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Minimizing COVID-19 Transmission Cases: Do Policies and Institutions Matter?

Abstract

This paper examines the effects of institutional factors and government policy responses on COVID-19 infection cases. It applies the Random Effects and GMM estimation techniques to panel data to explore the relationship between COVID-19 cases on the one hand and institutions and government policy responses on the other. The paper finds that the nature and timing of policy responses matter and that institutions play a crucial role in explaining observed infection cases across countries. The results also indicate that high population density and previous experience with infectious diseases are important factors in explaining infection cases across countries. One of the policy implications of our findings is the importance of timely policy intervention at the national level in reducing infection cases. The findings also underscore the need to enhance coherence between health measures and socio-economic policies.

Key words: COVID-19 pandemic, Infection, GMM estimation, Institutions, Policies

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Acknowledgements

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1. Introduction

The World Health Organization (WHO) declared the coronavirus (COVID-19) disease a pandemic in March 2020. As of 26 May 2020, 5.59 million cases had been confirmed worldwide and 347,872 people had died. By 25 August 2021, the number of cases had increased exponentially to nearly 214 million and the number of deaths to 4.5 million. The United States is the most affected country with about 38 million confirmed cases and 630, 838 deaths as of 25 August 2021. The US figures represent 18 percent of the global cases and 14 percent of the global number of deaths. Developing countries, such as India and Brazil, have also been badly hit by the pandemic, with India recording about 33 million cases and 435,758 deaths and Brazil recording about 21 million cases and 575,742 deaths as of 25 August 2021.

The pandemic has a devasting impact on the global economy and is slowly reversing the gains in economic and social performance made by countries over the past few decades, with dire consequences for efforts to achieve the Sustainable Development Goals (SDGs) by the target date of 2030. We are expected to get through this pandemic, but life will never be the same and there are likely to be profound changes in the way businesses and governments operate. The crisis began as a health problem, but quickly metamorphosized into an economic turmoil with dire consequences for households, enterprises, and governments. With the recent discovery of highly effective vaccines by, among others, Pfizer-BioNtech, Moderna, Oxford-AstraZeneca, Johnson & Johnson, and Sinovac, the world is beginning to see a light at the end of the tunnel. Despite this breakthrough, there is still uncertainty regarding the duration of the pandemic given the increasing mutation of the virus and the fact that many developing countries still do not have access to adequate supplies of the vaccines. This pandemic is unique in the sense that it is a health crisis that has degenerated into a global socio-economic crisis. Its impact is significant, mounting, and likely to be with us for quite some time. It is also evident that the pandemic will have long-term socio-economic impact on poor and vulnerable countries, such as those in the least developed countries (LDCs), because of their weak health systems, crammed living conditions, and the lack of the human and financial capacities to respond and cushion the impact of the crisis on their economies (Kovacevic and Jahic, 2020).

Two main strands of literature have emerged since the onset of the pandemic. The first strand focuses on identifying the impact of the pandemic on macroeconomic variables of interest such as output growth, employment, poverty, and inequality. Many of these studies adopt a global, multi-sector computable general equilibrium framework calibrated to data to examine the effects of the pandemic on economies. For example, Bekkers et. al. (2020) examined the macroeconomic effects of COVID-19 on growth based on optimistic and pessimistic scenarios. In the optimistic scenario, economies are expected to experience a V-shaped recovery from the crises, while in the pessimistic scenario recovery is expected to be L-shaped. Based on the optimistic scenario, global growth declined by 4.8 percent in 2020 relative to the benchmark without pandemic and in the pessimistic scenario it declined by 11.1 percent. In the model, the pandemic affects economies through three channels: a reduction in labour supply arising from lockdowns; a reduction in demand and supply in specific sectors; and an increase in trade costs due to travel restrictions and border controls.

United Nations (2021) estimates that because of the pandemic global output fell by 4.3 percent in 2020, with wide variations across regions. In the developed economies, output is estimated to have declined by 5.6 percent and in the developing economies by 2.5 percent. While the magnitude of the decline in growth seems to be more in developed countries, within developing regions several countries experienced large declines in growth in 2020. In Maldives output growth declined by 20.4 percent, in Barbados by 16 percent, in Peru by 13 percent, in India by 9.6 percent, in the Philippines by 8.8 percent, in Botswana by 8.5 percent, and in Cabo Verde by 8.4 percent. Undoubtedly, these output losses have had dire consequences for employment, government revenue, and poverty. For example, ILO (2020) estimates that at the global level the crisis led to the loss of about 420 million full-time-equivalent jobs. Furthermore, Sumner et al (2020) show that the economic contraction associated with the pandemic could increase global poverty by as much as 420-580 million people in 2020 relative to 2018.

The second strand of literature on the pandemic examines factors behind the number of COVID-19 cases and deaths. Brown and Ravallion (2020) investigated the role of poverty, income inequality and other socioeconomic characteristics in explaining infection rates across counties in the United States. Eichenbaum, Rebelo and Trabandt (2020) examined the interaction between economic decisions and epidemics. Ellison (2020) showed that incorporating heterogeneity in the frequency with which different population groups engage in risky interactions into models is important to avoid biased estimates of the impact of containment measures.

This paper fits into the second strand of literature on the pandemic. It attempts to identify the role of key institutional factors and government policy responses in explaining COVID-19 infection cases across countries. The quality of healthcare systems, availability of social protection coverage, the degree of inequality and poverty, vulnerability to diseases, fiscal space and government responses are some of the factors that have been identified as possible explanations for the variations in infection and mortality rates across countries and regions. But the role of the quality and nature of institutions have not been integrated into the analysis. The paper fills this gap. It examines whether the quality and nature of institutions have implications for COVID-19 infection cases, which is important given the wide disparities in the number of cases observed across countries. For example, as of 25 August 2021, the US accounted for about 18 percent of global cases and 14 percent of deaths. Furthermore, India accounted for 15 percent of cases and 10 percent of deaths, while Brazil accounted for 10 percent of cases and 13 percent of deaths. These facts suggest that the causes of transmission may vary across countries and regions and should be integrated into the analyses to derive useful policy recommendations on how to contain the virus and build back better. In this context, the paper is an important contribution to the extant literature on the pandemic.

The paper adopts the Random fixed effects estimation as the baseline model and the Generalized Method of Moments (GMM) estimation is also employed to control for endogeneity effects in the estimation. The paper uses the Oxford COVID-19 Government Response Tracker (OxCGRT) database to capture the government policy responses to the COVID-19 pandemic. The key institutional variables used in the estimation are the economic and political risk indicators provided by the International Country Risk Guide (ICRG).

The main findings of the paper are as follows: First, the nature and timing of policy responses matter for mitigation of COVID-19 infections. In particular, policies are more effective when they are adopted early during the initial phases of the pandemic. Second, institutions play a crucial role in explaining observed infection cases across countries. The paper finds that countries characterized by high degrees of law and order and less internal conflicts tend to have lower infection cases. But it also finds that there are aspects of good institutions that can also increase infection cases. For example, having better bureaucratic quality (or good governance) in a country may also make it more challenging for the government to unilaterally impose restrictive measures needed to control the spread of the virus. Third, the paper finds that high population density increases the number of COVID-19 cases while previous experience with infectious diseases (such as tuberculosis) reduces it.

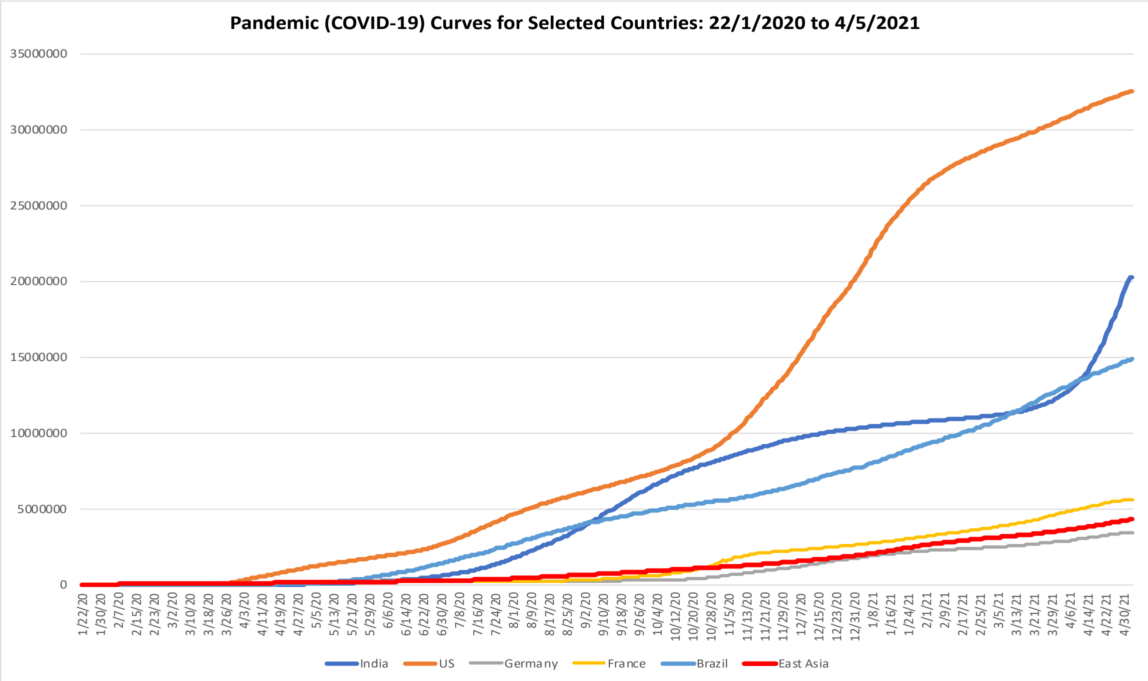
One of the policy implications of our findings is the importance of timely policy intervention at the national level in reducing infection cases. Another policy implication of our findings is the need to enhance coherence between health policy and socio-economic policies. The results of our study also underscore the importance of pre-existing health infrastructure and experience in dealing with infectious diseases (such as tuberculosis and HIV programmes) in reducing COVID-19 infection cases.

The paper is organized as follows. The next section highlights the differences in the COVID-19 pandemic cases across key countries and regions. Section 3 presents the institutional variables used in the estimation and discusses their relationship with the number of COVID-19 cases. The empirical framework adopted, and the results of the estimations performed are presented in Section 4. The policy conclusions are discussed in Section 5.

2. Trends in COVID-19 Cases for Selected Countries and Regions

At the onset of the COVID-19 crisis in the first half of 2020, most of the confirmed cases were in the developed world, particularly the United States and European countries. Since then, it has spread rapidly to the developing world, with India and Brazil being the most affected. Figure 1 presents the pandemic curve for selected countries and region. It shows the rising cases of COVID-19 pandemic in developing countries, such as Brazil and India, as developed countries are showing signs of mitigation against the pandemic. The cases in India have been increasing exponentially, since 1 March 2021, from 11.2 million on 1 March 2021 to nearly 20.2 million by 5 April 2021 and about 33 million by 25 August 2021. Similarly, in Brazil, the number of cases rose from 10.5 million on 1 March 2021 to 14.8 million by 5 April 2021 and about 21 million by 25 August 2021. Despite the recent increase in infection rates in some of the large developing countries, the United States is the still the leading country with the highest number of cases. However, it should be noted that the developed countries are showing signs of mitigating and flattening the pandemic curve with the number of cases falling in the United States and the pandemic curves for Germany, France, and East Asia flattening. The adoption of social isolation policies and the acceleration of vaccination programmes in developed countries seem to have contributed to the mitigation of the pandemic and thus flattening of their curves.

Figure 1. COVID-19 Pandemic Curve for Selected Countries



Source: Source: Johns Hopkins School of Public Health (2020), COVID-19 Pandemic. Novel Coronavirus (COVID-19) Cases Data. https://data.humdata.org/dataset/novel-coronavirus-2019-ncov-cases

The devastating effects of COVID-19 are clearly reflected in various forecasts of the impact on global and regional GDP. For example, the United Nations estimates that global output fell by 4.3 percent in 2020, while the World Bank estimates that global GDP fell by 3.5 percent in 2020 (World Bank, 2021). Table 1 shows the initial relief and stimulus packages provided by the respective selected countries to mitigate the negative impact on the economy, businesses, and workers (in the right-hand column).

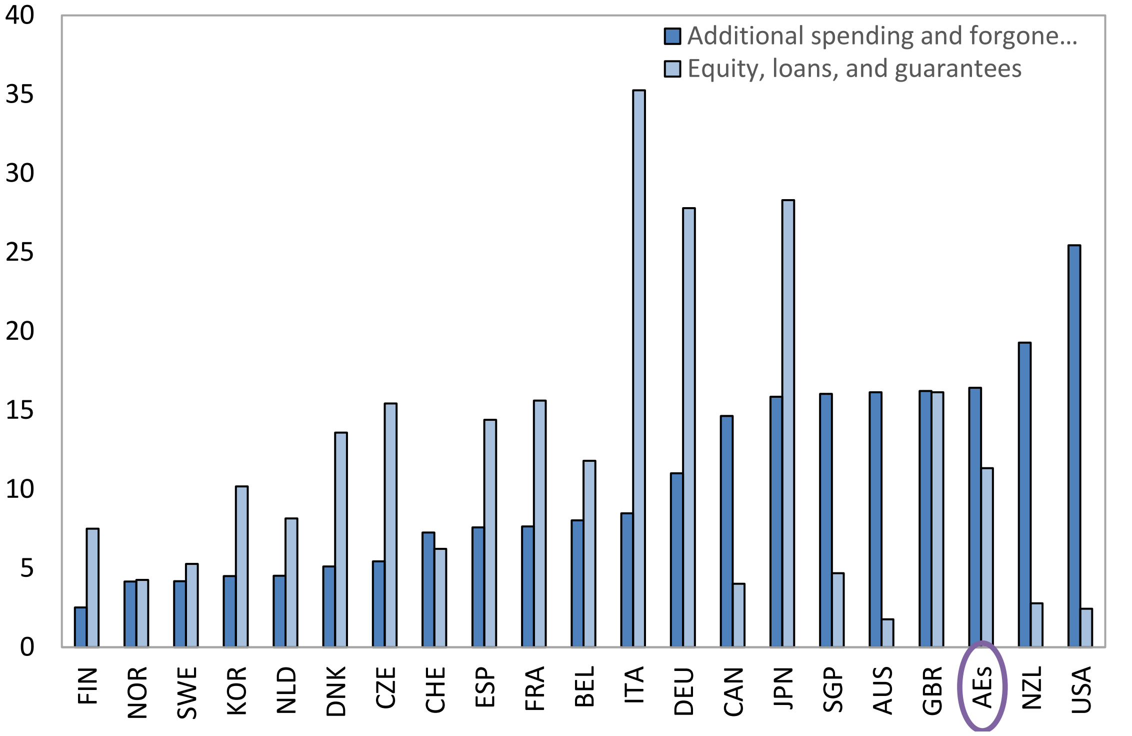
Table 1: Forecast of Impact of Global Pandemic (COVID-19) on Selected Countries' GDP in 2020 and Relief Packages

Countries	GDP (%)	Relief and Stimulus Packages*
Italy	–8.87	€25 billion (March 2020), €55 billion (May 2020), €25 billion (August 2020), €5.4 billion (October 2020), €72 billion (May 2021)
Australia	-0.28	A$312 billion (as of 1 July 2021)
Japan	–4.70	¥117 trillion (total second package) (7 April 2020), ¥117 trillion (May 2020), ¥73 trillion (December 2020)
Republic of Korea	–0.95	KRW 10.9 trillion (March 2020), KRW 14.3 trillion (April 2020), KRW 35.1 trillion (July 2020), KRW 71.1 trillion (July 2020), KRW 14.9 trillion (March 2021), KRW 33.3 trillion (July 2021)
France	–8.11	€180 billion (as of November 2020), €100 billion (2021 budget on recovery plan)
United States	–3.50	$2.20 trillion (26 March 2020)
Germany	–4.89	€156 billion (March 2020), €130 billion (June 2020), €60 billion (March 2021)
Indonesia	-2.07	IDR 579.8 trillion (in 2020)
China	2.30	RMB 4.9 trillion (as of 2020)
India	-7.96	INR 20 trillion ($267 billion) (Announced by PM on 12 May 2020)

COVID-19 = coronavirus disease, GDP = gross domestic product.
Notes: '$' refers to United States dollars, unless stated otherwise.
* The announcement date is shown in parentheses.
Sources: World Bank (2021) and the relief packages as reported at IMF COVID-19 Pandemic Policy Tracker (https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#S)

It is also interesting to observe that the level and amount of relief and stimulus packages provided by developed and developing countries differ significantly based on the macroeconomic and fiscal conditions of the respective countries. The discretionary fiscal response and loan guarantees by developed and developing countries (as of March 2021) are presented in figures 2A, 2B, and 2C below.

Figure 2A: Discretionary Fiscal Response by Developed Countries (% of GDP)



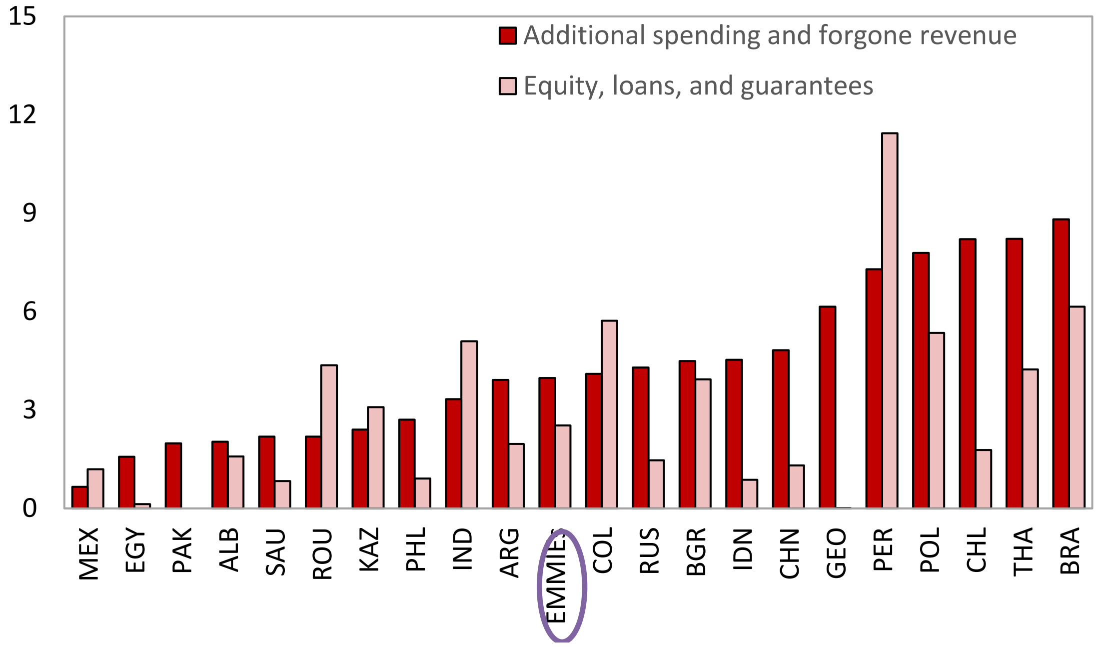
Sources: Database of Country Fiscal Measures in Response to the COVID-19 Pandemic; and IMF staff estimates.
Note: Estimates as of March 17, 2021. Numbers in U.S. dollar and percent of GDP are based on April 2021 World Economic Outlook Update unless otherwise stated. Country group averages are weighted by GDP in US dollars adjusted by purchasing power parity. Data labels use International Organization for Standardization country codes.[1] AEs = advanced economies
https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19

[1] Developed Countries (AEs = advanced economies): FIN=Finland, NOR=Norway, SWE=Sweden, KOR=South Korea, NLD=Netherlands, DNK=Denmark, CZE=Czech Republic, CHE=Switzerland, ESP=Spain, FRA=France, BEL=Belgium, ITA=Italy, DEU=Germany, CAN=Canada, JPN=Japan, SGP=Singapore, AUS=Australia, GBR=United Kingdom, NZL=New Zealand, US=United States

Developing Countries (EMMIEs = emerging market and middle-income economies): MEX=Mexico, EGY=Egypt, PAK=Pakistan, ALB=Albania, SAU=Saudi Arabia, ROU=Romania, KAZ=Kazakhstan, PHL=Philippines, IND=India, ARG=Argentina, COL=Columbia, RUS=Russian Federation, BGR=Bulgaria, IDN=Indonesia, CHN=China, GEO=Georgia, PER=Peru, POL=Poland, CHL=Chile, THA=Thailand, BRA=Brazil

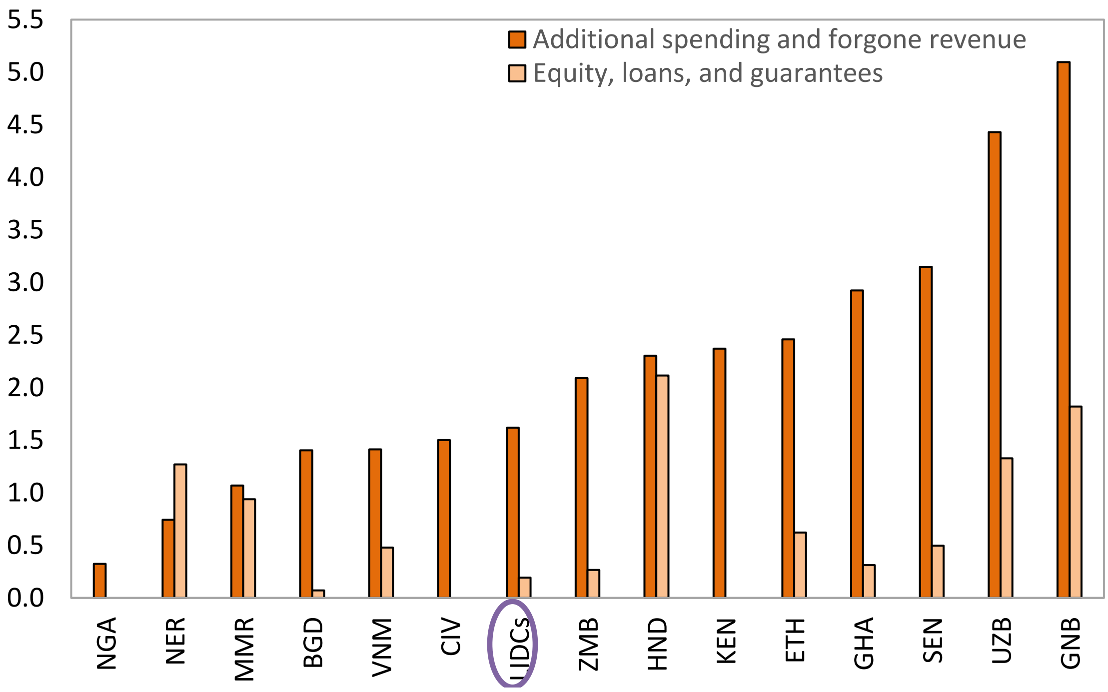
Less Developed Countries (Low and lower middle-income developing countries): NGA=Nigeria, NER=Niger, MMR=Myanmar, BGD=Bangladesh, VNM=Vietnam, CIV=Ivory Coast, ZMB=Zambia, HND=Honduras, KEN=Kenya, ETH=Ethiopia, GHA=Ghana, SEN=Senegal, UZB=Uzbekistan, GNB=Guinea-Bissau

Figure 2B: Discretionary Fiscal Response by Developing Countries (% of GDP)



Sources: Database of Country Fiscal Measures in Response to the COVID-19 Pandemic; and IMF staff estimates.
Note: Estimates as of March 17, 2021. Numbers in U.S. dollar and percent of GDP are based on April 2021 World Economic Outlook Update unless otherwise stated. Country group averages are weighted by GDP in US dollars adjusted by purchasing power parity. Data labels use International Organization for Standardization country codes (see footnote 1).
EMMIEs = emerging market and middle-income economies
https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19

Figure 2C: Discretionary Fiscal Spending by Less Developed Countries (% of GDP)



Sources: Database of Country Fiscal Measures in Response to the COVID-19 Pandemic; and IMF staff estimates.

Note: Estimates as of March 17, 2021. Numbers in U.S. dollar and percent of GDP are based on April 2021 World Economic Outlook Update unless otherwise stated. Country group averages are weighted by GDP in US dollars adjusted by purchasing power parity. Data labels use International Organization for Standardization country codes (see footnote 1).
LIDCs = low and lower middle-income developing countries
https://www.imf.org/en/Topics/imf-and-covid19/Fiscal-Policies-Database-in-Response-to-COVID-19

Based on Figures 2A to 2C, developed countries have provided more discretionary fiscal support compared to developing and less developed countries, reflecting the fact that they have more financial resources and capacity to respond to shocks than developing countries and the less developed countries. In addition, the persistence of the COVID-19 pandemic shock because of mutations of the virus will drain the limited fiscal resources of less developed countries and increase their vulnerability. In this context, the fiscal status or space of countries will play an important role in mitigating the effects of the COVID-19 pandemic.

3. Institutional Factors and Policy Responses to the COVID-19 Pandemic

In this section of the paper, we discuss the indicators used to capture institutional factors and government policy responses to the COVID-19 pandemic shock.

a) ***Institutional factors***: We have employed the economic and political risk indicators provided by the International Country Risk Guide (ICRG) to measure institutional risk. The ICRG uses 17 variables to quantify political and economic risk levels in countries. Political and economic risks in each country are assigned a numerical value (risk point), with the highest number of points indicating lowest risk level and the lowest number (0) representing the highest risk for the country. More detailed information on the components of the political and economic risk measures are discussed below:

(i) *Political risk*: according to the ICRG handbook, the political risk metric measures the level of political stability in each country. ICRG constructs the political risk composite index from 12 sub-components, including government stability, socio-economic conditions, investment profile, internal conflict, external conflict, corruption, military in politics, religious tensions, law and order, ethnic tensions, bureaucracy quality and demographic accountability. Each sub-component risk measure is assigned a risk point, where the lowest number of points (representing the highest risk) is zero and the maximum number of points (which represent the lowest risk) depends on the fixed weight given to the sub-component (Howell, 2013).

In our analysis, we first calculated the correlation between the 12 political risk components. Strong correlation between them may bias our coefficient estimates. Therefore, we have excluded some of the political risk components and have only used the following components in the study: socioeconomic conditions, bureaucracy quality, civil war, democratic accountability, ethnic tensions, external conflict, and religious tensions. Among these, the component (socioeconomic conditions) is based on an aggregation of indicators on unemployment, consumer confidence and poverty levels and it captures the socio-economic pressure at work in a society that influences government action. Similarly, bureaucratic quality assesses the strength of institutions and the quality of the bureaucracy. Countries with high bureaucratic quality tend to exhibit less risk of policy reversals after a shock such as COVID-19 (Howell, 2013).

(ii) *Economic risk:* The economic risk measure is derived from an aggregation of the following components: GDP per capita, real GDP growth, inflation, budget balance as a percentage of GDP, and the current account as a percentage of GDP. It measures the strength and weakness of the economy in each country. As with political risk, the minimum point number (zero) in economic risk indicates a higher risk level.

b) ***Oxford COVID-19 policy response variables***: In addition to the institutional factors discussed above, our study also incorporates the policy responsiveness of governments to the COVID-19 pandemic. The Oxford COVID-19 Government Response Tracker (OxCGRT) is used to quantify COVID-19 related policy measures and responsiveness of the respective countries to the COVID-19 pandemic. OxCGRT provides 20 specific policy indicators for 180 countries as well as the subnational jurisdictions in US, Brazil, United Kingdom and Canada (Hale et al, 2021). The ordinal quantitative value of each policy indicator varies from 0 to 2, and for some indicators from 0 to 4, where zero indicates that the policy measure is not applied. Based on these policy indicators, the OxCGRT computes four aggregate indices capturing different types of government policy responses to the pandemic. Each of the four indices range from 0 to 100 with higher values reflecting a higher or more stringent response. While the index captures government responses to the pandemic, it does not show whether a government's policy has been enforced or implemented effectively. Below, we explain the construction of the four aggregate indices used in the regression estimations.

i) *Government response index*: this measure is constructed using a simple average of 16 policies including school closure, work closure, cancellation of public events, restrictions on gathering, closure of public transport, stay at home requirements, restriction on domestic travel, restriction on international movement, income support, debt/ contract relief, public information campaign, testing policy, contact tracing, facial covering, vaccination policy and protection of the elderly.

ii) *Containment and health index:* this measure is a simple average of school closure, work closure, cancellation of public events, restrictions on gathering, closure of public transport, stay at home requirements, restriction on domestic travel, international travel control, public information campaign, testing policy, contact tracing, facial coverings, vaccination policy, and protection of the elderly.

iii) *Economic support index*: it is a simple average of income support and debt/ contract relief policies.

iv) *Stringency index:* this composite index is constructed by using the simple average of the following 9 policy specific measures: school closure, workplace closure, cancellation of public events, restrictions on gatherings, closure of public transport, stay at home requirements, restrictions on internal movement, international travel controls and public information campaigns.

The policy response indices described above are likely to be highly correlated and will therefore create high multicollinearity in our empirical analysis. To address the issue of high multicollinearity and to establish the robustness of our empirical work, we implemented the policy variables separately in the empirical estimations. Experience during this pandemic has shown that most governments only react and respond when there is a significant increase in the number of cases and deaths. In this context, the policy response variables should be interpreted as lagging variables and so, in the empirical analysis, we expect the covariates between government policy responsiveness to the COVID-19 cases to be positive because the government tends to respond as the number of COVID-19 cases increases.

4. The Empirical Framework and Results

The main objective of the paper is to explore the role of institutions and government policies in mitigating COVID-19 infection and transmission (cases) using a large panel data. We used the daily infection cases as a dependent variable to identify the impact and response of government policies on the number of COVID-19 infection cases. To establish the robustness of our results, we implemented each policy variable separately in our regression analysis.

Our regression model specification is as follows:

$$COVID_{it} = \beta_1 + \beta_2 \mathrm{P}_{it-k} + \beta_3 \mathrm{X}_i + \beta_4 \mathrm{I}_{it} + \eta_t + \varepsilon_{it} \quad (1),$$

where $COVID_{it}$ denotes the daily infection cases for country i at time t. The impact of policy on infection and new cases is given by policy variables, P_{it} (Government response index, Health and containment index, Economic support index, and Stringency index). A recent study indicates that countries that can respond faster to an increase in COVID-19 cases tend to have better control and mitigation of the infection cases compared to countries that are not able to respond swiftly and effectively (World Bank, 2021). To capture the time impact of policy variables on new cases, we lagged the policy variables by 7 days, 15 days and 45 days. We also included other control variables (given by X_i) such as the following time invariant macroeconomic variables: the incidence of tuberculosis, number of people aged 65 and above, population density, number of physicians per 10000 people, and mobile phone subscription per 100 people.

In Equation (1), I_{it} is a vector of institutional variables for country i at time t. As discussed in the previous section, there are two aggregate institutional variables that measure the institutional risk level across countries and over time: (a) economic risk and (b) political risk. The political risk index has the following sub-categories: socioeconomic conditions, bureaucratic quality, civil war, democratic quality, ethnic tensions, external conflict, religious tensions, and government stability. We also introduced these sub-categories in our estimations to establish the robustness of our results. η_t and ε_{it} represent the monthly fixed effect and the white noise random term of the model, respectively.

The empirical specification of our analysis is based on a panel data of cross-section of countries using daily cases from 1 January 2020 to 24 January 2021. We estimate Equation (1) using the panel random effects (RE) technique. In equation (1) the macroeconomic variables are time invariant since they are measured annually. Consequently, we cannot employ the fixed effects estimation technique in the baseline regression. However, if the country fixed effects correlate with the controlled explanatory variables, then our estimated regression coefficients with the RE model will be biased. To account for the potential endogeneity problem in the RE model, we have employed the generalized method of moments (GMM) estimation approach. We have used the system GMM approach (Blundell and Bond, 1998) because it allows us to control for the effect of the lagged infection cases on the current infection cases . It also permits us to address potential endogeneity problems. The system GMM estimation equation is specified as follows:

$$COVID_{it} = \alpha_1 + \alpha_2 COVID_{it-1} + \alpha_3 \mathrm{P}_{it-k} + \alpha_4 \mathrm{X}_i + \alpha_5 \mathrm{I}_{it} + \eta_t + \varepsilon_{it} \quad (2),$$

where $COVID_{it-1}$ is the first period lag of the infection cases. We expect a positive coefficient for the lag of the infection cases as previous period infection will raise the likelihood of more infection in the current period. Robust standard errors are employed in both the RE and system GMM estimation to control for arbitrary heteroscedastic errors. Furthermore, the US, India and Brazil are excluded from the estimations since they are outliers in terms of infection rates.

4.1. Baseline results

Table 2 presents the baseline results that show the effect of policy responses on COVID-19 cases. As we have illustrated in Equation (1), we have used various lags of a given policy to identify the impact of earlier policy responses on the number of COVID-19 cases. Column (1) reports the estimated coefficients for the 7 days lag. Column (2) and (3) report the estimated coefficients for the 15 days and the 45 days policy lags, respectively. We expect the policy responses to be more effective if countries respond and implement them swiftly and timely. In all the estimation specifications, we have controlled for the country fixed effects and the time fixed effects. Furthermore, robust (clustered) standard errors that control for arbitrary heteroskedasticity are used in all regressions.

Interestingly, the coefficients decline as the number of lags increase implying that the effectiveness and responsiveness of the policies to the number of COVID-19 cases tend to decline if there is a slower policy response from the government. For example, the estimated coefficient of the country health and containment index declines from 57.6 to 54.7 and then to 15.5 when the lag increased from 7 to 15 days and then to 45 days, respectively. Similarly, the coefficient of the government response index decreases from 62.6 in the 7 days lags to 60.2 in the 15 days lag and to 18.6 for the 45 days lag. The same is true for the stringency index policy measure. The only exception is the impact of the economic policy measure. For this variable, there is no significant difference between 7 and 15-days economic policy measures to counter the spread of the pandemic. However, if countries apply economic policies that are relevant to tackle COVID-19 spread 45 days in advance or more then the infection rate is lower. In general, the estimated results of the baseline model suggest that countries that react slowly tend have less responsiveness and impact on reducing new cases.

Table 2: Policy Impact on COVID-19 Pandemic

	7 days lag	15 days lag	45 days lag
Econ. Support Index	8.209** (1.637)	8.751** (1.631)	5.454*** (0.959)
Constant	-109.44 (596.11)	-414.82 (541.78)	-264.02 (351.02)
Observations	66331	66498	61354
R-Square	0.033	0.033	0.038
Country-Fixed Effects	Yes	Yes	Yes
Time-Fixed Effects	Yes	Yes	Yes
Health and Containment Index	57.581*** (2.888)	54.701*** (2.891)	15.463*** (1.786)
Constant	-2986.7** (611.35)	-3133.9** (557.2)	-834.814** (324.7)
Observations	66421	66498	61354
R-Square	0.038	0.037	0.039
Country-Fixed Effects	Yes	Yes	Yes
Time-Fixed Effects	Yes	Yes	Yes
Govt. Response Index	62.605*** (3.128)	60.153*** (3.136)	18.621** (1.922)
Constant	-3478.58** (555.12)	-3347.97** (555.48)	-989.67** (326.6)
Observations	66608	66608	61410
R-Square	0.038	0.037	0.039
Country-Fixed Effects	Yes	Yes	Yes
Time-Fixed Effects	Yes	Yes	Yes
Stringency Index	48.771*** (2.187)	45.721*** (2.192)	11.962** (1.335)
Constant	-2476.9** (599.4)	-2628.7 (546.3)	-643.0 (318.5)
Observations	66438	66571	61408
R-Square	0.039	0.038	0.039
Country-Fixed Effects	Yes	Yes	Yes
Time-Fixed Effects	Yes	Yes	Yes

Note: N is the number of observations and *, **, ***: represent 10%, 5% and 1% level of statistical significance respectively.

Table 3 reports the estimated coefficients when we include macroeconomic and institutional variables in the model. The five key macroeconomic variables used are the incidence of tuberculosis, the number of people aged 65 and above, population density, the number of physicians per 10000 people, and mobile phone subscription per 100 people. The two main institutional variables employed are the economic risk and political risk measures. Since the macroeconomic variables are time invariant, we estimated equation (1) with the random effects panel data model.

Table 3: The effects of policy and institution on COVID-19

	(1)	(2)	(3)	(4)
	Dependent variable: Number of daily confirmed cases			
Health and containment index (45 days lag)	12.971*** (3.918)			
Economic support index (45 days lag)		-2.113 (2.099)		
Gov't response index (45 days lag)			12.267*** (4.161)	
Stringency index (45 days lag)				7.940*** (2.694)
Incidence of TB	-0.002 (0.523)	0.030 (0.560)	0.016 (0.529)	-0.004 (0.528)
Number of people age 65 & above	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Population density	0.230** (0.097)	0.227** (0.108)	0.228** (0.102)	0.233** (0.101)
Number of physicians per 10,000 people	3.660 (5.467)	4.762 (5.882)	3.855 (5.575)	3.768 (5.536)
Mobile phone Subs. per 100 people	1.249 (2.468)	0.678 (2.643)	1.203 (2.508)	1.176 (2.511)
Economic Risk Rating	-1.735 (16.009)	-7.388 (16.669)	-0.031 (15.967)	-2.135 (16.120)
Political Risk Rating	-48.699** (19.637)	-52.183** (21.093)	-52.158*** (20.099)	-49.242** (19.670)
Month Fixed Effects	Yes	Yes	Yes	Yes
Constant	3008.069** (1220.023)	4283.496*** (1390.137)	3230.552*** (1252.248)	3314.600*** (1220.269)
Observations	23218	23215	23219	23219
R-Square	0.0373	0.0191	0.0331	0.0307

Country clustered standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

As Table 3 shows, while the economic support index has a statistically insignificant effect, the health and containment index, the stringency index and the government response index have significant effects on the COVID-19 infection cases. Among the macroeconomic factors, only population density has a positive and statistically significant effect on the infection cases. In other words, the higher the population density the higher the COVID-19 infection cases. The impact of population density is also highly stable for the different policy response variables indicating the results are robust across model specifications.

The results indicate that economic risk and political risk have negative effects on the COVID-19 infection cases. Since higher economic and political risks indices represent lower economic and political risk levels, the results indicate that the spread of COVID-19 declines when the institutional quality of the country increases. However, it should be noted that only the political risk measure has a statistically significant effect on containing the spread of the COVID-19 pandemic. The magnitude and the statistical significance of the political risk variable is almost the same when we control for the different economic policies that are applied to reduce the spread of the COVID-19 disease. Since the political risk measure is an aggregate index comprised of several subcomponents, the results do not permit us to determine the impact of the various components. Consequently, we have re-estimated the equation using the different components of political risk, namely: government stability, socioeconomic conditions, investment profile, internal conflict, external conflict, corruption, military politics, religious tensions, law and order, ethnic tensions, democratic accountability, and bureaucratic quality.

Table 4 reports the regression result when political risk is disaggregated. Some of the components of political risk are excluded since they are strongly correlated with the other components. Among the different measures of political risk, only socio-economic conditions and bureaucratic quality have statistically significant effects on the spread of COVID-19 pandemic. Socioeconomic condition is constructed from unemployment, consumer confidence and poverty. As the estimated coefficient shows, lower socioeconomic risk (in terms of lower unemployment, consumer confidence and poverty) leads to significantly lower infection cases globally. However, we observe higher bureaucratic quality, where the bureaucracy tends to be somewhat autonomous from political pressures and to have an established bureaucratic structure tend to experience higher number of COVID-19 cases. This result may be because having better institutions (or good governance) in a country also make it more challenging for the government to unilaterally impose restrictive measures needed to control the spread of the virus. The results presented in table 4 might be biased due to endogeneity effects in the estimated model. Therefore, we explore the stability and robustness of our results using GMM estimation.

Table 4: The effects of policy and institution on COVID-19 confirmed cases

	(1)	(2)	(3)	(4)
	Dependent variable: Number of daily confirmed cases			
Health and containment index (45 days lag)	11.969*** (3.820)			
Economic support index (45 days lag)		-2.455 (2.047)		
Gov't response index (45 days lag)			11.054*** (4.033)	
Stringency index (45 days lag)				7.178*** (2.603)
Incidence of TB	-0.496 (0.535)	-0.541 (0.610)	-0.496 (0.542)	-0.520 (0.554)
Number of people age 65 & above	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Population density	0.245*** (0.064)	0.244*** (0.072)	0.247*** (0.065)	0.247*** (0.066)

Number of physicians per 10,000 people	-0.605 (5.709)	-0.020 (6.338)	-0.565 (5.768)	-0.642 (5.857)
Mobile phone subscription per 100 people	1.168 (2.553)	0.657 (2.768)	1.061 (2.589)	1.085 (2.605)
Socioeconomic Conditions	-356.161*** (100.023)	-406.372*** (107.400)	-364.693*** (102.080)	-364.795*** (100.343)
Bureaucratic Quality	572.184*** (178.495)	656.395*** (186.119)	581.903*** (181.554)	589.428*** (177.128)
Civil War	-105.018 (263.939)	-147.106 (242.635)	-121.366 (250.398)	-102.162 (259.987)
Democratic Accountability	-99.738 (107.567)	-101.795 (106.437)	-107.168 (109.206)	-104.590 (104.652)
Ethnic Tensions	113.981 (108.008)	147.610 (116.621)	121.732 (107.967)	120.239 (109.451)
External Conflict	133.327 (106.951)	186.716* (112.621)	128.048 (100.863)	151.830 (108.652)
Religious Tensions	22.376 (123.539)	12.272 (129.808)	24.390 (121.831)	14.415 (124.021)
Government Stability	5.174 (110.176)	21.562 (110.941)	1.554 (111.632)	6.810 (111.355)
Month Fixed Effects	Yes	Yes	Yes	Yes
Constant	-345.233 (1252.260)	52.176 (1226.293)	-123.771 (1223.885)	-250.073 (1247.547)
Observations	23218	23215	23219	23219
R-Square	0.0181	0.0045	0.0155	0.0125

Country clustered standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4.2. Results of GMM Estimation

Although we have taken unobserved factors into account by controlling for fixed effects, the baseline estimation did not address the potential endogeneity problem related to the possibility of reverse causality between the infection cases and the policy variables. This is likely to bias the baseline estimation results obtained with the Random effects model. The baseline estimation indicates that the infection cases are lower for countries that are quick to put in place the COVID-19 intervention measures, such as health and containment policies or economic support policies. However, the results might be biased due to the possibility of reverse causalities in our estimation. In this context, the panel random effect estimator generates biased and inconsistent estimate (Olsen, 2006; Wooldridge, 2016). To correct the endogeneity problem in our empirical estimation, we re-estimated Equation (1) using the system GMM method that corrects for endogeneity and is more efficient than simple IV estimators (Arellano & Bond, 1991; Roodman, 2009). In the GMM estimation, robust standard errors are employed to control for arbitrary heteroscedastic errors.

Table 5 presents the results from the system GMM estimation. Before discussing the results, we need to discuss two standard post-estimation tests to establish the validity of econometric specification under GMM estimation. First, we used the Arellano-Bond test to check if there is serial autocorrelation among the residuals, under the null hypothesis that the error terms of two different time periods are uncorrelated, to validate the results of the GMM. Under this test, the estimation suffers second-order serial autocorrelation if the *p-value* is less than 0.05 (Roodman, 2009). Second, we established the joint validity of the lagged instruments. The estimate is said to satisfy the instrument validity condition if the *p*-value of the Sargan-Hansen test is greater than 0.05. The *p*-values of AR (2) and Sargan-Hansen tests are given in Table 5. The fact that the p-values for both tests are greater than 0.05 indicates the lagged instruments are valid and that there is no second-order serial autocorrelation in our GMM estimation. In this case, the GMM estimation provides efficient and consistent estimates.

In general, the key results of our GMM estimation are similar to the baseline regression results obtained with the Random effects estimations. The coefficients of the health and containment index, the government response index, and the stringency index are positive and statistically significant. The economic support index under the GMM estimation is positive but statistically insignificant. For the macroeconomic variables, results are similar to those of the baseline estimations in terms of sign and magnitude. Specifically, the number of elderly populations, the number of physicians and mobile phone subscription have insignificant effects on the infection cases. However, the GMM estimation provides more robust estimates for the incidence of tuberculosis and population density. The results suggest that countries with higher incidence of tuberculosis tend to have lower infection cases whereas the infection is higher in countries that have greater population density. The finding that the higher the incidence of tuberculosis in a country the lower the infection cases captures the notion that countries with a previous history of infectious diseases tend to have some experience and relevant health infrastructure necessary to manage and contain infectious diseases, which would enable them to reduce the transmission of the COVID-19 disease (Gholizadeh et al., 2021). Both the COVID-19 virus and tuberculosis are infectious diseases that primarily attack the lungs and also have similar symptoms.[2] However, tuberculosis has a longer incubation period compared to the COVID-19 virus. Therefore, countries with pre-existing national programmes and infrastructure for mitigating tuberculosis can respond better to the COVID-19 pandemic as opposed to countries with no pre-existing national programmes. This has important policy implications for developing and less developed countries that have pre-existing national programmes and infrastructure for tuberculosis and HIV which could be used to complement efforts to manage and contain the spread of COVID-19 (Sarinoglu et al., 2020).

Regarding the aggregate institutional variables, as expected, the relationship between the infection cases and the economic and political risk indices are negative. However, the coefficients are not statistically significant. We explore the impact of the sub-categories of political risk variable as we did for the baseline estimation.

Table 5: The estimates for policy effects on COVID-19 confirmed cases using GMM method

	(1)	(2)	(3)	(4)
VARIABLES	GMM	GMM	GMM	GMM
Health and containment index (45 days lag)	7.032* (3.749)			
Economic support index (45 days lag)		4.562 (2.847)		
Gov't response index			10.15** (4.211)	

[2] See WHO website: https://www.who.int/teams/global-tuberculosis-programme/covid-19#:~:text=While%20experience%20on%20COVID%2D,TB%20treatment%20as%20prescribed.

(45 days lag)				
Stringency index (45 days lag)				5.254** (2.411)
Incidence of TB	-0.582**	-0.520*	-0.571**	-0.603**
	(0.265)	(0.275)	(0.263)	(0.270)
Number of populations aged 65 and above	-1.28e-06	7.29e-08	-1.61e-06	-1.43e-06
	(1.92e-06)	(2.05e-06)	(1.84e-06)	(1.87e-06)
Population density	0.297***	0.289***	0.277***	0.289***
	(0.0475)	(0.0507)	(0.0603)	(0.0510)
Number of physicians	0.133	1.465	0.123	0.881
	(3.796)	(3.804)	(3.796)	(3.842)
Mobile subscription	0.937	0.705	1.841	1.459
	(1.466)	(1.380)	(1.562)	(1.587)
Economic risk rating	-4.082	-1.004	-5.891	-3.728
	(11.95)	(12.06)	(11.92)	(12.16)
Political risk rating	-1.206	-7.225	-2.383	-0.716
	(5.721)	(6.871)	(5.689)	(5.844)
Constant	177.5	519.6	218.2	66.94
	(358.5)	(362.9)	(355.8)	(357.0)
Month Fixed Effects	Yes	Yes	Yes	Yes
Observations	23,245	23,242	23,246	23,246
AR(2) (p-value)	0.600	0.599	0.601	0.601
Hansen test (p-value)	0.607	0.620	0.596	0.499

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

As with the baseline estimation, we also performed the GMM estimation using the sub-categories of the political risk index, to capture the effects of institutional factors on the COVID-19 infection cases. We excluded the economic risk and some of the sub-components of political risk as we found them to be strongly correlated with the other political risk measures. The results are reported in Table 6. The GMM estimation results provide further support for the findings of the baseline estimation based on the Random effects model with the coefficients for health and containment, government response and stringency measures are being positive and statistically significant. In addition, we also found the coefficient of economic support to be positive and statistically significant. This contrasts with the GMM estimation in Table 5, where the economic support variable was not statistically significant. This indicates that the economic support variable is sensitive to the control variables used in the estimation and hence not robust in our estimation.

In contrast to the Random effects estimation, where the coefficient of the socio-economic conditions variable is negative and statistically significant, in the GMM estimation the coefficient is positive and statistically significant. The positive coefficient on socio-economic conditions may reflect the fact that countries with higher socio-economic conditions are generally advanced countries, and in these countries, the governments tend to be hesitant in imposing strict measures on movement of people thereby constraining their ability to control the spread of the virus.

The bureaucratic quality variable is again positive and statistically significant as in the Random effects model. This result may be capturing the fact that having better institutions (good governance) in a country also make it more challenging for the government to unilaterally impose restrictive measures needed to control the spread of the virus. Regarding the other institutional variables, we find that internal conflict and law and order variables are negative and statistically significant. This suggests that countries with less internal conflicts and law and order tend to have lower infection cases. The other institutional variables such as democratic ability, external conflict, and government stability appear to have insignificant effects on infection cases.

Table 6: The estimates for institutional effects on COVID-19 confirmed cases using GMM method

VARIABLES	(1) GMM	(2) GMM	(3) GMM	(4) GMM
Health and containment index (45 days lag)	8.216** (3.666)			
Economic support index (45 days lag)		5.290* (2.904)		
Gov't response index (45 days lag)			9.519** (4.021)	
Stringency index (45 days lag)				5.437** (2.312)
Incidence of TB	-0.136 (0.269)	-0.167 (0.276)	-0.160 (0.277)	-0.176 (0.268)
Number of populations aged 65 and above	-1.99e-06 (2.25e-06)	-9.74e-07 (2.30e-06)	-2.13e-06 (2.27e-06)	-1.68e-06 (2.24e-06)
Population density	0.308*** (0.0511)	0.312*** (0.0447)	0.289*** (0.0670)	0.310*** (0.0539)
Number of physicians	1.383 (4.007)	1.107 (4.192)	1.143 (4.107)	1.313 (4.004)
Mobile subscription	1.587 (1.552)	1.122 (1.623)	1.846 (1.639)	1.594 (1.670)
Socioeconomic Conditions	96.78** (42.84)	86.47* (44.94)	86.55** (43.98)	98.06** (43.44)
Bureaucratic Quality	137.3* (81.79)	140.0* (84.61)	140.2* (84.12)	144.8* (84.12)
Democratic Accountability	47.30	31.85	41.34	41.50

	(35.79)	(37.22)	(35.58)	(35.80)
External Conflict	-141.8	-132.3	-135.5	-139.5
	(107.7)	(107.0)	(109.3)	(107.5)
Government Stability	28.57	38.95	34.97	30.85
	(60.41)	(64.50)	(64.05)	(62.90)
Internal Conflict	-99.33*	-109.7*	-93.23*	-98.55*
	(55.24)	(57.38)	(55.89)	(54.75)
Laws and Order	-180.6**	-200.0**	-183.2**	-182.4**
	(77.05)	(77.73)	(79.40)	(78.93)
Constant	1,442	1,660	1,351	1,413
	(951.9)	(1,022)	(979.1)	(972.1)
Month Fixed Effects	Yes	Yes	Yes	Yes
Observations	23,245	23,242	23,246	23,246
AR(2) (p-value)	0.600	0.599	0.601	0.601
Hansen test (p-value)	0.459	0.402	0.249	0.330

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

5. Conclusions

This section discusses the main findings and implications of the paper. Our econometric results indicate that population density is one of the drivers of infection cases. This implies that high population density, particularly in poor countries without basic infrastructure, presents significant risks to global health security. One of the lessons we have learned from the pandemic is that poor access to water, sanitation and handwashing facilities makes people vulnerable to infectious diseases which can be easily spread across countries because of the high degree of global economic integration. Policymakers can reduce this risk to global health security and prevent spread of infectious diseases by supporting the development of basic infrastructure (such as water and sanitation) in low-income countries. The international community recognized the importance of water and sanitation in improving human health and wellbeing by devoting goal 6 of the sustainable development goals (SDGs) to "clean water and sanitation." While some progress has been made in this area over the past few years, it is evident that more needs to be done to achieve the overall goal by the 2030 target date. For example, it is estimated that about 30 percent of the world's population do not have access to safe drinking water and about 40 percent lack access to basic hand-washing facilities with soap and water at home (United Nations 2020).

The results of our study also suggest that previous experience in dealing with infectious diseases such as tuberculosis, Ebola and HIV can play a positive role in containing the spread of the COVID-19 pandemic. The existence of pre-existing national programmes and health infrastructures for dealing with tuberculosis and other infectious diseases is one of the explanations that have been offered for the relatively lower infection cases observed in several African and Asian countries (Gholizadeh et al 2021; Sarinoglu et al., 2020).

The analysis conducted in this paper also indicate that institutions play a crucial role in explaining COVID-19 cases across countries. For example, the results show that countries characterized by law and order and less internal conflicts tend to have lower infection cases. In principle, countries with strong, credible and high-quality institutions are likely to have the capacity to respond effectively to public health challenges. The economic literature acknowledges the crucial role institutions play in the economic development process. For example, Acemoglu and Robinson (2013) argued that institutions are pivotal to the development process. In particular, they have demonstrated that promoting sustained and shared prosperity requires the existence of inclusive rather than extractive institutions. However, the results of our study also highlight the challenges and vulnerability of countries with better institutions (bureaucratic quality) to the COVID-19 pandemic. For example, having better institutions (or good governance) in a country may also make it more challenging for the government to unilaterally impose restrictive measures needed to control the spread of the virus.

Socio-economic conditions as reflected in, for example high unemployment and poverty, also affect the number of COVID-19 cases and deaths. Here the results are mixed. The results of the random effects model estimation indicate that better socio-economic conditions in a country will lead to lower infection cases, while the GMM estimation results suggest that better socio-economic conditions can increase the infection cases. In principle, poor socio-economic conditions increase people's exposure to risks of infectious diseases and reduces their capacity to respond to the economic consequences of public health problems. To improve socio-economic conditions, governments have to foster social protection and also provide education for individuals. In many developing countries, people have no social safety nets, which makes them highly vulnerable to shocks. In the period 2006-2016, about 43.2 percent of the population of developing countries did not have access to social protection and labour programs. In sub-Saharan Africa the number is 79.4 percent, in Latin America and the Caribbean 42.7 percent, and in South Asia 25.1 percent (Kovacevic and Jahic 2020). Protecting these vulnerable groups in developing countries should be a priority for governments. The introduction of well targeted social protection measures is one way to cushion the impact of shocks on these groups. Improving socio-economic conditions also require building resilience to shocks through the development of productive capacities, particularly in highly productive and growing sectors with high income elasticities of demand. This will ensure the creation of decent jobs and lay the foundation for robust growth and sustained employment.

One of the policy implications of our findings is the importance of timely policy intervention at the national level in reducing infection cases. During the first and second waves of the pandemic, governments-imposed travel restrictions and containment measures, but the timing, scope, depth, and duration of these measures differed across countries. For example, Australia and New Zealand reacted much more swiftly and had much more restrictive measures than the United States and member States of the European Union. An early response to a pandemic is crucial in halting its spread and reducing the potential damage to human health and the economy. In this context, there is the need for policymakers to be vigilant and to enhance their capacity to respond quickly to infectious diseases to avoid public health crises and associated social and economic consequences.

Another policy implication of our findings is the need to enhance coherence between health policy and socio-economic policies. Although the COVID-19 crisis began as a public health problem, it quickly triggered an economic crisis and some of the policy measures designed to deal with the economic turmoil also have consequences for the number of COVID-19 cases and deaths. In this context, there is the need for policy coordination at the national level to ensure that economic and social policies are consistent with the goal of promoting public health.

While national authorities have the responsibility and mandate to respond to the current challenges presented by the COVID-19 pandemic, it is important to stress that it is a global health crisis and so there is the need for a coordinated global response. The magnitude of the crisis is such that no country acting alone has either the resources or the capacity to effectively address the challenge. In this context, there is the need for a coordinated global response. A coordinated response will permit better exploitation of synergies across countries, avoid duplication, and enhance policy coherence (Kimura et al, 2020). It will also ensure that policy actions taken by one country do not have a negative impact on other countries thereby exacerbating the crisis. This is particularly important in the light of the fact that the crisis has asymmetric impact on countries and some, such as those in Africa and the least developed countries, neither have the resources nor the capacity to respond to the health crisis and the associated economic turmoil. In this regard, States acting alone are likely to take measures that might exacerbate the impact of these crises in poorer developing countries. It is the recognition of this need for global cooperation in the fight against infectious diseases that has led to calls for the establishment of a new pandemic treaty (Fukuda-Parr et. al. 2021). In December 2020, the President of the European Council mooted the idea of a global pandemic treaty to address global health security challenges. This idea has gathered momentum with the support of 25 Heads of State and international institutions in March 2021 and discussions at the World Health Assembly of the World Health Organization held in May 2021.

Appendix

List of Countries in the Sample

region	country	region	country	region	country	region	country
Africa	Algeria	Asia	Azerbaijan	Europe	Albania	America	Argentina
	Angola		Bahrain		Austria		Bahamas
	Botswana		Bangladesh		Belarus		Bolivia
	Burkina Faso		Brunei		Belgium		Canada
	Cameroon		China		Bulgaria		Chile
	Congo		Cyprus		Croatia		Colombia
	Egypt		Hong Kong		Czech Republic		Costa Rica
	Ethiopia		Indonesia		Denmark		Cuba
	Gabon		Iran		Estonia		Dominican Republic
	Gambia		Iraq		Finland		Ecuador
	Ghana		Israel		France		El Salvador
	Guinea		Japan		Germany		Guatemala
	Kenya		Jordan		Greece		Guyana
	Liberia		Kazakhstan		Hungary		Haiti
	Libya		Kuwait		Iceland		Honduras
	Madagascar		Lebanon		Ireland		Jamaica
	Malawi		Malaysia		Italy		Mexico
	Mali		Mongolia		Latvia		Nicaragua
	Morocco		Myanmar		Lithuania		Panama
	Mozambique		Oman		Luxembourg		Paraguay
	Namibia		Pakistan		Malta		Peru
	Niger		Philippines		Moldova		Suriname
	Nigeria		Qatar		Netherlands		Uruguay
	Senegal		Saudi Arabia		Norway		Venezuela
	Sierra Leone		Singapore		Poland	Oceania	Australia
	Somalia		Sri Lanka		Portugal		New Zealand
	South Africa		Syria		Romania		Papua New Guinea
	Sudan		Taiwan		Russia		
	Tanzania		Thailand		Serbia		
	Togo		Turkey		Slovenia		
	Tunisia		Vietnam		Spain		
	Uganda		Yemen		Sweden		
	Zambia				Switzerland		
	Zimbabwe				Ukraine		
					United Kingdom		

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