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To date, pharmaceutical spending in the United States is significantly higher than in other countries, a fact which is especially true of spending under Medicare Part B. To address the high cost of pharmaceuticals under Medicare Part B, the United States' Department of Health and Human Services has proposed a policy, the International Price Index. This policy would change the regulations on Medicare reimbursement of physicians and other consumers drugs covered under Part B. Currently, Medicare's reimbursement for Part B drugs is not limited to any specific price point, the International Price Index would establish an upper limit on the amount that Medicare is allowed to pay. This limit would be based upon the average price that other countries pay, thus bringing the price in the United States closer to international prices.

Critics speculate the International Price Index will drive the price of drugs covered by Medicare Part B so low that the pharmaceutical industry will lose revenue, which will have the unintended consequence of slowing down the pace of pharmaceutical development as companies will no longer invest in research and development at the same rate. This paper responds to these criticisms in two ways. First, it analyzes the relationship between revenue and research and development in the pharmaceutical industry. Second, it predicts the International Price Index's effect on the prices of pharmaceuticals in the countries that are referenced within the policy. This prediction is based on an analysis of the economics in the pharmaceutical industry and a comparison to the Robinson Patman Act. The result shows that investments into research and development will likely be unchanged because the International Price Index need only have a moderate degree of success in spreading out the costs of pharmaceuticals in order to avoid any substantial change in revenue within the pharmaceutical industry.

No Ordinary Process: The Flaws in Illinois Courts’ Use of Remote Video Technology in Mental Health Trials

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This article discusses and criticizes Illinois courts’ use of remote video conference technology in mental-health trials during the COVID-19 pandemic. It contends that, while the Illinois Supreme Court issued rules and guidance that directed how local courts should implement video conference technology with purpose and accommodations, the local courts (including the largest circuit court in Illinois) instead mandated remote video technology for mental health trials as a panacea without regard to participants’ preferences, objections, or disabilities. As detailed further, the issues only compound because of a separate shortcoming where, unlike other remote hearings and trials which are widely available to view by the public, no such public access links accompany any of these remote video mental health trials. Meaning, for the majority of 2020 and continuing to date (as of Feb. 20, 2021), trials involving fundamental liberty interests (i.e., involuntary commitments and forced administration of medications or electroconvulsive therapy) occurred out of public view, in a manner inconsistent with law and policy.

Catching Up with Convergence: Strategies for Bringing Together the Fragmented Regulatory Governance of Brain-Machine Interfaces in the United States

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After a decade of stalled innovation, the past five years have seen brain-machine interfaces (“BMIs”) make rapid advances through the convergence of ideas from and progress in other emerging technologies. However, the sheer complexity of these neurotechnologies will produce a complicated and incomplete regulatory environment. Regulating these neurotechnologies will demand managing risks at the intersection of safety, effectiveness, cyber-security, consumer protection, equity, data privacy, personal autonomy, and dual use. These convergent risks compound the thorny “pacing problem,” in which accelerating technological innovation can overtake public regulators and their efforts to understand and manage risks. In the United States, the Food and Drug Administration (“FDA”) and Federal Trade Commission (“FTC”) already have authority to regulate some neurotechnologies. However, these agencies’ jurisdictions are over different subject matters which overlap when applied to BMIs due to technological convergence. This convergence will ultimately create significant regulatory problems for BMIs and neurotechnologies generally. Managing the complexities of convergence in BMIs will require a policy response defined by early action, regulatory coordination, and political support from lawmakers.

Global Health Law & Governance Amidst the Pandemic

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The phrase “desperate times require desperate measures” holds true in the context of the mitigation efforts initiated at both the domestic and international levels by governments, corporations, multilateral institutions, and individuals to combat the COVID-19 pandemic. The pandemic has crippled the global economy and has showcased the urgent need for

better health infrastructure and efficient accessibility to healthcare services. COVID-19 has presented numerous challenges because of dispute resolution including general international and investment claims and trade law violations. Against this backdrop, this paper proposes the formation of a health index– the Health Infrastructure Index (HII) – as an alternative to the existing Human Development Index (HDI) and Healthcare Access and Quality (HAQ). In order to understand and tackle domestic health vulnerability, the HII includes the availability of skilled medical professionals, government expenditure on healthcare and the likelihood of international funding. International cooperation as a response is emerging as a key factor to fight against COVID-19. The HII index highlights critical areas where domestic or multilateral interventions are required. With the inherent limitations of conventional health indices, the HII offers both the possibility of evidence- and research-based international coordination of health-related policies and encourages participatory development.

Global Health Law & Governance Amidst the Pandemic Evidence, Lessons, and Reforms

*Julien Chaisse and Nilanjan Banik**

INTRODUCTION

During the past year, countries across the globe have reacted against the unprecedented circumstances caused by COVID-19 with incredulity and an “all hands on deck” approach.¹ COVID-19 is a special case which has attracted renewed attention to health systems’ abilities to tackle an emergency of such magnitude.² The virus has also generated growing interest in the capacity of countries internationally to effectively test large groups of a population and successfully enforce lockdowns and quarantines.³ International media carried sensational headlines warning of the impending disaster that will ensue if any country fails to conduct testing, implement contact tracing, quarantine residents, and treat those who are infected.⁴ Amid

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¹ See Lawrence O. Gostin et al., *Responding to Covid-19: How to Navigate a Public Health Emergency Legally and Ethically*, 50 HASTINGS CTR. REP. 8, 9 (2020) (describing ways that states could best mobilize by working together); Jean Tirole, *Rebuilding the World After COVID-19*, TOULOUSE SCH. ECON. (Apr. 3, 2020), <https://www.tse-fr.eu/rebuilding-world-after-covid-19> (emphasizing the need for solidarity in approaching the global pandemic).

² See COVID-19, LAW AND HUMAN RIGHTS: ESSEX DIALOGUES 29 (Carla Ferstman & Andrew Fagan eds. Univ. of Essex, 2020) (examining that like other epidemics and pandemics that have occurred, such as Ebola, new precautions in public are needed in order to tackle COVID-19).

³ Wendy E. Parmet & Michael S. Sinha, *COVID-19: The Law and Limits of Quarantine*, 382 NEW ENG. J. MED., e28(1), e28(3) (2020).

⁴ See e.g., Faheem Aslam et al., *Sentiments and Emotions Evoked by News Headlines of Coronavirus Disease (COVID-19) Outbreak*, 7 HUMANS. SOC. SCI. COMMUN 1, 3–4 (2020);

this media focus, developing and less developed countries were the most likely to receive scrutiny because—even before COVID-19 struck—they lacked the healthcare infrastructure such as number of hospital beds, doctors and paramedic staffs to react to a health emergency.⁵

Although governments are committed to the health of their citizens, capabilities to protect health of citizens and to impact health outcome vary.⁶ This ultimately questions the extent governments are responsible for ensuring a basic “right to health” for their citizens.⁷ While every country must confront this question, it is a particularly important consideration for developing countries because their citizens lack health insurance and adequate purchasing power, making them more vulnerable to health hazards.⁸ For those countries that have determined citizens have a “right to health,” their governments must make available sufficient quantities of functioning public health and healthcare facilities, goods and services, as well as access for all. Healthcare infrastructure, for example, N95 masks, ventilators, etc., are needed to control the spread of pandemics.⁹

Additionally, one must assess the current state of a country’s health infrastructure from the perspective of international aid and coordination of public policies worldwide. An audit of public provision of health

see also COLLEEN M. FLOOD ET AL., *VULNERABLE: THE LAW, POLICY AND ETHICS OF COVID-19* 15, (Univ. of Ottawa Press, 2020) (explaining that the pandemic has been used by some countries to seize control); see also COVID-19, *LAW & HUMAN RIGHTS: ESSEX DIALOGUES*, *supra* note 2 (examining the issues with contact tracing).

⁵ See NORMAN V. LOAYZA & STEVEN PENNINGS, *MACROECONOMIC POLICY IN THE TIME OF COVID-19: A PRIMER FOR DEVELOPING COUNTRIES* 4 (Mar. 26, 2020) (providing an example where middle and low income countries lack capacity to treat COVID-19 due to lack of resources).

⁶ See generally WHO, *MONITORING THE BUILDING BLOCKS OF HEALTH SYSTEMS: A HANDBOOK OF INDICATORS AND THEIR MEASUREMENT STRATEGIES*, vii–viii (2010), (explaining that sacrifice is necessary to protect public health during the pandemic, but governments must ensure that their needs are met).

⁷ See Gunilla Backman et al., *Health Systems and the Right to Health: An Assessment of 194 Countries*, 372 *LANCET* 2047, 2047 (2008), (discussing the obligation of governments to protect citizen health as a matter of human rights law).

⁸ See Abdulrahman M. El-Sayed, *Ineffective Insurance in Lower and Middle Income Countries is an Obstacle to Universal Health Coverage*, 8 *J. GLOBE HEALTH* 1, 1 (demonstrating that vulnerability is tied to lack of health insurance.); see generally WORLD ECONOMIC FORUM, *COVID-19 RISKS OUTLOOK: A PRELIMINARY MAPPING AND ITS IMPLICATIONS* 32 (May 2020) (stating that there is evidence that a sudden halt in the economy effects the poor disproportionately, leaving that population at risk to not being able to stay healthy during the pandemic).

⁹ Off. of Disease Prevention & Health Promotion, *Public Health Infrastructure*, HEALTHYPEOPLE.GOV, <https://www.healthypeople.gov/2020/topics-objectives/topic/public-health-infrastructure> (last visited Jan. 1, 2021) (listing some of the items including, but not limited to, monitoring, diagnosing, and researching).

infrastructure provides a measure for the extent of accessibility to healthcare-related services for their citizenry.¹⁰ For example, during COVID-19 there were an inadequate number of hospital beds in certain countries, which forced many governments to convert stadiums and other athletic centers into makeshift hospitals.¹¹ In the same vein, some political leaders are suggesting that residents stay at home to contain the spread of the virus.¹² This is largely a result of their poorly-funded health systems and inadequate healthcare infrastructure that would be overburdened by an outbreak.¹³ Despite these extraordinary efforts, many countries are still not able to respond to COVID-19 patients.¹⁴ Accordingly, during COVID-19, countries' health infrastructure capabilities need to be analyzed to determine how more people can be admitted to a hospital.

This article proposes an approach to identifying the deficiencies of health care infrastructure for any given country. We created a health infrastructure index ("HII") which considers the availability of physicians, dentists, nursing and midwifery personnel, pharmacists, hospital beds, number of hospitals, and skilled health care professionals—such as anaesthesiologist, radiologists, etc.—all of which are normalized with respect to the population.¹⁵ Additionally, HII accounts for variables such as money spent on account of healthcare activities by the governments as it affects the supply of health care-related infrastructure and affect the health outcomes. By taking all of

¹⁰ See WHO, *supra* note 6.

¹¹ Sean Gregory, *The World's Sports Stadiums are Being Converted into Hospitals to Fight the Coronavirus Outbreak*, TIME, (Apr. 1, 2020), <https://time.com/5813442/coronavirus-stadiums-hospitals/> (explaining that many countries are dependent on China to accommodate COVID-19).

¹² ANI, *COVID-19 Patients' Contacts can go for Home-Quarantine as Govt Unable to Provide Isolation Facilities to Lakhs: Mamata Banerjee*, NEW INDIAN EXPRESS, (April 27, 2020), <https://www.newindianexpress.com/nation/2020/apr/27/covid-19-patients-can-go-for-homequarantine-as-govt-unable-to-provide-isolation-facilities-to-lakhs-2136078.html>.

¹³ Banyan, *India's Government is Better at Curbing Critics than COVID-19*, ECONOMIST, (May 9, 2020), <https://www.economist.com/asia/2020/05/09/indias-government-is-better-at-curbing-critics-than-covid-19>; See also Anulekha Ray, *Indian Railways Coaches are Now Used for Treating Coronavirus Patients*, MINT (June 23, 2020) <https://www.livemint.com/news/india/covid-19-treatment-indian-railways-coaches-are-now-used-for-treating-coronavirus-patients-11592907307991.html>.

¹⁴ See generally Lalit K. Jha, *Failure to Stop Coronavirus at Source Led to 184 Countries 'Going Through Hell': Trump*, ECONOMIC TIMES (Apr. 29, 2020), <https://health.economic-times.indiatimes.com/news/industry/failure-to-stop-coronavirus-at-source-led-to-184-countries-going-through-hell-trump/75441030> (explaining that many countries are upset by China's lack of transparency regarding COVID-19).

¹⁵ Normalized with respect to population is done to change the numeric value of different variables in the dataset to a common scale, without distorting the difference in the range of values.

these factors into account, HII is able to demonstrate the vulnerability of a country's health infrastructure.

HII ranking also allows international funding to make targeted health interventions to lower ranking countries.¹⁶ The policy suggestions that we make is that ranking of countries on the basis of HII will help in international coordination of health-related policies and encourage towards participatory development by empowering the non-governmental organizations and other groups working in the healthcare sector. This index showcases the areas where governments, or multilateral organizations, should intervene and how they prioritize such interventions. Beyond national boundaries, international cooperation is required for an effective strategy to fight COVID-19.¹⁷ International funding can be used to augment already precarious healthcare infrastructures that may exist in certain countries, and for the development and distribution of new vaccines.¹⁸ As HII suggests, many countries do not have an adequate number of doctors, nurses, paramedic workers, or other skilled health professionals. To resolve this deficiency, it is important to liberalize (remove restrictions) the services sector and allow movement of skilled healthcare professionals.¹⁹

Due to greater interactions among humans and animals over the last few decades,²⁰ there is a greater chance of viral outbreaks (for example, a mutated version of COVID-19). Consequently there is an increased need for accountability, transparency, enforcement, and better surveillance of healthcare infrastructure, worldwide.²¹ There are already a variety of legal courses of action available to individuals at the domestic level to challenge

¹⁶ McDONNEL ET AL., REVIEW OF THE DEVELOPMENT COOPERATION POLICIES AND PROGRAMMES OF SWITZERLAND 9 (OECD (Dec. 2013) (explaining that domestic policies support or do not harm developing countries with lower life indexes).

¹⁷ Yern Fai Lee & Wenyan Yang, *Recovering from COVID-19: The Importance of Investing in Global Public Goods for Health*, UNITED NATIONS (July 27, 2020), <https://www.un.org/development/desa/dspd/2020/07/recovering-from-covid19/> (providing an example on how international cooperation can facilitate access to research COVID-19).

¹⁸ Jon Kim Andrus et al., *Introduction of Human Papillomavirus Vaccines into Developing Countries: International Strategies for Funding and Procurement*, 26 VACCINE, K87, K89 (2008) (exploring how international financing strategies can help develop vaccines).

¹⁹ See generally LINDSAY B. LOWELL & ALLAN FINDLAY, DRAFT SYNTHESIS REPORT: MIGRATION OF HIGHLY SKILLED PERSONS FROM DEVELOPING COUNTRIES: IMPACT AND POLICY RESPONSES 17 (Int'l Lab. Off. Dep't for Int'l Dev., UK, 2001) (describing strategies for managing migration of skilled workers from developing countries).

²⁰ Peter Daszak et al., *Emerging Infectious Diseases of Wildlife: Threats to Biodiversity and Human Health*, 287 SCIENCE 443–44 (2008) (discussing the causal themes between emerging infectious diseases and human population encroachment into animal habitats).

²¹ Renaud Seligman, *COVID-19 (Coronavirus) Policy Response to Enhancing Institutions for Effective and Transparent Management*, WORLD BANK (June 5, 2020), <https://www.worldbank.org/en/country/russia/brief/covid-19-response-enhancing-institutions-russia>.

state responsibility.²² The lack of response by the global community on the international health obligation will likely lead to complex disputes.²³ Furthermore, countries withdrawing within their borders will not eliminate their international law obligations as such obligations are of paramount importance.²⁴ The objective of analyzing non-compliance to such obligations is not only justified by the need to design immediate sanctions but also to induce greater international cooperation—which is the only way to mitigate the risk of future pandemics.²⁵

Part I of this article analyses the measures undertaken by governments in different countries and private sector responses toward the ongoing international health crisis. Part II discusses the international legal regime surrounding potential international law violation claims before the world court and possible challenges of domestic measures before the trade court and investment tribunals. Part III considers the limitations of conventional indices such as the Human Development Index (HDI) and the Healthcare Access and Quality (HAQ) on account of accessibility of health services and proposes the formation of HII which takes into account the health infrastructure of the countries to ascertain the capacity to combat pandemics like COVID-19. Part IV details conventional and unconventional covariates like income, age profile, tropical climate, dietary habits, associated living conditions, and health policy. As with the case with healthcare infrastructure, these factors may also impact COVID-19 fatality rates. Finally, reporting of such international health emergencies is a pivotal concern, and against this backdrop, Part V explores the international health reporting mechanism envisioned under the World Health Organization (WHO) Constitution.

²² See *Lawsuits about State Actions and Policies in Response to the Coronavirus (COVID-19) Pandemic*, BALLOTPEDIA, (last accessed Oct. 28, 2020), [https://ballotpedia.org/Lawsuits_about_state_actions_and_policies_in_response_to_the_coronavirus_\(COVID-19\)_pandemic,_2020](https://ballotpedia.org/Lawsuits_about_state_actions_and_policies_in_response_to_the_coronavirus_(COVID-19)_pandemic,_2020) (Listing US lawsuits concerning state actions and policies in response to the coronavirus (COVID-19) pandemic, 2020); see also Lara Marlowe, *Coronavirus: Lawsuits Fly in France as Blame Game Begins*, IRISH TIMES (Mar. 26, 2020), <https://www.irishtimes.com/news/world/europe/coronavirus-lawsuits-fly-in-france-as-blame-game-begins-1.4213267> (noting six lawsuits filed against the prime minister and current and previous health ministers on charges from unwillful harm to involuntary manslaughter).

²³ See discussion *infra* Part II.

²⁴ See David P. Fidler, *From International Sanitary Conventions to Global Health Security: The New International Health Regulations*, 4 CHINESE J. INT'L L. 325, 378 (2005).

²⁵ *Id.* at 362, 390.

I. THE GOVERNING FRAMEWORK FOR GLOBAL HEALTH SECURITY BEFORE COVID-19

This section first discusses the concept of transnational public policy and analyses the cross-country measures implemented by countries for global health pandemics. Next this section studies the role of the International Health Regulations and epidemic control.²⁶

A. Global Health Security & Transnational Governance

As this article centers around the theme of global health law and governance, it is important to clarify the role played by individual nations (which might be the target of investment claims) in light of the WHO laws and recommendations. The goal of these laws and recommendations is to organize countries' responses to the pandemic.²⁷ Most states, like New Zealand, are using the WHO guidelines, however, other nations have been lagging behind.²⁸

The WHO has been a target of criticism by the former United States' President Trump for its delayed response to the COVID-19 outbreak.²⁹ The criticism stems from the WHO's reliance on statistics reported by China in January 2020.³⁰ The WHO first received an alert from China on December 31, 2019,³¹ reporting several unusual cases of pneumonia in Wuhan, followed by a report of the first human-to-human transmission of the virus on January 21, 2020.³² However, the WHO did not declare a "public health emergency

²⁶ See generally Ching-Fu Lin, *COVID-19 and the Institutional Resilience of the IHR (2005): Time for a Dispute Settlement Redesign?*, 13 CONTEMP. ASIA ARBITER. J. 269 (2020).

²⁷ Hans Henri P. Kluge, *Statement: Novel Coronavirus Outbreak: Preparing Now as One*, WHO (Jan. 25, 2020), <https://www.euro.who.int/en/media-centre/sections/statements/2020/statement-novel-coronavirus-outbreak-preparing-now-as-one>.

²⁸ See Adam Ferhani & Simon Rushton, *The International Health Regulations, COVID-19, and Bordering Practices: Who Gets in, What Gets out, and Who Gets Rescued?*, 41 CONTEMP. SEC. POL'Y 458, 465–66 (2020) (noting that Taiwan, as an example, has contained its response to Taiwanese citizens, against the advice of the WHO to extend the response beyond borders).

²⁹ Emma Farge, *WHO Rejects 'China-Centric' Charge After Trump Criticism*, REUTERS (Apr. 8, 2020), <https://in.reuters.com/article/health-coronavirus-who-europe/who-rejects-china-centric-charge-after-trump-criticism-idINKBN21Q182>.

³⁰ Jordan Fabian & Lisa Du, *Trump Halts U.S. Payments to WHO, Citing Reliance on China*, BLOOMBERG (Apr. 15, 2020, 5:24 PM), <https://www.bloomberg.com/news/articles/2020-04-14/trump-says-he-s-halting-payments-to-who-for-data-sharing-failure>.

³¹ *Pneumonia of Unknown Cause: China*, WHO (Jan. 5, 2020), <https://www.who.int/csr/don/05-january-2020-pneumonia-of-unknown-cause-china/en/>.

³² *Timeline of WHO's Response to COVID-19*, WHO (Sept. 9, 2020), <https://www.who.int/news-room/detail/29-06-2020-covidtimeline>.

of international concern” (“PHEIC”) until January 30, 2020,³³ by which time it was too late to stop the spread of virus as Wuhan and most areas in Hubei province were already under lockdown.³⁴ Additionally, five million residents of Wuhan were evacuated out of the city to other parts of Mainland China and elsewhere in the world.³⁵ However, over a billion trips were still made into and out of China as people celebrated the Spring Festival.³⁶

Preventive measures might have been implemented globally more rapidly had the WHO declared a PHEIC before China announced its province-wide lockdown.³⁷ For example, similar measures as the WHO Emergency Committee’s travel advisories and trade restrictions that responded to the 2003 SARS epidemic in Hong Kong, would have encouraged countries to implement and follow consistent travel and/or trade restrictions for COVID-19.³⁸ Additionally, declaring a PHEIC would have sent a cautionary signal to more countries at the initial stage of COVID-19 outbreak, paving the way for collaborative initiatives and plans with other foreign nations, strengthening each countries’ response.³⁹

New Zealand’s Prime Minister, Jacinda Ardern, has provided model strategies and was one of the first few developed countries affected by the

³³ *Id.*

³⁴ James Griffiths & Paul Murphy, *Millions are Living in Isolation in Hubei Province*, CNN (Jan. 31, 2020, 1:53 PM), https://edition.cnn.com/asia/live-news/coronavirus-outbreak-01-30-20-intl-hnk/h_634c8fc851ff0ed4d5ed576f8e7dd6ac.

³⁵ Josephine Ma & Zhuang Pinghui, *5 Million Left Wuhan Before Lockdown, 1,000 New Coronavirus Cases Expected in City*, S. CHINA MORNING POST (Jan. 26, 2020, 10:23 PM), <https://www.scmp.com/news/china/society/article/3047720/chinese-premier-li-keqiang-head-coronavirus-crisis-team-outbreak>.

³⁶ See Cui Xingyu, *2020 Spring Festival Travel Rush in Numbers*, CHINA GLOBAL TELEVISION NETWORK (Feb. 21, 2020), <https://news.cgtn.com/news/2020-02-20/2020-Spring-Festival-travel-rush-in-numbers-OeD3cMH6Y/index.html> (showing travel in and out of China).

³⁷ Rich Lowly, *Blaming China and WHO Over Coronavirus Isn’t Scapegoating*, BOS. HERALD (Apr. 11, 2020), <https://www.bostonherald.com/2020/04/11/blaming-china-and-who-over-coronavirus-isnt-scapegoating/> (describing deception by China and lack of independent action by the WHO as worsening the global spread of COVID-19).

³⁸ See *World Health Organization Issues Emergency Travel Advisory*, WHO (Mar. 15, 2020), <https://www.who.int/mediacentre/news/releases/2020/pr23/en> (outlining guidelines for travelers and airlines due to the spread of SARS).

³⁹ See Lin, *supra* note 26, at 275 (detailing the effect a declaration of a PHEIC has on State Parties).

virus.⁴⁰ After its first confirmed case on February 28, 2020,⁴¹ and reported at total of twenty COVID-19 confirmed cases by March 18, 2020.⁴² Just one week after the observed number of cases increased, New Zealand unveiled a four-level alert system to combat the pandemic.⁴³ Subsequently, the country changed the alert from a level two to a level three and then to a level four in just four days' time.⁴⁴ After establishing the level four alert on March 25, 2020, the country immediately declared a state of emergency and implemented a month-long lockdown.⁴⁵ The level four alert implemented a mandatory stay-at-home order, closed all non-essential services (excluding essential services like supermarkets, pharmacies and medical clinics), and closed all public areas.⁴⁶ Some critics attribute the success of the containment of the pandemic by categorizing the alert level system as a snug propaganda by the government to instill fear and concern amongst citizens and propel them into abiding by the government's order.⁴⁷

New Zealand's process for contact tracing efforts was incredibly effective. Contact tracers start with an "index" person, track everyone exposed to that individual, and then limits future transmission of the virus by isolating the

⁴⁰ Uri Friedman, *New Zealand's Prime Minister May Be the Most Effective Leader on the Planet*, ATLANTIC (Apr. 19, 2020), <https://www.theatlantic.com/politics/archive/2020/04/jacinda-ardern-new-zealand-leadership-coronavirus/610237> (detailing policies and approaches taken by the Prime Minister from the onset of the virus outbreak).

⁴¹ *New Zealand Confirms First Case of Coronavirus: Health Ministry*, HEALTHWORLD.COM (Feb. 28, 2020, 12:15 PM), <https://health.economictimes.indiatimes.com/news/diagnostics/new-zealand-confirms-first-case-of-coronavirus-health-ministry/74377332>.

⁴² Media Release, N.Z. Ministry of Health, COVID-19: Eight new cases linked to overseas travel (Mar. 18, 2020) <https://www.health.govt.nz/news-media-releases/covid-19-eight-new-cases-linked-overseas-travel>.

⁴³ Derek Cheng, *Coronavirus: PM Jacinda Ardern Outlines NZ's New Alert System, Over-70s Should Stay at Home*, N.Z. HERALD (Mar. 21, 2020 8:45 PM), <https://www.nzherald.co.nz/nz/coronavirus-pm-jacinda-ardern-outlines-nzs-new-alert-system-over-70s-should-stay-at-home/NKTHAAX6D5JET6DIBEMLDZ2FSU/>; New Zealand Government, *History of the COVID-19 Alert System*, UNITE AGAINST COVID-19, <https://covid19.govt.nz/alert-system/history-of-the-covid-19-alert-system/#timeline-of-key-events> (last visited Jan. 28, 2021).

⁴⁴ New Zealand Government, *supra* note 43.

⁴⁵ *Id.*

⁴⁶ Susan Strongman, *COVID-19 Pandemic Timeline*, RADIO N.Z., <https://shorthand.radionz.co.nz/coronavirus-timeline/> (last visited Jan. 28, 2021).

⁴⁷ See Bryce Edwards, *New Zealand's Covid-19 Strategy Looks Successful, But We Must Safeguard Democracy*, GUARDIAN (Apr. 15, 2020), <https://www.theguardian.com/commentisfree/2020/apr/16/new-zealands-fight-against-covid-19-looks-successful-but-democracy-is-under-threat> (discussing New Zealand's response to COVID-19 as exacerbating undemocratic principles); see generally Michael G. Baker et al., *New Zealand's Elimination Strategy for the COVID-19 Pandemic and What is Required to Make it Work*, 133 N.Z. MED. J., 10, 10–12 (2020) (discussing benefits and risks of New Zealand's 4-tier system).

contacts.⁴⁸ This strategy, when used with public health measures, had a ninety percent efficacy rate in containing COVID-19 at the population level which is a success in comparison to the previous contact tracing methods.⁴⁹ New Zealand supplemented contacted tracing by introducing “FluTracking,” an online surveillance system designed to monitor community spread of the virus by allowing all citizens to fill out a short weekly survey reporting any presence of typical flu-like symptoms and face-to-face interactions with others in the community.⁵⁰

In comparison, Italy’s response to the pandemic, led by Former prime minister, Matteo Renzi, also offers valuable lessons on inadequate responses.⁵¹ Italy was described as the “guinea pig” of Europe in combatting COVID-19 because it was the first country in Europe to be affected by COVID-19.⁵² Italian authorities were uncertain regarding the proper protocols for testing after the first two cases were discovered on January 31, 2020,⁵³ despite Italy being the first country in Europe to cut all transportation from China and declare a state of emergency.⁵⁴ Some critics of the response attributed Italy’s high infection and fatality rates to the large elderly population, population density, and its citizens’ close interaction level which results from Italian culture.⁵⁵

⁴⁸ *Interim Guidance: Contact Tracing in the Context of COVID-19*, WHO (May 10, 2020) https://apps.who.int/iris/bitstream/handle/10665/332049/WHO-2019-nCoV-Contact_Tracing-2020.1-eng.pdf?sequence=1&isAllowed=y.

⁴⁹ AYESHA VERRALL, RAPID AUDIT OF CONTACT TRACING FOR COVID-19 IN NEW ZEALAND 4 (New Zealand Ministry Health, May 2020), https://www.health.govt.nz/system/files/documents/publications/contact_tracing_report_verrall.pdf.

⁵⁰ AMANDA KVALSVIG ET AL., *SUPPORTING THE COVID-19 PANDEMIC RESPONSE: SURVEILLANCE AND OUTBREAK ANALYTICS* 22 (MINISTRY HEALTH 2020), https://www.health.govt.nz/system/files/documents/publications/report_for_moh_covid-19_surveillance_outbreak_analytics_final.pdf.

⁵¹ Julien Chaisse, *Both Possible and Improbable: Could COVID-19 Measures Give Rise to Investor-State Disputes?*, 13 CONTEMP. ASIA ARB. J. 99, 108 (2020).

⁵² *Id.*

⁵³ *Italy’s Coronavirus Epidemic Began in January, Study Shows*, REUTERS (Apr. 24, 2020, 9:38 AM) <https://www.reuters.com/article/us-health-coronavirus-italy-study/italys-coronavirus-epidemic-began-in-january-study-shows-idUSKCN2262B1>; see e.g. Jason Horowitz, *Italy, Mired in Politics Over Virus, Asks How Much Testing is Too Much*, N.Y. TIMES (updated Mar. 2, 2020), <https://www.nytimes.com/2020/02/27/world/europe/italy-coronavirus.html> (discussing how Italian officials were uncertain of the correct response).

⁵⁴ Dave Keating, *Italy Banned Flights from China Before America: It Didn’t Work*, FORBES (Mar. 12, 2020), <https://www.forbes.com/sites/davekeating/2020/03/12/italy-banned-flights-from-china-before-america-it-didnt-work/-499725d7481b>.

⁵⁵ See generally Marina Goumenou et al., *COVID-19 in Northern Italy: An Integrative Overview of Factors Possibly Influencing the Sharp Increase of the Outbreak (Review)*, 22 MOLECULAR MED. REP. 20 (2020).

The Italian leadership made several mistakes that are apparent when compared New Zealand's responses.⁵⁶ Even with a timely declaration of a state emergency made January 31, 2020,⁵⁷ the Italian government failed to convey the urgency to its populace.⁵⁸ Conversely, the New Zealand alert level system introduced by New Zealand, which was criticized as propaganda that instilled fear and concern amongst citizens and propelled them into abiding by the government's order.⁵⁹ Even in late February, Italian officials were actively downplaying the seriousness of the virus by publicly shaking hands with supporters to reassure citizens that panic was unnecessary and that it was imprudent to halt economic activities.⁶⁰ Building onto that, the Italian government ordered decrees laying down practices to be undertaken by the citizens which further increased the pre-existing restrictions within red zones of the lockdown areas.⁶¹ Over time, these restrictions were expanded and finally culminated in a country-wide lockdown.⁶² Additionally, Italy has inconsistent regional responses as evidenced by the slower approach in testing taken by Italy's Lombardy's regional government that resulted in a heavy burden on the hospitals.⁶³ Conversely, Veneto, a neighboring region, focused on a more proactive testing tactic.⁶⁴ This tactic covered symptomatic

⁵⁶ Jason Horowitz et al., *Italy, Pandemic's New Epicenter, Has Lessons for the World*, N.Y. TIMES (Mar. 21, 2020), <https://www.nytimes.com/2020/03/21/world/europe/italy-coronavirus-center-lessons.html>.

⁵⁷ *Italy Declares State of Emergency Over Coronavirus*, FRANCE 24 (Jan. 31, 2020), <https://www.france24.com/en/20200131-italy-declares-state-of-emergency-over-coronavirus>.

⁵⁸ Jason Horowitz, *Italy Announces Restrictions Over Entire Country in Attempt to Halt Coronavirus*, N.Y. TIMES (Mar. 9, 2020), <https://www.nytimes.com/2020/03/09/world/europe/italy-lockdown-coronavirus.html> (reporting how former Italian prime minister criticized the current government's failure in communicating the importance of the restrictions).

⁵⁹ Glen Johnson, *How New Zealand's Media Endangered Public Health*, ALJAZEERA (July 8, 2020), <https://www.aljazeera.com/opinions/2020/7/8/how-new-zealands-media-endangered-public-health>.

⁶⁰ Gary P. Pisano et al., *Lessons from Italy's Response to Coronavirus*, HAR. BUS. REV. (Mar. 27, 2020), <https://hbr.org/2020/03/lessons-from-italys-response-to-coronavirus>.

⁶¹ *Coronavirus: Italy Extends 'Red Zones' as Infections Soar*, BBC (Dec. 13, 2020), <https://www.bbc.com/news/world-europe-54937699>.

⁶² Michele Bertelli, *Italy Quarantines 16 Million People Over Coronavirus Fears*, ALJAZEERA (July 27, 2020), <https://www.aljazeera.com/news/2020/03/italy-quarantines-quarter-population-fight-coronavirus-200308071832617.html>.

⁶³ *Id.*

⁶⁴ *Id.*

and asymptomatic patients early on, ordered self-quarantine to any individual residing in proximity to patients, and engaged in home diagnosis and care.⁶⁵

In preparation for a foreseeable COVID-19 outbreak in Taiwan, the Central Epidemic Command Center (“CECC”) was set up on January 20, 2020.⁶⁶ At this point, Taiwan had prepared an intensive inspection and quarantine strategy to be enforced by border control in response to frequent cross-strait travels during the Lunar New Year holiday.⁶⁷ Additionally, Taiwan was prepared with an ample stock of surgical masks and N95 masks that was sufficient for its population.⁶⁸ Furthermore, Taiwan implemented a ban on mask exports.⁶⁹ Taiwan also adopted an alert level system like New Zealand’s, enforcing a mandatory surveillance for both individuals in close proximity to patients and those who travelled to Hubei province through a mobile phone app.⁷⁰ Beginning in early February 2020, Taiwan implemented tentative guidelines citizens and owners of local businesses about maintaining operations.⁷¹ Taiwan further proactively researched more efficient testing methods and imposed stricter border control and restrictions upon travelers.⁷² On the technological front, in March 2020, Taiwan developed a successful data model computed from mobile phone tracking data.⁷³ As such, a “protean network of databases was initiated by the

⁶⁵ Alaa Sbai, *Two COVID-19 Testing Strategies for Two Italian Regions: A History of Success and Failure*, INFOMINEO.COM (May 22, 2020), <https://infomineo.com/covid-two-regions-history-success-failure/>.

⁶⁶ Press Release, Ministry of Health & Welfare, Taiwan Established a Level 3 “Central Epidemic Command Center for Severe Pneumonia with Novel Pathogens” (updated June 2, 2020), <https://covid19.mohw.gov.tw/en/cp-4868-53714-206.html>.

⁶⁷ See *Timeline: COVID-19 in Taiwan*, FOCUS TAIWAN (Apr. 18, 2020), <https://focus.taiwan.tw/society/202004185001> (discussing entry restrictions).

⁶⁸ *Id.*

⁶⁹ *Taiwan Ups Chinese Visitor Curbs, to Stop Mask Exports*, REUTERS (Jan. 27, 2020, 6:43 AM), <https://www.reuters.com/article/us-china-health-taiwan/taiwan-ups-chinese-visitor-curbs-to-stop-mask-exports-idUSKBN1ZQ1C6>.

⁷⁰ *Taiwan to Electronically Monitor Potential Coronavirus Patients*, TAIWAN NEWS (Jan. 29, 2020), <https://www.taiwannews.com.tw/en/news/3866302>.

⁷¹ Cho-Hung Chiang et al., *Maintaining Mask Stockpiles in the COVID-19 Pandemic: Taiwan as a Learning Model*, INFECTION CONTROL & HOSP. EPIDEMIOLOGY 1, 2 (2020).

⁷² See generally Sheng-Chia Chung et al., *A Rapid Systematic Review and Case Study on Test, Contact Tracing, Testing, and Isolation Policies for Covid-19 Prevention and Control*, (June 17, 2020), (awaiting peer reviewed, MEDRXIV), <https://www.medrxiv.org/content/10.1101/2020.06.04.20122614v2.full>; Benjamin J. Cowling & Wey Wen Lim, *They’ve Contained the Coronavirus. Here’s How*, N.Y. TIMES: OPINION (Mar. 13, 2020), <https://www.nytimes.com/2020/03/13/opinion/coronavirus-best-response.html>.

⁷³ Heather Yourex-West, *Taiwan Used Cellphone Tracking, Big Data to Contain Spread of COVID-19 - Should Canada Do The Same?*, GLOBAL NEWS (Mar. 6, 2020), <https://globalnews.ca/news/6642722/taiwan-cellphone-tracking-data-contain-covid-19/>.

government,⁷⁴ however, all response (from mask distribution to residence of confirmed cases) flowed bottom-up and top-down. This approach operated like an “online town hall” where online tool developers and citizens collaborated with the government to discover issues and develop solutions in response to the rapidly changing dynamic of the pandemic.⁷⁵

B. The Private Sector Responses to the COVID-19

The transnational analysis requires an understanding of the private sector’s role as it, in addition to governments and international organizations, plays an important role in the governance of the COVID-19 crisis.

In the United States, the demand for disposable N95 respirators skyrocketed.⁷⁶ To address this rapidly growing demand, some private companies increased their production of such products, shifting to manufacturing masks or donating them.⁷⁷ Namely, in March 2020, Honeywell hired 500 new employees to ramp up the production for N95s in the United States and other parts of the world.⁷⁸ It is also been reported that many companies helped by providing necessary materials, for example clothing manufacturer, Hanes Brands Inc., shifted its focus to cotton masks approved for the public to wear as a protective measure.⁷⁹ Apple has reported donating millions of masks.⁸⁰ To cater to the demand of local hospitals, small

⁷⁴ Julien Chaisse, *Both Possible and Improbable—Could COVID-19 Measures Give Rise to Investor-State Disputes?*, 13 CONTEMP. ASIA ARB. J. 99, 109 (2020); Andreas Kluth, *If We Must Build a Surveillance State, Let’s Do It Properly*, BLOOMBERG (Apr. 22, 2020), <https://www.bloomberg.com/opinion/articles/2020-04-22/taiwan-offers-the-best-model-for-coronavirus-data-tracking>.

⁷⁵ *Id.*

⁷⁶ Neil Vigdor, *Home Depot Halts Sale of N95 Masks Amid Shortage, Company Says*, N. Y. TIMES (July 27, 2020), <https://www.nytimes.com/2020/04/01/business/n95-face-masks-home-depot-virus.html>.

⁷⁷ Lena H. Sun & Rachel Siegel, *As Demand Spikes for Medical Equipment, Texas Manufacturer is Caught up in Coronavirus’s Supply Chain Panic*, WASH. POST (July 26, 2020), <https://www.washingtonpost.com/business/2020/02/15/coronavirus-mask-shortage-texas-manufacturing/>.

⁷⁸ Press Release, Honeywell, Honeywell further expands N95 Face Mask Production by Adding Manufacturing Capabilities in Phoenix (Mar. 30, 2020), <https://www.honeywell.com/en-us/newsroom/pressreleases/2020/03/honeywell-further-expands-n95-face-mask-production-by-adding-manufacturing-capabilities-in-phoenix>.

⁷⁹ Daniel Finnegan, *HanesBrands to Produce Masks to Help Combat Shortage*, TRIAD BUS. J. (Mar. 22, 2020), <https://www.bizjournals.com/triad/news/2020/03/22/hanesbrands-to-produce-masks-to-help-combat.html>.

⁸⁰ Rachel Sandler, *Tim Cook says Apple is Sourcing 10 Million Masks From its Supply Chain*, FORBES (Mar. 25, 2020), <https://www.forbes.com/sites/rachelsandler/2020/03/25/tim-cook-says-apple-is-sourcing-10-million-masks-from-its-supply-chain/#367b15191c15>.

regional companies were dedicating their efforts to produce cotton masks.⁸¹ For example, AST Sportswear in Orange County, California and MyPillow in Minnesota were some of the notable mask producers.⁸² Furthermore, some automobile and electronics manufacturers are producing ventilators in their factories.⁸³ Additionally, Amazon has pledged to provide \$5 million of aid to local businesses near its Seattle, Washington headquarters which are likely to suffer losses due to Amazon's work from home policy.⁸⁴ Tech giants like Microsoft and Amazon have created a COVID-19 response fund to support Washington State, which has been badly hit by the virus.⁸⁵ In addition to these, big businesses like "Alaska Airlines and the Starbucks Foundation have donated \$2.5 million."⁸⁶ Whereas, Facebook and Apple have announced donations of \$20 million and \$15 million, respectively.⁸⁷

Meanwhile, in other parts of the world, like in Britain, "aerospace multinational Airbus has led the Ventilator Challenge UK Consortium."⁸⁸ This was a "unified national effort" that seems to have brought "rival manufacturers from a range of industries" together in an attempt to "increase

⁸¹ See Rachel Abrams et al., *Governments and Companies Race to Make Masks Vital to Virus Fight*, N.Y. TIMES (updated Apr. 3, 2020), <https://www.nytimes.com/2020/03/21/business/coronavirus-masks-hanes-trump.html> (discussing the efforts being made by companies to shift production to help with mask shortages).

⁸² Mark Reilly, *They Made Pillows, Cubicles, Gin and Kayaks. Now They're All Making COVID-19 Gear*, MINNEAPOLIS / ST. PAUL BUS. J. (Mar. 30, 2020), <https://www.bizjournals.com/twincities/news/2020/03/30/they-made-pillows-and-cubicles-and-gin-and-kayaks.html>; Mindy Schauer, *Brea Apparel Maker Donates Thousands of Masks in Drive-Through Giveaway*, ORANGE CTY. REG. (Apr. 18, 2020, 8:27 PM) <https://www.oregister.com/2020/04/18/brea-apparel-maker-donates-30000-face-masks-in-drive-through-giveaway/>.

⁸³ See Kristin Korosec, *Tesla CEO Elon Musk: New York Gigafactory Will Reopen for Ventilator Production*, TECH CRUNCH (Mar. 25, 2020), <https://techcrunch.com/2020/03/25/tesla-ceo-elon-musk-new-york-gigafactory-will-reopen-for-ventilator-production/> ("Stating that Tesla is one of several automakers, including GM, Ford and FCA that has pledged support to either donate supplies or offer resources to make more ventilators. Earlier this week, Ford said it is working with GE Healthcare to expand production capacity of ventilators.").

⁸⁴ Sean Fleming, *How Big Business is Joining the Fight Against COVID-19*, WORLD ECON. FORUM (Mar. 23, 2020), <https://www.weforum.org/agenda/2020/03/big-business-joining-fight-against-coronavirus/>.

⁸⁵ Sibahle Malinga, *Tech Giants Pledge Billions to Help Fight COVID-19*, ITWEB (Apr. 9, 2020), <https://www.itweb.co.za/content/JBwEr7nBJoV76Db2>.

⁸⁶ Fleming, *supra* note 84.

⁸⁷ David Hessekkel, *Companies Taking First Steps to Support COVID-19 Response Efforts*, FORBES (Mar. 11, 2020, 2:37 PM), <https://www.forbes.com/sites/davidhessekkel/2020/03/11/companies-taking-first-steps-to-support-covid-19-response-efforts/#17ba64fc6f8f>.

⁸⁸ Dan Robinson, *The Companies Repurposing Manufacturing to Make Key Medical Kit During Covid-19 Pandemic*, NS MED. DEVICES (Apr. 1, 2020), <https://www.nsmedicaldevices.com/analysis/companies-ventilators-shortage-coronavirus/>.

the number of ventilators ... from 8,175 to 30,000 within weeks.”⁸⁹ A significant number of companies (such as Formula 1 team McLaren, Siemens AG, Rolls-Royce Motor Cars, GKN and Meggit, BAE Systems PLC, and Ford) have come forward to provide facilities to efficiently construct more “machines based on proven designs already used by medical device manufacturers Smiths Medical and Penlon.”⁹⁰

The AMG-Mercedes department of automotive giant Daimler-Benz strived for a target to construct about 10,000 continuous positive airway pressure machines.⁹¹ These machines are key in facilitating the oxygen required by patients before ventilators may be needed.⁹² The Daimler-Benz company has been working alongside academics and mechanical engineers at University College London and clinicians “at University College London Hospitals NHS Foundation Trust” to accomplish the process of reverse engineering (a procedure to adapt a pre-existing breathing aid for mass production).⁹³ To produce the first device, which was used by NHS, less than 100 hours (from the time of initial meeting) was required.⁹⁴ According to a statement given by Mercedes, in Italy, about half of the patients who were given continuous positive airway pressure machines have not required invasive mechanical ventilation.⁹⁵ It is highly problematic to observe that these continuous positive airway pressure machines have been in relatively low supply in British hospitals since the COVID-19 wave hit the UK.⁹⁶

Ineos, the chemical giant and technically Britain’s biggest company (by sales), has set up plans to start a new plant on the outskirts of Middlesbrough.⁹⁷ This plant is said to be capable of making a million bottles of hand sanitizer per month.⁹⁸ A similar strategy has been employed in Germany which established another factory for manufacturing hand

⁸⁹ *Id.*

⁹⁰ *Id.*

⁹¹ *Id.*

⁹² *Id.*

⁹³ Fergus Walsh, *Coronavirus: Mercedes F1 to Make Breathing Aid*, BBC NEWS (Mar. 30, 2020), <https://www.bbc.com/news/health-52087002>.

⁹⁴ *UCL Ventura Breathing Aids for COVID-19 Patients*, UCL INST. HEALTHCARE ENG’G (July 28, 2020), <https://www.ucl.ac.uk/healthcare-engineering/covid-19/ucl-ventura-breathing-aids-covid-19-patients>.

⁹⁵ *Mercedes F1 Team Helps Create Breathing Aid to Keep Coronavirus Patients out of Intensive Care*, TELEGRAPH (Mar. 30, 2020, 8:21 AM), <https://www.telegraph.co.uk/news/2020/03/30/mercedes-f1-team-helps-create-breathing-aid-keep-coronavirus/>.

⁹⁶ *Id.*

⁹⁷ Rory Sullivan, *Coronavirus: Hand Sanitiser Plant Capable of Producing One Million Bottles a Month to Be Built in UK*, INDEPENDENT (Mar. 24, 2020, 11:12 AM), <https://www.independent.co.uk/news/uk/home-news/coronavirus-ineos-hand-sanitiser-plant-middlesbrough-a9420611.html>.

⁹⁸ *Id.*

sanitizer.⁹⁹ Moreover, Ineos has increased the production of isopropyl and alcohol in its factories in Scotland and Germany to aid with the production of hands sanitizers.¹⁰⁰ BrewDog, a Scottish craft beer brand, unfurled a new sanitizer named Brewgel Punk Sanitizer in March.¹⁰¹ Brewgel Punk would be limited to giving it for charity purposes and at Aberdeen hospital.¹⁰² Pernod Richards, the French spirits empire behind the famous Jameson Irish Whiskey and Absolut Vodka has initiated the US-based production of hand sanitizer by converting its factories to produce hand sanitizer instead of its usual line of products.¹⁰³ In the same vein, rum giant Bacardi, Anheuser-Busch InBev, and several other independent companies have significantly contributed to the effort of increased demand for hand sanitizer.¹⁰⁴ Three factories that are owned by luxury goods French group Moët Hennessy – Louis Vuitton SE (LVMH) that normally produce, among others, Givenchy, Dior, and Guerlain cosmetics and perfumes have also shifted its production to produce hand sanitizers, with priority for French hospitals.¹⁰⁵ Gucci has also pledged to make more than a million masks.¹⁰⁶ The joint CEOs of the Italian luxury brand Prada have offered money to help the construction of much needed intensive care units in Milan.¹⁰⁷ Zara has also come forward in

⁹⁹ *Id.*

¹⁰⁰ Andrea D. Steffen, *Two Hand Sanitizer Factories to be Built in Ten Days by UK Chemicals Giant*, INTELLIGENT LIVING (Mar. 28, 2020), <https://www.intelligentliving.co/two-hand-sanitizer-factories-built-ten-days/>.

¹⁰¹ Annette Cameron, *BrewDog Set to Deliver First Batch of Hand Sanitiser to Aberdeen Hospital*, EVENING EXPRESS (Mar. 22, 2020, 1:48 PM), <https://www.eveningexpress.co.uk/fp/news/local/brewdog-set-to-deliver-first-batch-of-hand-sanitiser-to-aberdeen-hospital/>.

¹⁰² *Id.*

¹⁰³ Jessica Snouwaert, *The Maker of Absolut Vodka and Jameson Irish Whisky is Converting its Facilities to Produce Hand Sanitizer that it Will Donate Amid the Shortage*, BUS. INSIDER (Mar. 20, 2020, 12:07 AM), <https://www.businessinsider.Nin/retail/news/the-maker-of-absolut-vodka-and-jameson-irish-whisky-is-converting-its-facilities-to-produce-hand-sanitizer-that-it-will-donate-amid-the-shortage/articleshow/74719622.cms>.

¹⁰⁴ Chris Furnari, *With Sanitizer in Short Supply, Alcohol Producers Pivot to Battle Coronavirus Pandemic*, FORBES (Mar. 25, 2020, 5:35 PM), <https://www.forbes.com/sites/chrisfurnari/2020/03/25/with-sanitizer-in-short-supply-alcohol-producers-pivot-to-battle-coronavirus-pandemic/#7242075f71f2>.

¹⁰⁵ Richard Kestenbaum, *LVMH Converting its Perfume Factories to Make Hand Sanitizer*, FORBES (Mar. 15, 2020, 4:13 PM), <https://www.forbes.com/sites/richardkestenbaum/2020/03/15/lvmh-converting-its-perfume-factories-to-make-hand-sanitizer/#6a2adcb84a9a>.

¹⁰⁶ Ellie V. Bramley, *Prada the Latest Fashion Brand to Make Medical Face Masks*, GUARDIAN (Mar. 24, 2020, 11:00 AM), <https://www.theguardian.com/fashion/2020/mar/24/prada-the-latest-fashion-brand-to-make-medical-face-masks>.

¹⁰⁷ Giacomo Tognini, *Giorgio Armani and 22 Other Italian Billionaires Donate More than \$63 Million to Fight Coronavirus in Italy*, FORBES (Mar. 19, 2020, 4:33 PM), <https://www.forbes.com/sites/giacomotognini/2020/03/19/giorgio-armani-and-17-other-italian-billionaires-donate-more-than-28-million-to-fight-coronavirus-in-italy/#68cc755dad3>.

this regard and has aimed to “provide 40,000 surgical masks to hospitals.¹⁰⁸ H&M has pledged to provide protective equipment.”¹⁰⁹ While questions have popped up regarding the absence of larger luxury and/or design brands in both US and Britain, smaller brands like Collina Strada, Hanes and LL Bean and many others have shown continuous support and came forward during the pandemic in to offer help in the US.¹¹⁰

C. The WHO International Health Regulations

The growing interdependence and the exponential development of international trade and tourism has transformed state isolated health risks into global risks.¹¹¹ Although it should be noted, two exceptions to this new rule aggravating risk are quarantine clauses in old trade treaties and the rules of international humanitarian law concerning the protection of the sick and wounded in situations of armed conflict since these are helpful in the present context.¹¹² Many actors contribute to these risks, including the states themselves, private actors, and international organizations.¹¹³ Additionally, certain instances of action, or a lack thereof, may also contribute to causing global damage such as pandemic like poorly constructed social distancing norms or no social distancing norms at all.¹¹⁴

The internationalization of health protection has evolved as nations have been forced to face contemporary health risks together, and as a result, a purely isolated-nation framework is now impossible.¹¹⁵ As such, there are three aspects of such internationalization which should be highlighted.

¹⁰⁸ Dan Robinson, *The Companies Repurposing Manufacturing to Make Key Medical Kit During Covid-19 Pandemic*, NS MED. DEVICES (Apr. 1, 2020), <https://www.nsmedicaldevices.com/analysis/companies-ventilators-shortage-coronavirus/>.

¹⁰⁹ *Id.*

¹¹⁰ *Id.*

¹¹¹ See Yipeng Liu et al., *The Challenges and Opportunities of a Global Health Crisis: The Management and Business Implications of COVID-19 from an Asian Perspective*, 19 ASIAN BUS. & MGMT. 277, 280 (2020), (discussing the interconnected nature of businesses in the modern world).

¹¹² See Geneva Convention Relative to the Treatment of Prisoners of War Art. 1, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135.

¹¹³ Joshua Busby, *What International Relations Tells Us About COVID-19*, E-INT’L REL. (2020), <https://www.e-ir.info/2020/04/26/what-international-relations-tells-us-about-covid-19/>.

¹¹⁴ Timothy Bella, *Places Without Social Distancing Have 35 Times More Potential Coronavirus Spread, Study Finds*, WASH. POST (May 15, 2020 6:21 AM), <https://www.washingtonpost.com/nation/2020/05/15/social-distancing-study-coronavirus-spread/>.

¹¹⁵ David P. Fidler, *The Globalization of Public Health: Emerging Infectious Diseases and International Relations*, 5 IND. J.L. STUD. 1, 11 (1997).

First, the revised WHO International Health Regulations in 2005 set out a series of obligations relating to health protection in response to a “health emergency of international concern.”¹¹⁶ The scope of these preventive obligations shows that there is a significant convergence in the declaration of a health emergency and infectious diseases. The preventive obligations rely on specific criteria including: the sharing of information in a prompt and transparent manner, the exchange of epidemiological data, the sharing of research advances, and the strengthening of national health systems.¹¹⁷

Second, the “no harm rule” developed through customary international obligations, aims to protect states from being harmed.¹¹⁸ When a nation becomes aware of a risk, it has a duty to prevent by responding with due diligence and it must reasonably deploy all available resources so as to forestall the nation’s acknowledgement.¹¹⁹ The concept of due diligence is not limited to general obligations, but also distinct obligations, such as early caution and the sharing of information with other nations.¹²⁰

Third, various human rights protection treaties, case law of treaty bodies, and frequent introduction into national constitutions speak to the evolving obligations pertaining to an individual’s right to health.¹²¹ Specifically, the U.N. Committee on Economic, Social and Cultural Rights (CESCR) details an individual’s right to health in its general comment No. 14,¹²² the International Covenant on Economic, Social and Cultural Rights (ICESCR) (to which 171 States, including China since 2001, are parties).¹²³ Under such obligations, one can emphasize the duty of informing the nations and persons concerned of the existence of health risks as soon as they are made

¹¹⁶ Ferhani & Rushton, *supra* note 28, at 467.

¹¹⁷ David P. Fidler & Lawrence O. Gostin, *The New International Health Regulations: An Historic Development for International Law and Public Health*, 34 J. L. MED. & ETHICS 85, 90–91, 93 (2006).

¹¹⁸ Marte Jervan, *The Prohibition of Transboundary Environmental Harm. An Analysis of the Contribution of the International Court of Justice to the Development of the No-Harm Rule*, UNIV. OSLO 1, 5 (2014).

¹¹⁹ Lucas Bastin, *State Responsibility for Omissions: Establishing a Breach of the Full Protection and Security Obligation by Omissions* 19–20 (2017) (unpublished Ph.D. thesis, Magdalen College) (on file with the University of Oxford).

¹²⁰ *Id.*

¹²¹ See generally *The Right to Health*, WHO Fact Sheet No. 31, <https://www.ohchr.org/documents/publications/factsheet31.pdf>.

¹²² Comm. on the Highest Attainable Standard of Health, Office of the High Commissioner for Human Rights, (Art. 12), U.N. Doc. E/C.12/2000/4 (2000).

¹²³ *UN Treaty Collection, Chapter IV, Human Rights*, (2020) International Covenant on Economic, Social and Cultural Rights, Dec. 16, 1966, 999 U.N.T.S. 3.

aware.¹²⁴ Instrumentally, such duty also includes developing an adequate health system capable of combating the exigencies.¹²⁵

China's failure to caution the WHO and foreign nations is a blatant example of failing to apply International Health Regulations and Epidemic Control to the COVID-19 crisis.¹²⁶ The first COVID-19 case was identified in November 2019.¹²⁷ Several doctors in Wuhan voiced concerns by the end of December, but some of these were neglected and some were arrested for sharing this information.¹²⁸ This censorship led to the delayed recognition of the existence of the pandemic, which was not officially recognized by the WHO until March 12, 2020.¹²⁹ Consequently, China has yet to effectively fulfill its duties and obligations under international legislation.¹³⁰

II. INSTABILITY AT THE GATE: COVID-19 IMPLICATIONS FOR DISPUTE RESOLUTION

The manifest lack of countries cooperation in addressing the pandemic raises serious issues under international law in terms of the responsibility of each of them in contributing to the spread of a virus that is not just killing thousands of citizens but is also causing considerable damages to economies. The question of international responsibility is especially important as a number of countries did not comply with international rules (whether health standard, trade rules, human rights norms, etc.).

¹²⁴ Comm. on the Highest Attainable Standard of Health, *supra* note 122, at 4.

¹²⁵ *Id.* at 6.

¹²⁶ *Statement on the First Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV)*, WHO (2020), [https://www.who.int/news-room/detail/23-01-2020-statement-on-the-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/23-01-2020-statement-on-the-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)).

¹²⁷ *First COVID-19 Case Can Be Traced Back to November 17 in China's Hubei Province: Report*, ECON. TIMES (Mar. 13, 2020), <https://economictimes.indiatimes.com/news/international/world-news/first-covid-19-case-can-be-traced-back-to-november-2017-in-chinas-hubei-province-report/articleshow/74608199.cms?from=mdr>.

¹²⁸ Gerry Shih & Hannah Knowles, *A Chinese Doctor Was One of the First to Warn About Coronavirus. He got Detained and Infected*, WASH. POST (Feb. 4, 2020), <https://www.washingtonpost.com/world/2020/02/04/chinese-doctor-has-coronavirus/>.

¹²⁹ See Dawn Kopecki et al., *World Health Organization Declares the Coronavirus Outbreak a Global Pandemic*, CNBC (Mar. 11, 2020), <https://www.cnn.com/2020/03/11/who-declares-the-coronavirus-outbreak-a-global-pandemic.html> (stating that miscommunication between governments and their citizens created confusion in the wake of the epidemic).

¹³⁰ Steven Lee Myers, *China Created a Fail-Safe System to Track Contagions. It Failed*, N.Y. TIMES (Apr. 17, 2020), <https://www.nytimes.com/2020/03/29/world/asia/coronavirus-china.html> (discussing China's internal failings amid the outbreak).

In fact, multiple measures sanctioned by the governments worldwide have already raised concerns in the context of an erupting a wave of foreign investment claims. For example, in April 2020, threatened by an investment claim, the elected Congress of Peru adopted a law suspending the collection of toll fees on major highways as a measure to mitigate the ramifications caused by COVID-19 throughout the country.¹³¹ Legal discussions by scholars to review the circumstances are necessary, as not all measures were successful, taken at the same time and/or with the same reliance on scientific evidence.¹³² The time delay will lead to further complications with the assessment of investors' operations (and possibly bankruptcies).¹³³ Axiomatically, the pandemic cannot act as a façade for all recent laws and rules enacted in several countries.¹³⁴ Given the global reach of the pandemic, it is conceivable that the crisis led multiple governments to embrace such contentious measures; however, such multiplicity of actions to address the health crisis will inevitably usher a host of complex issues, peculiarly in the arena of investment treaties.¹³⁵

¹³¹ Cosmo Sanderson, *Peru Warned of Potential ICSID Claims over Covid-19 Measures*, GLOB. ARB. REV. (Apr. 9, 2020), <https://globalarbitrationreview.com/article/1225319/peru-warned-of-potential-icsid-claims-over-covid-19-measures>.

¹³² See, e.g., German Lopez, *America's Coronavirus Testing Failure has Forced Us to Rely More on Painful Social Distancing*, VOX (Mar. 20, 2020), <https://www.vox.com/policy-and-politics/2020/3/20/21183696/coronavirus-social-distancing-testing-covid-19-trump> (describing failures to implement social distancing measures); Kyle Ferrier, *South Korea Ramps-up Exports of COVID-19 Testing Kits*, DIPLOMAT (Apr. 9, 2020), <https://the-diplomat.com/2020/04/south-korea-ramps-up-exports-of-covid-19-testing-kits/> (describing how South Korea's mass testing helped keep its outbreak under control); but see, *Lockdowns, Immunity, 'Test, Test, Test': Searching for the Right Virus Strategy*, FRANCE 24 (Apr. 23, 2020, 6:30 PM), <https://www.france24.com/en/20200423-lockdowns-immunity-test-test-test-searching-for-the-right-virus-strategy> (listing COVID-19 safety measures that countries around the world have enacted with varying success).

¹³³ See generally, CTR. FOR ECON. POL'Y RES., ECON. IN THE TIME OF COVID-19 39 (Richard Baldwin & Beatrice Weder di Mauro eds., 2020), <https://voxeu.org/content/economics-time-covid-19>.

¹³⁴ Pavol Blahusiak & Boris Brhlovic, *Legislative Changes in View of the Covid-19 Pandemic (In Some Countries There are Changes to Insolvency Law, Tenancy Law, Law on Consumer Contracts and Corporate Law)*, LEGALINK (Apr. 4, 2020), <https://www.legalink.ch/covid-19/europe/legislative-changes-in-view-of-the-covid-19-pandemic-in-some-countries-there-are-changes-to/1595/>.

¹³⁵ *COVID-19 and Investment Treaties: Balancing the Protection of Public Health and Economic Interests*, JONESDAY: INSIGHTS (May 2020), <https://www.jonesday.com/en/insights/2020/05/covid19-and-investment-treaties>.

A. *State Responsibility and COVID-19: The Role of Public International Law*

Several scholars have argued that China's actions while combating COVID-19 are in violation of the IHR.¹³⁶ In light of these allegations, China was believed to have breached its obligations under Article 6 and 7 of IHR.¹³⁷

For any party attempting to sue China for its conduct, the major challenge is identifying the jurisdictional basis for such action.¹³⁸ Article 56 of the IHR provides for such a mechanism, however, by asking parties to identify the jurisdictional basis the form of arbitration, which under any event, can only be executed upon China's consent, which inherently is very unlikely.¹³⁹ Another basis to continue with such a claim is through Article 75 of the WHO Constitution, which provides that "any question or dispute concerning the interpretation or application of this Constitution which is not settled by negotiation or by the Health Assembly shall be referred to the International Court of Justice ...".¹⁴⁰ In a nutshell, either Article 56 of the IHR or Article 75 of the WHO Constitution would constitute a solid legal basis to trigger the ICJ's jurisdiction.¹⁴¹

Furthermore, another basis could be breach of Article 63, which provides: "Each Member shall communicate promptly to the Organization important laws, regulations, official reports and statistics pertaining to health which have been published in the State concerned."¹⁴² China was alleged to withhold crucial documents such as reports of medical staff infections¹⁴³ and data regarding the number of the asymptomatic persons ("classified Chinese government data"), which are important in determining the contagiousness

¹³⁶ David Fidler, *COVID-19 & International Law: Must China Compensate Countries for the Damage?*, JUST SECURITY (Mar. 27, 2020), <https://www.justsecurity.org/69394/covid-19-and-international-law-must-china-compensate-countries-for-the-damage-international-health-regulations>.

¹³⁷ WHO, *International Health Regulations* (3rd. ed. 2005).

¹³⁸ Peter Tzeng, *Taking China to the International Court of Justice over COVID-19*, EJIL: TALK! (Apr. 2, 2020), <https://www.ejiltalk.org/taking-china-to-the-international-court-of-justice-over-covid-19>.

¹³⁹ *Id.*

¹⁴⁰ *Id.*

¹⁴¹ See *Armed Activities on the Territory of the Congo (New Application: 2002) (Democratic Republic of Congo v. Rwanda)*, INT'L CT. JUST. (May 28, 2002), <https://www.icj-cij.org/en/case/126>. (In the DR Congo v. Rwanda case, the ICJ found that "[t]he jurisdiction of the Court comprises all cases which the parties refer to it and all matters specially provided for in the Charter of the United Nations or in treaties and conventions in force." In this respect, one can derive that the WHO Constitution is an acceptable legal basis.).

¹⁴² WHO CONSTITUTION, Oct. 2006, Art. 63, 45th ed.

¹⁴³ Nick Givas, *WHO Haunted by January Tweet Saying China Found No Human Transmission of Coronavirus*, FOX NEWS (Mar. 18, 2020), <https://www.foxnews.com/world/world-health-organization-january-tweet-china-human-transmission-coronavirus>.

of COVID-19.¹⁴⁴ Although China was obligated to notify and alert WHO within twenty-four hours of such assessment,¹⁴⁵ the WHO was alerted by its own office in China and not by the Chinese authorities.¹⁴⁶ Further, the Chinese government has censored various posts on social media by Chinese doctors,¹⁴⁷ which reinforces the allegations of withholding crucial documents. However, whether these documents can fall within the ambit of ‘published’ sources under Article 63 is still a matter under deliberation.¹⁴⁸

Finally, a purpose and objective of the WHO Constitution—specifically “the attainment by all peoples of the highest possible level of health”—was defeated by China,¹⁴⁹ despite international law aimed at avoiding this precise outcome.¹⁵⁰

B. Are COVID-19 Related Domestic Trade Measures WTO-Consistent?

Turkey, Indonesia, Myanmar, Russia, and the Philippines and, in fact, most governments tend to under-report outbreaks to protect their economic and tourist activities;¹⁵¹ a major reason behind WHO’s advice on trade and travel restrictions throughout the pandemic.¹⁵² Therefore, implementation of punitive travel and trade restrictions may hinder the promise of mutual transparency by nations necessary to combat the pandemic.¹⁵³

According to an official WTO report published in April 2020, “80 countries and separate customs territories have introduced export prohibitions or restrictions as a

¹⁴⁴ Josephine Ma et al., *A Third of Coronavirus Cases May be ‘Silent Carriers’*, CHINA MORNING POST (Mar. 22, 2020, 06:00 PM), <https://www.scmp.com/news/china/society/article/3076323/third-coronavirus-cases-may-be-silent-carriers-classified>.

¹⁴⁵ WHO Guidance for the Use of Annex 2 of the International Health Regulations (2005).

¹⁴⁶ *WHO Says it was Alerted About Virus by its Own Office in China, Not the Government*, DECCAN CHRON. (July 4, 2020, 08:54 AM), <https://www.deccanchronicle.com/world/neighbours/040720/who-says-it-was-alerted-about-virus-by-its-own-office-in-china-not-th.html>.

¹⁴⁷ Reuters Staff, *China's Online Censors Tighten Grip After Brief Coronavirus Respite*, REUTERS (Feb. 11, 2020, 5:23 AM), <https://www.reuters.com/article/uk-china-health-censorship-idUKKBN2051BV?edition-redirect=uk>.

¹⁴⁸ Tzeng, *supra* note 138.

¹⁴⁹ WHO Constitution, *supra* note 142, at 187.

¹⁵⁰ Vienna Convention on the Law of Treaties, art. 18, May 23, 1969, 1155 U.N.T.S. 331, 336.

¹⁵¹ *See Tourism Flows and Death Rates Suggest Covid-19 is Being Under-reported*, ECONOMIST (Mar. 7, 2020), <https://www.economist.com/graphic-detail/2020/03/07/tourism-flows-and-death-rates-suggest-covid-19-is-being-under-reported>; *see also* Laura Pitel & Funja Guler, *Turkey Admits Publishing Incomplete Coronavirus Tally*, FIN. TIMES (Oct. 1, 2020), <https://www.ft.com/content/5307a438-f083-4f7f-a1da-5b0a0eaa6047>.

¹⁵² Ruud Koopmans, *A Virus that Knows no Borders?* (WZB Berlin Soc. Sci. Ctr. Discussion Paper No. SP VI 2020-103, 2020) at 4.

¹⁵³ Ferhani & Rushton, *supra* note 28, at 458, 460.

result of the COVID-19 pandemic.”¹⁵⁴ The COVID-19 pandemic is major challenge to international trade law rules which also means that many lawsuits could be launched at WTO. The General Agreement on Tariffs and Trade (GATT) Article XI:1 generally eliminates quantitative restrictions on trade in goods (including any medical products need to treat the virus), stating “no prohibitions or restrictions other than duties, taxes or other charges, whether made effective through quotas, import or export licenses [sic] or other measures, shall be instituted”¹⁵⁵ However, such restriction can also be challenged by a WHO member nation if it fulfils the criterion established.¹⁵⁶

In spite of the quantitative export restriction imposed by WTO, a broad range of carve-outs have been provided, like export restrictions to address “critical shortages” (GATT Article XI:2(a)), health protection (GATT Article XX(b)), products in “general or local short supply” (GATT Article XX(j)), and certain export restrictions on raw materials to supply a domestic processing industry (GATT Article XX(i)) and national security (GATT Article XXI).¹⁵⁷

Under European Union (“EU”) law, a principle of strict proportionality applies in the sense that for a WTO Member to rely on the carve-out or any of the exceptions, a series of conditions must be met. These conditions range from the type of products covered (foodstuffs or other “essential” products” under Article XI:2(a))¹⁵⁸ and “necessity” (for health measures under Article XX(b))¹⁵⁹ to “equitable” distribution of supplies (under Article XX(j)).¹⁶⁰ Herein, it is pertinent to note that during a pandemic, time is of the essence when discussing legal actions which move at a delayed pace. WTO dispute settlement delays are so significant that filing a standard case to enforce

¹⁵⁴ Information Note, *Export Prohibitions and Restrictions*, ¶4.3, WTO (Apr. 23, 2020), https://www.wto.org/english/tratop_e/covid19_e/export_prohibitions_report_e.pdf.

¹⁵⁵ General Agreement on Tariffs and Trade, art. XI, July 1, 1986, 101 Stat. 2067, U.N.T.S. 17–18 [hereinafter GATT].

¹⁵⁶ *Id.*

¹⁵⁷ Joost Pauwelyn, *Export Restrictions in Times of Pandemic: Options and Limits under International Trade Agreements* 6–13 (Apr. 30, 2020) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3579965; see also Chaisse J., *Exploring the Confines of International Investment and Domestic Health Protections: General Exceptions Clause as a Forced Perspective*, 39 AM. J.L. & MED. 332, 344–46 (2013) (noting the deviations from key trade principles and from all provisions of the GATT that WTO employs).

¹⁵⁸ GATT, *supra* note 156, at 1.

¹⁵⁹ *Id.*

¹⁶⁰ *Id.* at 263.

WTO limits on export restrictions is hardly an option.¹⁶¹ Adding to the current hinderances, the WTO's Appellate Body is currently out of service¹⁶² but a sub-group of WTO Members set up an interim appeal arbitration arrangement.¹⁶³ If both the parties agree, Article 25 of the Dispute Settlements Understanding ("DSU") can be invoked to envisaged expedited arbitration.¹⁶⁴ Even in the heat of the crisis, one can expect transparency, notifications and consultations.¹⁶⁵

C. COVID-19 & International Investment Protection: Could Investment Arbitration Play a Role?

The effects of COVID-19 are not only restricted to the health sphere but also extend to the political arena. This is especially difficult for already struggling regimes like Iran—a country which has been exposed to many social and economic crises.¹⁶⁶ For the first time during the COVID crisis, Tehran requested assistance from the International Monetary Fund (IMF).¹⁶⁷ While addressing matters related to Mr. Vladimir Putin, it becomes difficult to evaluate whether the pandemic will guide him towards passing aside from Iran, whether he will further complicate the oil battle against Saudi Arabia and indirectly, the United States or make a reform in the constitution to extend his power in light of the pandemic. In fact, foreign investors, via legal claims, are only escalating pressure under such political environment.

¹⁶¹ See Joost Pauwelyn & Weiwei Zhang, *Busier than Ever? A Data-Driven Assessment and Forecast of WTO Caseload*, 21 J. INT'L ECON. L. 461, 476 (2018) (discussing the reasons behind the WTO caseload as that of pending past cases); see also Joost Pauwelyn, *The Real Rot in the System: Delays are Making WTO Dispute Settlement Irrelevant, Especially During a Pandemic*, IELP BLOG (Mar. 27, 2020), <https://ielp.worldtradelaw.net/2020/03/the-real-rot-in-the-system-delays-are-making-wto-dispute-settlement-irrelevant-especially-during-a-p.html>.

¹⁶² Joost Pauwelyn, *WTO Dispute Settlement Post 2019: What to Expect?*, 22 J. INT'L ECON. L. 297, 297 (2019).

¹⁶³ Multi-Party Interim Appeal, *Statement on a Mechanisms for Developing, Documenting and Sharing Practicing and Procedures in the Conduct of TWO Disputes*, WTO Doc. 20-3358, at 1 (Apr. 30, 2020).

¹⁶⁴ See CUTS Int'l, *COVID-19 and a Global Call to the WTO Members, Pledge for Trade as a Global Public Good*, at 2 (2020) (urging WTO Members to "avoid raising trade disputes at the WTO as under the existing mechanisms").

¹⁶⁵ WTO SECRETARIAT, *TRANSPARENCY: WHY IT MATTERS AT TIMES OF CRISIS 1* (Apr. 7, 2020), https://www.wto.org/english/tratop_e/covid19_e/transparency_report_e.pdf.

¹⁶⁶ Amirhossein Takian et al., *COVID-19 Battle During the Toughest Sanctions Against Iran*, 395 LANCET 1035, 1035–36 (2020).

¹⁶⁷ Roland Oliphant, *Iran Requests \$5 Billion Emergency Loan from International Monetary Fund to Fight Coronavirus Pandemic*, TELEGRAPH (July 28, 2020), <https://www.telegraph.co.uk/news/2020/03/12/iran-request-5-billion-emergency-loan-international-monetary/>.

Foreign firms operating in host countries with lockdowns and a wide range of other measures might economically suffer from the situation.¹⁶⁸ Directly or indirectly countries responses will negatively affect the management of many businesses.¹⁶⁹ It is clear that some measures undertaken by states to mitigate the risk of the pandemic might have been more effective than others. This difference can also be inferred by comparing the results of South Korea or Singapore from that of say Italy and Spain.¹⁷⁰ A substantial number of these measure have the potential to negatively affect many businesses and cause harm to companies.¹⁷¹ Lockdowns and side measures, by definition, restrict business, and for that reason foreign investors may decide to sue host states (see example of Peru).¹⁷² For that reason, those actions can be challenged by foreign investors under relevant investment treaties.¹⁷³

International Investment Tribunals and other tribunals might well once again be entrusted with the role of reviewing States' measures to tackle the COVID-19 pandemic.¹⁷⁴ Among these businesses the foreign investor stands out because they can claim a number of rights under investment treaties.¹⁷⁵

¹⁶⁸ Turgut Aycan Özcan et al., *Turkey: Assessment of the State Measures in Response to Covid-19 Outbreak in Terms of International Investment Arbitration*, MONDAQ (Dec. 17, 2020), <https://www.mondaq.com/turkey/operational-impacts-and-strategy/1016990/assessment-of-the-state-measures-in-response-to-covid-19-outbreak-in-terms-of-international-investment-arbitration> (concluding that Turkey's measures have directly and indirectly caused economic harms to many businesses).

¹⁶⁹ Richard Smith-Bingham & Kavitha Hariharan, *This is the Impact of the Coronavirus on Business*, WORLD ECON. F. (Feb. 21, 2020), <https://www.weforum.org/agenda/2020/02/why-is-coronavirus-a-global-business-risk/> (explaining that the impact of COVID-related measures can take different form).

¹⁷⁰ G. Seetharaman, *How Countries are Using Technology to Fight Coronavirus*, ECONOMIC TIMES (Mar. 29, 2020), <https://economictimes.indiatimes.com/tech/software/how-countries-are-using-technology-to-fight-coronavirus/articleshow/74867177.cms?from=mdr>.

¹⁷¹ *The Biggest Business Impacts of the Coronavirus Pandemic*, EMARKETER (Mar. 14, 2020), <https://www.emarketer.com/content/the-biggest-business-impacts-of-the-coronavirus-pandemic-according-to-business-insider-intelligence>.

¹⁷² See generally, Pierina Pighi Bel & Jake Horton, *Coronavirus: What's Happening in Peru?*, BBC NEWS (July 9, 2020), <https://www.bbc.com/news/world-latin-america-53150808> (demonstrating that lockdowns and side measures, by definition, restrict business, and for that reason foreign investors may decide to sue host states).

¹⁷³ Joshua Paffery et al., *Investor-State Disputes Arising from COVID-19: Balancing Public Health and Corporate Wealth*, LEXOLOGY (Aug. 27, 2020), <https://www.lexology.com/library/detail.aspx?g=89234581-29f2-4284-97e5-47a98010b3ca>.

¹⁷⁴ Lucas Bento & Jingtian Chen, *Investment Treaty Claims in Pandemic Times: Potential Claims and Defenses*, KLUWER ARB. BLOG (Apr. 8, 2020), <http://arbitrationblog.kluwerarbitration.com/2020/04/08/investment-treaty-claims-in-pandemic-times-potential-claims-and-defenses/>.

¹⁷⁵ Özcan, *supra* note 168; see generally Xu Qian, *Challenges of Water Governance (and Privatization) in China-Traps, Gaps, and Law*, 47 GA. J. INT'L COMP. L. 49 (2018); see also

Indirectly, investment claims will contribute assessing the legality of many countries COVID responses.¹⁷⁶

Additionally, under the general international law on foreign investment, the sovereign states have the autonomy to decide whether to welcome foreign investors into their economies and to determine their subsequent admission and establishment.¹⁷⁷ The global investment regime has been gradually developed through a myriad of fragmented and bilateral negotiations, as opposed to multilateral negotiations, which is precisely why no multilateral international organization supports the international investment regime.¹⁷⁸ Due to the fact that treaty models prepared by the capital-exporting countries are the genesis for the proceedings of individual negotiations, structures, principles and purposes of the investment treaties are similar.¹⁷⁹

As a consequence of the current legal environment, many disputes related to COVID-19 measures will be addressed by the states in front of an investment tribunal. In order to resolve investment claims effectively, it is necessary for every International Investment Agreement (“IIA”) to have a provision for dispute settlements, arbitration.¹⁸⁰ Investment arbitration is flexible since parties have the option to choose either the International Centre for the Settlement of Investment Disputes (“ICSID”) or other arbitration

XU QIAN, ‘WATER DISPUTES IN INTERNATIONAL ARBITRATION: RECONSIDERING THE NEXUS OF INVESTMENT PROTECTION, ENVIRONMENT, AND HUMAN RIGHTS’ 415 (Kluwer L. Int’l, Int’l Arb. L. Libr. Series Stavros Brekoulakis & Julian D. Lew eds., 2020 (discussing the application of investment treaties to water-related rights)).

¹⁷⁶ COVID-19: Pressure Points: A Balance of Obligations: The Response to the Pandemic and Investment Treaty Protections (Global), HERBERT SMITH FREEHILLS (Apr. 8, 2020), <https://www.herbertysmithfreehills.com/latest-thinking/covid-19-pressure-points-a-balance-of-obligations-the-response-to-the-pandemic-and>.

¹⁷⁷ U.N. Conference on Trade & Development, Admission and Establishment, a part of UNCTAD Series on issues in international investment agreements, at 7 (2002), https://unctad.org/system/files/official-document/iteiit10v2_en.pdf.

¹⁷⁸ Guiguo Wang, *International Investment Law: An Appraisal from the Perspective of the New Haven School of International Law*, 18 ASIA PAC. L. REV. 19, 22 (2010); see also Julien Chaisse & Can Eken, *The Monetization of Investment Claims: Promises and Pitfalls of Third-Party Funding in Investor-State Arbitration*, 44 DE. J. CORP. L. 463 (2020); see also FLAVIA MARISI, ENVIRONMENTAL INTERESTS IN INVESTMENT ARBITRATION: CHALLENGES & DIRECTIONS 252 (2020).

¹⁷⁹ JULIEN CHAISSE, ET AL., ASIA’S CHANGING INTERNATIONAL INVESTMENT REGIME: SUSTAINABILITY, REGIONALIZATION, AND ARBITRATION 5–7 (2017).

¹⁸⁰ Tsai-fang Chen, *Foreword to the Special Issue on “COVID-19 and International Dispute Settlement”*, 13 CONTEMP. ASIA ARB. J. 1, 4 (2020); see also generally, A. Reinisch, *The Scope of Investor-State Dispute Settlement in International Investment Agreements*, 21 ASIA PAC. L. REV. 3 (2013).

types, such as ad hoc or institutional arbitration to settle disputes.¹⁸¹ Rules of the arbitration depend on the choice of the type of arbitration, for example, if parties have chosen to resolve their disputes by ICSID, the parties must follow the applicable rules of the convention.¹⁸² Apart from it, as per Article 25(1)¹⁸³ of the ICSID Convention, they are required to give irrevocable consent for the arbitration.¹⁸⁴ Whereas other rules such as UNCITRAL rules or the New York Convention shall be applied if any other type of arbitration is used by the parties to resolve the dispute.¹⁸⁵ However, in IIA most of the arbitration is governed by ICSID, where both the capital exporting countries and host countries have signed the ICSID convention.¹⁸⁶

Especially, bilateral investment treaties (“BIT”) within IIA, which are more within popular between the countries. These BITs have some basic characteristics, which include definition and scope of application, admission of the investment, national treatment, most favored nation, fair and equitable treatment, expropriation and dispute settlement.¹⁸⁷ The details regarding the level of protection afforded to investment, such as national standard of treatment, most-favored-nation treatment, full protection and security, and the so-called umbrella clause, are directly influenced by the “additions”

¹⁸¹ Susan D. Franck, *The Legitimacy Crisis in Investment Treaty Arbitration: Privatizing Public International Law through Inconsistent Decisions*, 73 FORDHAM L. REV. 1521, 1541 (2005) (discussing that there is a trend to provide options and, thus can be interpreted as flexible).

¹⁸² A SIMPLE GUIDE TO ARBITRATION IN HONG KONG, DEACONS 4 (2014), https://www.deacons.com/assets/Images/News%20and%20Insights/Publication/2014/201405_GuidetoArbitrationInHK_newVI.pdf (explaining that if the arbitration agreement sets out the applicable rules, the arbitrator must follow them).

¹⁸³ INTERNATIONAL CENTRE FOR SETTLEMENT OF INVESTMENT DISPUTES, ICSID CONVENTION, REGULATIONS AND RULES 18–19 (April 2006).

¹⁸⁴ Jaemin Lee, *The Coronavirus Pandemic and International Investment Arbitration—Application of “Security Exceptions” Clauses in Investment Agreements*, 13 CONTEMP. ASIA ARB. J. 185, 185 (2020); see also XU QIAN, WATER DISPUTES IN INTERNATIONAL ARBITRATION: RECONSIDERING THE NEXUS OF INVESTMENT PROTECTION, ENVIRONMENT, AND HUMAN RIGHTS 415 (2020) (discussing the consent in advance that is given by States at the time investment treaties are signed); see also Julien Chaisse, *Both Possible and Improbable—Could COVID-19 Measures Give Rise to Investor-State Disputes?*, 13 CONTEMP. ASIA ARB. J. 99, 141 (2020) (mentioning the requirement of irrevocable consent in the ICSID rules).

¹⁸⁵ Stephan Wilske, *The Impact of COVID-19 on International Arbitration: Hiccup or Turning Point?*, 13 CONTEMP. ASIA ARB. J. 7, 17 (2020); see also Julien Chaisse & Rahul Donde, *The State of Investor-State Arbitration: A Reality Check of the Issues, Trends, and Directions in Asia-Pacific*, 51 INT’L L. 47, 51 (2018) (discussing the UNCITRAL rules).

¹⁸⁶ OECD, INTERNATIONAL INVESTMENT LAW: UNDERSTANDING CONCEPTS AND TRACKING INNOVATIONS 8 (2008).

¹⁸⁷ OECD, NOVEL FEATURES IN RECENT OECD BILATERAL INVESTMENT TREATIES 5 (2006).

provisions of IIAs.¹⁸⁸ Clauses referring to the standard of protection accorded in situations of emergency, necessity, armed conflicts, and force majeure; guarantees of access to justice, fair procedure, and protection against denial of justice; and clauses covering the import and repatriation of funds, capital and profits are some common additional clauses.¹⁸⁹

Exceptions, though not central, are useful accessories of law existing in every aspect. The existence of exceptional circumstances and occurrences inclusive of the pandemic in this ever-evolving global precipice strengthens the need for such exceptions.¹⁹⁰ Sometimes harsh and unfair measures like imposing a heavy penalty for citizens not abiding by the established social distancing norms need to be adopted for the benefit of the masses which may fall under the domain of exceptions. More importantly, however, in practice, exceptions have only been invoked in a limited number of investment disputes as a result of which limited case laws prevail leaving much room for speculations.¹⁹¹ Even though, under the general conception, most potential breaches of investment treaties could be justified by some of these exceptions, specifically given the sudden emergency caused by COVID-19, some actions of the states have stretched too far even from the context of mitigating the risk of the pandemic, triggering non application of such exceptions.¹⁹²

WHO has imposed a number of duties (e.g. declaration of a health emergency and infectious diseases, sharing of information in a prompt and transparent manner, the exchange of epidemiological data, the sharing of research advances, and the strengthening of national health systems) in order to respond to a “health emergency of international interest”.¹⁹³ The liability

¹⁸⁸ Yas Banifatemi, *The Emerging Jurisprudence on the Most Favored Nation Treatment in Investment Arbitration*, in INVESTMENT TREATY LAW: CURRENT ISSUES III 241, 247 (Andrea Bjorklund et al. eds., 2009).

¹⁸⁹ OECD, *Fair and Equitable Treatment Standard in International Investment Law* 2 (OECD Working Papers on Int'l. Inv. 2004/03, 2004).

¹⁹⁰ WHO, IMPLEMENTATION OF THE INTERNATIONAL HEALTH REGULATIONS (2005) 134 (2011).

¹⁹¹ KATHERINE V.W STONE & ALEXANDER J.S. COLVIN, THE ARBITRATION EPIDEMIC: MANDATORY ARBITRATION DEPRIVES WORKERS AND CONSUMERS OF THEIR RIGHTS 9 (2015).

¹⁹² Alexandre Dayant, *Europe, United in Recovery- For Now*, INTERPRETER (July 29, 2020), <https://www.lowyinstitute.org/the-interpreter/europe-united-recovery-now>.

¹⁹³ WHO, *COVID-19 Public Health Emergency of International Concern (PHEIC) Global Research and Innovation Forum* 1–7 (Feb. 11, 2020), [https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-\(pheic\)-global-research-and-innovation-forum](https://www.who.int/publications/m/item/covid-19-public-health-emergency-of-international-concern-(pheic)-global-research-and-innovation-forum); WHO, *Statement on the Second Meeting of the International Health Regulations (2005) Emergency Committee Regarding the Outbreak of Novel Coronavirus (2019-nCoV)* (Jan. 30, 2020), [https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-\(2005\)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-\(2019-ncov\)](https://www.who.int/news-room/detail/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)).

of the nations under the investment treaties will be affected based on their level of transparency vis-à-vis the pandemic.¹⁹⁴ While reviewing such measures, the tribunal will have to consider international health regulations and epidemic control measures, nations' practices, and limited (or, more precisely, fast-evolving) scientific evidence, in addition to the parties' arguments.¹⁹⁵ The breaches of IIAs are probable and this article highlights that nations will however be able to defend themselves using a wide range of exceptions.¹⁹⁶ In the, specific context of a health crisis of the magnitude of COVID-19, exceptions invoked by countries might be able to cover a wide range of problematic measures. However, a number of potential innovations have already emerged, which suggest that tribunals could further define the scope and regime of applications of many exceptions.¹⁹⁷ Additionally, policymakers are encouraged to articulate better connections between IIAs and WHO regulations.¹⁹⁸

III. BENCHMARKING HEALTH SYSTEMS PERFORMANCES

In the words of Professor Amartya Sen, development is synonymous with freedom.¹⁹⁹ Freedom from poverty, illiteracy, infant mortality, and freedom to participate in political processes are all good things and characterizes any developed society.²⁰⁰ Health is an important component of development.²⁰¹ Countries investing in health are likely to have a stronger and more productive workforce, and hence grow faster than countries with a less healthy workforce.²⁰² Citizens living in developed nations live almost

¹⁹⁴ Federica Paddeu & Kate Parlett, *COVID-19 and Investment Treaty Claims*, KLUWER ARB. BLOG (Mar. 30, 2020), <http://arbitrationblog.kluwerarbitration.com/2020/03/30/covid-19-and-investment-treaty-claims/>.

¹⁹⁵ Matiangai Sirleaf, *Responsibility for Epidemics*, 97 TEX. L. REV. 285, 336 (2020).

¹⁹⁶ See generally Matiangai Sirleaf, *Responsibility for Epidemics*, 97 TEX. L. REV. 285 (2020).

¹⁹⁷ OECD, COVID-19: FROM A HEALTH TO A JOBS CRISIS (2020), https://www.oecd-ilibrary.org/sites/1686c758-en/1/3/1/index.html?itemId=/content/publication/1686c758-en&_csp_=fc80786ea6a3a7b4628d3f05b1e2e5d7&itemIGO=oecd&itemContentType=book.

¹⁹⁸ See, e.g., Tsung-Ling Lee, *Global Health in a Turbulence Time: A Commentary*, 15 ASIAN J. WTO & INT'L. HEALTH L. & POL'Y. 27, 38 (2020) (discussing an example of communicating WHO regulations through a U.N. resolution); see also KATHARINA PISTOR, LAW IN THE TIME OF COVID-19 174 (Columbia Law School Faculty Publications, 2020).

¹⁹⁹ AMARTYA SEN, DEVELOPMENT AS FREEDOM 1 (Oxford University Press, 1999).

²⁰⁰ *Id.*

²⁰¹ Max Roser, *Human Development Index (HDI)*, OUR WORLD IN DATA (Nov. 2019), <https://ourworldindata.org/human-development-index>.

²⁰² WHO, WORKING FOR HEALTH AND GROWTH: INVESTING IN THE HEALTH WORKFORCE 9–10 (2016).

nineteen years longer in comparison to their counterparts in less developed countries.²⁰³

United Nations Development Program (“UNDP”) has a way of examining the development of a country through the HDI.²⁰⁴ The HDI is calculated as the average of life expectancy (a proxy for health), education (a proxy for literacy), and the per-capita GDP (a proxy for income) of a country.²⁰⁵ These variables are considered as “output” or “outcome” variables because they estimate how long a person is likely to live, education attainment, and income level. HDI does not consider the “input” variables such as the factors which determine outcome variables. For example, longevity is an outcome variable. It is result of input variables such as healthy diet, or having access to healthcare infrastructure²⁰⁶.

Similar to HDI index is the HAQ index. The HAQ index is more specific and only considers variables related to health.²⁰⁷ That is, unlike the HDI, the HAQ does not include the income and education variables.²⁰⁸ The HAQ index is based on thirty-two preventable causes of death.²⁰⁹ Drawing from the *Global Burden of Diseases, Injuries, and Risk Factors Study 2015*, the HAQ index ranks countries based on the causes of death, controlling for terminal illness or end-stage disease such as cancer. That is, HAQ does not consider death of people from terminal-illness but because of lack of access to adequate healthcare services. While ranking countries based on HAQ index, adequate attention is paid to the fact that the cause of death is lack of effective healthcare services, with countries ranked higher implying access to better

²⁰³ UN DEV. PROGRAMME, HUMAN DEVELOPMENT REPORT 2019: BEYOND INCOME, BEYOND AVERAGES, BEYOND TODAY 7 (2019).

²⁰⁴ Izete Pengo Bagolin & Flavio Comim, *Human Development Index (HDI) and its Family of Indexes: An Evolving Critical Review*, 34 REVISTA DE ECONOMIA 7, 18 (2008).

²⁰⁵ UN Dev. Programme, *Human Development Index (HDI)*, UNITED NATIONS DEV. PROGRAMME, <http://hdr.undp.org/en/content/human-development-index-hdi> (last visited Jan. 28, 2021).

²⁰⁶ See WHO, GLOBAL REFERENCE LIST OF 100 CORE HEALTH INDICATORS (PLUS HEALTH-RELATED SDGs) 16 (2018) (“The *Global Reference List of 100 Core Health Indicators* is a standard set of *core indicators* prioritized by the *global* community to provide concise information on the *health* situation and trends, including responses at national and *global* levels.”); Peter J. Kpolovie et al., *Continental Comparison of Human Development Index (HDI)*, 4 INT’L. J. HUMAN. SOC. SCI. & EDUC. 9, 27 (2017).

²⁰⁷ See GBD 2015 Healthcare Access and Quality Collaborators, *Healthcare Access and Quality Index Based on Mortality from Causes Amenable to Personal Health Care in 195 Countries and Territories, 1990–2015: A Novel Analysis from the Global Burden of Disease Study 2015*, 390 LANCET 231, 231–34 (2017) (“The HAQ Index showed strong convergence validity as compared with other health-system indicators.”).

²⁰⁸ *Id.*

²⁰⁹ *Id.*; Rafael Lozano, *Measuring Performance on the Healthcare Access and Quality Index for 195 Countries and Territories and Selected Subnational Locations: A Systematic Analysis from the Global Burden of Diseases Study 2016*, 391 LANCET 2236, 2238 (2018).

healthcare services.²¹⁰ This study primarily uses Mortality-to-Incidence ratios (“MIRs”) data for cancer patients.²¹¹ One drawback of the HAQ measures is its dependence on the cause of death due to the fact that deaths cannot be self-reported.²¹² For evidence of this issue, data collected from a sample of fourteen countries reveals that countries under-reported the number of COVID-19 related deaths, and the actual number of deaths are sixty percent higher than the official count.²¹³ Under reporting the number of deaths is a limitation for calculating HAQ because relative performance of countries may change - with countries under reporting number of deaths getting a higher rank, when ranked on the basis of health indicators. Likewise, this index does not account for living conditions such as a person living in a slum with congested spaces, polluted air and water, and poor access to healthcare infrastructure.²¹⁴ Notwithstanding these limitations, the HAQ measure works under the assumption that any country can make effective use of its health care services.²¹⁵

A. Methodology: Constructing HII

We use Principal Component Analysis to construct HII. The number of principal components (“PC”) will be equal to the number of variables we consider to form an Index, thus if there are N numbers of variables, there will be N principal components. *PC analysis* is a dimensionality-reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information that are there in the large data set. For example, to comment on the level of healthcare infrastructure in any country, researchers may choose variables like the availability of doctors, nurses, and paramedic staffs. Alternatively, using PCA we can arrive at an index, which is a single variable and yet contains information about each one of these three different variables, namely, doctors, nurses, and paramedic staffs.

²¹⁰ GBD 2015 Healthcare Access and Quality Collaborators, *supra* note 207.

²¹¹ *Id.*

²¹² Bonnie Bruce & James F. Fries, *The Stanford Health Assessment Questionnaire: Dimensions and Practical Applications*, 1 HEALTH & QUALITY LIFE OUTCOMES 1, 3 (2003).

²¹³ John Burn-Murdoch et al., *Global Coronavirus Death Toll Could be 60% Higher than Reported*, FIN. TIMES (Apr. 26, 2020), <https://www.ft.com/content/6bd88b7d-3386-4543-b2e9-0d5c6fac846c>.

²¹⁴ Carolina Sanchez-Paramo, *COVID-19 Will Hit the Poor the Hardest. Here's What We Can Do About It*, WORLD BANK BLOGS (Apr. 23, 2020), <https://blogs.worldbank.org/voices/covid-19-will-hit-poor-hardest-heres-what-we-can-do-about-it>.

²¹⁵ See WHO, *supra* note 206 (showing HAQ measures considers the input variables and the resulting output variables, while it does not consider is how effectively the input variables are used to achieve certain output variables).

Thus, for constructing HII, we consider the following variables – physicians per 1000 population (X_1), nursing and midwifery personnel per 10000 populations (X_2), dentists per 10000 populations (X_3), pharmacists per 10000 populations (X_4), hospital beds per 10000 populations (X_5), skilled health professionals (such as anesthesiologist, radiologist, etc.) per 10000 populations (X_6), number of hospitals per 10000 populations (X_7), and government expenditure on health as a percentage of GDP (X_8). These eight variables encapsulate the health infrastructure of any country. Corresponding to these eight variables are eight such principal component indexes, each uncorrelated to the others. However, we consider only the first principal component index as a proxy for the HII. The first principal component index represents the linear combination of the constituent health indexes with maximal variance. The objective is to create the HII which separate out or characterize different countries according to the chosen measures of health infrastructure. Maximizing the variance of the linear combination of the constituent health index is equivalent to maximizing information content in the subsequent information index ranking. Rather than giving equal weight (which is $1/8$) to each one of the constituent elements of the health infrastructure, the weights are derived using principal component methodology. The constituent element among the chosen eight elements of the health the infrastructure, with highest variance, gets the maximum weight. The linear combination of the constituent variables with maximum variance accounts for interdependence among component indexes, thus ensuring full use of the available information.

Data:

All health-related data used in this study was collected from the WHO, 2020.²¹⁶ WHO categorizes all available information related to health data into four buckets. The first bucket relates to *Inputs and Process*, and cover data related to health financing, health workforce, health infrastructure, health information and governance. The second bucket relates to *Output*, and captures data related to service access and availability (inpatient admissions and surgical volume), service quality and safety, and health security (international health regulations). The third bucket relates to *Outcome*, and captures data related to outcome variables such as coverage of interventions (antenatal care coverage, antiretroviral therapy coverage, coverage of essential health services, etc.), and risk factors and behaviors (air pollution, accessibility to safe drinking water, etc.). And, the fourth basket relates to *Impact*, and covers data related to health status (life expectancy at birth,

²¹⁶ *Indicators*, WHO, <https://www.who.int/data/gho/data/indicators?> (last visited Jan. 28, 2021).

infant mortality rate, etc.).²¹⁷ The data sets refer to the categories, *Output*, *Outcome*, and *Impact*, and the categories are used by UNDP and Lancet to create indexes such as HDI, HAQ, and to monitor sustainable development goals (SDGs).²¹⁸ Data on income and Gini coefficients (measuring income inequality) are collected from World Development Indicators (WDI), World Bank, 2020.²¹⁹ To maintain uniformity we consider data related to health, income and “Gini” coefficients for the latest available year for each country as reported in WDI, 2020 and WHO, 2020.²²⁰ The number of persons affected and the number of deaths from COVID-19 are collected from Our World in Data,²²¹ and report data as of July 2, 2020.

B. Results

Identification of the largest characteristic root (eigenvalue) from (4) gives 8 optimal weights, one for each one of the constituent elements of HII. The first principal component has a variance (characteristic root or eigenvalue) of 4.02 and accounts for 50.30% variation in all the regressors. The second principal component has a variance of 1.01, however, accounting for only 12.63% of the total variation. For the purpose of ranking, we therefore only considered the first principal component. Considering the first principal component, the weights for physicians per 1000 population (X_1), nursing and midwifery personnel per 10000 populations (X_2), dentists per 10000 populations (X_3), pharmacists per 10000 populations (X_4), hospital beds per 10000 populations (X_5), skilled health professionals per 10000 populations (X_6), number of hospitals per 10000 populations (X_7), and government expenditure on health as a percentage of GDP (X_8) are 0.44, 0.43, 0.39, 0.37, 0.25, 0.44, 0.02, and 0.23, respectively. The principal component weights are different than assigning equal weights for each one of these variables. We observe, considering first principal component, number of physicians, skilled

²¹⁷ WHO, *supra* note 206 at 14–16.

²¹⁸ UNDP (2020), <https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-3-good-health-and-well-being.htm>.

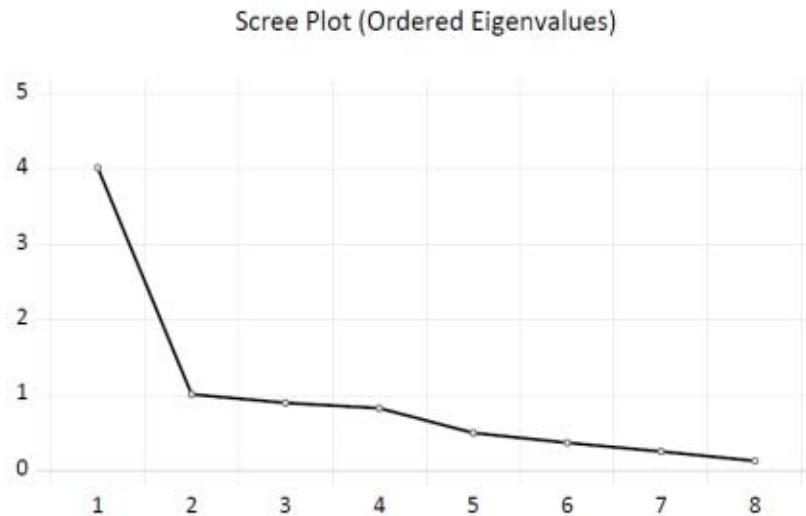
²¹⁹ *Indicators*, WORLD BANK, <https://data.worldbank.org/indicator> (last visited Jan. 28, 2021).

²²⁰ *See id.* (showing some of the data, for instance, the ones on Gini coefficients do not change within a span of few years. For instance, the National Sample Survey Organization, Government of India conducts a consumption expenditure survey (an instrument used for income variable) at an interval of every 5 years to report Gini coefficient data for India. World Bank 2020 reports data on Gini coefficients, the latest available for each country).

²²¹ *Cumulative Confirmed COVID-19 Cases*, OUR WORLD DATA, https://ourworldindata.org/coronavirus-data-explorer?zoomToSelection=true&time=earliest..2020-07-02&country=~USA®ion=World&casesMetric=true&interval=total&smoothing=0&pickerMetric=total_cases&pickerSort=desc (last visited Jan. 28, 2021).

healthcare professional, and nursing and midwifery personnel, loading heavily on this principal component, implying they are important component of healthcare infrastructure. On the other hand, number of hospitals are weighted the least, implying merely having bricks and mortar hospital will be of little use without healthcare professionals.

Figure 1: Cumulative Proportions of Eigen values



Source: Authors' Calculation, Eviews 11.

Weighting with first principal component and ranking all 186 countries in terms of health infrastructure yields the following results. A higher HII score means that there is a better healthcare infrastructure available. Monaco tops the list with the best available health infrastructure, conversely, Somalia is found to have the least available health infrastructure (see the Appendix for the ranking of countries on the basis of HII scores).

IV. ENHANCING HEALTH SYSTEMS PERFORMANCES

The HII framework considers variables related to health infrastructure. However, there can be other variables such as income, age profile, tropical climate, dietary habits, and health policy, which may impact COVID-19 fatality rate. Below we discuss these factors and also their relationships with HII.

A. HII and Income

There is a statistically significant positive relationship between HII and income. (Figure 2). This relationship is not surprising because high income countries are likely to spend more and have a more developed or robust health infrastructure. However, as the U.S. suggests, spending more does not always guarantee that an effective health care system is in place.²²² For instance in 2016, data reveals that the U.S. government spent almost double the amount on medical care in comparison to eleven other wealthier nations.²²³ The higher amount spent by the United States (and this exclude money spent by the private insurers) was mostly on account of high costs of labor, pharmaceuticals, and administrative costs, and this did not translate to having better health outcomes.²²⁴ Life expectancy was still lowest and infant mortality rates still the highest in the United States., in comparison to the eleven developed countries in the OECD group.²²⁵ Even in the case of COVID-19, the U.S. has had the highest number of infected persons with 22,761,269 affected and 382,105 deaths as of January, 10 2021.²²⁶ As the case with the U.S. suggests, developed infrastructure set-up for any high-income country does not necessarily translate into a better health outcomes.²²⁷

Plotting HII against the number of COVID-19 deaths (Figure 3), reveals a horizontal trend suggesting that COVID-19 is equally likely to affect countries irrespective of their level of per-capita income. The result is not surprising, as a vaccine has not been widely distributed, thus both the rich and the poor income countries are equally like to get impacted.²²⁸ Yet, we find some difference in terms of overall fatality rates, which may be due to other factors that will be discussed next.

²²² Harris Meyer, *Why Does the U.S. Spend So Much More on Healthcare? It's the Prices*, MODERN HEALTHCARE (Apr. 7, 2018), <https://www.modernhealthcare.com/article/20180407/NEWS/180409939/why-does-the-u-s-spend-so-much-more-on-healthcare-it-s-the-prices>.

²²³ Irene Papanicolas et al., *Health Care Spending in the United States and Other High-Income Countries*, 319 J. AM. MED. ASS'N 1024, 1027 (2018).

²²⁴ *Id.* at 1038.

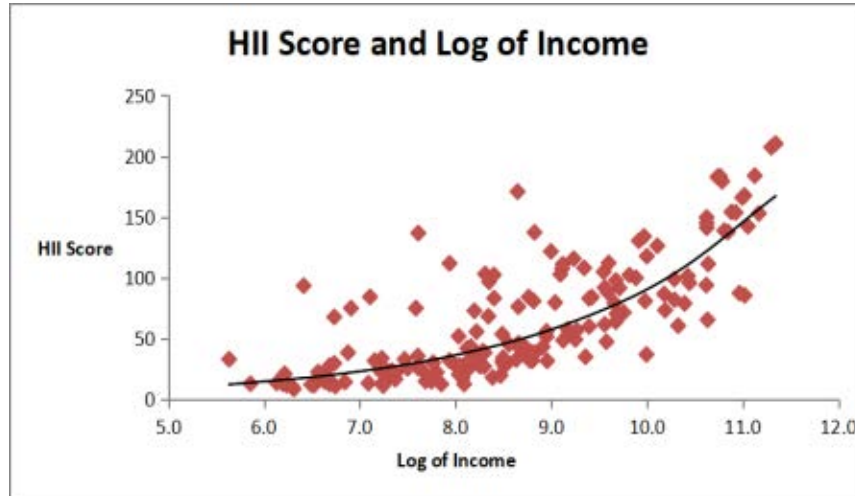
²²⁵ *Id.* at 1028.

²²⁶ *COVID-19 Coronavirus Pandemic*, WORLDOMETER, <https://www.worldometers.info/coronavirus/country/us/> (last visited on Jan. 28, 2021).

²²⁷ Don E. Detmer, *Building the National Health Information Infrastructure for Personal Health, Health Care Services, Public Health, and Research*, 3 BMC MED. INFORMATICS & DECISION MAKING 1, 4–5 (2003) (discussing the variance of Medicare spending and lack of correlation to better health care updates).

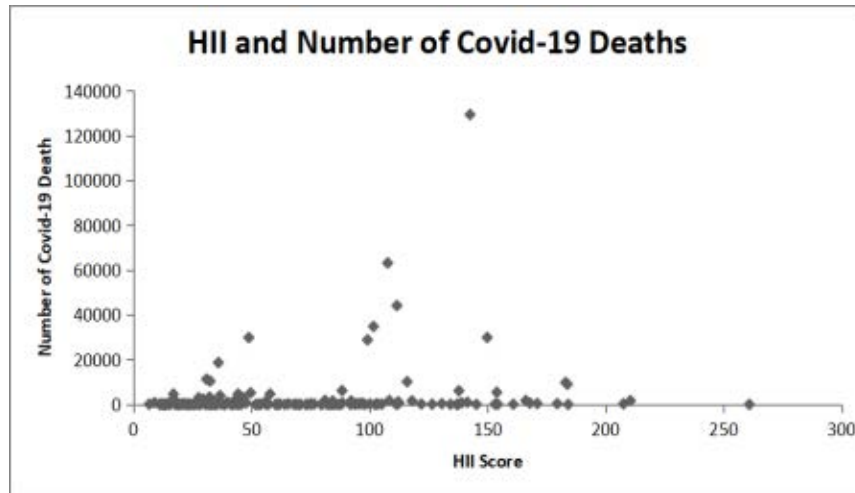
²²⁸ At the time of writing this paper, vaccination administration program for COVID-19 has not started.

Figure 2. *HII score and Log on Income*



Source: compiled by the authors

Figure 3. *HII and number of COVID-19 deaths*



Source: compiled by the authors

B. *HII and Income distribution*

Plotting HII against the Gini coefficient for the sample countries gives a negative relationship, and this is statistically significant at five percent level. (Figure 4). Although, COVID-19 is equally likely to affect all the low, middle, and high-income countries, lower-income households, however as

other study shows, within a given country are more to be severally affected thus far (studying the first wave).²²⁹ Evidence suggests five percent of the poor income-households residing in the low and middle income countries, spend disproportionately more than the rich as a percentage of household income on health care.²³⁰ To top it all, governments in less developed economies spend less on public healthcare infrastructure, which generally comes free of charge.²³¹ In India, for instance, the government spends less than seventy-five dollars per person per year towards provision of public healthcare.²³² The corresponding figures for the United States and the United Kingdom are \$9,536 and \$4,396, respectively.²³³ The Indian government spends less on healthcare and as a result 63.21% of healthcare expenses are “out-of-pocket” expenses for Indian citizens.²³⁴ For the poor residing in high-income countries with larger income inequalities (that is higher gini coefficients), they are also deprived of the healthcare services. As the case with the United States suggests life expectancy for the bottom five percent of poor people did not change between 2001 and 2014.²³⁵ However, during the same period, the life expectancy of people in the high-income bracket showed improvement.²³⁶ Poor health outcomes for individuals with lower-income directly result from exposure to harmful environments.²³⁷ In Europe, it was found foregone medical care (that is, self-reported unmet need for medical care) has increased between 2008 and 2013 in the majority of the 30 countries, especially among the disadvantaged part of the population.²³⁸ The results show that HII and Gini Coefficient are negatively related, that is, countries scoring high HII are the ones with lower income inequalities. However, there can be

²²⁹ DHURUV KHULLAR & DAVE A. CHOKSHI, HEALTH AFF., HEALTH, INCOME, & POVERTY: WHERE WE ARE & WHAT COULD HELP 2 (Oct. 4, 2018).

²³⁰ *Id.*

²³¹ *Current Healthcare Expenditure Per Capita*, WORLD BANK, <https://data.worldbank.org/indicator/SH.XPD.CHEX.PC.CD?view=map> (last visited Jan. 28, 2021).

²³² Nilanjan Banik, *Dealing with a Health Catastrophe*, TIMES INDIA BLOG (Jan. 26, 2020), <https://timesofindia.indiatimes.com/blogs/info-nomics/dealing-with-a-health-catastrophe/>.

²³³ *Id.*

²³⁴ NAT'L HEALTH ACCOUNTS TECH. SECRETARIAT, GOV'T OF INDIA, NATIONAL HEALTH ACCOUNTS ESTIMATES FOR INDIA 2016-17, at 13, 1035 (2019) (see table 3).

²³⁵ Raj Chetty et al., *The Association Between Income and Life Expectancy in the United States*, 315 J. AM. MED. ASS'N. 1750, 1751 (2016).

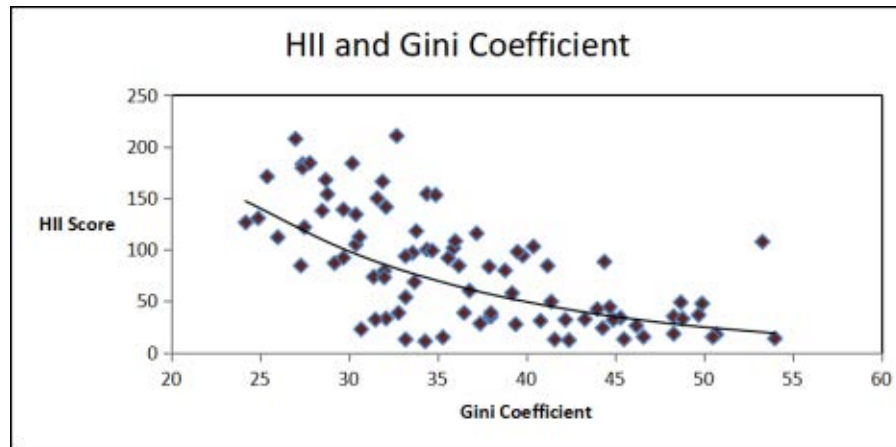
²³⁶ *Id.*

²³⁷ Ernie Hood, *Dwelling Disparities: How Poor Housing Leads to Poor Health*, 113 ENV'T HEALTH PERSPS. 310, 312 (2005).

²³⁸ Jon Ivar Elstad, *Income Inequality and Foregone Medical Care in Europe during the Great Recession: Multilevel Analyses of EU-SILC surveys 2008-2013*, 15 INT'L J. EQUITY HEALTH 101, 3-4 (2016) (generally noting for the low-income group, unmet need for medical care tended to be higher in countries with larger income inequalities, regardless of the average economic standard in terms of GDP per capita).

exceptions. As noted above for the high-income countries with large income inequalities, there is a need for targeted healthcare intervention designed for the low-income households.

Figure 4. HII and Gini Coefficient



Source: compiled by the authors

C. Additional Covariates outside the purview of HII that may affect COVID-19 fatality rates

Vaccine for COVID-19 has not yet arrived, and therefore both the rich and the poor-income households are equally like to get affected by this disease.²³⁹ As discussed in the previous section, in terms of accessibility, the rich-income households have better access to healthcare infrastructure in comparison to the poor-income households. A better HII may help the rich with better access to healthcare. However, in addition to the variables that we used for constructing HII, there can be other exogenous factors (that is, outside ambit of any government policy) that may impact COVID-19 fatality rate. In this section we consider these other exogenous variables, such as age profile, comorbidity, climatic conditions, clean air quality, and dietary habits (culture). We consider India as a special case - a country which has second highest COVID-19 caseload, after the

²³⁹ At the time of writing this paper, vaccination administration program for COVID-19 has not started for the majority of the world.

United States.²⁴⁰ However, COVID-19 fatality rate is less for India. This may be because of these exogenous variables which we discuss below.

1. Age Profile and Comorbidity

The global evidence thus far indicates that the severity of COVID-19 is directly correlated with old age,²⁴¹ this is because the elderly are usually comorbid, meaning that they are suffering from more than one disease at a time.²⁴² The prevalence of medical conditions such as hypertension, diabetes, and heart disease, increases rapidly with age.²⁴³ The increased risk of becoming severely ill due to COVID-19 may either be due to increased age, comorbidity, inadequate treatment or a combination of these factors.²⁴⁴ For the elderly group, there is considerable likelihood of hospitalization and intensive care once infected.²⁴⁵ For example, a report of 72,314 cases from mainland China shows that the overall fatality rate increased from 2.3% to 8.0% for those aged between 70 and 79 and for those above 80 years, the fatality rate was at 14.8%.²⁴⁶ Similarly, for Italy, the fatality rates the 70–79-year category was 12.8% and 20.2% for those above 80 years.²⁴⁷ In the United States, according to the CDC, people suffering from other diseases like heart disease and diabetes were twelve times more likely to die and six times more likely to be hospitalized because of COVID-19 in comparison to the younger healthy populations.²⁴⁸ India may have a lower COVID-19-

²⁴⁰ See generally, *Live: Delhi Records 125 New Cases of COVID-19, 3 Deaths*, HINDUSTAN TIMES (Feb. 13, 2021), <https://www.hindustantimes.com/india-news/coronavirus-india-world-latest-news-covid-19-death-toll-february-8-2021-101612748889531.html> (explaining a lower COVID-19 fatality rate in India).

²⁴¹ Wang et al., *Epidemiological and Clinical Features of 125 Hospitalized Patients with COVID-19 in Fuyang, Anhui, China*, 95 INT’L J. INFECTIOUS DISEASES 421, 421 (2020).

²⁴² Seung-Ji Kang & Sook In Jung, *Age-Related Morbidity and Mortality Among Patients with COVID-19*, 52 INFECTION & CHEMOTHERAPY 154, 158 (2020).

²⁴³ James W. Davis et al., *Prevalence of Comorbid Conditions with Aging Among Patients with Diabetes and Cardiovascular Disease*, 70 HAW. MED. J. 209, 210 (2010).

²⁴⁴ KJETIL BRURBERG & ATLE FRETHEIM, COVID-19: THE RELATIONSHIP BETWEEN AGE, COMORBIDITY AND DISEASE SEVERITY: A RAPID REVIEW 8–10 (Norwegian Institute of Public Health, 2020).

²⁴⁵ *Id.*

²⁴⁶ Graziano Onder et al., *Case-Fatality Rate and Characteristics of Patients Dying Relation to COVID-19 in Italy*, 323 J. AM. MED. ASS’N. 1775, 1776 (2020).

²⁴⁷ *Id.*

²⁴⁸ Sanchita Sharma, *People with Co-Morbidities 12 Times More Likely to Die of Covid: US Study*, HINDUSTAN TIMES (June 17, 2020), <https://www.hindustantimes.com/india-news/people-with-co-morbidities-12-times-more-likely-to-die-of-covid-us-study/story-MjafvURM5fxc4nFxmmsmlK.html>.

related mortality rate due to its relatively younger population.²⁴⁹ However, as cited earlier, individual factors, such as age and underlying disease (for instance a young person may suffer from a heart disease) can be linked to the risk of a severe course of disease.²⁵⁰

2. Tropical Climate

Most viruses exhibit seasonality with peak in activity in different seasons.²⁵¹ This seasonal attribute cause differential impact on humans, depending upon the climatic conditions across geographical regions.²⁵² In temperate regions, upper respiratory tract infection increase in frequency in autumn, remains high through winter, and decreases in spring.²⁵³ Human coronaviruses cause respiratory tract infections which usually peak with cold weather condition.²⁵⁴ COVID-19, specifically, has been found to be less communicable in hot and humid climates.²⁵⁵ A study with 166 nations confirmed for every 1°C increase in temperature, there is a daily reduction in new COVID-19 cases by 3.08%.²⁵⁶ Likewise, a 1°C rise in humidity leads to a 0.85% decrease in COVID-19 cases and the resultant death rate decrease of 0.51%.²⁵⁷ Conversely, temperature below 3°C, was found to increase the COVID-19 prevalence rate by 4.8% daily.²⁵⁸ These relationships reflect how the immune system does not work as effectively in cold and dry climates as it does in warm and humid climates.²⁵⁹ Thus, the relatively high COVID-19 mortality rates in Western European nations and the U.S., may be largely

²⁴⁹ Soutik Biswas, *India Coronavirus: The 'Mystery' of Low Covid-19 Death Rates*, BBC NEWS (July 30, 2020), <https://www.bbc.com/news/world-asia-india-52435463>.

²⁵⁰ BRURBERG, *supra* note 244.

²⁵¹ Rory Henry Macgregor Price et al., *Association Between Viral Seasonality and Meteorological Factors*, 9 SCI. REP. 1, 2 (2019).

²⁵² Micaela E. Martinez, *The Calendar of Epidemics: Seasonal Cycles of Infectious Diseases*, 14 PLOS PATHOGENS 1, 1 (2018).

²⁵³ Terho Heikkinen & Asko Järvinen, *The Common Cold*, 361 LANCET 251, 252 (2003).

²⁵⁴ Robert Kozak et al., *Severity of Coronavirus Respiratory Tract Infections in Adults Admitted to Acute Care in Toronto, Ontario*, 126 J. CLINICAL VIROLOGY 1, 1 (2020).

²⁵⁵ Qasim Bukhari et al., *Effects of Weather on Coronavirus Pandemic*, 17 INT'L J. ENVTL. RES. & PUB. HEALTH 1, 5 (2020).

²⁵⁶ Yu Wu et al., *Effects of Temperature and Humidity on the Daily New Cases and New Deaths of COVID-19 in 166 Countries*, 729 SCI. TOTAL ENV'T 1, 3 (2020).

²⁵⁷ *Id.*

²⁵⁸ Jingui Xie & Yongjian Zhu, *Association Between Ambient Temperature and COVID-19 Infection in 122 Cities from China*, 724 SCI. TOTAL ENV'T 1, 1 (2020).

²⁵⁹ Mohammad Sarmadi et al., *Association of COVID-19 Global Distribution and Environmental and Demographic Factors: An Updated Three-Month Study*, 188 ENVTL. RES. 1, 2 (2020).

dependent on their cold weather conditions, as opposed to other health infrastructure factors.²⁶⁰

3. Dietary habits, clean air, and health policy

India's Ministry of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy (AYUSH) has issued guidelines for the use of Indian Ayurvedic (traditional, plant-based) medicines with antipyretic properties as a general immunity booster.²⁶¹ In Ayurveda,²⁶² there is a belief that the phytochemicals found in herbs such as *andropogon paniculata*, *vetiveria zizanioides*, *Cymbopogon jwarancusa*, *cymbopogon jwarancusa*, ginger, *cyperus rotundus*, and others can stop COVID-19 from replicating itself.²⁶³ In addition, the guidelines further suggest that practicing yoga, in addition to maintaining a healthy diet with these herbs and spices, can develop immunity.²⁶⁴ The actual efficacy of such advice, however, remains unfounded.²⁶⁵

Clean air quality may also help to reduce the impact of COVID-19 and the subsequent deaths.²⁶⁶ Recent studies in the United States and northern Italy found that citizens in these countries living in densely populated, polluted regions were more likely to contract and die from COVID-19.²⁶⁷ For

²⁶⁰ *Id.*; Bukari et al., *supra* note 255, at 1.

²⁶¹ MINISTRY OF AYUSH, AYURVEDA'S IMMUNITY BOOSTING MEASURES FOR SELF-CARE DURING COVID-19 CRISIS 1-2 (2020).

²⁶² See, *Ayurvedic Medicine: In Depth*, NAT'L. INSTS. HEALTH (Jan. 2019), <https://www.nccih.nih.gov/health/ayurvedic-medicine-in-depth> (stating that Ayurveda is the traditional Hindu system of medicine, which is based on the idea of balance in bodily systems and uses diet, herbal treatment, and yogic breathing).

²⁶³ U Tejonmayam, *Ingredients in Kabasura Kudineer Can Fight Virus, Says Researchers in Chennai*, TIMES INDIA (Apr. 24, 2020 6:50 PM), <https://timesofindia.indiatimes.com/city/chennai/ingredients-in-kabasura-kudineer-can-fight-covid-say-researchers/articleshow/75335027.cms>.

²⁶⁴ *Covid-19 Battle: Immunity Boosting Tips from the Ayush Ministry*, ECON. TIMES (Apr. 16, 2020), <https://economictimes.indiatimes.com/news/politics-and-nation/covid-19-battle-immunity-boosting-tips-from-the-ayush-ministry/pm-modis-appeal/slideshow/75177676.cms>.

²⁶⁵ *Homoeopathy for Coronavirus: Is AYUSH Commitment to Alt Meds Healthy or Promoting Quackery?*, PRINT (Jan 29, 2020 6:12 PM), <https://theprint.in/talk-point/homoeopathy-for-coronavirus-is-ayush-commitment-to-alt-meds-healthy-or-promoting-quackery/356179/>.

²⁶⁶ Isabelle Gerretsen, *How Air Pollution Exacerbates Covid-19*, BBC (Apr. 27, 2020), <https://www.bbc.com/future/article/20200427-how-air-pollution-exacerbates-covid-19>.

²⁶⁷ Leonardo Setti et al., *SARS-Cov-2RNA Found on Particulate Matter of Bergamo in Northern Italy: First Evidence*, 188 ENVTL. RES. 109754, 1–2 [online format page numbers] (2020), <https://www.sciencedirect.com/science/article/abs/pii/S0013935120306472> (discussing recent studies that found a relationship between high concentration of particulate matter COVID-19 mortality rates).

example, in March 2020, deaths due to COVID-19 were more among people living in the polluted more industrialized regions of Milan, in the province of Lombardy, than in any other part of Italy.²⁶⁸ A nationwide study on 3,080 counties confirmed that long-term exposure to air pollution increases vulnerability to the most severe COVID-19 outcomes.²⁶⁹

Conversely, one of the primary reasons for low COVID-19 mortality rate in India may be due to the fact that the country saw a massive improvement in air quality during the period of lockdown.²⁷⁰ The air quality in Delhi improved drastically, with micro-pollutants in air falling from 900 micrograms per cubic meter in 2019 to 2020 micrograms during the period of lockdown.²⁷¹ In fact, the COVID-19 lockdown has improved the air quality in many parts of the world in terms of reduction in pollutant elements such as particulate matter 2.5, nitrogen dioxide, and sulphur dioxide.²⁷² The extended period of lockdown in various parts of the world including Europe, Asia, and North America has helped to slower the spread of COVID-19.²⁷³

As in the case with dietary habit and clean air, another factor that may affect covid-19 fatality rate is the national health policies. health policy that encourages universal vaccination may help to explain lower covid-19 related death.²⁷⁴ There is evidence that administering the Bacille Calmette-Guérin (“BCG”) vaccine may have provided protection against COVID-19.²⁷⁵ People residing in African and South Asian nations usually get vaccinated at

²⁶⁸ Damian Carrington, *Air Pollution Linked to Far Higher COVID-19 Death Rates, Study Finds*, GUARDIAN (Apr. 7, 2020 12:16 PM), <https://www.theguardian.com/environment/2020/apr/07/air-pollution-linked-to-far-higher-covid-19-death-rates-study-finds>.

²⁶⁹ Xiao Wu et al., *Exposure to Air Pollution and COVID-19 Mortality in the United States at 6, 8*, (April 27, 2020) (unpublished manuscript) <https://www.medrxiv.org/content/medrxiv/early/2020/04/27/2020.04.05.20054502.full.pdf>.

²⁷⁰ Hannah Ellis-Petersen et al., *‘It’s Positively Alpine!’: Disbelief in Big Cities as Air Pollution Falls*, GUARDIAN (Apr. 11, 2020), <https://www.theguardian.com/environment/2020/apr/11/positively-alpine-disbelief-air-pollution-falls-lockdown-coronavirus>.

²⁷¹ *Id.*

²⁷² Surinder Suthar, et al., *Epidemiology and Diagnosis, Environmental Resources Quality and Socio-economic Perspectives for COVID-19 Pandemic*, 280 J. ENVTL. MGT. 111700, 4 [online format page numbers] (2021), <https://www.sciencedirect.com/science/article/pii/S030147972031625X>.

²⁷³ *Id.*

²⁷⁴ Kalyan Ray, *BCG Vaccination Can Reduce Covid-19 Incidence, Lower Death Rates, New Study Finds*, DECCAN HERALD (July 12, 2020), <https://www.deccanherald.com/science-and-environment/bcg-vaccination-can-reduce-covid-19-incidence-lower-death-rates-new-study-finds-860335.html>.

²⁷⁵ Paul K. Hegarty et al., *BCG Vaccination May be Protective Against Covid-19*, UROTODAY (June 16, 2020), <https://www.urotoday.com/recent-abstracts/covid-19-and-genitourinary-cancers/120589-bcg-vaccination-may-be-protective-against-covid-19.html>; Nigel Curtis et al., *Considering BCG Vaccination to Reduce the Impact of COVID-19*, 395 LANCET 1545, 1545 (2020).

a young age, which may explain why the fatality rate in this part of the world is lower in comparison to countries in North America and Europe.²⁷⁶ In fact, countries with higher COVID-19 fatality rates, such as the United States and Italy, do not have universal BCG vaccination policy.²⁷⁷

V. ACCOUNTABILITY FOR INTERNATIONAL HEALTH REGULATIONS REPORTING

Any government, especially the developing and less-developed countries, have limited fiscal resources to fight pandemic like COVID-19.²⁷⁸ Thus, there is a need to prioritize health expenditure during health during COVID-19. Governments across the globe are resorting to policies to fight against COVID-19.²⁷⁹ In the short-run, supply-side economics may not work.²⁸⁰ For instance, to increase availability of skilled workers such as health care professionals (doctors, paramedic staff, nurses, etc.) is not possible in the short-run unless otherwise a favorable immigration policy helps to bridge the shortage by allowing doctors and paramedical staffs to migrate.²⁸¹ These supply-side ideas require planning over a longer period of time horizon and require investment in school, university, and education system of a country.²⁸² COVID-19 has also led to disruption in the supply of output. The ship lining companies, for example, Maersk had to cancel dozen of container ships, and estimate that China's factories are operating at fifty to sixty percent capacity.²⁸³ Therefore, countries are stressing on demand-management

²⁷⁶ Aaron Miller et al., Correlation Between Universal BCG Vaccination Policy and Reduced Morbidity and Mortality for COVID-19: An Epidemiological Study (Sept. 14, 2020) (unpublished manuscript) (on file with Dep't. of Biomedical Sci., NYIT Coll. of Osteopathic Med., NY Inst. of Tech.); Luis E. Escobar et al., *BCG Vaccine Protection from Severe Coronavirus Disease 2019 (COVID-19)*, 117 PROCEEDINGS NAT'L. ACAD. SCI. 17720, 17724–25 (2020).

²⁷⁷ Gil Redelman-Sidi, *Could BCG Be Used Protect Against COVID-19?*, 17 NATURE REV. UROLOGY 316, 316 (2020).

²⁷⁸ HELENE BARROY ET AL., ASSESSING FISCAL SPACE FOR HEALTH EXPANSION IN LOW-AND-MIDDLE INCOME COUNTRIES: A REVIEW OF THE EVIDENCE, at v (2016).

²⁷⁹ Peter A. Diamond, *Aggregate Demand Management in Search Equilibrium*, 90 J. POL. ECON. 881, 881 (1982); CTR. FOR ECON. POL'Y. RES., *supra* note 133.

²⁸⁰ Bennett T. McCallum, *The Current State of the Policy-Ineffectiveness Debate*, 69 AM. ECON. REV. 240, 242 (1979).

²⁸¹ Jan Rutkowski, *From the Shortage of Jobs to the Shortage of Skilled Workers: Labor Markets in the EU New Member States 19–25* (Dec. 2007) (Inst. for the Study of Lab., discussion paper No. 3202).

²⁸² Gostin et al., *supra* note 1, at 10.

²⁸³ RICHARD BALDWIN & BEATRICE WEDER DI MAURO, *ECONOMICS IN THE TIME OF COVID-19*, 32 (2020) (ebook); *see also* CTR. FOR ECON. POL'Y. RES., *ECON. IN THE TIME OF COVID-19* (Richard Baldwin & Beatrice Weder di Mauro eds., 2020), <https://voxeu.org/content/economics-time-covid-19>.

policies to fight the pandemic.²⁸⁴ To revive the demand, governments, particularly from the high-income countries, have already pledged more than ten trillion dollars, which is three times more than the response to 2008 financial crisis.²⁸⁵ These fiscal and monetary packages are geared towards building additional hospitals, makeshift health care infrastructure (for example, converting a football stadium into a hospital), manufacturing greater number of health personal protective types of equipment and other healthcare kits.²⁸⁶ As health and human rights are related, some developing countries are opting for, “cash transfer (for example, Iran and Malaysia), subsidizing utilities (Maldives), reducing or deferring social security payments (Brunei Darussalam), deferring student loans (Fiji), providing rental subsidies (Nepal) and providing free food and ration (India and Myanmar).”²⁸⁷ Additionally, countries across the economic stratum are also spending on administration such as implementing travel restrictions, social distancing and enforcing lockdown measures.²⁸⁸

While most of these targeted interventions to fight COVID-19 are domestic-centric, there is a need for building an international coalition. In the COVID-19 Fund created by the WHO, countries like Australia, Azerbaijan, and New Zealand have contributed.²⁸⁹ Japan is contributing to the Catastrophe Containment and Relief Trust set up by the IMF.²⁹⁰ Similarly, South and South-West Asian countries are contributing to COVID-19 Fund in the South Asian Association for Regional Cooperation (SAARC) region.²⁹¹ Such funds will be of use and will save more lives in the poorer

²⁸⁴ Giovanni Dell’Ariccia et al., *Economic Policies for the COVID-19 War*, IMF BLOG (Apr. 1, 2020), <https://blogs.imf.org/2020/04/01/economic-policies-for-the-covid-19-war/>.

²⁸⁵ ZIYAD CASSIM ET AL., *THE \$10 TRILLION RESCUE: HOW GOVERNMENTS CAN DELIVER IMPACT 2* (2020).

²⁸⁶ *Policy Responses to COVID-19 World Health Organization*, INT’L. MONETARY FUND, <https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19> (last visited Jan. 28, 2021); Srishti Choudhary, *Covid-19: India Ramps Up Manufacture of Personal Protection Kits, Devices*, MINT (Mar. 30, 2020), <https://www.livemint.com/news/india/covid-19-india-ramps-up-domestic-manufacturing-of-ppes-masks-ventilators-11585580452636.html>.

²⁸⁷ ZHENQIAN HUANG & SWETA C. SAXENA, *COMBATING COVID-19 IN ASIA AND THE PACIFIC: MEASURES, LESSONS AND THE WAY FORWARD 2–9* (2020).

²⁸⁸ Matteo Chinazzi et al., *The Effect of Travel Restrictions on the Spread of the 2019 Novel Coronavirus (COVID-19) Outbreak*, 368 SCI. 395, 398 (2020).

²⁸⁹ *Coronavirus Disease (COVID-19) Donors & Partners: WHO Says Thank You!*, WHO, <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/donors-and-partners/funding> (last visited Jan. 28, 2021).

²⁹⁰ HUANG & SAXENA, *supra* note 287, at 3.

²⁹¹ Abhishek Trivedi, *COVID-19: Why a New Normative and Institutional Framework for SAARC Nations is Needed to Fight the Coronavirus*, LONDON SCH. ECON. & POL. SCI.:

countries. HII contains information about how vulnerable a country is when it comes to the paucity of health infrastructure. Countries with lower HII ranks are ideal candidates to get more international funding to make targeted health intervention in their domestic economies.²⁹²

International funding can also be used for the development of a joint research project to develop any new vaccine to fight future pandemics.²⁹³ For this to happen, there is an added requirement to bring in extra-trade subjects into negotiations. As HII suggests, many countries do not have an adequate number of doctors, other skilled health professionals such as anesthesiologists, radiologists, nurses, and paramedic workers.²⁹⁴ In this regard, it is important to liberalize the services sector and allow movement of these skilled healthcare professionals because some countries, particularly low-income countries, face a shortage in the availability of doctors and other skilled paramedical healthcare workers. Like in the case with ASEAN, EU, and NAFTA, mobility of these skilled healthcare professionals should be promoted through Mutual Recognition Arrangements (“MRA”),” so that a degree granted in any country also remains valid for other countries as well.²⁹⁵ For instance, India has an abundant supply of skilled healthcare professionals and is known for medical tourism. The cost of medical tourism in India and Malaysia is least in the South East Asian region.²⁹⁶ Most of the patients involved in the medical tourism market in India come from Bangladesh, Afghanistan, the Gulf (Iraq and Oman), and some African countries such as Nigeria, Kenya and Tanzania.²⁹⁷ During pandemics, coordination of public policies enabling cross borders movement of these health professionals will be of great help.²⁹⁸

SOUTHEAST ASIA BLOG (Apr. 2, 2020), <https://blogs.lse.ac.uk/southasia/2020/04/02/covid-19-why-a-new-normative-and-institutional-framework-for-saarc-nations-is-needed-to-fight-the-coronavirus/>.

²⁹² Susan Horton et al., *Ranking 93 Health Interventions for Low- and Middle-Income Countries by Cost-Effectiveness*, 12 PLoS ONE 1, 10 (2017).

²⁹³ Tung Thanh Le et al., *The COVID-19 Vaccine Development Landscape*, 19 NATURE REV. 305, 306 (2020).

²⁹⁴ WHO, *supra* note 216.

²⁹⁵ Chandra Shah & Michael Long, *Global Labour Mobility and Mutual Recognition of Skills and Qualifications: European Union and Australia/New Zealand Perspectives* 17–20, (Monash Univ. Ctr. for the Econ. of Educ. & Training Working Paper, Paper No. 65, 2007), <https://www.researchgate.net/publication/226731340>.

²⁹⁶ NEIL LUNT ET AL., *MEDICAL TOURISM: TREATMENTS, MARKETS AND HEALTH SYSTEM IMPLICATIONS: A SCOPING REVIEW* 12 (2011).

²⁹⁷ Manveena Suri, *India Wants to Make Medical Tourism a \$9 Billion Industry by 2020*, CNN HEALTH (Feb. 15, 2019), <https://www.cnn.com/2019/02/13/health/india-medical-tourism-industry-intl/index.html>.

²⁹⁸ Kelley Lee et al., *Global Coordination on Cross-Border Travel and Trade Measures Crucial to COVID-19 Response*, 395 LANCET 1593, 1593–94 (2020).

Another area that requires international coordination is research collaboration in the healthcare sector. India is emerging as the hotspot for clinical contract research and knowledge process outsourcing. Foreign players are setting up their offices because of lower input costs in India.²⁹⁹ Future negotiations for better health outcome should try to enable services related to delivery of online health services. For this to happen there is a need to remove restrictions on outsourcing of clinical data and patient health related information.³⁰⁰ The argument for restricting outsourcing of clinical data is based on the fact that there is no guarantee to ensure safety and rights of the trial volunteers in the developing countries, as happens in high-income countries such as European and North American nations.³⁰¹ If such a concern is taken care of then coordinated activities ensuring free flow of knowledge and disease surveillance will be helpful.³⁰²

A. What should be obliged to communicate to the WHO?

Amidst the unprecedented circumstances caused by COVID-19, regulating nations' response to the global pandemic emerges as a pivotal concern because the IHR was created to prevent the spread of diseases globally and provide a public health response.³⁰³ Its main function is to protect, control the spread disease in such a way that reduced the risk of public health and avoid unnecessary interference with international traffic and trade.³⁰⁴

Soon after the declaration of COVID-19 as a 'public health emergency of international concern' by the WHO through an order dated January 30, 2020,

²⁹⁹ Falguni Sen & Michael Shiel, *From Business Process Outsourcing (BPO) to Knowledge Process Outsourcing (KPO): Some Issues*, 25 HUMAN SYS. MGMT. 145, 155 (2006), <https://content.iospress.com/articles/human-systems-management/hsm620>.

³⁰⁰ Umesh Soni & Monica Singh, *Clinical Trials Outsourcing: Good or Bad?*, 2 Drug Designing 1, 2 (2013) (Although outsourcing has several advantages, there is a need for having strong regulations in developing and less-developed countries so that human safety and human rights are not violated).

³⁰¹ James Cekola, *Outsourcing Drug Investigations to India: A Comment on U.S., Indian, and International Regulation of Clinical Trials in Cross-Border Pharmaceutical Research*, 28 NW. J. INT'L L. & BUS. 125, 145 (2007).

³⁰² Mary H. Stanfill & David T. Marc, *Health Information Management: Implications of Artificial Intelligence on Healthcare Data and Information Management*, 28 IMIA YEARBOOK MED. INFORMATICS 56, 64 (2019).

³⁰³ *Alert, Response, and Capacity Building Under the International Health Regulations*, WHO, <https://www.who.int/ihr/howtheywork/10things/en/#whatis> (last visited Jan. 28, 2021); see generally Lee et al., *supra* note 298, at 1593–95 (discussing importance of border control during a pandemic).

³⁰⁴ WHO, INTERNATIONAL HEALTH REGULATIONS (2005): A BRIEF INTRODUCTION TO IMPLEMENTATION IN NATIONAL LEGISLATION 2 (2009).

the global community demonstrated solidarity and cooperation³⁰⁵. However, travel and trade restrictions were excluded from the additional recommendation.³⁰⁶ Notably, the WHO provides a recommendation regarding the health measures to states at the point of entry and if recommendations are further extended by the states by doing any activities such as closing their borders against the advice of the WHO, then the states as per the Article 43(5) are required to justify their actions to the WHO.³⁰⁷ However, the power of the WHO as per Article 43(4) is limited to request the state party to reconsider their decision and not restrict the governments from exceeding its advised measures.³⁰⁸

In the case of SARS in China, the outbreak was covered up and, ultimately, wasted the valuable preparation and prevented countries from taking mitigation steps. To avoid such situation, all the countries need to be more transparent.³⁰⁹ Common surveillance and containment strategies need to be defined, which can be done if countries work together and with the WHO with proper co-ordination.³¹⁰ The SARS pandemic demonstrated that there is a need to delegate more power to the WHO so that it can investigate the outbreaks independently rather than relying on the information provided by the government official sources.³¹¹

Recently, the WHO revised its account and stated that it was “alerted by its own office in China, and not by the Chinese Authorities.”³¹² Timely and accurate communication of information and transparency are very important to tackle the spread of disease.³¹³ The COVID-19 pandemic is reemphasizing the need for efficient risk communication to control the outbreak and reduce the impacts (economic, health, psychological) of infectious diseases.³¹⁴

³⁰⁵ Yuri Bruinen de Bruin et al., *Initial Impacts of Global Risk Mitigation Measures Taken During the Combatting of the COVID-19 Pandemic*, 128 SAFETY SCI. 1, 7 (2020); WHO, *supra* note 137.

³⁰⁶ Ferhani & Rushton, *supra* note 28, at 458.

³⁰⁷ WHO, *supra* note 137, at 29.

³⁰⁸ *Id.*

³⁰⁹ Ferhani & Rushton, *supra* note 28, at 463.

³¹⁰ WHO, THE WORLD HEALTH REPORT 2003: SHAPING THE FUTURE 78–79 (2003).

³¹¹ See generally WORLD HEALTH ASSEMBLY RES. 56/29, SEVERE ACUTE RESPIRATORY SYNDROME (2003).

³¹² Agence France-Presse, *WHO Revises Coronavirus Timeline to Clarify its China Officer Raised Alert, Not Authorities*, S. CHINA MORNING POST (July 4, 2020), <https://www.scmp.com/news/china/science/article/3091820/who-revises-coronavirus-timeline-clarify-its-china-office-raised>.

³¹³ P. O'Malley et al., *Transparency During Public Health Emergencies: From Rhetoric to Reality*, 87 BULL. WORLD HEALTH ORG. 614, 616 (2009).

³¹⁴ See e.g. *New Study Highlights the Role of Risk Communication in Coping with COVID-19*, PREVENTION WEB (Oct. 16, 2020), <https://www.preventionweb.net/news/view/74240> (reporting that early risk communication during COVID-19 mitigated damage).

B. Whether in terms of tests, patients, or even how states implement the WHO regulations

The responsibility for implementing the IHR rests jointly with WHO and its state parties.³¹⁵ IHR reporting during a state of pandemic is necessary to analyze the condition and work towards discovering ways to mitigate such risks.³¹⁶

A state can implement regulations through varied channels, including the set-up of an adequate legal framework to support IHR.³¹⁷ It is upon the state's discretion whether or not to implement these regulations.³¹⁸ So, in order to implement regulations through diverse means, a nation might as well setup an appropriate legal framework to promote IHR. Some states have a strict requirement that in order to apply IHR within the national law or domestic jurisdiction, relevant authorities need to adopt the implementing legislation for the rights and obligations for member states that are appropriate.³¹⁹ However, if it is not conceivable for a nation's legal system to adopt the implementing legislation in order to give effect to IHR, it might as well revise some legislation, regulations, or other such instruments of the country's legal system to facilitate IHR in an efficacious and beneficial manner.³²⁰

One of the chief tasks while channeling the assessment of national regulations, legislations, and other instruments in order to include provisions of IHR involves determining all legislative subjects and operational functions at all governmental levels.³²¹ These need to be appropriate for the state party to give effect to the implementation of IHR. Identifying the instruments, legislations or regulations (if any) that has the capability to intervene with effective implementation of IHR; determining any potentially enabling or authorizing legislation which may be suitable for the State party to implement its rights or fulfill obligations, cross-referencing other the WHO guidance documents on the Regulations, maintaining a record (written) of the outcomes of the assessment, consenting on a follow-up action when adoption/revision of legislation, regulations or other instruments are deemed appropriate to implement IHR provisions.³²²

³¹⁵ See Lee, *supra* note 198, (explaining that IHR implementation is however dependent on each State Party in light of relevant domestic legal and governance systems); see also PISTOR, *supra* note 198, (stressing that each Party must have the capacity to identify issues and needs through a well-established domestic surveillance but also response system).

³¹⁶ WHO, MANAGING EPIDEMICS, KEY FACTS ABOUT MAJOR DEADLY DISEASES 218 (2020).

³¹⁷ WHO, *supra* note 304, at 10.

³¹⁸ *Id.* at 14.

³¹⁹ *Id.* at 5.

³²⁰ *Id.* at 2.

³²¹ *Id.* at 17.

³²² *Id.* at 8–9.

There are, however, other approaches that could possibly be applied for implementation. These include the incorporation of State parties and the WHO equally to report the implementation of IHR in World Assembly,³²³ official communication related to events under the IHR to be undertaken and performed by National IHR Focal-point and the associated Regional the WHO IHR Contact Point, both of whom are officially appointed and need to be accessible 7 days a week on a 24 hour basis.³²⁴ Additionally, state parties should inform and report to the WHO of all the events that are, in general, evaluated as potentially composing a PHEIC, considering the background in which an event takes place within 24 hours of assessment of such happening and a definitive assessment cannot be concluded.³²⁵ Further, there is an explicit option available to the state parties of starting confidential consultations with the WHO and trying to get advice on the evaluation, assessment and reliable measures related to health to be taken.³²⁶ State Parties should mandatorily notify the WHO through the National IHR Focal Point within 24 hours of receipt of evidence of any identified risk to public health risk outside the territory that may result into spreading of the disease internationally. Such is evidenced by exported or imported human cases. Vectors are responsible for transfer of infection or contamination, or by goods that are contaminated. The WHO and state parties should work together in the assessment and regulation of public health events and risks, even before the WHO has been informed about such kind of events in an official manner. All State Parties should prepare, enhance, and maintain the key public capacities for the response procedure and surveillance, while applying for the health measure procedures related to IHR. State Parties are required to treat the international travelers with respect, taking full consideration of parameters such as their socio-cultural, religious and ethnicity, gender and they must necessarily be provided with accommodation, food, water, and medical necessities and if quarantined, isolated or otherwise subject to public or medical health measures under IHR.³²⁷ All that said, approaches may prove to be beneficial in alleviating the current risks.

³²³ *Strengthening Health Security by Implementing the International Health Regulations* (2005), WHO, <https://www.who.int/ihr/procedures/annual-reporting/en/> (last visited Jan. 28, 2021).

³²⁴ WHO, *supra* note 304, at 7.

³²⁵ WHO, WHO TECHNICAL CONSULTATION ON THE IMPLEMENTATION AND EVALUATION OF ANNEX 2 OF THE INTERNATIONAL HEALTH REGULATIONS (2005), at 14.

³²⁶ WHO, International Health Regulations (3rd. ed. 2005) part VIII, Article 44, <https://www.who.int/csr/ihr/WHA58-en.pdf>.

³²⁷ WHO, *supra* note 303.

C. WHO Public Health Emergency of International Concern (PHEIC) declarations

The present definition of PHEIC places emphasis on the serious nature of the situation which extends beyond the national borders of a country.³²⁸ The term PHEIC is defined in the IHR as “an extraordinary event which is determined... to constitute a public health risk to other States through the international spread of disease; and to potentially require a coordinated international response.”³²⁹ The purpose of a PHEIC declaration is to catalyze timely evidence-based actions, to cause increased international funding and support, and to restrict the emerging and re-emerging of disease risks thereby impacting public health and society.³³⁰

Under the IHR, a nation is bound to report any event that may constitute a PHEIC.³³¹ Countries are expected to assess each event occurring within their territories within forty-eight hours by applying a specific algorithm contained in Annex 2 of the IHR.³³² The criteria upon which such assessment is based includes the following questions of consideration – (1) is the public health impact of the event serious or not, (2) is the event unusual or unexpected, (3) is there a significant risk of international spread, and (4) is there a significant risk of international travel or trade restrictions?³³³ And, if two or more of the four questions are answered in the affirmative, a nation is required to notify the WHO within twenty-four hours.³³⁴ The Director-General of the WHO (DG) carries with him the responsibility to determine whether a particular situation calls to be declared as a PHEIC or not.³³⁵ The DG is advised in this duty by the IHR Emergency Committee.³³⁶ Temporary recommendations, which contain all the measures that should be promulgated on an emergency basis are made on the advice of the IHR Emergency Committee.³³⁷ The members of the IHR committee are selected by two methods - i) from the roster of experts maintained by the WHO ii)

³²⁸ *IHR Procedures Concerning Public Health Emergencies of International Concern* (PHEIC), WHO, <https://www.who.int/ihr/procedures/pheic/en/> (last visited Jan. 28, 2021).

³²⁹ *Id.*

³³⁰ David N. Durrheim et al., *When Does a Major Outbreak Become a Public Health Emergency of International Concern?*, 20 LANCET 887, 889 (2020).

³³¹ *Reporting Events*, WHO, <https://www.euro.who.int/en/health-topics/health-emergencies/international-health-regulations/event-reporting-and-review/reporting-events> (last visited Jan. 28, 2021).

³³² *Id.*

³³³ *Id.*

³³⁴ WHO, *supra* note 325, at 5.

³³⁵ WHO, *supra* note 303.

³³⁶ *Id.*

³³⁷ *Id.*

from the WHO expert advisory panels and committees.³³⁸ Further, it is mandatory that at least one member be an expert nominated by a state party within whose territory the event arises.³³⁹

The confusion faced by COVID PHEIC dates back to January 2020 when the initial concerns surfaced, the WHO preferred to communicate about its knowledge through Twitter,³⁴⁰ which was inherently contrary to the agreed communication plan as established in the IHR.³⁴¹ In addition to their website, subsequent updates were also made through other social media platforms with scattered presence culminating into unequal access of such paramount information.³⁴² Furthermore, WHO's failed communication strategy muddled the definition of key terms like entry/exit screening, risk assessments, travel recommendations, etc.³⁴³

The WHO's situation reports try to highlight the conundrum.³⁴⁴ The global risk was originally stated as "moderate" under the situation Report No. 3 and No. 4.³⁴⁵ Later, the error in the previous reports was corrected in situation Report No. 6 which published the global risk as "high."³⁴⁶ This major error caused a lot of uncertainty over the WHO risk assessment as it came through at a critical point in time.³⁴⁷ Further, when situation Report No. 9 stated that there were no particular travel recommendations yet, the situation extended automatically to the domain of travel as well.³⁴⁸ Despite claiming no recommendations existed, Report No. 9 also included a separate section on travelling and traffic advice.³⁴⁹ However, based on the information that is currently accessible, it would be a difficult task to ascertain whether there was an error in the risk assessment or communication.³⁵⁰

³³⁸ *Id.*

³³⁹ *Id.*

³⁴⁰ WHO (@WHO), TWITTER (Jan. 23, 2020, 12:28 PM), <https://twitter.com/who/status/1220413117001322497?lang=en>.

³⁴¹ L. O. Gostin & R. Katz, *The International Health Regulations: The Governing Framework for Global Health Security*, 94 MILBANK Q. 264, 270, 294 (2016).

³⁴² The Editors, *WHO Failed*, NAT'L REV. (Apr. 7, 2020 9:07 PM), <https://www.nationalreview.com/2020/04/coronavirus-pandemic-world-health-organization-failed/>.

³⁴³ Gabriel Blouin-Genest et al., *The WHO's Risky Communication Strategy Created Confusion Around COVID-19*, CONVERSATION (July 2, 2020), <https://theconversation.com/the-whos-risky-communication-strategy-created-confusion-around-covid-19-140043>.

³⁴⁴ *Id.*

³⁴⁵ *Id.*

³⁴⁶ *Id.*

³⁴⁷ *Id.*

³⁴⁸ *Id.*

³⁴⁹ *Id.*

³⁵⁰ *Id.*

CONCLUSION

The outpour of regulatory responses aimed at mitigating the development of the COVID-19 pandemic may well be culminating into the development of new transnational health policy. States (whether federal or centralized), public and private companies, international organizations, non-governmental organizations, and individuals have cumulatively contributed to the development of such responses and all have some degree of responsibility. While many scholars are echoing a need for a globally cohesive integrated action to tackle the aftermath of COVID-19,³⁵¹ each nation is due to resolve their own predicaments. While the pandemic led governments to spend trillions of dollars in aid to mitigate the economic shock, with the goal of returning to the pre-pandemic business era, before companies go bankrupt remains high priorities.³⁵² With businesses shutting down, the fear is that this pandemic may lead the world to a double-recession.³⁵³ The COVID-19 crisis is the worst healthcare crisis that the world has witnessed in a century and is affecting all the low, middle, and high-income countries.³⁵⁴ However, within a given country it is the lower-income households who are most likely to be severely affected.³⁵⁵ We proposed a novel approach to identify the deficiencies of health care infrastructure among countries so that the interventions by the governments and multilateral organizations can be tailored in an effective fashion. We created HII to understand how well a country is equipped to face the pandemic. Countries with lower HII ranks are ideal candidates to receive more international funding to make targeted health intervention in their domestic economies. This index shows cases the areas where governments, or multilateral organizations, should intervene.

Economic policy in the short-run should be targeted towards providing healthcare access to the vulnerable section of the population, especially from

³⁵¹ Patrick Brown, *Studying COVID-19 in Light of Critical Approaches to Risk and Uncertainty: Research Pathways, Conceptual Tools, and Some Magic from Mary Douglas*, 22 HEALTH RISK & SOC'Y 1, 1–14 (2020).

³⁵² *The Global Economic Outlook During the COVID-19 Pandemic: A Changed World*, WORLD BANK (June 8, 2020), <https://www.worldbank.org/en/news/feature/2020/06/08/the-global-economic-outlook-during-the-covid-19-pandemic-a-changed-world>.

³⁵³ See *Coronavirus: World Economy 'May Face Double Recession'*, BBC NEWS (Apr. 16, 2020), <https://www.bbc.com/news/business-52306001> (noting that the world economy is already facing an economic downturn, and there is a likelihood that this could be followed by another possibly much worse downturn).

³⁵⁴ See *COVID-19 Position Paper: A Multidimensional Crisis that Affects Us All*, ESU (Apr. 6, 2020), <https://www.esu-online.org/?policy=covid-19-position-paper-a-multidimensional-crisis-that-affects-us-all> (noting that the recent outbreak of COVID-19 is the gravest health crisis that the world has faced).

³⁵⁵ Univ. Coll. London, *Low-Income Workers Disproportionally Affected by COVID-19*, SCI. DAILY (May 1, 2020), www.sciencedaily.com/releases/2020/04/200430191258.htm.

the low and middle-income countries. The economic costs of lockdowns are likely to be worse for low-income countries, which generally have fragile healthcare systems.³⁵⁶ Beyond national boundaries, international cooperation is required for an effective strategy to fight COVID-19. So far, individual countries experience to fight against COVID-19 differ. The U.S., for example, has four percent of the world population but is accounting for twenty-five percent of the COVID-19 cases.³⁵⁷ This is in spite of the U.S. creating a two trillion dollars economic relief package.³⁵⁸ In this regard, it is pertinent to learn from the experience of countries such as New Zealand or Taiwan, which have been able to successfully contain spread of COVID-19.

³⁵⁶ NORMAN V. LOAYZA & STEVEN PENNINGS, *MACROECONOMIC POLICY IN THE TIME OF COVID-19: A PRIMER FOR DEVELOPING COUNTRIES 1* (2020).

³⁵⁷ Scottie Andrew, *The US Has 4% of the World's Population but 25% of its Coronavirus Cases*, MERCURY NEWS (June 30, 2020), <https://www.mercurynews.com/2020/06/30/the-us-has-4-of-the-worlds-population-but-25-of-its-coronavirus-cases/>.

³⁵⁸ Stephanie Denning, *Why the \$2 Trillion Stimulus Package is Putting Dollars in the Wrong Place*, FORBES (Apr. 8, 2020), <https://www.forbes.com/sites/stephaniedenning/2020/04/08/why-the-2-trillion-stimulus-package-is-putting-dollars-in-the-wrong-place/#c8981b367773>.

APPENDIX

THEORETICAL FRAMEWORK FOR DERIVING HEALTH INFRASTRUCTURE INDEX (HII) ³⁵⁹

The healthcare infrastructure is represented by vector X (*where, $X = X_1, X_2, \dots, X_8$*). The first principal component, Z (also representing HII), is the weighted average of X_1, X_2, \dots, X_8 with maximal variance. Therefore, $Z = Xw$, where, w represents the vector of optimal weights $w = (w_1, w_2, \dots, w_8)$.

The variance of Z is

$$Var(Z) = Var(w_1X_1 + w_2X_2 + \dots + w_8X_8) \quad (1)$$

Or, $Var(Z) = wSw$, subject to the normalization constraint $w'w = 1$. Here, S represents variance-covariance matrix with S_{ij} is the covariance between X_i and X_j , and S_{ii} representing the variance of X_i .

To optimize in terms of weights, we use the Lagrangian Function as $L = w'Sw + \lambda(1 - w'w)$. To maximize the variance we select the weight, w , in accordance to the first order condition of maximization.

$$\frac{\partial L}{\partial w} = \frac{\partial [w'Sw + \lambda(1 - w'w)]}{\partial w} = 0 \quad \frac{\partial L}{\partial w} = \frac{\partial [w'Sw + \lambda(1 - w'w)]}{\partial w} = 0 \quad (2)$$

$$\text{which implies, } (S - \lambda I)w = 0 \quad (3)$$

The solution to (3) is the characteristic vector, w . Thus, the roots are chosen such that

$$|S - \lambda I| = 0 \quad (4)$$

The solution to (4) will have multiple roots but we consider largest characteristic root of S . This will ensure all maximum possible use of available information which are there in the individual variables. Before undertaking to construct PCA, we standardize the data with respect to mean and standard deviation to ensure unit-free comparison between the data. For each country, we then compute HII using software package Eviews 11.

³⁵⁹ See generally KANTILAL V. MARDIA ET AL., MULTIVARIATE ANALYSIS 15–17 (1979).

RANKING OF COUNTRIES

Countries	Medical doctors per 1000 popn.	Nursing and mid-wifery per 10000 popn.	Dentists per 10000 popn.	Pharmacists per 10000 popn.	Hosp. density per 10000 popn.	Hosp. beds per 10000 popn.	Skilled health professionals density per 10000 popn.	Govt. Health Spending as % of GDP	PCI
Monaco	75.1	201.6	10.2	26.3	10.6	29.0	271.6	1.8	260.9
Switzerland	42.5	173.3	5.0	7.0	1.1	47.0	223.0	12.3	210.5
Norway	29.2	182.2	8.7	8.3	1.1	39.0	222.1	10.4	207.6
Iceland	39.8	157.1	8.3	5.1	3.6	32.0	190.8	8.3	184.1
Germany	42.5	132.4	8.5	6.5	1.1	83.0	179.8	11.2	183.8
Belgium	30.7	189.7	7.5	12.3	1.1	63.0	141.7	10.3	183.1
Finland	33.9	146.8	7.3	10.9	1.4	49.0	182.3	9.2	179.5
Denmark	40.1	103.2	7.4	5.2	1.0	31.0	206.7	10.1	167.9
Ireland	32.9	161.0	6.5	11.6	1.1	28.0	152.0	7.2	166.1
Cuba	83.0	77.3	16.8	2.4	2.0	51.0	155.0	11.7	160.9
Australia	36.8	125.5	5.9	8.8	1.1	29.0	157.2	9.2	154.3
Sweden	39.8	117.6	8.2	7.7	1.1	26.0	160.6	11	153.9
Luxembourg	30.1	121.7	9.8	7.0	1.1	51.0	152.4	5.5	153.1
France	32.7	114.7	6.7	10.6	1.1	65.0	138.0	11.3	149.8
New Zealand	34.7	123.2	6.2	6.8	1.1	28.0	143.0	9.2	145.3
United States of America	26.1	145.5	5.8	9.2	1.1	29.0	117.3	17.1	142.6
Japan	24.1	119.5	8.0	18.0	1.1	29.0	136.0	10.9	141.4
Austria	51.7	70.9	5.7	7.1	1.1	76.0	135.1	10.4	138.9

Netherlands	36.1	111.8	5.1	2.1	0.8	29.0	139.8	10.1	137.8
Lithuania	48.3	79.8	10.0	9.9	2.2	73.0	124.2	6.5	137.5
Uzbekistan	23.7	112.8	1.5	0.4	1.1	40.0	149.5	6.4	137.0
Estonia	44.8	111.6	13.8	10.9	1.9	50.0	98.0	6.4	134.2
Czechia	40.7	84.0	7.4	6.9	1.3	65.0	120.9	7.2	130.6
Slovenia	30.9	99.7	7.0	6.8	1.3	46.0	116.6	8.2	126.5
Kazakhstan	39.8	72.0	3.7	8.2	3.5	67.0	116.8	3.1	121.9
Portugal	51.2	69.7	10.1	9.1	1.1	34.0	108.0	9	118.0
Russian Federation	40.1	45.3	2.8	0.5	1.1	82.0	126.6	5.3	115.9
Hungary	34.1	69.2	7.1	8.1	1.0	70.0	97.3	6.9	112.4
Ukraine	29.9	66.6	6.0	0.3	1.1	88.0	100.4	7	112.1
United Kingdom	28.1	81.7	5.2	8.9	1.1	28.0	112.5	9.6	111.6
Maldives	45.6	64.3	2.0	3.5	6.7	29.0	118.3	9	111.4
Romania	29.8	73.9	8.0	9.1	1.7	63.0	90.8	5.2	108.3
Brazil	21.7	97.4	12.5	6.8	1.1	23.0	93.0	9.5	107.7
Croatia	31.7	61.9	7.9	7.2	1.5	59.0	96.4	6.8	105.1
Azerbaijan	34.5	64.3	2.7	2.0	8.0	47.0	102.7	6.7	103.4
Bulgaria	40.3	48.2	10.5	1.7	1.1	68.0	93.2	8.1	103.1
Belize	11.2	185.1	1.5	6.8	2.1	9.0	25.8	5.6	102.6
Slovakia	34.4	60.1	4.9	4.9	1.5	58.0	94.7	6.7	102.5
Italy	39.8	57.4	8.2	10.9	2.1	29.0	97.4	8.8	101.6

Greece	54.8	36.3	12.5	10.6	1.1	29.0	96.5	8	100.1
Spain	38.7	57.3	7.9	11.5	1.6	30.0	92.0	8.9	99.1
Uruguay	39.5	58.7	7.4	2.4	3.9	25.0	97.9	9.3	98.0
Armenia	44.0	61.1	5.6	0.5	4.0	41.0	82.3	10.4	96.9
Kuwait	26.5	71.5	6.7	4.9	1.1	22.0	96.5	5.3	96.1
Republic of Korea	23.6	71.2	5.0	7.2	3.4	29.0	92.2	7.6	95.3
Israel	34.8	57.0	7.3	8.0	0.6	31.0	88.8	7.4	94.2
Libya	20.9	65.3	8.8	6.0	2.6	37.0	89.9	8.2	93.7
Poland	23.8	57.0	3.5	7.7	0.9	65.0	79.8	6.5	92.1
Latvia	31.9	47.5	7.1	8.3	1.6	58.0	81.1	6	91.9
Republic of Moldova	32.1	49.2	4.2	4.1	2.1	58.0	77.1	7	88.5
Chile	25.9	133.2	12.5	5.3	1.0	22.0	11.8	9	88.3
Singapore	22.9	61.7	3.9	5.1	0.5	21.0	94.0	4.4	87.6
Malta	28.6	83.7	4.8	12.9	0.9	48.0	40.1	9.3	87.0
Qatar	24.9	72.6	6.3	8.9	1.1	14.0	76.7	2.6	85.8
Kyrgyzstan	22.1	59.4	1.7	0.4	2.6	45.0	81.0	6.2	84.5
Serbia	31.1	60.9	2.1	8.1	1.1	29.0	71.6	8.4	84.4
Argentina	39.9	26.0	9.2	5.1	1.1	49.0	81.2	9.1	84.3
Andorra	33.3	40.1	8.2	10.1	1.1	29.0	81.3	10.3	84.3
Georgia	71.2	47.3	7.6	1.0	2.2	26.0	45.7	7.6	83.4
Nauru	13.5	67.3	1.9	1.9	10.0	29.0	83.6	11	83.2

Brunei Darussalam	17.8	66.4	2.3	1.7	1.4	29.0	82.6	2.4	82.1
Saudi Arabia	26.1	54.8	5.0	8.6	1.0	22.0	77.7	5.2	81.1
Turkmenistan	22.2	44.3	1.2	1.7	1.1	74.0	70.6	6.9	81.1
Montenegro	27.6	52.3	0.5	1.9	2.1	29.0	80.8	6.3	79.8
Seychelles	21.2	80.8	3.6	4.7	1.1	29.0	54.2	5	79.5
North Korea	36.8	44.5	2.2	4.0	6.9	29.0	75.3	4	79.2
Cook Islands	14.1	65.5	12.4	0.6	1.1	29.0	69.5	3.3	78.1
Bosnia and Herzegovina	21.6	61.8	2.4	1.3	1.0	11.0	77.6	8.9	76.5
Tajikistan	21.0	47.5	1.6	1.0	4.7	48.0	69.9	7.2	75.2
Niue	18.8	100.0	12.5	6.3	1.1	29.0	18.3	6.3	75.2
Republic of North Macedonia	28.7	37.9	8.8	2.4	1.1	44.0	66.7	6.1	75.0
Cyprus	26.2	40.3	7.5	6.5	7.5	34.0	66.1	6.7	73.6
Mongolia	28.6	40.8	2.3	5.0	2.5	29.0	72.6	4	73.1
Palau	14.2	63.1	2.6	1.1	1.1	23.0	64.5	12	71.7
Trinidad and Tobago	41.7	40.9	3.5	6.6	1.1	27.0	51.0	7	70.6
Barbados	17.7	47.4	3.0	9.1	1.1	62.0	45.7	6.8	69.9

Jordan	23.2	33.6	7.3	16.0	1.9	18.0	65.4	8.1	68.6
Mali	1.4	4.1	0.1	0.1	0.5	29.0	130.5	3.8	68.0
United Arab Emirates	25.3	57.3	6.5	8.8	1.1	12.0	46.2	3.3	65.7
Antigua and Barbuda	29.6	45.0	0.4	1.8	1.1	39.0	45.7	4.5	64.1
Oman	20.0	42.0	3.0	5.6	1.4	17.0	60.7	3.8	61.9
Saint Kitts and Nevis	26.8	42.2	3.9	2.4	7.4	29.0	45.7	5	61.1
Bahamas	20.1	32.5	2.7	2.4	1.1	29.0	62.4	5.8	60.8
Mauritius	23.1	35.2	3.2	4.2	1.0	29.0	53.5	5.7	60.2
China	19.8	26.6	4.5	3.2	1.1	29.0	59.7	5.2	57.8
Malaysia	13.3	38.1	1.6	3.3	0.5	29.0	56.6	3.9	57.2
Lebanon	21.0	16.7	10.2	12.9	3.1	29.0	49.4	8.2	56.2
Philippines	6.0	52.7	2.4	3.3	1.8	29.0	45.7	4.4	55.9
Albania	12.2	36.5	2.2	8.4	1.4	29.0	45.7	6.3	53.9
Saint Vincent and the Grenadines	9.3	46.5	1.2	3.3	0.0	25.0	45.7	4.5	53.2
Grenada	14.1	30.6	1.5	6.8	0.9	37.0	45.2	4.8	52.7
Kiribati	2.0	46.4	0.6	0.3	0.0	29.0	48.1	10.8	52.1
Dominica	5.4	44.9	0.6	2.4	5.6	29.0	45.7	5.9	51.7
Turkey	18.5	27.1	3.4	3.5	1.6	27.0	44.1	4.2	49.6
Mexico	23.8	25.1	1.4	0.5	3.5	16.0	48.8	5.5	48.8

Panama	15.7	29.9	2.8	2.4	0.9	29.0	38.5	7.3	47.6
South Africa	8.0	13.3	1.1	2.7	0.7	29.0	60.5	8.1	46.4
Suriname	7.1	30.6	0.5	0.6	0.4	29.0	45.7	6.2	45.5
Ecuador	20.6	25.1	5.3	0.4	0.3	15.0	37.5	8.3	44.3
Venezuela (Bolivarian Republic of)	19.5	11.4	5.6	2.4	1.1	29.0	45.7	1.2	44.2
Tunisia	12.8	26.6	3.1	2.3	2.3	21.0	39.6	7.2	43.5
Botswana	5.3	41.2	0.4	2.1	1.3	29.0	31.1	6.1	43.3
Bolivia (Plurinational State of)	15.9	11.2	2.2	2.2	1.1	29.0	45.7	6.4	42.4
Fiji	8.6	30.2	0.7	1.1	0.0	29.0	37.8	3.5	42.1
Syrian Arab Republic	12.9	15.4	7.2	10.7	1.1	15.0	38.5	6.3	41.2
Algeria	17.2	15.5	3.7	4.5	1.1	29.0	31.2	6.4	39.8
Thailand	8.1	27.6	2.3	5.5	1.8	29.0	27.6	3.7	38.7
Nepal	7.5	31.1	1.0	4.0	0.4	29.0	26.4	5.6	38.7
Sri Lanka	10.0	21.8	0.7	0.8	0.1	29.0	36.8	3.8	38.6
Gabon	6.8	29.5	0.2	0.6	3.5	29.0	33.0	2.8	38.5
Bahrain	9.3	24.9	1.0	1.6	1.1	21.0	34.1	4.7	37.1
Colombia	19.7	11.7	9.7	2.4	1.1	15.0	29.0	7.2	36.6

India	8.6	17.3	2.0	8.9	1.1	29.0	28.5	3.5	35.9
Costa Rica	13.8	30.1	1.4	7.3	0.8	11.0	19.5	7.3	35.2
El Salvador	15.7	18.0	7.6	6.5	0.5	11.0	24.1	7.2	35.1
Namibia	4.2	19.5	0.7	2.4	1.9	29.0	31.3	8.6	34.5
Comoros	1.7	9.2	0.2	0.2	0.7	29.0	45.7	7.4	34.0
Eswatini	3.3	37.7	0.4	0.3	0.8	29.0	15.3	6.9	33.5
Burundi	1.0	8.5	0.0	0.0	0.5	29.0	45.7	7.5	33.2
Bangladesh	5.8	4.1	0.6	1.8	0.2	29.0	45.7	2.3	33.1
Paraguay	13.5	16.6	1.6	0.3	2.4	29.0	23.3	6.7	33.0
Peru	13.0	21.8	1.8	0.5	1.1	15.0	26.1	5	32.4
Eritrea	0.8	9.2	0.1	0.1	0.4	29.0	45.7	2.9	32.4
Egypt	4.5	19.3	20.0	4.6	0.6	5.0	22.5	5.3	32.1
Equatorial Guinea	4.0	5.0	0.1	0.2	1.1	29.0	45.7	3.1	32.1
Lesotho	0.4	5.6	0.0	0.0	1.1	29.0	45.7	8.8	32.0
Dominican Republic	15.3	11.7	2.2	3.9	1.1	16.0	28.3	6.1	31.9
Micronesia (Federated States of)	6.2	1.5	1.4	2.4	4.8	29.0	38.0	12.4	31.8
Saint Lucia	6.4	31.5	1.7	4.4	1.7	13.0	19.6	4.5	31.6
Marshall Islands	4.2	33.0	0.7	0.7	3.8	29.0	7.9	16.4	31.2

Iran (Islamic Republic of)	15.8	4.4	4.5	2.9	1.1	15.0	30.4	8.7	30.9
Viet Nam	8.3	14.5	2.2	3.4	1.1	29.0	22.6	5.5	30.4
Sudan	4.1	8.2	2.1	4.4	1.4	8.0	42.2	6.3	29.8
Iraq	8.4	18.1	2.5	2.9	1.1	13.0	26.6	4.2	29.5
Bhutan	4.2	18.5	0.8	0.6	1.7	35.0	18.9	3.2	28.2
Vanuatu	1.8	18.4	0.7	1.2	2.4	29.0	24.0	3.3	28.1
Haiti	2.3	6.8	0.2	0.3	0.2	7.0	45.7	8	27.9
Indonesia	4.3	24.1	0.6	0.9	0.4	29.0	15.5	3	27.6
Jamaica	13.1	14.7	0.9	0.2	0.8	17.0	21.3	6	27.5
Samoa	4.8	17.9	0.6	0.7	4.2	29.0	18.8	5.5	27.2
Solomon Islands	1.9	19.9	0.5	1.3	1.1	29.0	19.7	4.7	27.1
Nicaragua	9.8	15.3	0.4	1.9	1.0	9.0	23.0	8.6	26.1
Timor-Leste	7.2	16.7	0.1	1.9	1.1	29.0	15.1	3.9	25.9
Cabo Verde	7.8	9.5	0.1	0.1	1.0	29.0	20.4	5.2	25.0
Zimbabwe	2.1	19.3	0.1	1.0	0.5	29.0	12.4	6.6	23.9
Zambia	11.9	13.4	0.0	0.4	0.5	29.0	9.8	4.5	23.7
Ghana	1.4	23.5	0.0	0.2	1.4	29.0	10.2	3.3	23.4
Gambia	1.0	15.4	0.1	0.0	0.7	29.0	17.3	3.3	22.8
Myanmar	6.8	10.0	0.7	0.7	0.6	29.0	15.0	4.7	22.7

Lao People's Democrat ic Republic	3.7	12.6	0.7	2.5	2.3	29.0	14.5	2.5	22.5
Kenya	1.6	11.7	0.2	0.2	1.5	29.0	17.8	4.8	22.1
Congo	1.6	17.9	0.3	0.6	1.1	29.0	10.5	2.9	21.3
Morocco	7.3	13.9	1.4	2.6	1.1	9.0	14.9	5.2	20.7
Guyana	8.0	10.4	0.4	0.1	3.4	29.0	7.4	4.9	19.9
Uganda	1.0	15.6	0.1	0.0	0.4	29.0	7.4	6.3	19.1
Rwanda	1.3	12.0	0.2	0.7	1.1	29.0	9.0	6.6	18.9
Guatemala	3.5	0.7	0.1	0.0	0.3	29.0	17.6	5.8	18.3
Angola	2.1	4.1	0.1	0.5	1.1	29.0	15.9	2.8	17.8
Guinea- Bissau	1.3	5.9	2.2	0.0	56.5	29.0	7.3	7.2	17.7
Pakistan	9.8	6.7	1.0	1.6	0.5	6.0	14.8	2.9	16.8
Congo	0.9	4.1	0.0	0.0	0.5	29.0	10.5	6.3	15.5
Cameroon	0.9	9.2	0.0	0.1	0.8	29.0	6.0	4.7	15.4
Côte d'Ivoire	2.3	6.3	0.2	1.1	1.7	29.0	6.2	4.5	15.3
Honduras	3.1	7.4	0.3	0.5	0.4	7.0	15.2	7.9	15.1
Burkina Faso	0.6	6.6	0.0	0.1	1.1	29.0	6.8	6.9	15.0
Yemen	5.3	8.8	0.2	1.1	3.0	7.0	10.7	6.3	14.5
Mozambique	0.8	6.8	0.1	0.1	1.1	29.0	4.6	4.9	13.8
Benin	0.8	3.9	0.0	0.3	0.4	29.0	7.5	3.7	13.5

Sierra Leone	0.3	2.8	0.0	0.3	1.1	29.0	3.4	13.4	13.3
Cambodia	1.9	9.6	0.2	0.3	0.6	7.0	10.9	5.9	13.1
Malawi	0.4	4.4	0.0	0.1	0.4	29.0	3.5	9.6	13.1
Ethiopia	0.8	7.1	0.2	0.4	0.2	29.0	2.8	3.5	12.9
Papua New Guinea	0.7	4.5	0.2	0.1	1.6	29.0	5.9	2.5	12.8
Djibouti	2.2	7.3	0.2	2.3	1.1	14.0	7.9	3.3	12.8
Togo	0.8	4.1	0.0	0.3	0.6	29.0	3.6	6.2	12.5
United Republic of Tanzania	0.6	4.3	0.0	0.1	1.1	29.0	4.4	3.6	12.2
Madagascar	1.5	3.0	0.0	0.0	0.5	29.0	3.6	5.5	12.1
Chad	0.5	2.5	2.2	0.1	0.7	29.0	3.5	4.5	12.0
Senegal	0.7	3.1	0.1	0.1	0.2	29.0	3.8	4.1	11.6
Central African Republic	0.7	2.1	0.0	0.0	0.5	29.0	3.0	5.8	11.1
Guinea	0.8	1.2	0.0	0.1	0.4	29.0	4.4	4.1	11.1
Niger	0.4	2.7	0.0	0.0	0.6	29.0	1.6	7.7	11.1
Afghanistan	2.8	1.5	0.0	0.5	0.4	5.0	6.4	11.8	8.8
Somalia	0.2	1.1	2.2	2.4	1.1	9.0	1.1	6.3	6.6

Source: Authors' Calculation, Eviews 11.