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Physical distancing worked to combat the spread of Covid-19 Using Google Mobility data

Abstract

Physical distancing was mandated in countries around the world to combat the spread of Covid-19, but not in every country, nor do individuals strictly comply. Mobility data from Google provide a direct measure of distancing behavior, and indicate a precipitous drop in visits to locations such as retail and transit stations soon after the arrival of Covid-19. The evidence indicates it worked too. In a sample of 95 countries, distancing one day later is associated with a peak in new cases of 0.58 days later. Earlier peaks are also lower. Physical – distinct from social – distancing works.

Keywords: COVID-19, public policy, social distancing, lockdown, containment measures, mobility

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Introduction

It is not surprising that physical distancing has worked to combat the spread of Covid-19, yet not everyone agrees and mandatory lockdown measures differ substantially across countries. Some argue that obtaining herd immunity is more appropriate[1] or believe individuals will voluntarily enact containment measures. Sweden served as an example, but their chief epidemiologist recently admitted they should have done more (as reported by the Guardian). Is he right?

To what degree does distancing work? – physical not social, an issue I return to later. Recent research demonstrates that stronger and earlier government measures such as mandatory distancing have been effective at slowing the spread.[2] However, there should be significant heterogeneity in their effectiveness, depending for instance on a country's demographics and how individuals respond.[3] Individuals behave according to the risks they perceive: legal, economic, and health. Many self-impose stay-at-home measures, while others flaunt health policy. Ultimately, what matters are people's interactions – opportunities to spread the virus. For this reason, it is valuable to directly assess individuals' behavior. Indeed, two recent articles argue voluntary measures matter more than mandatory stay-at-home policies.[4]

This article presents the case for physical distancing in 95 countries around the world using Google mobility data[5], which show individuals' time spent in various types of places during the pandemic. Similar research using mobility data indicates physical distancing works, but is confined to the United States and China.[6] In the present analysis, I quantify when individuals in countries around the world changed their behavior and provide evidence that indicates the sooner individuals distanced, the sooner their country peaked in

[1] See a discussion in Bethune and Korinek (2020).

[2] Deb et al. (2020), Dergiades, Milas, & Panagiotidis (2020), Flaxman et al. (2020), and Hsiang et al. (2020).

[3] Barnett-Howell & Mobarak (2020), Chudik, Pesaran, & Rebucci (2020), and Makris (2020).

[4] Engle, Stromme, & Zhou (2020) and Malony & Taskin (2020).

[5] Google LLC (2020).

[6] Chinazzi et al. (2020) Kraemer et al. (2020) Lai et al. (2020) and Pei, Kandula, & Shaman (2020).

confirmed new cases per day. Further, I demonstrate that earlier peaks are also lower. This result holds using two different estimation techniques and whether or not other factors such as economic development or population density are accounted for.

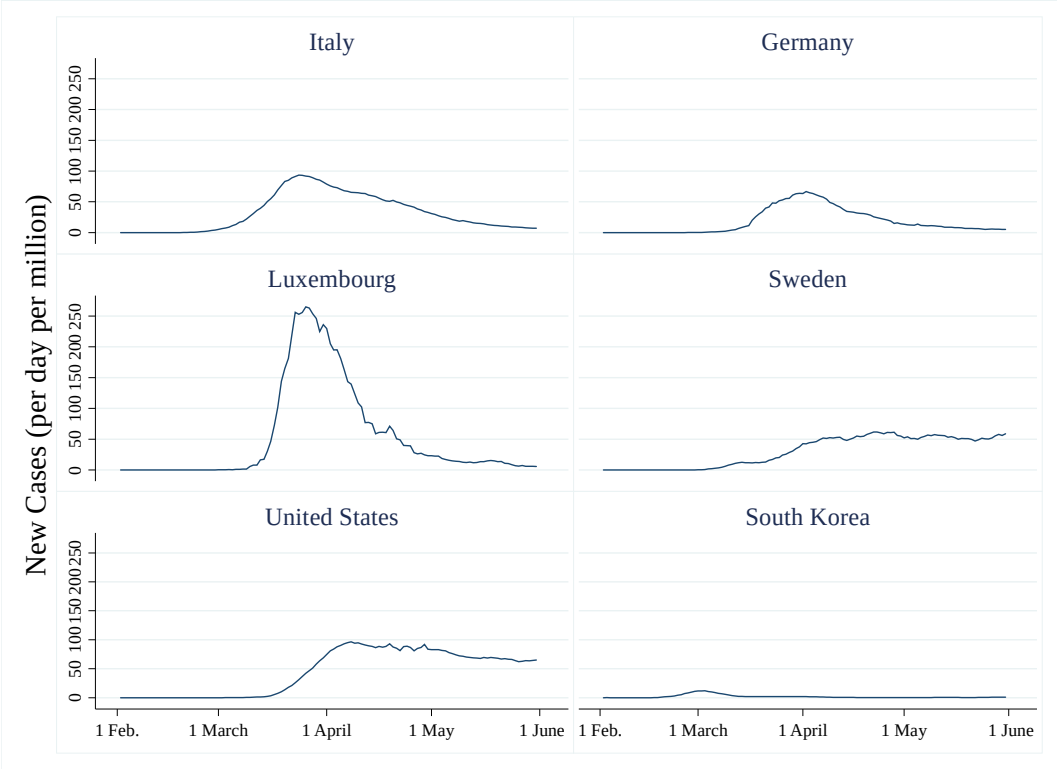
The day in which countries hit their peak in new confirmed cases is an important outcome, because the duration of the pandemic is independently important, but also because it reflects the severity of the pandemic in a country. Uncontrolled, infections grow more rapidly when there are more people infected.

Data: illustrations of different experiences with Covid-19 and associated physical distancing behavior

The spread of Covid-19 differed notably across countries.[7] As an illustration, Figure 1 presents the number of new confirmed cases daily in six different countries. Luxembourg stands out in a number of ways. First the peak is substantially higher and occurs earlier than in several countries. Italy and the United States reached similar heights, though the United States peaked later and began to decline more slowly. In Sweden, there appears to be no peak at all. In this group, the success story must be South Korea, whose curve hardly registers a blip.

[7] Based on data from Our World in Data (Roser et al. 2020).

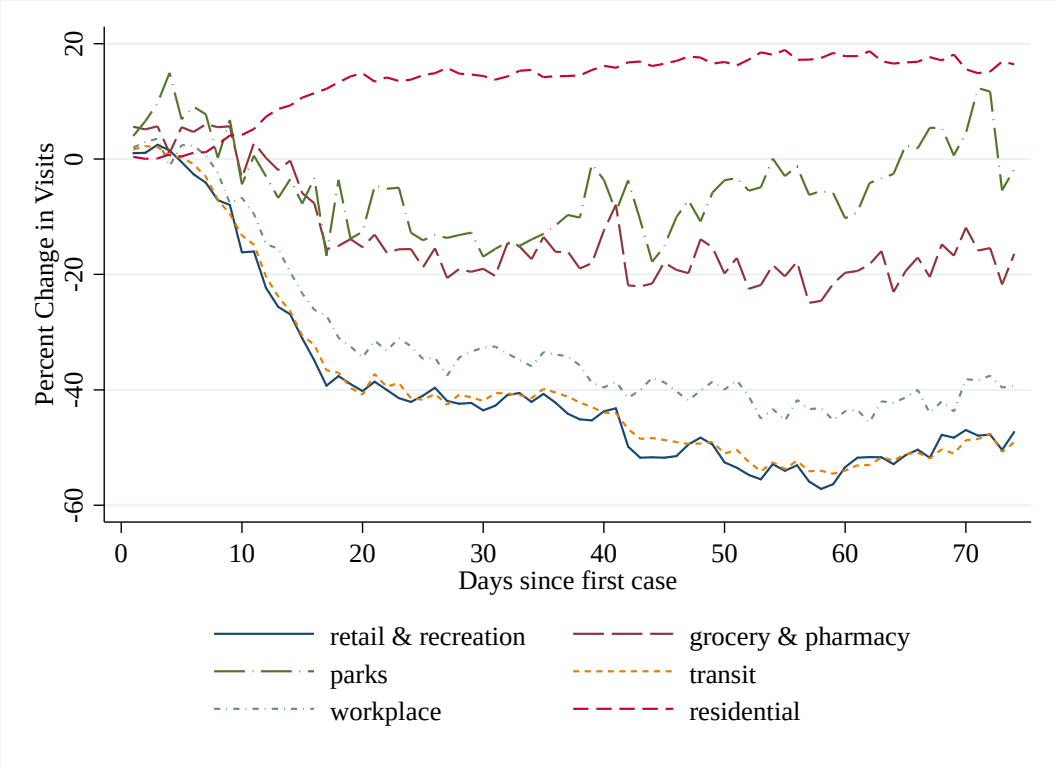
Figure 1. New Covid-19 cases per day in six countries.



Source: author elaboration, based on data from https://covid.ourworldindata.org/.

To what degree did these countries distance? In general, countries responded by implementing stringent lock-down measures and people responded by reducing their mobility. Figure 2 presents the mobility data, showing how visits and lengths of stay changed relative to a baseline period prior to the pandemic. The figures reflect the average across the Organization for Economic Cooperation and Development (OECD) countries (except Iceland, missing due to data constraints). The data is collected across various devices, e.g., smart phones and computers, from users that have opted-in to location history on their Google account. Visits to retail, transit stations, and workplaces began to drop precipitously within ten days of the first case in a country. Workplace visits declined similarly, while parks, grocery and pharmacy visits declined to lesser degrees. Naturally individuals' time spent at home increased relative to the period before the crisis – residential places reached an approximate 15 percent increase about 20 days out.

Figure 2. Evolution of visits to six categories of places, averages across 36 OECD countries.



Note: baseline is the five-week period from the 3rd of January to the 6th of February.
Source: author elaboration, based on Google Mobility Data.

There is of course significant heterogeneity across countries. Figure 3 presents the changes in individuals' visitation behavior over time in six countries. To simplify the figure, the average changes across the location categories was used (excluding residential); this average was also reversed such that greater values represent fewer visits. In Italy and Luxembourg, there was a sharp increase in distancing behavior, reaching approximately 70 percent fewer visits. In contrast, Germany, Sweden, United States, and South Korea all had levels generally below 50 percent. The countries also differ according to when they started distancing.

Figure 3. Distancing behavior in six countries

Note: distancing is an index whereby greater values represent fewer visits to retail and recreation, grocery and pharmacy, parks, transit centers, and workplaces. The daily index has been smoothed using a four-day moving average.
Source: author elaboration, based on Google Mobility Data.

Did physical distancing behavior work?

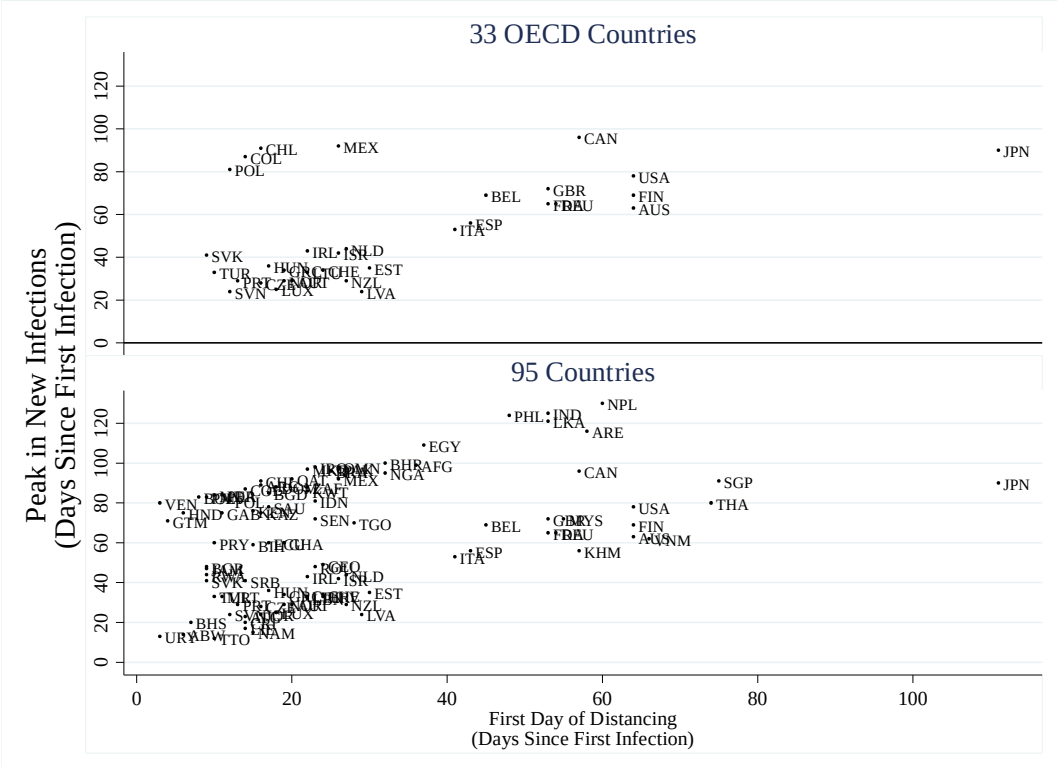
One way to assess whether distancing worked is to look at when people began to distance and to see if that is related to when the country peaked in new confirmed cases per day. If distancing works, the sooner individuals comply, the sooner a country peaks and the lower the peak will be.

To that end, I determined the days in which countries peaked and started distancing. The peak was determined simply as the day in which the maximum number of new cases was confirmed using a centered-seven-day moving average for new cases. The day when distancing started was selected as when the population distanced at 30 percent or more using a moving average of distancing as defined above. Thirty percent was selected based

on observing the average distancing behavior across more than 100 countries – the average just exceeded 30 percent and then stayed relatively steady beginning approximately 20 days after the pandemic began in a country.

The evidence suggests that the sooner countries distanced, the sooner they peaked. Figure 4 presents the day of peak new confirmed cases along the vertical axis and day when distancing occurred along the horizontal. The top panel is for 33 OECD countries (except Iceland, and Denmark, Sweden, and South Korea which did not significantly reduce mobility), while the bottom includes an additional 62 countries from around the world. Japan, Canada, the United States, Singapore, and Thailand, represent countries where people waited to reduce their mobility and it took them longer to peak.

Figure 4. The peak in new infections occurred later in countries where distancing began later.



The figure plots the day of the peak in new infections against the day when reduced mobility (greater distancing) began in two sets of countries. The set of 95 countries includes the 33 OECD countries. ISO codes indicate the country.
Source: author elaboration, based on data from https://covid.ourworldindata.org/ and Google Mobility data.

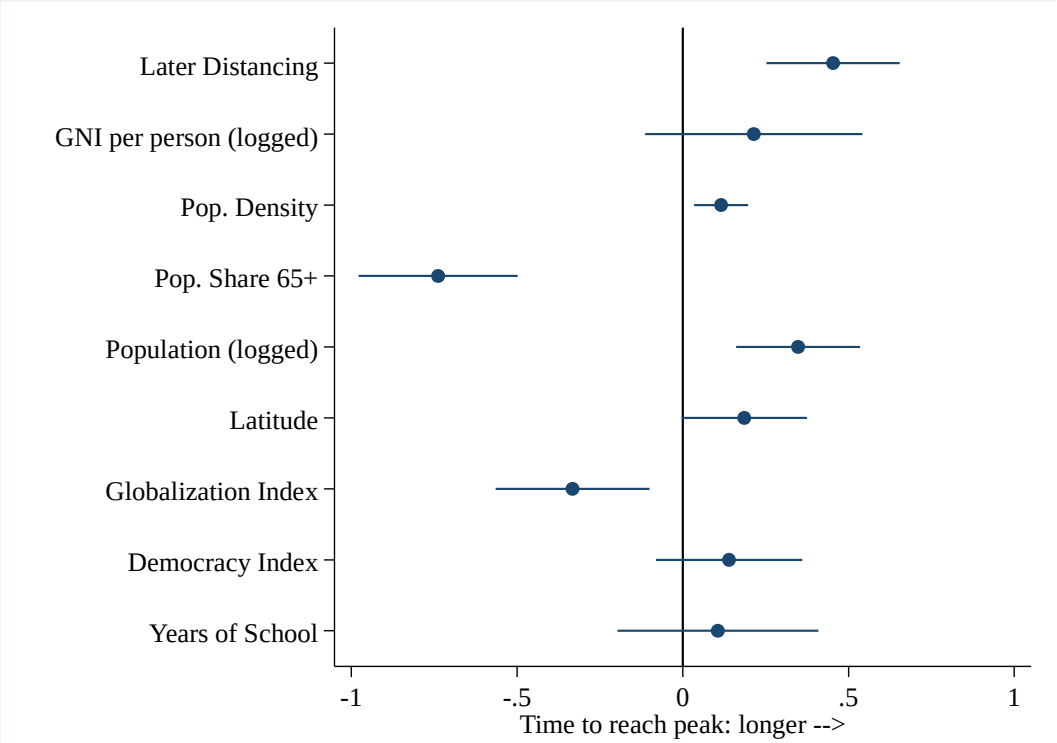
Clearly, these countries differ across multiple dimensions, some of which might explain their distancing behavior and spread of Covid-19. For this reason, I conduct regression analysis,[8] which simultaneously assesses the role of multiple contributors to the peak in Covid-19, in particular: the level of a country's development, in the form of Gross National Income (GNI) per person (in logarithmic form); population density; the population share that is 65 years or older; the total population (in logarithmic form); the capital city's latitude; an index of global interconnections (globalization index); an index of democracy; and the average number of years of school.[9]

The regression results indicate that distancing helps to statistically explain when the peak occurred even when accounting for these additional characteristics. Figure 5 presents the estimates. The positive relation for Later Distancing indicates that the later distancing began, the later the peak in new cases occurred. The impact is larger than for the other variables. To compare across variables, they were standardized to use consistent units. The relation indicates that later distancing by one standard deviation is associated with a delayed peak of approximately 0.45 standard deviations. The more intuitive relation in days (unpresented) indicates that delayed distancing by one day is associated with a later peak of 0.58 days.

[8] Ordinary least squares (OLS) and Cox Hazard Proportional Hazard models. For brevity, I only present the OLS results but the Cox estimates are qualitatively similar.

[9] This set of variables reduces the number of countries that can be analyzed to 72. In particular, education and latitude data are not readily available for all 95 countries. However, the regression results are qualitatively similar when dropping these variables and using the larger sample. Data are available from the World Bank's World Development Indicators, KOF Swiss Economic Institute, Polity IV Project, Barro-Lee Educational Attainment Dataset, and the Quality of Government Institute at the University of Gothenburg.

Figure 5. Relations with the day of peak new infections. The later distancing occurred, the later the peak occurred.



The figure presents estimates of how the peak day in new cases varies with changes in the day distancing began and other characteristics. All variables have been standardized so relations can be compared. 72 countries. Horizontal lines represent confidence intervals, in which we are 90 percent sure the relation falls within. Estimates are based on ordinary least squares regression.
Source: author elaboration based on data from https://covid.ourworldindata.org/ and Google Mobility data.

The other relations indicate that countries' population characteristics and level of integration also help to explain when the peak occurred. Countries that are denser or have greater populations experienced the peak on a later day. Somewhat surprisingly, countries with a greater share of 65 years and older people reached the peak sooner after their first case. Perhaps that is because they practiced particularly-strict measures to restrict the spread, e.g., better adherence to the use of masks or handwashing. It also unclear why more globalized countries peaked earlier. Greater GNI per capita, higher latitudes, more democracy, and more education are each associated with a later peak, however, we are not certain enough of their estimates for them to be considered statistically significant. The bar represents the range in which we are 90 percent confident that the relation falls, and for

each the range includes zero (latitude just barely). Meaning these variables did not statistically affect when the peak occurs.

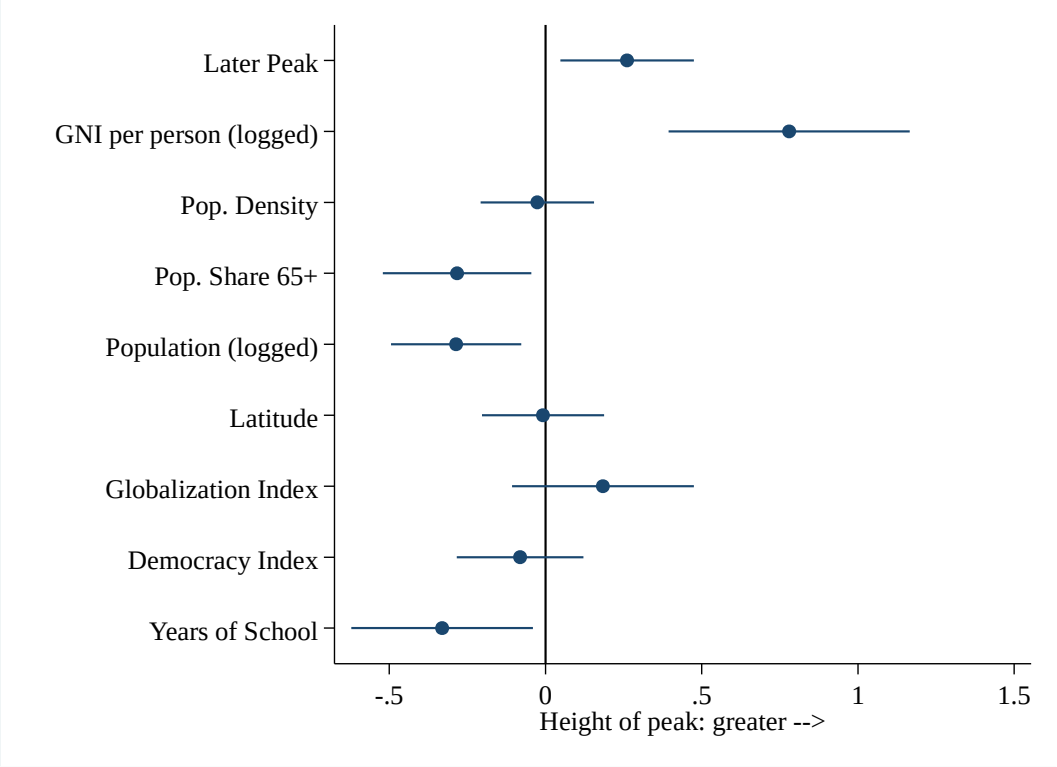
One might speculate that the day in which Covid-19 arrived in a country (Initial Date) also predicts when a country peaked. Countries that were affected later could learn from the experience of the countries first affected and implement better containment strategies. Indeed, the countries that were affected later began distancing sooner after their first case, on average. Which then, when distancing began or the Initial Date, provides a better explanation of when countries peaked? I argue distancing, because it represents a lever policymakers used to respond to the crisis. The date of arrival does not likely affect the spread of Covid-19 per se, but does affect the policy response. To provide some statistical reassurance, I conducted additional analysis which supports the view that the Initial Date does not affect the peak independently of distancing.[10]

The sooner a country peaked the lower it was.

The regression result confirms expectations; on average, the sooner a country peaked the lower it was (fewer maximum confirmed new cases). Figure 6 presents the results of a regression of countries' maximum confirmed new cases in a day on when the maximum occurred and the same characteristics from Figure 5. The results indicate larger economies (GNI per capita) experienced higher peaks, while countries with a larger share of elderly (65 plus), larger total populations, or more education (years of school) experienced lower peaks. Population density, latitude, globalization, and democracy did not exhibit statistically significant relations. Another important factor for explaining the number of cases is the level of testing. The main analysis excludes tests because the data on testing is not available in as many countries, however, the results are robust to their inclusion in a regression using the smaller sample (unreported).

[10] I regressed the residual from the estimation used in constructing Figure 5 on the Initial Date. The estimated relation was insignificant.

Figure 6. Relations with the maximum number of new confirmed cases in a day (per million people), changes associated the day the maximum occurred and other characteristics.



The figure presents estimates of how the maximum number of new confirmed cases in a day varies with changes in when the peak occurred and other characteristics. All variables have been standardized so relations can be compared. 72 countries. Horizontal lines represent confidence intervals, in which we are 90 percent sure the relation falls within. Estimates are based on ordinary least squares regression.
Source: author elaboration, based on data from https://covid.ourworldindata.org/ and Google Mobility data.

Considering both figures, countries with greater GNI fared worse – they experienced higher peaks (Figure 6) later, albeit insignificantly (Figure 5). Greater population density relates to a later peak, but not directly to one that is higher or lower. Countries benefited from a greater elderly population share, experiencing both an earlier and lower peak. Perhaps that is because this group interacted with others less often or better adhered to other health guidelines. The total population size operated in different directions; larger populations experienced lower (Figure 6) peaks later in time (Figure 5). More interconnected countries peaked earlier, but the height did not vary. Democracy had little impact. Countries with more education experienced lower peaks but at an indistinguishable time.

Social versus physical distancing

In this article, I have focused on the spread of Covid-19; however, the collateral effects of containment measures are significant in their own right. See for example, the *Economist's* recent cover story, "Grim Calculus: The stark choices between life, death and the economy" or the recent STATEC Research report on mental health in Luxembourg during lockdown. Beyond the economy, it is becoming increasingly acknowledged that containment measures significantly affect mental health. These effects are no less important to assess. Mental health contributes more than poverty to overall feelings of well-being[11] and well-being is not only intrinsically important but positively affects traditional economic outcomes.[12] Indeed the World Health Organization (WHO) changed their recommendation from social distancing to physical distancing at the end of March 2020, in order to mitigate the impacts of containment measures on mental health.

Social distancing, as it was called, places strain on already strained populations. Prior to the Covid-19 pandemic, loneliness was declared an epidemic in the United States and the United Kingdom expressed similar concern, dedicating an entire ministry to combatting it. Social isolation is expected to affect the whole population; indeed its effects on youth and the elderly recently caught the attention of three different organizations: WHO, OECD, and Gallup (known for their US and international surveys). Moreover, social capital is a key ingredient to well-being and contributes to economic growth.[13] To date, there are few studies which assess the psychological impacts of Covid-19, direct and indirect through containment measures.[14]

Physical distancing appears to be working. Echoing others, but it bears repeating, we need to keep at it; more research is necessary; targeted policies, for containment and the

[11] Flèche & Layard (2017).
[12] See for example two publications of STATEC Research: DiMaria, Peroni, & Sarracino (2019) and O'Connor (2020).
[13] Helliwell & Putnam (2004) & Knack & Keefer (1997) and by STATEC Research, Sarracino (2010).
[14] Brodeur et al. (2020), Greyling, Rossouw, & Adhikari (2020) and Hamermesh (2020).

relaxation of containment, are necessary; and not least, physical distancing does not mean social distancing. Mental health concerns are not to be disregarded.

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