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Are COVID-19 containment measures equally effective in different world regions?

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Abstract. – In response to the COVID-19 pandemic, countries around the world are implementing a range of non-pharmaceutical interventions, such as social distancing, travel-related and contact tracing measures, with the goal of reducing the spread of the virus. Many low-income countries (LICs) have started applying these measures preventively, well before the point of contagion reached by high income countries (HICs). These measures will have and are already having a strong impact on the global and local economy. Understanding if and to what extent they are effective in halting the spread the virus is crucial to design and target policies, not only in the ongoing crisis, but also and perhaps more importantly, to face future challenges. Using data provided by the Oxford COVID-19 Government Response Tracker we analyze how different policies affect the number of active COVID-19 cases in 166 countries, with a temporal lag of seven and fourteen days. We divide countries according to different geographic and socio-economic characteristics. We find that confinement measures such as school closures and lockdowns are highly effective in reducing the diffusion of active cases. While they are more effective in HICs, these measures are proving effective also in LICs: the rapid response of many LICs seems to have been the right choice. When evaluating the cost of adopting strong measures in LICs we should consider that they may have likely prevented much higher human and economics costs in the future. At the same time, further consideration should be given in how to best adapt the measures to the specificity of the context.

JEL Classification: C1, C5, I1
Keywords: COVID19, mitigation measures, policy analysis

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1. Introduction

The introduction of containment measures of the current pandemic has risen questions, especially in their application to low- and middle- income countries (LMICs)[1]. The pandemic will have long-lasting effect on global economy and society: early World Bank estimates foresee a global reduction in GDP and a raise in poverty, pushing about 40-60 million people into extreme poverty[2]. Disruption in essential services and preventive care, such as maternal and new-born health care, could result in an increase in maternal and infant mortality (Roberton et al., 2020); disruption in education will result in lower human capital.

Although the pandemic has mainly occurred in industrialized countries (Cornia et al. 2020), people living in already fragile contexts will be much more affected.

It has been pointed out how confinement measures and the consequent disruption of services may not be effective in the context of LMICs, if not actively harmful: shelter in place orders, lockdowns, curfews are all likely to have worse effects on a context with fragile and informal employment, no or scarce public transport and infrastructure. Indeed, the lockdown orders in India have elicit protests and disorders when it became clear there was no plan to address the huge migrant population in urban spaces[3].

In this context it becomes crucial to address the effectiveness of the containment measures taken by countries in 'flattening' the epidemic curves and comparing their response in different world regions. Almost all countries have adopted similar containment measures, and LMICS have basically replicated the restrictions imposed in the industrialized countries, the first infected by the virus. Quarantine, social distancing, isolation of infected populations and school closures have shown to be effective in China, the first country hit by the pandemic. The time that passes from the initial spread of the virus to the imposition of restrictions is crucial to determine the spread and the duration of the pandemic. Preventative measures can indeed be key in avoiding positive cases and deaths. Taking the example of China and other countries firstly affected by the virus, such as Italy and Iran, many other countries, still not hit by the pandemic, imposed similar precautionary measures. This happened both in LMICS and in some HICs. However, there is no guarantee that the same measures will give similar results in different contexts. It is possible that given the institutional, political, social and economic characteristics, country or region-specific policies could have been more appropriate. In high income countries basic services continued to operate mostly normally during the lockdown period, while in other countries the pandemic led to the arrest of some public services, generating further problems not directly related to the virus. In Ecuador for instance the funeral service was not able to support the high number of victims, rising hygienic concerns among relatives and neighbors of the victims[4]. In India the lockdown posed problems of overcrowding, given that an average Indian family has five members and 37% of all houses have only one room[5]. In light of these examples, it is clear how some restrictions could have disruptive consequences, which could be higher than the benefits of the measure. On the other hand, a strong preventive action could be effective in avoiding even further

[1] https://www.cgdev.org/blog/does-one-size-fit-all-realistic-alternatives-covid-19-response-low-income-countries
[2] https://blogs.worldbank.org/opendata/impact-covid-19-coronavirus-global-poverty-why-sub-saharan-africa-might-be-region-hardest
[3] https://www.aljazeera.com/news/2020/04/indias-migrant-workers-protest-lockdown-extension-curb-virus-200415063431190.html
[4] https://www.aa.com.tr/en/world/ecuador-bodies-of-coronavirus-victims-are-on-streets/1791407
[5] http://mohua.gov.in/upload/uploadfiles/files/Housing_in_India_Compendium_English_Version2.pdf

problems and human and economic costs in the immediate and longer terms. Our first question is therefore: *have the measures been effective in slowing the spread of the novel-coronavirus? And is the effect similar across HICs and LMICs?*

In this study countries will be grouped in terms of income level, as a proxy of economic development, and based on their geographic location, to understand the extent to which the containment measures taken by government have been effective. We use a pooled time series framework with errors corrected for cross sectional dependence to assess the short- and medium- term impacts of a set of containment policies on the variation of COVID19 caseloads.

Our results show that containment measures have heterogeneous effects across the different regions: in particular, school closure, prohibition of large gathering, travel restrictions have been proven to me quite effective on the reduction of the spread of active cases. We show that measures are effective for both HICs and LMICs: the low number of COVID-19 cases in many LMICs can be rightfully attributed to the prompt action of governments in adopting restriction measures, so, the speed matters too. We argue that, while these measures may be costly to the economy, the cost of no response would be much higher in both human and economic terms.

The paper is structured as follows: section 2 discusses the relevant literature; section 3 discusses the trajectory of active cases and the measures implemented in different countries to date; section 4 presents the data and the methodology and then discusses the results; section 5 concludes.

2. Literature Review

Since the outbreak of the pandemic in late-February - early-March 2020[6] several scholars of different disciplines have been seeking to assess the effectiveness of the Non-Pharmaceutical Interventions (NPIs)- including both hygiene measures such as mandatory face masks and sanitization, and confinement measures such as lockdowns, border closure, quarantine, social isolation, etc. increasingly taken by countries across the globe to control the spread of the virus.

A surge of papers has become available during the spring of 2020. Cowling et al. (2020) study the implementation of NPIs in Hong Kong: they find that NPIs (including confinement measures) were effective in reducing the transmission of COVID-19. Civcir (2020) evaluates the effect of the social distancing measures in Turkey, looking at breaks in the trend of infections. The author finds that social distancing measure seems to be effective in slowing down the transmission of the virus and delaying the peak. Hartl et al. (2020) find that containment policies in Germany were effective in slowing the growth rate of infections, with a lag of seven or eight days after policy implementation.

A study reviewing the available evidence on the effect of school closure in previous coronavirus outbreaks (Viner et al., 2020) highlights how the evidence is very scarce, and what is known points towards an irrelevance of school closure on the diffusion of previous viruses.
However, a recent paper by Dergiades et al. (2020) analyzes 32 HICs, using the OxCGRT dataset, and finds that confinement measures, especially school closure, are effective in reducing deaths related to COVID-19. The authors also find that the earlier the measures were adopted, the better the outcomes.

The work of Jinjarak et al. (2020) analyzes the pattern of COVID-19-related mortality, making use of the OxCGRT dataset to take into account the implementation of policies. They use a panel local projection analysis, and their results confirm that more stringent measure are associated with a lower growth rate of deaths. They find the effect to be particularly pronounced in countries with high population density, high level of internal travels, and large share of population over 65.

Binny et al. (2020), analyze the effect of rapid response and preventive measures on the effective rate of infection for 25 locations (states/provinces or countries), and find that a high alert level at early stages substantially reduces the infection rate.
In this respect, an interesting case among LMICs seems to come from Mongolia: the country has started to prepare for the outbreak and implement NPIs already in January 2020 and has had 0 cases of local transmission[7]. Albeit anecdotical, this evidence stresses the importance of implementing a rapid response and preventive measures.

Previous literature on the effect of NPIs concentrates mostly on the effect of face mask and handwashing and sanitization on the spread of influenza. A 2009 RCT conducted in Berlin finds that early adoption of NPIs (face mask and increase hand sanitization) strongly decreased the onset of influenza among families (Suess et al., 2012). A systematic review of the available evidence in 2015 (Smith et al., 2015) finds that results are positive for handwashing and oral hygiene of the elderly. However, the authors point towards a lack of good evidence about the effectiveness of NPIs.

Recently, there has been some discussion about the -somewhat similar- outbreak of the 1918 'spanish' influenza. Hatchett et al (2007) examine NPIs in 17 US cities during the 1918 pandemic: they find

[6] Official declaration by the WHO was on March 12th, 2020: http://www.euro.who.int/en/health-topics/health-emergencies/coronavirus-covid-19/news/news/2020/3/who-announces-covid-19-outbreak-a-pandemic
[7] https://medium.com/@indica/covid-underdogs-mongolia-3b0c162427c2

that early implementation of multiple measures was associated with a lower peak of deaths and lower excess mortality. They also find that the closure of schools and social gatherings such as theaters had the most positive influence, lowering the number of deaths associated with the influenza. Recently, a paper by Correia, Luck, and Verner (2020) has drown attention: the authors examine the economic impact of the 1918 in the US to assess the cost-benefic impact of NPIs. They find that cities that responded earlier and more strongly, recovered more rapidly after the pandemic, while cities that were more exposed, experienced a substantial reduction in economic output. In a similar direction, the paper by Barro et al (2020) highlights how the excess deaths caused by the Spanish Influenza have had a detrimental effect on the global economy. On the same topic, the work of Bodenstein et al. (2020), shows that the infection peak itself could have serious consequences for the economic system of a country, if not mitigated by public health interventions.

When it comes to LMICs, evidence on the effectiveness and costs of NPIs to prevent the spread of influenza or similar diseases, is scarce. A global review by Peasah et al. (2013) finds that there is no substantial evidence on the costs of influenza in LMICs. A more recent review (de Francisco et al., 2015) finds that in LMICs the burden of the costs of an influenza pandemic comes from indirect costs, mostly from the loss of productivity. It is quite reasonable to assume that the COVID-19 pandemic will have similar effects, which will have long lasting consequences on countries, unless the spread of the coronavirus is slowed down substantially.

In recent years, several countries in West Africa have faced a severe epidemic of Ebola: in August-September 2014, cases in Sierra Leone, Guinea, reached an all-time high. Although the Ebola virus is different, in particular its mode of transmission is substantially different from that of the current COVID-19, analyzing the response to Ebola and its effectiveness can provide some clue in how the diffusion of the novel coronavirus can be fought in LMICs and in particular in the African continent. Studies generally find a positive impact of preventive measures, mainly in terms of community-based response and awareness campaigns. Pronyk et al. (2016) find that Community Care Centers were effective in preventing Ebola transmission in Sierra Leone. Studies that model transmission of the Ebola virus, find that the introduction of preventing measures was effective in slowing down the spread of the virus (Guo et al., 2016; Merler et al., 2015; Fang et al., 2016).

One major obstacle to the effectiveness of hygiene and personal protection measures is the lack of adequate infrastructure of many families in LMICs: a recent study by Brown et al. (2020) finds that 90% of households in low income countries lack adequate home environment protections as recommended by the WHO. Wealth plays a crucial role also in HICs: evidence from the US points towards a higher spread of the virus among poor communities (Harris, 2020; Buoye et al, 2009). By all accounts, poor people around the globe will be bearing the biggest share of the consequences of the pandemic. Understanding how we can rapidly design effective policies is crucial.

We contribute to the emerging literature on the effectiveness of NPIs for the control of the COVID-19 pandemics, by conducting the first, to our knowledge, analysis on a global scale, and by taking a specifically perspective in comparing HICs and LICs. The increased availability of data related to the current crisis allows us to expand the analysis to several world regions and compare the results. This will also expand the evidence on the response to pandemics by LMICs.

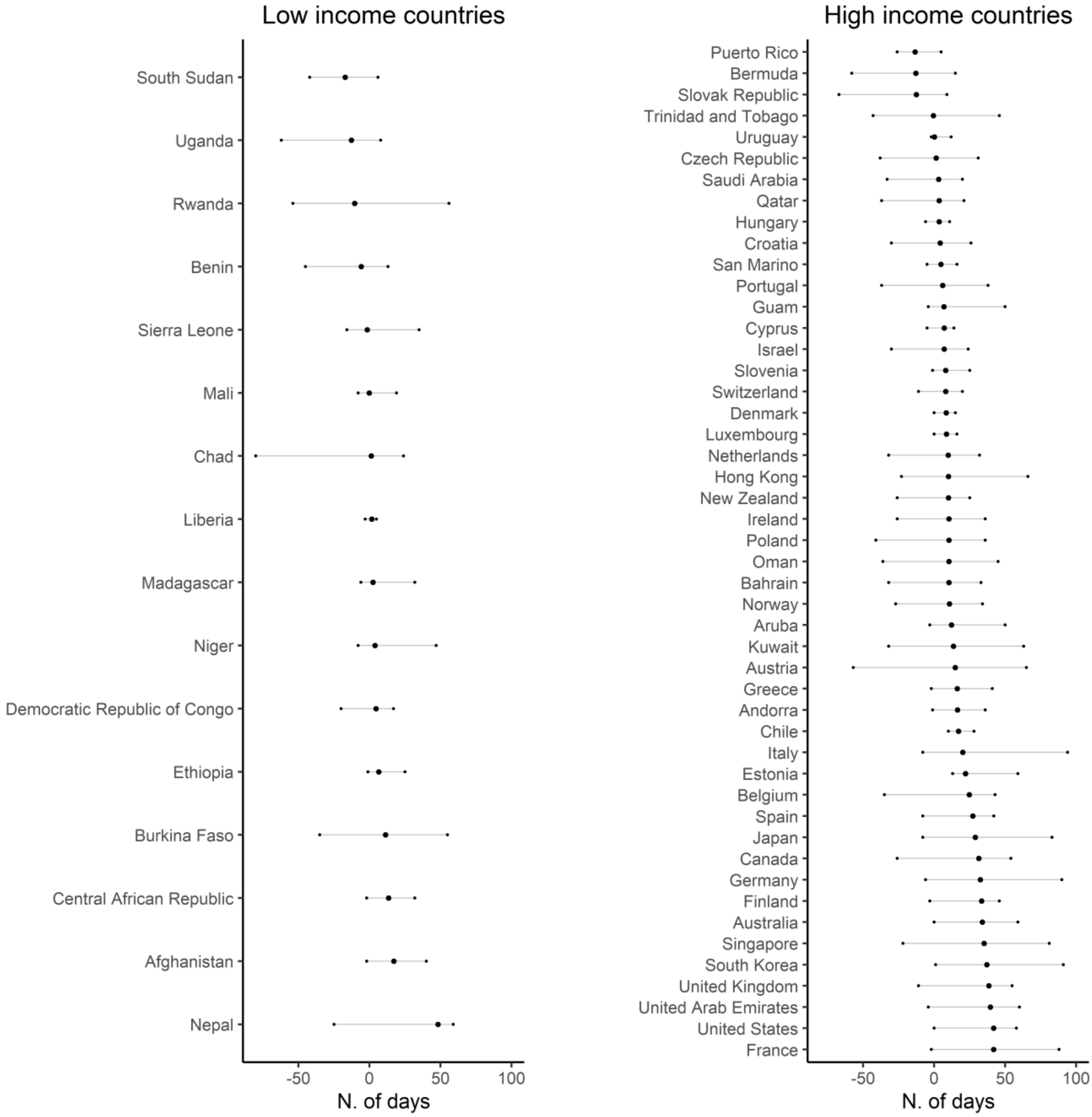
3. COVID-19 containment measures and the epidemic curves

Our main data source is represented by the Oxford COVID-19 Government Response Tracker (OxCGRT) as of 30 May 2020 (Hale et al, 2020). The OxCGRT is an ongoing data collection project which tracks worldwide governments policy responses to the COVID-19. There are two reasons why OxCGRT is preferable to other measures. First OxCGRT systematically captures the type of stringency and health related policy responses we are interested in and provides a concise measure of the timing and intensity of measures for a broad range of world economies (i.e. 166 countries) with a daily frequency. Second, the OxCGRT uses three different subcomponents (containment and closure, health systems and economic responses) to measure the robustness of government measures, thus allowing us to examine the impact of each of them on the variation of the COVID-19 contagion and to clearly assess to what extent their implementation reduces its likelihood.

The restrictions' measures considered in this study will focus on both policies aimed to containment and closure, and policies related to the health system. In the first category there are the closure of schools and workplaces, restrictions on gatherings, cancellation of public events, requirements to stay at home, and restrictions on public transports and travels. The second group instead includes public information campaigns, testing policies and systems of contact tracing. A full list of the measures with their descriptive statistics can be found in the Appendix.

The majority of policies have been implemented, with different intensities, in all countries considered. Public information campaigns and school closure are the most implemented policies, registered in respectively 165 and 164 countries out of 166. Closure of public transportations and contact tracing instead are the ones less implemented, imposed in 131 and 146 countries. It is important to consider not only the number of policies each country enforced, but also when they have gone into force and the time lag between them. Figure 1 shows the average number of days of the implementation of all policies since the first case registered, and the time lag from the first to the last policy implemented, differentiated by LICs and HICs. Most of LICs managed to apply the measures before registering the first case, mainly because they had more time to put in place such policies. On the contrary, many high-income countries implemented the policies only after infection was already happening in the country. It is worth noticing the time lag between different policies: some countries, such as Liberia, Uruguay, Denmark and Luxembourg executed all policies very close each other, while countries such as Chad, Uganda, Macao and Austria present a substantial time lag between the first and the last measure. This is mainly explained by the different strategies adopted by the governments, and by the different speed of contagion. In general, restrictions on domestic travels, on public transports and staying at home orders are implemented early, while international travels, public information campaigns and testing policies are the ones executed later (see Figure A1 in Appendix).

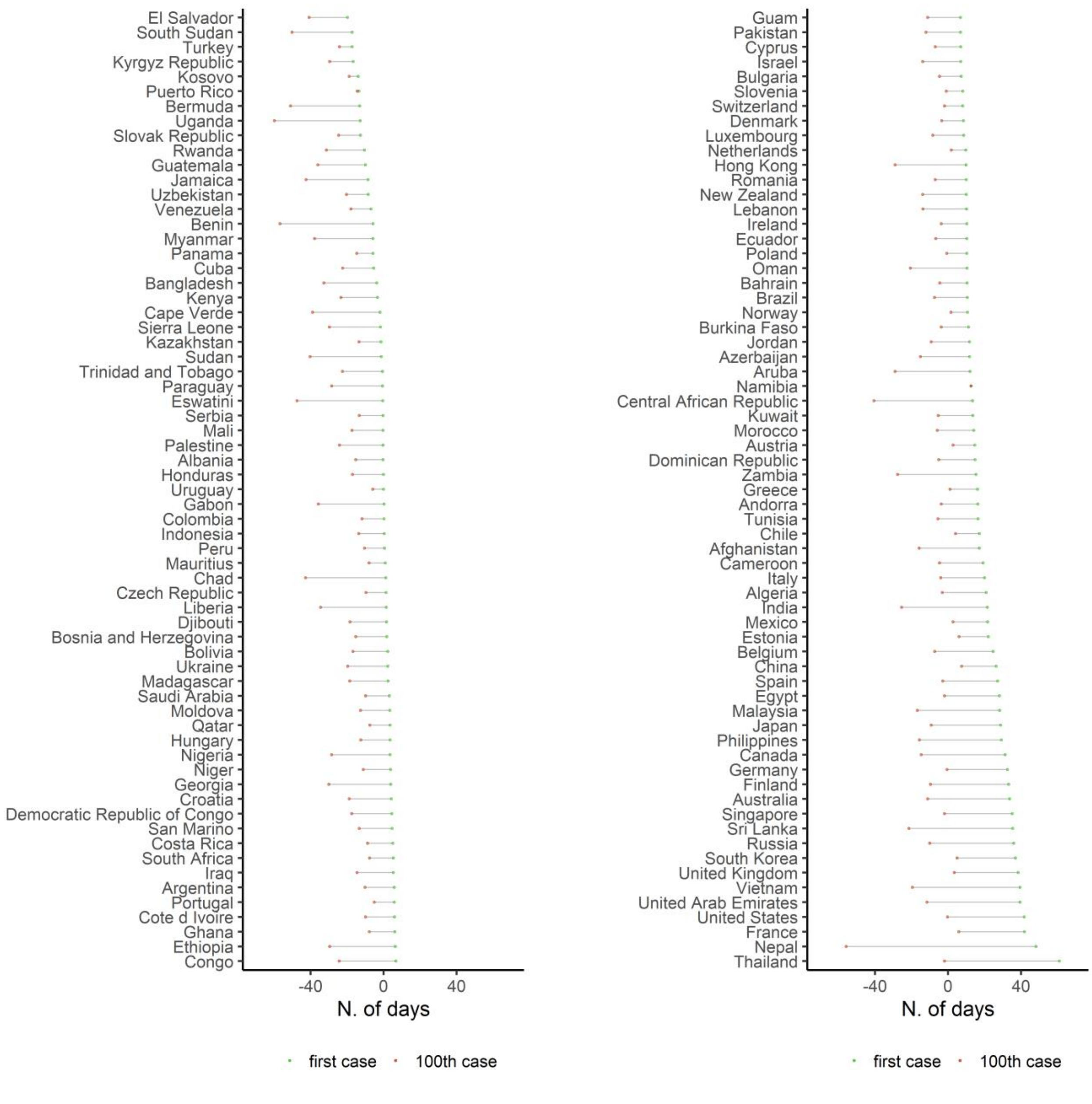
Figure 1. Average n. of days and time variation of measures' implementation since the 1st case



Note: bars indicate the time lag occurred between the first and the last measure implemented in each country.

Figure 2 provides information on the speed of implementation for the entire set of countries, reporting also the time lag between the first and the 100th case. As expected, countries firstly affected by the virus, like China and many European countries, reported a delay in the implementation, while other countries managed to intervene before the first case was observed. Among the more rapid government interventions there are El Salvador, South Sudan and Turkey, while among the slowest ones we can find the United States, France, Nepal and Thailand. The number of days passed from the first to the 100th case tells us about the speed of contagion and the effectiveness of measures implemented. The variability in this case is high. In fact, some countries registered the 100th case few days after the first one, showing a very high speed of contagion, that could be interpreted as an ineffectiveness of the restrictions imposed. Examples are Uruguay, Norway, Netherland, Kosovo and Turkey. All these countries differ in terms of both geographical location and level of economic development. Countries such as Nepal, Uganda and Benin instead, reported a long interval between the first and the 100th case. In both cases, different drivers contributed to accelerate or slow down the contagion, some are directly linked to government's restrictions, other instead are related to country-specific characteristics (such as population density, land morphology, level of pollution, social norms, etc.).

Figure 2. Average time lag of implementation since the first and the 100th cases



The vast majority of countries managed to implement the policies before the 100th case was observed. However, some countries reported critical delays. This occurred in the most affected countries, in particular in China and France. In the European area also Estonia registered a huge delay in the implementation of policies. The worst case however is Namibia, where policies entered into force 13 days after having observed the 100th case. Sub-Saharan Africa (SSA) instead reported the best results, with Uganda managing to execute the measures 2 months before registering the 100th case.

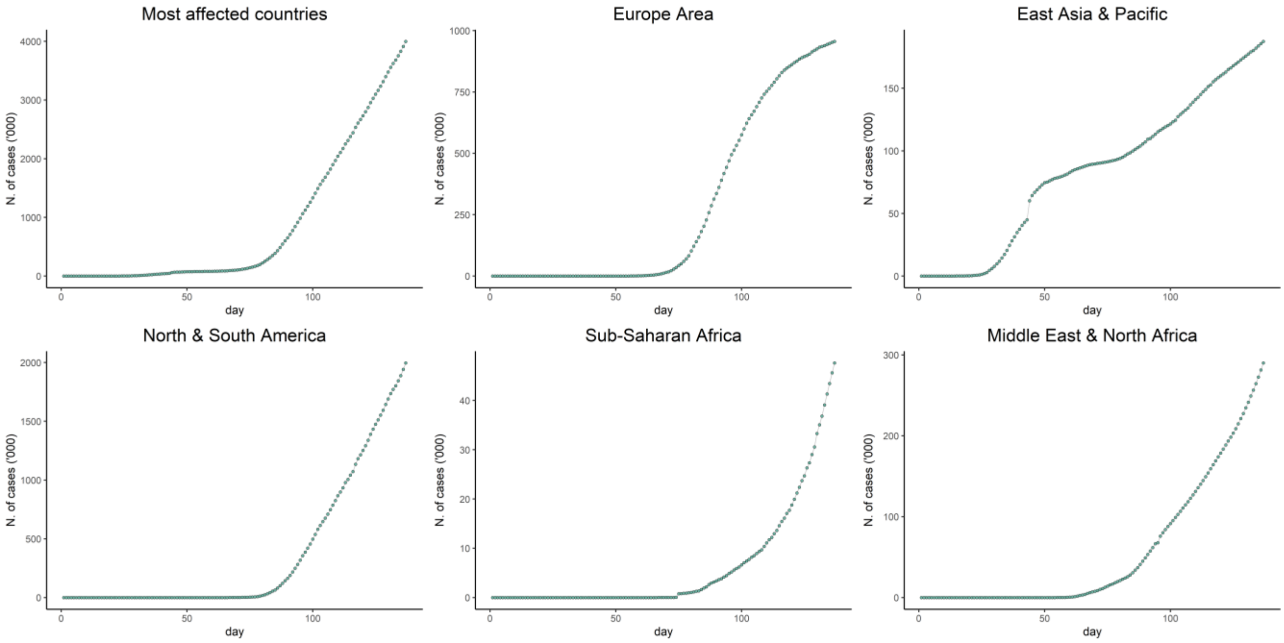
The policies considered so far could have different and opposite effects on the number of confirmed contagions. Indeed, the number of cases registered can variate in relation to different aspects. If the political governance does not put enough importance to the negative effects of the virus, the awareness among public opinion would be low, and little public effort would be put in testing and tracking new cases. Therefore, public information campaign, together with testing policy and contact tracing could increase the number of cases observed. On the other hand, movement restrictions, and in particular school and workplace closure and the requirements to stay at home, should positively impact in the reduction of confirmed cases. However, it is possible as well that results are mixed: school closure causes children to spend more time with parents and relatives, increasing the possibility of contagion within the family. The same can occur with the requirements to stay at home and the closure of workplaces. Restrictions on gatherings, public transportations and travels, both domestic and internationals, should have a clearer path on the sign of the effect.

Although some hypotheses on the effects of these policies can be formulated, evidence on the real effect and on the magnitude of each measure is still scarce. Since different mechanisms can intervene in mitigating or strengthening the impact of the policies, in section 4 an econometric analysis is undertaken to estimate the effect of policy restrictions on caseloads in a more rigorous way.

3.1. COVID-19 trajectories

To understand the spread of COVID-19, the pandemic is more usefully viewed as a series of distinct local epidemics. The way the virus has spread in different countries, and even in particular states or regions within them, has been quite heterogeneous. To better gauge such differences, Figure 4 compares the COVID-19 caseloads trajectories across geographic regions along with a group including the most affected countries (i.e. those reporting more than 25000 cases; See Appendix 1 for additional details on countries and groups). On 15-May 2020 the most affected countries show a linear positive trend, with a steep slope. A similar trend can be observed in the Americas, reaching 2 million of confirmed cases. An encouraging trend is the one observed in Europe, where the curve has started to flatten, suggesting an inverted U-shaped curve. In East Asia and Pacific (EAP) the curve started to have a linear trend after that China managed to contain the spread of the contagion. The most warrying figure concerns SSA, that shows now an exponential increase. Although the number of cases in this region is still low compared to other country groups, this trend suggests alarming future scenarios, if proper measures to contain the virus are not implemented on time.

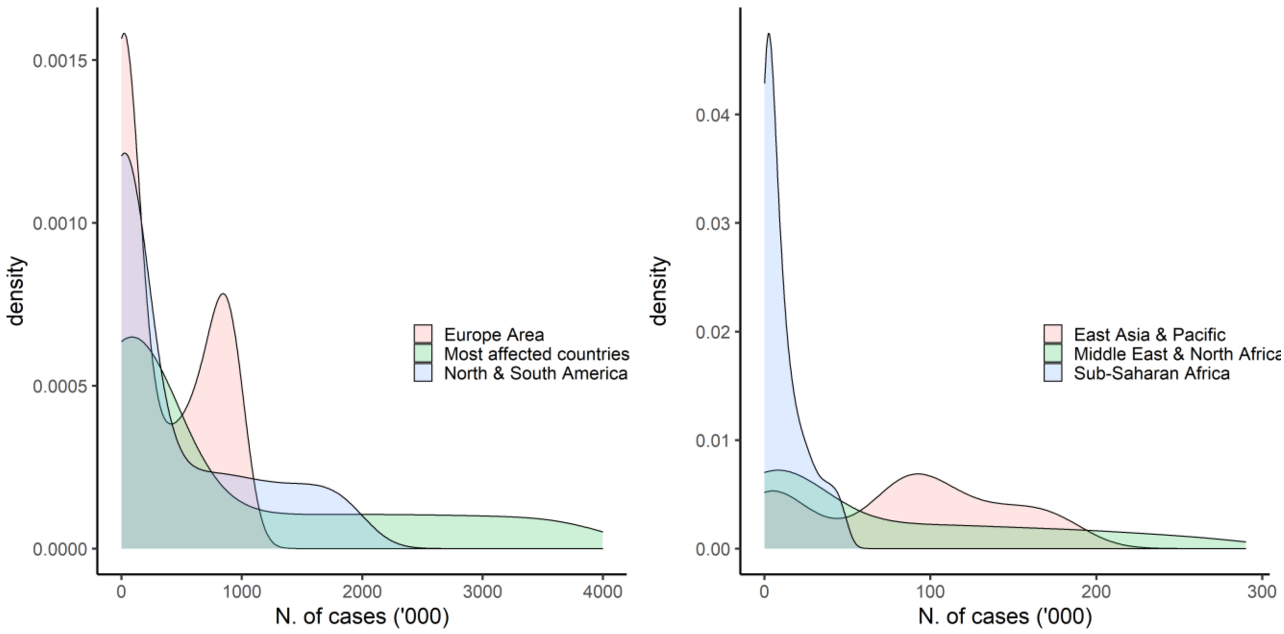
Figure 4. Trends of confirmed cases over time



Note: Data ranges from 01-Jan 2020 to 15-May 2020. Y axis has different ranges in each graph, to facilitate the visual interpretation.

As mentioned above, SSA registered few cases of COVID-19 during the period analyzed. This is illustrated in Figure 5, where the density of the total cases observed every day is reported by country groups. All groups show a more or less skewed distribution, with the peak of the distribution varying considerably between regions. In SSA for instance the peak is very high, meaning that cases are concentrated around very small numbers. EAP and Middle East and North Africa (MENA) show instead a smoother distribution with a long tail on the right. Asian countries report two peaks, one around zero and the other around 100,000 cases, but the curve falls more quickly to zero than for MENA region. In the European area the distribution reports two peaks, suggesting two waves of contagion. The concentration of cases in the left-hand graph is much lower, but the tail is much longer, reaching the 4 million of cases by the group composed by the most affected countries. North and South America report a constant concentration of cases until 2 million, where the curve then starts to decrease to zero.

Figure 5. Density plot of confirmed cases by country groups



4. Empirical Approach

4.1. Econometric model

Our sample is formed by 166 countries with daily data ranging from 01-Jan 2020 to 15-May 2020. In this section, we empirically test the effect of 11 different types of policy interventions on the evolution of the pandemic, proxied by the change in COVID-19 cases. We expect the number of caseloads count to be exogenously determined by the implementation of the mitigation measures.

The dependent variable is represented by the (logged) number of COVID-19 cases reported every day by each country. As shown in Figure 4 the COVID-19 cases in levels look non-stationary and present an irregular pattern. The presence of unit root in a panel data can lead to biased estimates due to spurious correlations, hence we perform a set of tests to ascertain if the panel contains unit root. Unit root tests consider country cross sectional dependence (Breitung and Das, 2005). The common pandemic shock tends to cause dependence among the units in the panel even though their impacts might not be uniform across the cross-section units. Results in Table 1 confirm that the panel is I(1) (i.e. integrated of order unity) and therefore the differencing transformation of the COVID-19 caseloads was incorporated as a useful approach to stabilize the original time series.

Table 1. Panel Unit Root test under cross sectional dependence.

	Levels		First Difference			
Country group	Lambda	pval	Lambda	pval	N	N Countries
MAC	6.38	0.99	-33.46	0.00	3640	28
EUR	7.50	0.98	-16.83	0.00	2080	16
EAP	7.02	1.00	-24.19	0.00	2730	21
NSA	9.06	1.00	-30.97	0.00	4030	31
SSA	12.74	1.00	-39.81	0.00	5200	40
MENA	6.64	1.00	-24.77	0.00	2600	20
HIC	11.95	1.00	-36.24	0.00	7280	56
LIC	10.69	1.00	-30.27	0.00	3120	24

The proposed effects of government interventions on the epidemic are tested using pooled OLS approach corrected for cross sectional dependence (POLS-CSD) the following specification:

$$\Delta COVID19cases_{it} = \beta_0 + \beta_1 Intervention_{it-l} + \beta_2 Z_{it} + \tau_t + \epsilon_{it} \quad (1)$$

Given that the median COVID-19 incubation period is estimated to be in 5.1 days and 97.5% of those who develop symptoms do so within 11.5 days (CI, 8.2 to 15.6 days) (Lauer et al. 2020; ECDC 2020; WHO 2020) it is appropriate to assume that an $Intervention_{it-k}$ issued at day $t = 0$ in country i is likely to impact starting from the first week. The intervention variables embed the different OxCGRT containment measures as reported in Table A.2 in Appendix. Those measures are included one at a time using two separate time lags, $l = 7$ and $l = 14$ days, to account for both short- and medium-term effects. We expect the mitigation measures to have more robust effects after 14 days. Since panel data introduce a substantial amount of unobserved heterogeneity we introduce a vector of controls Z that includes three demographic and economic time invariant confounders updated to the last year available: log of GDP per capita (in constant 2010 USD), the log of population density and the share of people over 65 years old living in the country (World Development Indicators). GDP per capita is used as a proxy for the country wealth status and therefore the potential capacity of the health system to detect and treat COVID-19 cases. Population density measures the degree of urbanization of a country, which is relevant in the COVID-19 setting as high population densities are found to catalyze the spread of the virus (Rocklov and Sjodin, 2020). Advanced aging is also a factor affecting the spread of COVID-19. Elder patients with high comorbidities and high frailty status are those who are more at risk of developing severe features of the COVID-19 and therefore are those more likely to be tested (Wang et al. 2020). These three variables are time invariant with respect to the time dimension (in days) we use for this analysis To purge the data from time trend we include daily dummy variables τ_t.

With large N and large T the estimates will suffer from both cross-sectional and temporal dependencies. Assuming the cross-sectional independence is generally inappropriate as neighborhood effects clearly indicate that panel datasets tend to exhibit mutual dependence between the cross-sectional units. Ignoring such interdependence in panel regression may lead to estimate too optimistic standard errors. To overcome this issue we estimate Eqn. (1) correcting the standard errors using the Driscoll and Kraay (1998) nonparametric covariance matrix estimator (Hoechle 2007). The Driscoll and Kraay (1998) correction produces heteroskedasticity- and autocorrelation-consistent standard errors, therefore accounting for possible spatial dependence in the residuals.

4.2. Empirical Results

Table 2 shows the results of the pooled sample for containment measures. We analyze the effect of each intervention separately, with a lag of 7 (panel A) or 14 (panel B) days. We find that containment measures are generally effective, even when adding controls to the equation. Effects are stronger after a 14 days lag, as expected. In particular, stay at home policies become effective only after 14 days, while school and workplace closure seem to be effective even after 7 days, if to a lower degree. The only measure that does not seem to have a significant impact is transport control. Measures are effective depending on their actual implementation on the ground: in particular, transport restriction may be subject to several exception to ensure the continuation of basic services, and therefore rendered less relevant. Controls have the expected sign: GDP is associated positively with COVID-19 cases, as the first and hardest hit countries have mostly been HICs, as well as the share population over 65. We find that population density doesn't seem play a role in the rate of new cases. However, it is possible that the implementation of containment measures counteracts the effect that density would have had in a null scenario (i.e. no containment measures).

Table 3 shows the impact of travel bans, public information campaigns, testing, and tracking policies. Ban on domestic travel is effective in reducing the number of reported cases, while international travel bans don't seem to have an effect, both at 7 and 14 days lag. Public information, testing and tracing all have positive effects: the latter two are expected to have a positive relationship with the number of cases recorded, showing that these particular policies are effective in tracking the spread of the virus. While the result for information campaign can seem counterintuitive, it can also be read as a proxy of government commitment, and more public awareness can lead more people to report symptoms and, therefore, be tested, thus leading indirectly to an increase in recorded cases.

Table 2. Impact of containment measures on COVID-19 caseloads. POLS-CSD. World level.

	School		Work		Events		Gatherings		Transport		StayHome	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Panel A. 7 days lag												
$Intervention_{t-7}$	-0.011*	-0.020***	-0.012***	-0.023***	-0.000	-0.009	-0.004	-0.009*	0.006	0.004	0.001	-0.007*
	[-1.83]	[-2.96]	[-2.90]	[-3.91]	[-0.03]	[-1.52]	[-1.01]	[-1.74]	[1.43]	[0.85]	[0.15]	[-1.67]
Ln GDP pc (2010 Constant USD)		0.006**		0.006***		0.005**		0.005**		0.005**		0.005**
		[2.55]		[2.63]		[2.47]		[2.48]		[2.41]		[2.44]
ln Population Density		0.002		0.001		0.001		0.001		0.001		0.001
		[1.60]		[1.38]		[1.40]		[1.13]		[1.10]		[1.32]
ln Share of people over 65		0.006*		0.006*		0.006*		0.006*		0.006*		0.006*
		[1.74]		[1.89]		[1.73]		[1.74]		[1.74]		[1.78]
Constant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	18942	18942	18942	18942	18942	18942	18942	18942	18942	18942	18942	18942
r2	0.129	0.135	0.130	0.136	0.129	0.135	0.129	0.135	0.129	0.134	0.129	0.135
Panel B. 14 days lag												
$Intervention_{t-14}$	-0.019***	-0.028***	-0.018***	-0.029***	-0.017***	-0.027***	-0.005	-0.010*	0.003	0.001	-0.011***	-0.020***
	[-2.90]	[-3.83]	[-3.57]	[-4.17]	[-2.93]	[-3.57]	[-1.26]	[-1.93]	[0.99]	[0.18]	[-2.96]	[-3.82]
Ln GDP pc (2010 Const. USD)		0.006***		0.006***		0.006**		0.006**		0.006**		0.006**
		[2.63]		[2.67]		[2.57]		[2.47]		[2.43]		[2.48]
ln Population Density		0.002*		0.002		0.002*		0.001		0.001		0.002
		[1.70]		[1.42]		[1.73]		[1.14]		[1.15]		[1.54]
ln Share of people over 65		0.006*		0.007*		0.006*		0.006*		0.006*		0.007*
		[1.75]		[1.92]		[1.78]		[1.75]		[1.73]		[1.94]
Constant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	17864	17864	17864	17864	17864	17864	17864	17864	17864	17864	17864	17864
r2	0.123	0.129	0.123	0.130	0.123	0.129	0.122	0.128	0.122	0.128	0.123	0.129

Asterisks denote different levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.Time fixed effects included.

Table 3. Impact of travel bans, info campaigns, testing and tracing policies issues on COVID-19 caseloads. POLS-CSD. World level

	Domestic		International		PublicInfo		Testing		Tracing	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Panel A. 7 days lag										
$Intervention_{t-7}$	-0.011**	-0.016**	0.001	-0.001	0.021***	0.016***	0.038***	0.031***	0.029***	0.023***
	[-2.17]	[-2.59]	[0.14]	[-0.13]	[4.49]	[3.77]	[6.73]	[6.72]	[4.07]	[4.05]
Ln GDP pc (2010 Constant USD)		0.005**		0.005**		0.005**		0.004*		0.004**
		[2.45]		[2.39]		[2.25]		[1.86]		[1.99]
ln Population Density		0.001		0.001		0.001		-0.000		0.000
		[1.09]		[1.22]		[0.62]		[-0.04]		[0.39]
ln Share of people over 65		0.006*		0.006*		0.006*		0.004		0.006*
		[1.83]		[1.78]		[1.81]		[1.38]		[1.79]
Constant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	18942	18942	18942	18942	18942	18942	18942	18942	18942	18942
r2	0.130	0.135	0.129	0.134	0.131	0.136	0.136	0.139	0.134	0.137
Panel B. 14 days lag										
$Intervention_{t-14}$	-0.012**	-0.017***	0.003	0.001	0.013***	0.008*	0.027***	0.019***	0.015***	0.008*
	[-2.28]	[-2.84]	[0.56]	[0.22]	[3.18]	[1.90]	[5.41]	[4.30]	[2.90]	[1.89]
Ln GDP pc (2010 Constant USD)		0.006**		0.006**		0.005**		0.005**		0.005**
		[2.46]		[2.39]		[2.34]		[2.09]		[2.29]
ln Population Density		0.001		0.001		0.001		0.001		0.001
		[1.11]		[1.14]		[0.95]		[0.45]		[0.93]
ln Share of people over 65		0.007*		0.006*		0.006*		0.005		0.006*
		[1.86]		[1.79]		[1.77]		[1.51]		[1.75]
Constant	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	17864	17864	17864	17864	17864	17864	17864	17864	17864	17864
r2	0.123	0.128	0.122	0.128	0.123	0.128	0.126	0.129	0.123	0.128

Asterisks denote different levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.Time fixed effects included.

The next three tables (4, 5, 6) report the same results dividing the countries between HICs and LICs. While the majority of confinement measures, with the exception of transport restriction, are effective in HICs, especially with a 14 days lag, the picture is more mixed in LICs. Workplace closure and stay at home orders seem to be effective in reducing the caseloads, however school closure and the banning of public events and gatherings are not. The banning of domestic travel appears to also be effective in low-income countries, with a lag of 14 days. Part of these heterogenous results are arguably due to the low number of cases reported in general in LICs: this is in part a testament itself of the fact that preventive action, as taken for example in many SSA countries, has been effective in slowing infections. However, a substantial part of the effectiveness of a measure comes from the actual implementation. Strict measures may be strict only on paper if there is no enforcement or they are impossible to put into practice. In the context of many LICs some measures can be less effective due to structural vulnerabilities: lack of adequate infrastructure, for example, can prevent adequate hygiene practices, and housing may not offer adequate distancing of family members.

Table 4. Heterogeneous impact of containment measures by Income group. POLS-CSD.

	School		Work		Events		Gatherings	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - High Income Countries								
$Intervention_{t-7}$	-0.046***		-0.017		-0.037***		-0.007	
	[-3.62]		[-1.53]		[-3.15]		[-0.83]	
$Intervention_{t-14}$		-0.041***		-0.036***		-0.055***		-0.025***
		[-2.80]		[-3.02]		[-4.00]		[-3.56]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES
Observations	6273	5916	6273	5916	6273	5916	6273	5916
r2	0.214	0.205	0.211	0.204	0.213	0.207	0.210	0.203
Panel B - Low Income Countries								
$Intervention_{t-7}$	-0.019		-0.016**		0.029		-0.015	
	[-1.12]		[-2.23]		[1.44]		[-0.62]	
$Intervention_{t-14}$		-0.014		-0.014**		0.011		0.011
		[-1.05]		[-2.19]		[0.78]		[0.82]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2706	2552	2706	2552	2706	2552	2706	2552
r2	0.167	0.162	0.166	0.162	0.167	0.162	0.166	0.162

Asterisks denote different levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.

Table 5. Heterogeneous impact of containment measures by Income group. POLS-CSD.

	Transport		StayHome		Domestic		International	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A - High Income Countries								
$Intervention_{t-7}$	-0.017*		-0.007		-0.008		-0.003	
	[-1.96]		[-0.73]		[-0.53]		[-0.29]	
$Intervention_{t-14}$		0.001		-0.018**		-0.000		-0.009
		[0.41]		[-2.59]		[-0.01]		[-0.66]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES
Observations	6273	5916	6273	5916	6273	5916	6273	5916
r2	0.210	0.202	0.210	0.203	0.210	0.202	0.210	0.202
Panel B - Low Income Countries								
$Intervention_{t-7}$	0.007		0.000		-0.004		-0.007	
	[1.33]		[0.06]		[-0.43]		[-0.52]	
$Intervention_{t-14}$		-0.010		-0.019**		-0.027**		0.006
		[-1.16]		[-2.47]		[-2.51]		[0.55]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES	YES	YES
Observations	2706	2552	2706	2552	2706	2552	2706	2552
r2	0.167	0.162	0.167	0.163	0.167	0.164	0.167	0.162

Asterisks denote different levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.

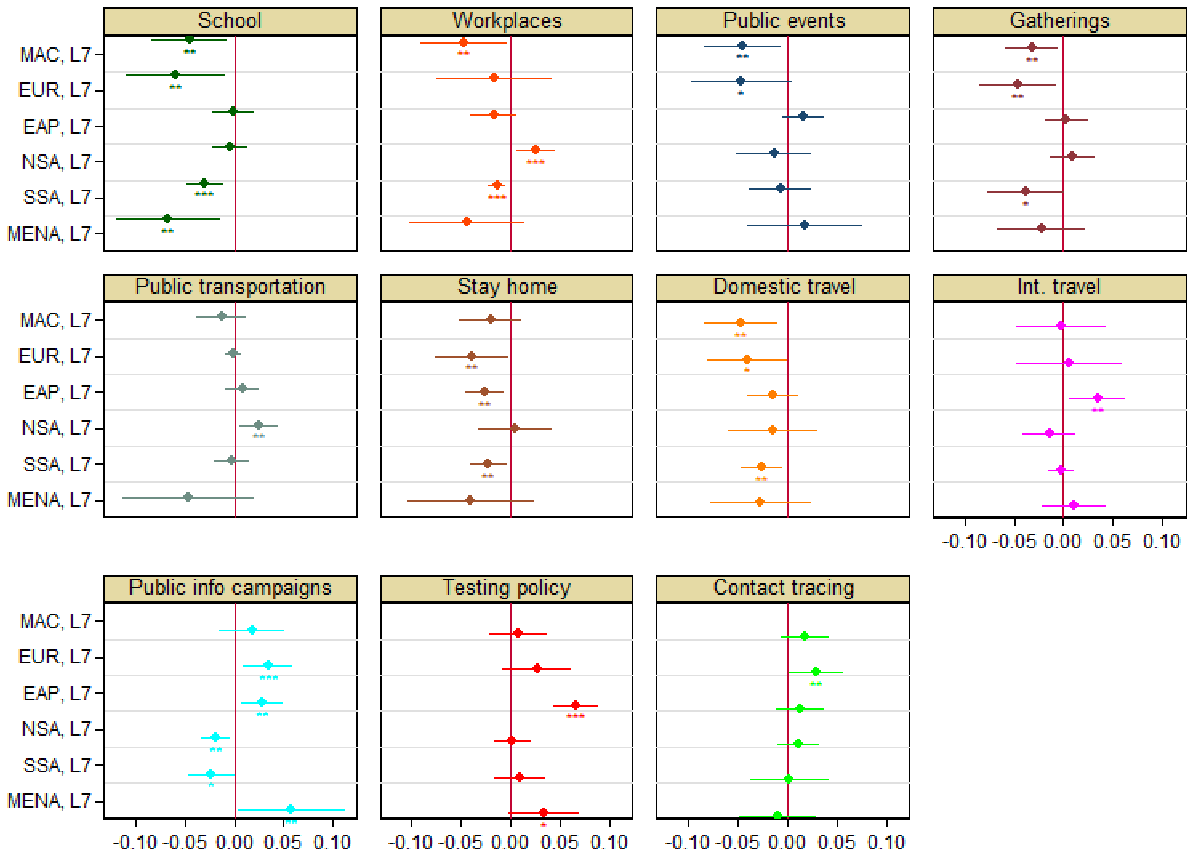
Table 6. Heterogeneous impact of containment measures by Income group. POLS-CSD.

	PublicInfo		Testing		Tracing	
	(1)	(2)	(3)	(4)	(1)	(2)
Panel A - High Income Countries						
$Intervention_{t-7}$	0.018*		0.029***		0.013	
	[1.86]		[2.80]		[1.49]	
$Intervention_{t-14}$		0.007		0.019*		-0.004
		[0.63]		[1.72]		[-0.52]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES
Observations	6273	5916	6273	5916	6273	5916
r2	0.211	0.202	0.214	0.203	0.214	0.202
Panel B - Low Income Countries						
$Intervention_{t-7}$	-0.008		0.023*		0.014	
	[-0.87]		[1.78]		[0.56]	
$Intervention_{t-14}$		-0.015		0.016		-0.025**
		[-1.33]		[1.12]		[-2.40]
Socioeconomic Controls	YES	YES	YES	YES	YES	YES
Time trend	YES	YES	YES	YES	YES	YES
Observations	2706	2552	2706	2552	2706	2552
r2	0.166	0.163	0.169	0.163	0.167	0.163

Asterisks denote different levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.

Finally, we look at how the different policies act in different world regions. We analyze again both the 7 days (Figure 6) and 14 days (Figure 7) lags. The most effective measures in the short run appear to be school closure, stay at home orders, and ban on domestic travel. School closure in particular appears to be strongly effective even in the short run in the most affected countries (MAC), the European, SSA, and MENA regions. The ban on public events and gatherings prove effective for MACs and European countries. Among the other measures, testing policy has a strong impact on the number of cases in EAP, capturing the effect of the strong effort put in place in many countries of the region in testing the population. Information campaigns seem to have a positive association with number of cases in European and east Asian countries, likely capturing the awareness effect. However, they appear to have a significant effect in reducing cases in SSA and the Americas (NSA). The latter region is the one with the most counterintuitive results. Given the strong heterogeneity of the region, it is hard to pinpoint the exact pathway for these results: there could easily be contrasting trends within the region, which includes big countries with very different policy approaches such as the US, Brazil, Canada, Argentina, Mexico. However, it is worth noting that the results do not seem to be driven by the US or Brazil, therefore posing a puzzle that would need further investigation.

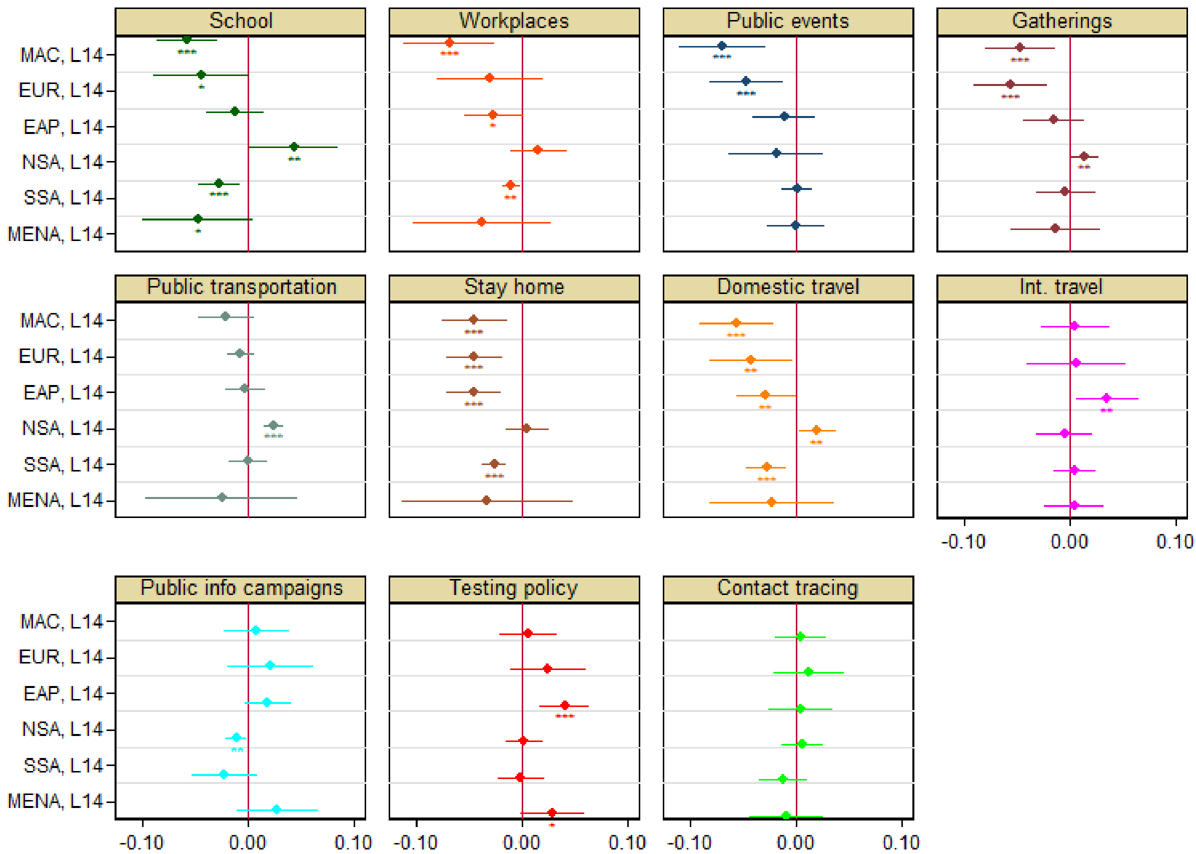
Figure 1. Heterogeneous impact of containment measures by region. POLS-CSD. 7 lags.



Note: Each marker represents the region-specific estimate COVID-19 infection growth for each 7-day lagged policy variable, whiskers represent 95%CI. Countries are grouped as follows: MAC= Most Affected Countries; EUR= Euro Area; EAP = East Asia and Pacific, NSA= North and South America, SSA= Sub Saharan Africa, MENA= Middle East North Africa. Asterisks denote different levels of significance: * p < 0.10, ** p < 0.05, *** p < 0.01. All regressions include socio – economic characteristics of the countries along with a time trend. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.

The 14 days lag analysis (fig. 7) confirms these results, with some effects becoming clearer and stronger: school and workplace closure, stay at home orders, and domestic travel ban all have strong negative effect on the growth of COVID-19 cases. In particular, we can notice that many results for SSA mimic the same results as for the most affected and European countries. From this analysis it appears that the preventive action taken by many SSA governments in 'importing' policies from HICs was justified and may have prevented a much worse scenario. However, the latest trend from the region does not appear to be equally encouraging (fig. 4): further investigation and action is needed to address the crisis in a way that can more strongly contain the spread of the virus.

Figure 7. Heterogeneous impact of containment measures by region. POLS-CSD. 14 lags.



Note: Each marker represents the region-specific estimate COVID-19 infection growth for each 14-day lagged policy variable, whiskers represent 95%CI. Countries are grouped as follows: MAC= Most Affected Countries; EUR= Euro Area; EAP = East Asia and Pacific, NSA= North and South America, SSA= Sub Saharan Africa, MENA= Middle East North Africa. Asterisks denote different levels of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Standard errors clustered at the community level. All regressions include socio – economic characteristics of the countries along with a time trend. Errors are corrected for cross-sectional dependence and heteroskedasticity using Driscoll and Kraay (1998) estimator.

5. Conclusions

In this paper we analyze the effect of different containment measures on the spread of the novel coronavirus (COVID-19) in 166 countries around the globe. We use a novel dataset that tracks on a daily basis measures implemented globally by each country (OxCGRT), and use it to perform a panel analysis on the variation in number of recorded COVID-19 caseloads. We analyze each measure separately, using both a 7 and 14 days lags. We look at the global effect, and then by country income, comparing high-income with low-income countries; finally, we look at different world regions.

We find that confinement measures are generally effective, especially school closure and stay at home orders. However, the effect differs by income level: in LICs fewer measures are effective. This may be in part due to the lower number of cases (most affected countries are mostly high-income countries) and in part by the fact that measures may not be adequate to the context.

We further investigate this by dividing countries into regions. We find strong evidence of the effect of confinement measures in European and most affected countries, as well as in MENA and SSA regions. It appears that, especially in SSA, containment measures such as school closure and stay at home orders have been effective in preventing the spread of the virus. However the latest trends coming from SSA are worrying: although the preventive action of government may have been crucial in avoiding a first wave of infection, further and most context specific measures may be needed in order to address the specific obstacles and vulnerabilities of each country. Institutional and infrastructural problems may prevent measures from being fully effective: from the access to adequate hygiene, to reaching remote populations. Lessons from previous epidemic should be taken into account when designing and implementing policies in these contexts.

The paper has several limitations: first, the number of cases, lacking a widespread testing of the population, is somewhat endogenous to testing policies and availability and to the severity of the crisis. The presence of asymptomatic cases and the availability of testing makes the official cases likely to be an underestimation of the true number. This is likely to be particularly true in LICs, where health systems have fewer means and population may be more difficult to reach. Second, the econometric model could suffer of omitted variable bias, and policies could be endogenous to the number of cases, to some extent. However, we argue that our results still provide a reliable indication of the effectiveness of the policies put in place.

Containment measures are costly, and they will cause a global economic slowdown, much of which will be felt by the most vulnerable and poor groups and countries. It is therefore imperative to understand if these measures are being effective in slowing down the infection. Our evidence seems to confirm that they are, indeed, able to decrease the growth of new cases.

Much of the attention of the research community towards LICs has pointed towards the economic consequences of the preventive measures. However, the impact of the pandemic itself could be equally, if not more, devastating to LICs economies. These results confirm the importance of taking preventive action, especially in fragile contexts.
However, further investigation is needed to disentangle the pathway of the effect in different settings: the latest trends coming from SSA are worrying, and we need to understand why it is so. More evidence is needed to make sure policies address the systemic obstacles that prevent these measures from being effective, and what other complementary action should be taken.

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Annex A

Table A.1 – Country groups

High Income Countries		Low Income	Most Affected Countries	Euro Area	East Asia and Pacific	North and South America	Sub Saharan Africa	Middle East & North Africa
HIC		LIC	MAC	EUR	EAP	NSA	SSA	MENA
Andorra	Japan	Afghanistan	Belarus	Austria	Australia	Argentina	Angola	Algeria
Aruba	Kuwait	Benin	Belgium	Belgium	Brunei	Aruba	Benin	Bahrain
Australia	Luxembourg	Burkina Faso	Brazil	Cyprus	China	Barbados	Botswana	Djibouti
Austria	Macao	Burundi	Canada	Estonia	Guam	Belize	Burkina Faso	Egypt
Bahrain	Netherlands	Central African Republic	Chile	Finland	Hong Kong	Bermuda	Burundi	Iran
Barbados	New Zealand	Chad	China	France	Indonesia	Bolivia	Cameroon	Iraq
Belgium	Norway	Dem. Republic of Congo	Ecuador	Germany	Japan	Brazil	Cape Verde	Israel
Bermuda	Oman	Ethiopia	France	Greece	Laos	Canada	Central African Republic	Jordan
Brunei	Poland	Gambia	Germany	Ireland	Macao	Chile	Chad	Kuwait
Canada	Portugal	Liberia	India	Italy	Malaysia	Colombia	Congo	Lebanon
Chile	Puerto Rico	Madagascar	Iran	Luxembourg	Mongolia	Costa Rica	Cote d'Ivoire	Libya
Croatia	Qatar	Malawi	Italy	Netherlands	Myanmar	Cuba	Dem. Republic of Congo	Morocco
Cyprus	San Marino	Mali	Mexico	Portugal	New Zealand	Dominica	Eswatini	Oman
Czech Republic	Saudi Arabia	Mozambique	Netherlands	Slovak Republic	Papua New Guinea	Dominican Republic	Ethiopia	Palestine
Denmark	Seychelles	Nepal	Pakistan	Slovenia	Philippines	Ecuador	Gabon	Qatar
Estonia	Singapore	Niger	Peru	Spain	Singapore	El Salvador	Gambia	Saudi Arabia
Finland	Slovak Republic	Rwanda	Portugal		Solomon Islands	Guatemala	Ghana	Syria
France	Slovenia	Senegal	Qatar		South Korea	Guyana	Kenya	Tunisia
Germany	South Korea	Sierra Leone	Russia		Taiwan	Honduras	Lesotho	United Arab Emirates
Greece	Spain	Somalia	Saudi Arabia		Thailand	Jamaica	Liberia	Yemen
Greenland	Sweden	South Sudan	Singapore		Vietnam	Mexico	Madagascar	
Guam	Switzerland	Tanzania	Spain			Nicaragua	Malawi	
Hong Kong	Taiwan	Uganda	Sweden			Panama	Mali	
Hungary	Trinidad and Tobago	Zimbabwe	Switzerland			Paraguay	Mauritania	
Iceland	United Arab Emirates		Turkey			Peru	Mauritius	
Ireland	United Kingdom		United Kingdom			Puerto Rico	Mozambique	
Israel	United States		United States			Suriname	Namibia	
Italy	Uruguay					Trinidad and Tobago	Niger	
						United States	Nigeria	
						Uruguay	Rwanda	
						Venezuela	Senegal	
							Sierra Leone	
							Somalia	
							South Africa	
							South Sudan	
							Sudan	
							Tanzania	
							Uganda	
							Zambia	
							Zimbabwe	
7280		3120	3510	2240	2940	4340	5460	2800

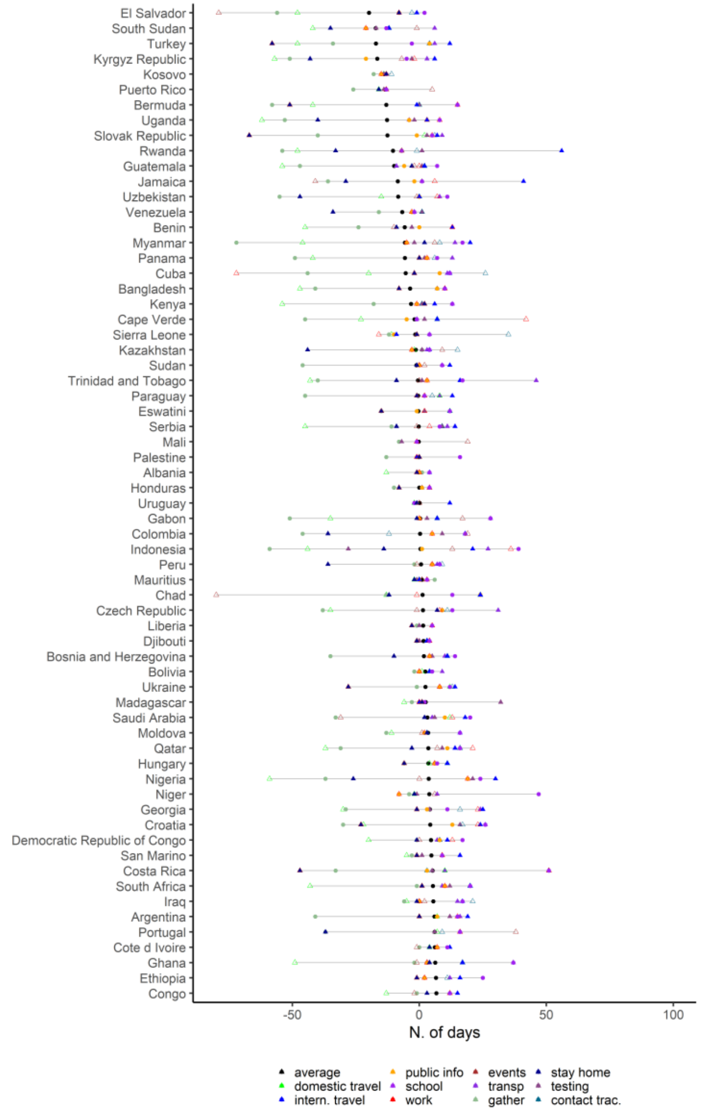
Table A.2 – Summary statistics

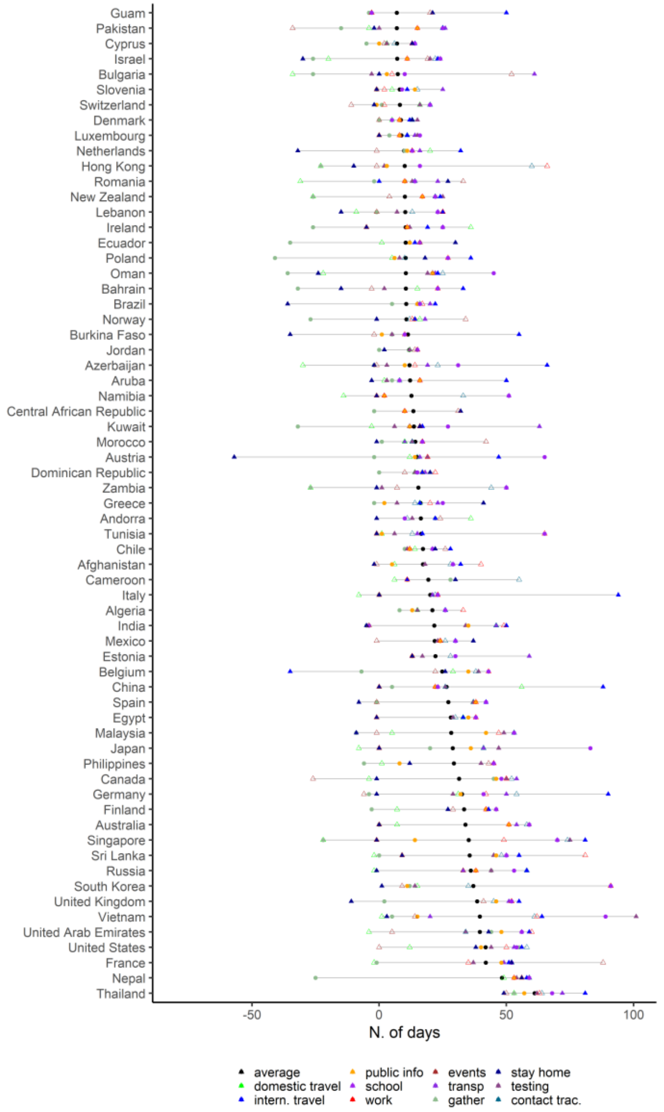
Variable	**Obs.**	**Mean**	**Std. Dev.**
Low income countries			
School closing	3,360	0.38	0.49
Workplace closing	3,360	0.24	0.43
Cancel public events	3,360	0.39	0.49
Restrictions on gathering size	3,360	0.38	0.49
Close public transport	3,360	0.21	0.40
Stay at home requirements	3,360	0.26	0.44
Restrictions on domestic travels	3,360	0.29	0.45
Restrictions on international travels	3,360	0.51	0.50
Public information campaign	3,360	0.56	0.50
Testing policy	3,360	0.41	0.49
Contact tracing	3,360	0.36	0.48
Max n. cases	3,331	766	1293
GDP per capita (in constant 2010 US$)	3,220	6.48	0.43
Pop. density	3,220	114.65	126.89
Over65 (% of total pop.)	3,360	2.93	0.69
High income countries			
School closing	7,840	0.47	0.50
Workplace closing	7,840	0.42	0.49
Cancel public events	7,840	0.48	0.50
Restrictions on gathering size	7,840	0.40	0.49
Close public transport	7,840	0.28	0.45
Stay at home requirements	7,840	0.37	0.48
Restrictions on domestic travels	7,840	0.36	0.48
Restrictions on international travels	7,840	0.59	0.49
Public information campaign	7,840	0.68	0.47
Testing policy	7,840	0.61	0.49
Contact tracing	7,840	0.56	0.50
Max. n. cases	7,773	55486	198409
GDP per capita (in constant 2010 US$)	7,700	10.48	0.53
Pop. density	7,700	871.83	3051.34
Over65 (% of total pop.)	7,140	15.01	6.20
Most affected countries			
School closing	3,755	0.48	0.50
Workplace closing	3,755	0.43	0.50
Cancel public events	3,755	0.47	0.50
Restrictions on gathering size	3,755	0.43	0.50
Close public transport	3,755	0.30	0.46
Stay at home requirements	3,755	0.43	0.49
Restrictions on domestic travels	3,755	0.44	0.50
Restrictions on international travels	3,755	0.57	0.49
Public information campaign	3,755	0.65	0.48
Testing policy	3,755	0.64	0.48
Contact tracing	3,755	0.61	0.49

Max. n. cases	3,755	150705	268767
GDP per capita (in constant 2010 US$)	3,755	9.87	1.09
Pop. density	3,755	431.87	1475.65
Over65 (% of total pop.)	3,755	13.28	6.34
Europe Area			
School closing	2,240	0.48	0.50
Workplace closing	2,240	0.45	0.50
Cancel public events	2,240	0.48	0.50
Restrictions on gathering size	2,240	0.47	0.50
Close public transport	2,240	0.34	0.47
Stay at home requirements	2,240	0.43	0.50
Restrictions on domestic travels	2,240	0.43	0.50
Restrictions on international travels	2,240	0.49	0.50
Public information campaign	2,240	0.67	0.47
Testing policy	2,240	0.63	0.48
Contact tracing	2,240	0.53	0.50
Max. n. cases	2,222	59928	80504
GDP per capita (in constant 2010 US$)	2,240	10.56	0.46
Pop. density	2,240	160.30	126.31
Over65 (% of total pop.)	2,240	18.91	2.90
East Asia and Pacific			
School closing	2,940	0.51	0.50
Workplace closing	2,940	0.42	0.49
Cancel public events	2,940	0.57	0.50
Restrictions on gathering size	2,940	0.35	0.48
Close public transport	2,940	0.20	0.40
Stay at home requirements	2,940	0.29	0.46
Restrictions on domestic travels	2,940	0.33	0.47
Restrictions on international travels	2,940	0.73	0.44
Public information campaign	2,940	0.78	0.42
Testing policy	2,940	0.63	0.48
Contact tracing	2,940	0.62	0.49
Max. n. cases	2,909	8986	18301
GDP per capita (in constant 2010 US$)	2,800	9.25	1.36
Pop. density	2,800	1923.21	4859.58
Over65 (% of total pop.)	2,800	9.78	5.93
Sub-Saharan Africa			
School closing	4,340	0.43	0.49
Workplace closing	4,340	0.39	0.49
Cancel public events	4,340	0.43	0.49
Restrictions on gathering size	4,340	0.37	0.48
Close public transport	4,340	0.28	0.45
Stay at home requirements	4,340	0.38	0.48
Restrictions on domestic travels	4,340	0.38	0.49
Restrictions on international travels	4,340	0.56	0.50
Public information campaign	4,340	0.62	0.49
Testing policy	4,340	0.53	0.50

Contact tracing	4,340	0.42	0.49
Max. n. cases	4,308	65823	259018
GDP per capita (in constant 2010 US$)	4,340	9.12	0.90
Pop. density	4,340	159.51	248.40
Over65 (% of total pop.)	4,060	9.65	3.95
North and South America			
School closing	5,600	0.40	0.49
Workplace closing	5,600	0.28	0.45
Cancel public events	5,600	0.40	0.49
Restrictions on gathering size	5,600	0.39	0.49
Close public transport	5,600	0.25	0.43
Stay at home requirements	5,600	0.29	0.45
Restrictions on domestic travels	5,600	0.32	0.47
Restrictions on international travels	5,600	0.57	0.50
Public information campaign	5,600	0.55	0.50
Testing policy	5,600	0.41	0.49
Contact tracing	5,600	0.36	0.48
Max. n. cases	5,549	1241	2477
GDP per capita (in constant 2010 US$)	5,460	7.18	0.96
Pop. density	5,320	104.65	137.18
Over65 (% of total pop.)	5,600	3.28	1.50
Middle East and North Africa			
School closing	2,800	0.48	0.50
Workplace closing	2,800	0.42	0.49
Cancel public events	2,800	0.46	0.50
Restrictions on gathering size	2,800	0.39	0.49
Close public transport	2,800	0.38	0.49
Stay at home requirements	2,800	0.37	0.48
Restrictions on domestic travels	2,800	0.40	0.49
Restrictions on international travels	2,800	0.53	0.50
Public information campaign	2,800	0.59	0.49
Testing policy	2,800	0.47	0.50
Contact tracing	2,800	0.39	0.49
Max. n. cases	2,774	14941	26878
GDP per capita (in constant 2010 US$)	2,520	9.04	1.16
Pop. density	2,800	260.44	452.52
Over65 (% of total pop.)	2,800	4.59	2.56

Figure A.1 – implementation of policy measures by country





Note: n. of days of each policy since the first case registered. Average n. of days is reported in black.

Figure A.2. Average time of implementation of measures form the 100th case