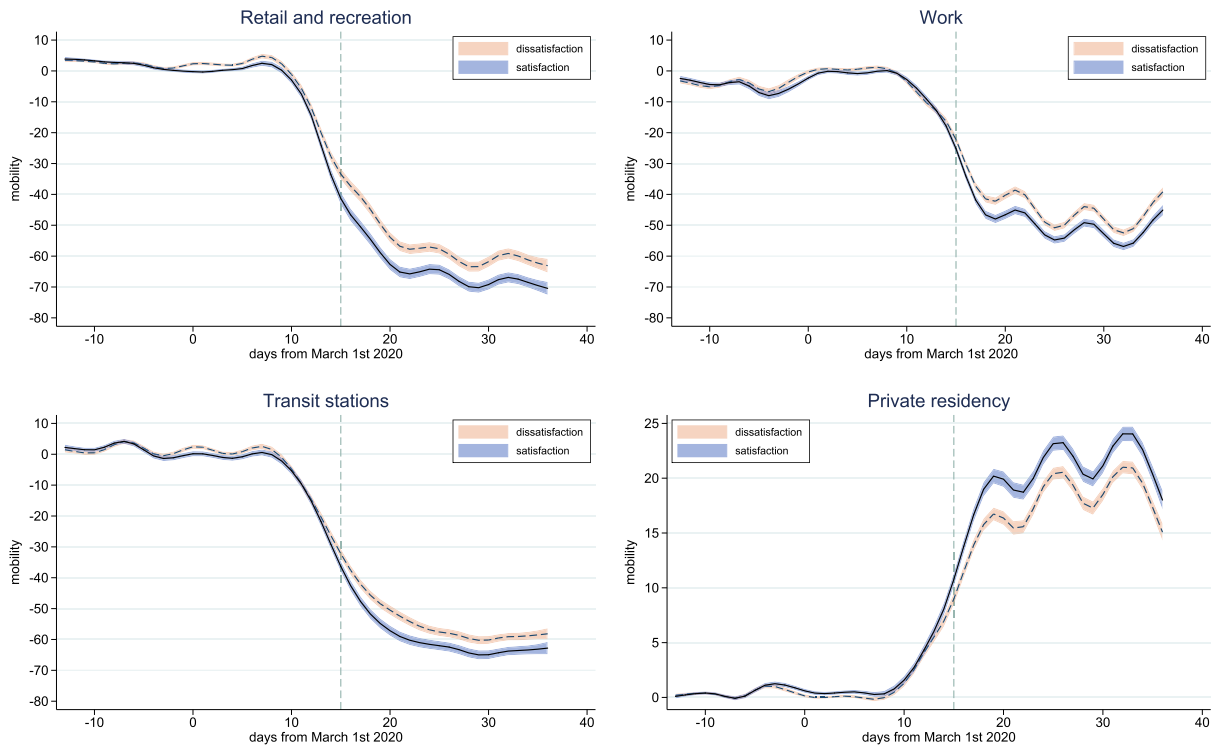
Variation across European Regions (local polynomial fit)
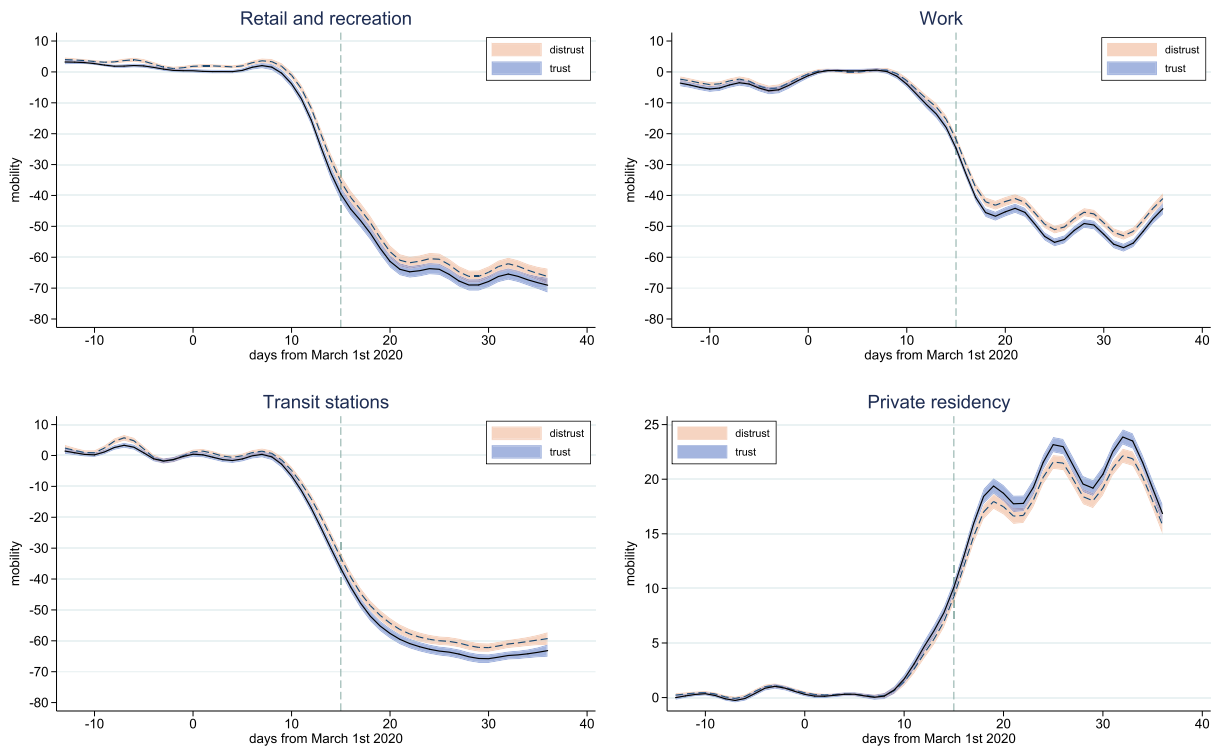
Source: authors' calculations based on Google mobility data and EUROBAROMETER data on trust in government. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Distrust indicates regions, within each country, with trust level below country average.

Fig. A.3. Daily Mobility and Political Trust (Eurobarometer): Variation across European Regions (local polynomial fit).

Variation across European Regions (local polynomial fit)

Source: authors' calculations based on Google mobility data and ESS data on satisfaction with government. Areas represent the 95% CI of average daily mobility across European regions, weighted by 1/number of regions in the corresponding country. Dissatisfaction indicates regions, within each country, with satisfaction level below country average.

Fig. A.4. Daily Mobility and Satisfaction in Governments (ESS): Variation across European Regions (local polynomial fit).

Binary Trust

Continuous Trust
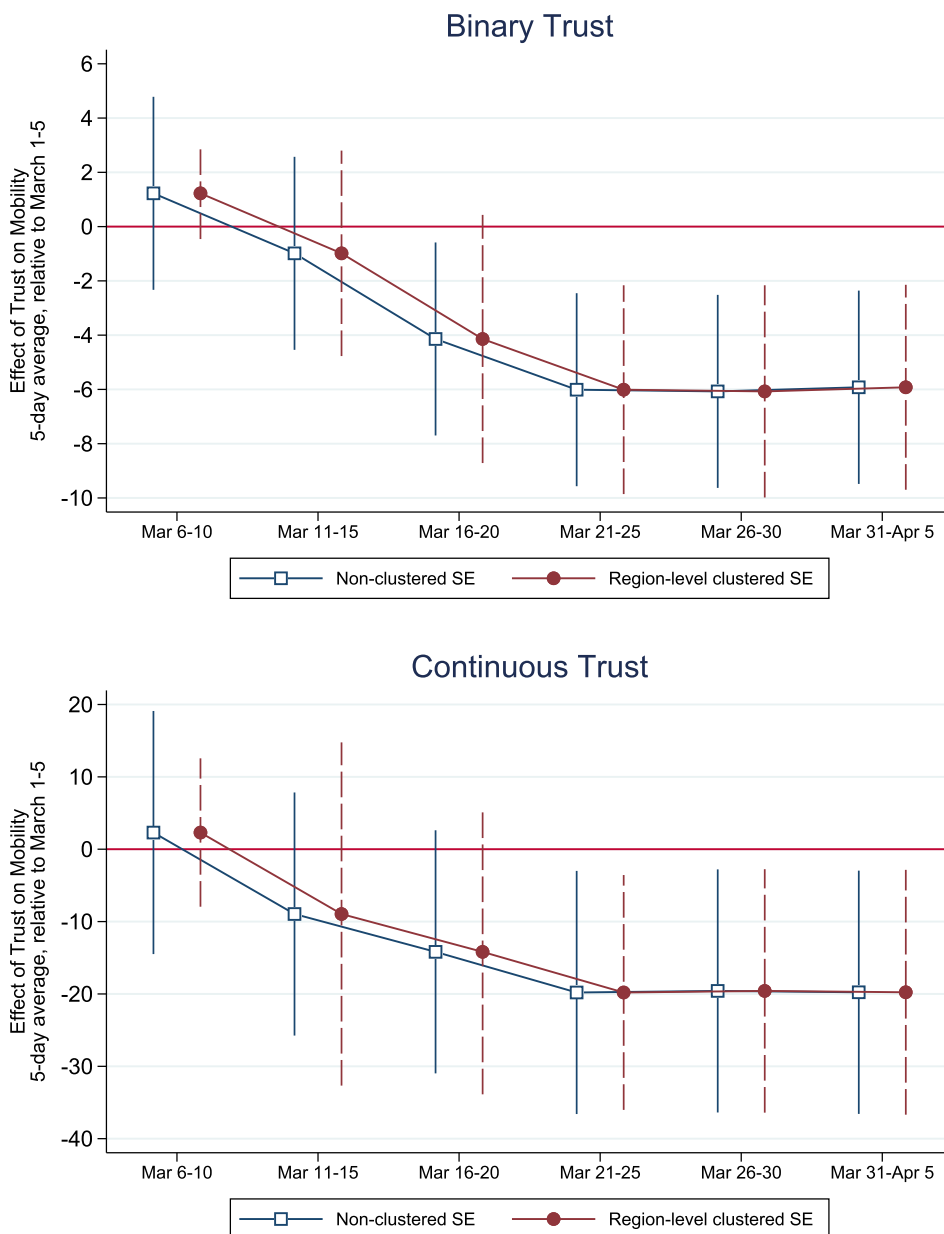
Source: author's estimations of 5-day average Google mobility index (retail and recreation) on trust data (ESS) for the period from March 1 to April 5, 2020. Estimations include lagged nuber of COVID-fatalities (cf. European Centre for Disease Prevention and Control) and 5-day period dummies. All estimations account for regional fixed effects. Confidence intervals are calculated using robust or region-level clustered standard errors.

Fig. A.5. Time-heterogeneous Effects of Trust on Mobility.

decreases individuals' mobility (fear factor). We have replicating our estimations using the number of positive cases rather than the number of death cases in t-1 but results were hardly changed.

3.3. Trust and COVID-19 death growth rate

We provide suggestive evidence on how trust translates into a slower epidemic growth through mobility reduction. Clearly, it is not possible to find a relationship between current mobility and future deaths, as both are highly correlated with the current mortality level. However, it is possible to establish how the upcoming death growth rate responds to the instantaneous mobility index, reflecting the efficiency of lockdown policies. Note that other factors are excluded (in March-April, none of the European countries had reached a level of infection leading to collective immuniza-

tion). Our calculations are purely indicative given the medical uncertainty on key parameters.

Using international data, Soucy et al. (2020) also point to an impact of the reduction in human mobility on the infection growth rate. They find that a 10% decrease in relative mobility in the second week of March was associated with a 11.8% relative decrease in the average daily death growth rate in the fourth week of March, i.e. an elasticity of 1.18. We obtain similar results when focusing on Europe. We also suggest an alternative calculation based on daily mobility data throughout March and until April 5, fully exploiting the variation in containment policies over time and across countries. For each day, we compare the current cumulated death toll attributed to COVID-19 to that of 2 weeks ahead, and divide the corresponding growth rate by 14 to obtain a daily upcoming death growth rate. This growth rate is regressed on the instantaneous mobility index, day fixed effects and country fixed effects.

We find a significant estimate of.021 (std. err. of.0016). It yields an elasticity of death growth rate with respect to mobility of 1.20, which is very similar to Soucy et al. (2020). We combine it with our previous estimates to compute an elasticity of death growth rate with respect to trust, systematically reported in the last row of all the previous tables. Take for instance the DD approach with region fixed effects as baseline model. For recreational mobility, we find an elasticity of.218 in this case, i.e. doubling trust would lead to a 21.8% decrease in the mortality growth rate. This corresponds to a decrease from 39.1% to 28.9% in the median daily death growth rate, i.e. a doubling in the number of deaths in 3.5 days rather than 2.6 days. To get a notion of how it translates in terms of death toll, note that there was a total of 2,000 cumulated deaths mid-March in Europe and around 90,000 by mid-April (ECDC figures). Consider a benchmark variation of + 25% in trust (1 standard deviation): with the baseline model, this leads to a 6.5% decrease in the mortality growth rate and around 10,000 less deaths by April 15. Robustness checks confirm these orders of magnitude.[23]

4. Conclusion

Trust in governments is an important determinant of citizens' compliance with public health policies, especially in times of crisis. This relationship, rarely studied in the literature, deserves a particular attention in the present context of global pandemic. COVID-19 has forced governments to take drastic measures all over the world. Lockdown policies are often very constraining and must receive a large support by the population to be efficient – this support is not guaranteed and certainly not homogenous. Using mobility data at regional level in Europe, we show that higher political trust is associated with a larger reduction in non-essential mobility following the implementation of containment policies in March 2020. This effect is interpreted as a higher level of compliance to national directives in high-trust regions. It coincides in magnitude with the effect of trust on the efficacy of policy stringency.

Persistent differences in regional attitudes towards national policy makers are important and should be taken into account by authorities for policy design and especially for the implementation of nationwide emergency policies. This is relevant in the present context for both the enforcement of lockdown policies and the necessary roll back of these measures at the time we write these lines. Notice that regional diversity captures only one dimension of the heterogeneity in civic values within countries. Further research should attempt to exploit more local or individual data on mobility and compliance to health policies such as social distancing measures.[24] The fact that variation in trust at a broad regional level already yields significant differences in mobility responses to recent health policies is striking. New research could go further to identify relevant social groups and connect this issue with the work on conflicts. Recent episodes of social unrest (e.g. the yellow jackets in France) point to groups that show more socio-economic vulnerability and less adherence to the political system (Algan et al., 2019).

The present paper also relies on policy stringency. Much remains to be known about the causes and consequences of the great diversity of national policy responses to the pandemic. All the more so as many governments will be accountable to their population regarding the management of this crisis and the chosen tradeoff between death toll, economic downturn and other consequences of the lockdown in terms of health and mental health.

Appendix A

Tables A.1 and A.2.
Figs. A.1.–A.5

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[23] A two-week lag for the death growth rate calculation is the average known duration between infection and public report. Results are similar when using 1 or 3 weeks. Robustness checks also include taking out countries with less than 100 cumulated deaths at the end of the period.

[24] The conclusion of the present paper is corroborated by a survey on Danish citizen showing that the 'willingness to distance' depends on political trust, among other determinants (Olsen and Hjorth, 2020).