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The Relation Between Restriction Policies against Covid-19, Economic Growth and Mortality Rate in Society

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Abstract

How do mortality rate of Coronavirus Disease 2019 (COVID-19) and economic growth of countries are affected by high restrictions and compulsory measures? This study confronts this question through a comparative analysis of countries that implement high and low level of restrictions against COVID-19 in order to understand whether high levels of restrictions are better at diminishing the adverse impacts of COVID-19 on public health and economies. The results of the study indicate that countries that implement high levels of restrictions are unable to reduce mortality per 1,000 people in comparison to those implementing little compulsory measures. Furthermore, that adopt high levels of restrictions exhibit a lower average growth of quarterly Gross Domestic Product than those with low levels of restrictions. The results obtained from this study can encourage countries to craft balanced and influential restriction policies to address COVID-19 and other pandemic crises of similar nature, which reduce mortality rates while safeguarding the socioeconomic systems.

Keywords: *COVID-19; Fatality rate; Economic growth; Government responses; Health policy; Crisis management.*

1. Introduction

We are still struggling with the pandemic of Coronavirus Disease 2019 (COVID-19), an infectious illness caused by new Severe Acute Respiratory Syndrome Coronavirus 2/SARS-CoV-2 (Bontempi et al., 2021; Bontempi et al., 2021; Coccia, 2020; Johns Hopkins Center for System Science and Engineering, 2022; Vinceti et al., 2021). One of the key challenges of dealing with a pandemic crisis is to devise and execute suitable policy responses with the aim of mitigating the adverse effects on public health, healthcare sector and socioeconomic systems in general. Nicoll & Coulombier (2009, p. 3ff) assert that health policies addressing a pandemic can be: a) Mitigation measures that are mainly based on nonpharmaceutical measures, such as social distancing, school closures, etc., which target reducing the dynamics of spread of the disease as well as the social pressure on hospitals and healthcare sector (cf., Moore et al., 2021); b) Containment measures that aim to disrupt the transmission of the virus by effectively tracing contacts (e.g. contact tracing apps on smartphones), implementing quarantines and general lockdowns as well as suitable treatments with vaccines and vaccine certifications to regulate movements of individuals, etc. Countries can opt to apply these policy responses through two primary approaches: a) implementation of high levels of

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restrictions and strict containment policies, such as prolonged periods of total lockdowns, vaccine certificates and miscellaneous compulsory measures for societal control; b) introduction of low levels of restrictions based on mitigation policies for short periods of time accompanied by little compulsory measures that respect the liberties of individuals. There are certain indices that can be used to measure the restriction levels of countries, such as the stringency index (Stringency Index, 2022). While informative about the restrictions implemented by governments as well as their strictness, this measure does not provide sufficient information on how appropriate is a country's response to the negative impacts of the pandemic crises in society. More specifically, it is unknown whether a higher score on the stringency index (or a similar index) signifies a more appropriate national response to COVID-19 than countries scoring lower on the index (Hale et al., 2021; Stringency Index, 2022). Nonetheless, whether exercising increased levels of restriction in a society lead to a national strategy and response that prove the most effective in dealing with COVID-19 remains as a fundamental problem in the field of science in terms of appropriate preparedness and crisis management in order to diminish the adverse impacts of the current COVID-19 pandemic and similar ones that may break out in the future. This study aims to comparatively analyze countries that have introduced either high or low levels of restrictions to address the COVID-19 pandemic crisis in order to understand whether a policy response that relies on high compulsory measures is more effective or not in ensuring a decrease in the detrimental effects of COVID-19 on public health and socioeconomic systems.

Specifically, the core purpose of this study is to investigate whether countries implementing high levels of restrictions and compulsory measures have attained lower fatality rates of COVID-19 and have performed better economically than those countries with lower levels of restrictions underpinning their policy responses. The results of the study can provide valuable insights to build upon in the future in this subject matter, helping to improve the process of crisis management and devise best practices and efficient policy responses to address the COVID-19 pandemic crisis and similar pandemics. This study constitutes a part of a larger research project intended to explain the drivers of transmission dynamics of COVID-19 and craft effective policy responses to deal with and/or to prevent pandemic threats in society (Coccia, 2020, 2020a, 202l, 2021a, 2022).

2. Theoretical framework

Sociology studies investigating COVID-19 aim to evaluate the impact of COVID-19 crisis and associated policies on the socioeconomic systems of countries (Coccia, 2022; 2022a). Generally, COVID-19 crisis management relies on a multilevel governance, which combines national, regional and urban strategies so as to ensure prompt policy responses and provide improved safety among society (Anttiroiko, 2021). To measure the how effective countries are in coping with the pandemic and assess their efficiency over the course of the epidemic, Taherinezhad & Alinezhad (2022) introduce a two-stage relational model that incorporates desirable and undesirable variables. Research demonstrate that, on average, the policy responses adopted in 2020 in Europe appear to be less stringent than those implemented by countries in East Asia (Ritchie et al., 2020). Anttiroiko (2021) investigates the effects of socioeconomic context, institutional arrangements, culture, and technology level on the responses of Eastern and Western countries to the COVID-19 pandemic. The research shows that Asian countries exercised proactive policies while Western countries adopted reactive policy responses to COVID-19 (cf., Coccia, 2021b, 2022). In addition, Anttiroiko (2021) emphasizes that Asian countries have acted with determination when implementing their policy responses to the COVID-19 crisis in 2020 due to the early spread of the pandemic, which has backed their process of extracting lessons from the pandemic and improving crisis management capabilities. Conversely, European countries are characterized by their different culture,

political systems and strategies to minimize the adverse effects of the COVID-19 pandemic crisis on their socioeconomic systems (Anttiroiko, 2021). Gupta et al. (2022) note that the countries that have imposed total lockdowns in order to stop the spread of the COVID-19 have experienced negative impacts on many of their sectors and their overall economic system. Specifically, manufacturing, agriculture and service sectors have seen significant stagnations due to lockdown measures implemented as part of the containment policies, which have led to detrimental effects on socioeconomic systems (cf., also Oshakbayev et al., 2022). Salisu et al. (2022) reveal that the unwanted impacts of the COVID-19 crisis on real GDP are widespread and more extensive in the developed than emerging economies. Yao et al. (2022) analyze the factors influencing the COVID-19 pandemic in different countries. The results of their study indicate that countries that have a higher democracy index have higher fatality rates linked to COVID-19 in the first phase of the pandemic, potentially because of the low flexibility practiced by governments and institutions in tackling the unexpected events through use of prompt policy responses. In particular, Yao et al. (2022) report that the percentage of the population aged 65 years and above as well as the health expenditures as a percentage of GDP were positively linked to countries' case fatality rates. This research proposes that practices of improving health system through increased hospital beds and healthcare workforce per capita should bring down the case fatality rate (cf., Coccia, 2022). Han et al. (2022) argue that COVID-19 transmission are closely linked to climate variables, air pollution, and socioeconomic factors, which also affect policy responses of countries (cf., Coccia, 2020, 2020a 2022). Buechler et al. (2022) indicate that stricter government restrictions and greater decreases in mobility (retain and recreation, in particular) are most closely associated with decreases in electricity consumption, causing socioeconomic challenges during the pandemic to numerous businesses. Pedauga et al. (2022) look into the sequence of reactions linked to the shocks that result from the COVID-19 lockdowns. Their findings show that lockdown policies bear varying macroeconomic impacts on sectors and businesses. Total lockdowns detrimentally affect small and medium sized businesses due to greater decreases in demand. Kufel et al. (2022) posit that, in the beginning, governments exercised nationwide lockdowns to deal with the COVID-19 pandemic, which have had impacts on both energy consumption and economies. Findings for some of the European countries affirm the adverse effect of such nonpharmaceutical measures and containment policies on both energy consumption and business cycle. In the subsequent waves of the pandemic, reducing the level of restrictions contributed to increased electricity consumption, which is suggestive of a potential exit from the economic recession. Kirson et al. (2022) present a model (that does not take into consideration the Delta and other variants and improvements in COVID-19 treatments), which shows how COVID-19 vaccines can substantially contribute to the US GDP and lives saved by reduced COVID-19 infections (cf., Gächter et al., 2022). Therefore, COVID-19 pandemic crisis and the level of restriction policies implemented by countries impact the dynamics of socioeconomic systems. Indeed, Economic Outlook (2023) demonstrates that, there has been a decrease in the global GDP growth forecast as of October 2022, from 4.7% to 4.2%. One of the reasons is the emergence of the Omicron variant, which less severe health impacts, however, the disproportionate rise in the global COVID-19 cases has been encouraging some countries to persist on control measures and/or loosen the restrictions gradually, which fuels social insecurity, disrupts businesses and put continued pressure on economies. In this framework, assessing the efficiency of policy responses of countries in dealing with the pandemic crisis in terms of decreasing fatalities linked to COVID-19 and in backing of the recovery of their socioeconomic system are among the pivotal aspects in social sciences. Following section introduces a methodology aimed to address these issues in order to build up on the available knowledge in this field of study, while improving the policy responses to be devised by countries in the future in order to contain and/or avert adverse effects of pandemics on the health of people and economies.

3. Method

3.1. Sample

The sample of this study is based on 12 main countries: Australia, Denmark, Finland, France, Germany, Greece, Italy, New Zealand, Norway, Portugal, Sweden and the United Kingdom.

3.2. Measures for statistical analyses

- The stringency index is a composite measure based on nine response indicators, including school closures; workplace closures; cancellation of public events; restrictions on public gatherings; closures of public transport; stay-at-home requirements; public information campaigns; restrictions on internal movements; international travel controls, etc. The daily index score is calculated as the average score of the nine metrics, with each metric being assigned a value between 0 and 100. A higher score stands for a stricter response (i.e., 100 = strictest response). This index mainly serves as a record of the strictness of government policies and does not imply the appropriateness or effectiveness of a country's response to address COVID-19. Higher scores are not necessarily an indication that a country's response is 'better' compared to others that score lower on the index to minimize the effects of the pandemic crisis in society (Hale et al., 2021; Stringency Index, 2022). Period January 2020 - January 2022.

- Quarterly gross domestic product total, percentage change, previous period, based on quarterly national accounts. Gross Domestic Product (GDP) is the standard measure of the value added generated by means of production of goods and services in a country during a certain time frame. It is also a measure of the income generated from that production, or the total amount expensed on final goods and services (less imports). Whereas GDP is a crucial indicator of capturing economic activity, it is limited when it comes to providing a suitable measure of individuals' wellbeing, for which alternative indicators may be more fruitful. This indicator relies on real GDP (also known as GDP at constant prices or GDP in volume). In other words, the developments over time are adjusted for price changes while the numbers are adjusted for seasonal influences. All member countries of the Organisation for Economic Co-operation and Development (OECD) compile their data in accordance with the 2008 System of National Accounts. Sources: OECD Data (2022). Period 2020-2021: Q=Quarterly; 2020-Q1,2020-Q2, 2020-Q3, 2020-Q4, 2021-Q1, 2021-Q2, 2021-Q3 and 2021-Q4

- Current health expenditure (% of GDP). Level of current health expenditure expressed as a percentage of GDP. Estimates of current health expenditures encompass healthcare goods and services consumed during each year. This indicator excludes capital health expenditures such as buildings, machinery, IT and stocks of vaccines for emergency or outbreaks. (The Word Bank, 2022). Period 2008-2018 (last year available)

- Population total 2020. Total population is based on the de facto definition of population, which counts all residents regardless of their legal status or citizenship. The values are midyear estimates. Source: The World Bank (2022a).

- Vaccination is measured by percent share of people that are fully vaccinated against COVID-19 as of 11 February 2022. The data gathered refer to February 2022; however, some countries, because of difficulty in gathering and transmitting the data, may have reported the data of January 2022. Of course, this slight temporal variation in the reported data does not impact the statistical analyses. The data gathered in this study take into account all types of COVID-19 vaccines used in different countries, such as vaccines by Johnson & Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Moderna, etc. (Mayo Clinic, 2021; Ritchie et al., 2020). Of course, every country has been using a different combination of these COVID-19 vaccines to safeguard the public against COVID-19 and its variants. Source: Our World in Data (2022).

- COVID-19 deaths. Total number of deaths in February 2022. It indicates the severity of this novel infectious disease in society. Source of data: Johns Hopkins Center for System Science and Engineering (2022).

- Fatality rate. Case Fatality Ratio % (on 11 February 2022). It indicates the severity of an infectious disease and assesses the quality of health systems (Lau et al., 2021; WHO, 2020; Wilson et al., 2020). Case Fatality Ratio (CFR) calculates the proportion of deaths among identified confirmed cases of COVID-19 and it is given by:

- $$Case\ Fatality\ Ratio\ (\text{CFR})\ \% = \left(\frac{Number\ of\ deaths\ from\ COVID-19}{Number\ of\ confirmed\ cases\ of\ COVID-19}\right) \times 100$$

Angelopoulos et al. (2020) argue that Case Fatality Ratios (CFRs) among countries are critical in measuring relative risk that guide policymakers in their decisions to allocate medical resources to deal with COVID-19 pandemic crisis. This study also measures the mortality rate per 1,000 people for a comparative analysis with CFRs in order to accurately evaluate the effects of policy responses of countries.

$$Mortality\ rate\ per\ 1000\ people = \left(\frac{Total\ number\ of\ deaths\ from\ COVID-19\ at\ February\ 2022}{Total\ population\ in\ 2020}\right) \times 1000$$

Source of data: Johns Hopkins Center for System Science and Engineering (2022).

3.3. Data analysis procedure

First, the Stringency Index (2022) of the countries analyzed is used to categorize them in two groups:

- Group 1: Countries implementing a high level of restrictions and mandatory measures of control (measured with Stringency Index having an average value of about 63; 100 =strictest), such as Australia, France, Germany, Greece, Italy and Portugal.

- Group 2: Countries implementing a low level of restrictions and requirements in society to address COVID-19 (Stringency Index has an average value of 49): Denmark, Finland, New Zealand, Norway, Sweden and the United Kingdom.

Second, descriptive statistics obtained from using arithmetic mean and standard error of the mean of variables (Quarterly GDP-Percentage change, Health expenditure % of GDP; Fully vaccinated people; Case Fatality Ratio % and Mortality per 1,000 people) is calculated for the two groups mentioned. Findings present an initial comparative analysis of how the effectiveness of the policy responses of countries, on the basis of higher/lower scores of the strictness of government policies, on socioeconomic systems.

Third, a follow-up investigation involving the 12 countries is conducted using bivariate Pearson correlation and partial correlation (controlling health expenditure as % of GDP) to evaluate the sample correlation coefficient, denoted as r. This coefficient measures the strength and direction of linear relationships between pairs of continuous variables that are being analyzed in this study. The strength can be assessed following the general guidelines below:

$0.1 < |r| < 0.3$ … small / weak correlation
$0.3 < |r| < 0.5$ … medium / moderate correlation
$0.5 < |r|$ …… large / strong correlation

Following, the Independent Samples t-Test is conducted to compare the means of two independent groups so as to ascertain whether there is statistical evidence that the associated population means are significantly different. The assumption that there is a homogeneity of variance in the Independent Samples t Test -i.e., that both groups have the same variance- is verified with Levene's Test according to the statistical hypotheses below:

H_0: $\sigma_1^2 - \sigma_2^2 = 0$ (population variances of group 1 and 2 are equal)
H_1: $\sigma_1^2 - \sigma_2^2 \neq 0$ (population variances of group 1 and 2 are not equal)

The rejection of the null hypothesis in Levene's Test indicates that variances of the two groups are not equal, which means the assumption of homogeneity of variances is violated. If Levene's test indicates that variances are equal between the two groups (i.e., p-value large), it is assumed that the variances are equal. If Levene's test suggests that the variances are not equal between the two groups (i.e., p-value small), equal variances are not assumed. After that, null hypothesis (H'0) and alternative hypothesis (H'1) of the Independent Samples t-Test are:
H'_0: $\mu_1 = \mu_2$, the two-population means are equal in countries implementing high and low restrictions.
H'_1: $\mu_1 \neq \mu_2$, the two-population means are not equal in countries implementing high and low restrictions.

Statistical analyses are performed utilizing the Statistics Software SPSS□ version 26.

4. Findings

Based on the arithmetic mean (M) of the stringency index of countries that are analyzed in this study, the countries are categorized in the following two groups for a comparative analysis:

□ Countries implementing High levels of restrictions and compulsory measures of control, average stringency index over 2020-2022 (January) period = 62.97 (Std. Error .279)

□ Countries implementing Low levels of restrictions and compulsory measures of control, average stringency index over 2020-2022 (January) period=49.01 (Std. Error .282)

Table 1. Descriptive statistics

	Countries with HIGH restrictions		Countries with LOW restrictions	
Description of variables	M	Std. Error Mean	M	Std. Error Mean
Stringency Index over 2020-2022 period	62.97	0.279	49.01	0.282
Quarterly GDP, Percentage change, 2020-2021	0.14	1.05	0.37	0.89
Current health expenditure % of GDP, 2008-2018	9.64	0.14	9.70	0.086
Mortality per 1000 people, February 2022	1.39	0.40	0.89	0.37
Fatality rates %, February 2022	0.82	0.17	0.43	0.12
Share of people fully vaccinated against COVID-19, February 2022	77.17	3.00	74.60	1.45

Note: M= arithmetic mean

Table 1 illustrates the countries implementing higher levels of restrictions and requirements in society (average stringency index of 62.97) experience higher mortality per 1,000 people and higher fatality rate (%) compared to countries exercising lower levels of restrictions and mandatory measures: 1.19 vs. 0.89 and 0.82 vs. 0.43, respectively. Furthermore, the average quarterly GDP of countries that score higher on the stringency index (having high restrictions) is +0.14, which is 64% lower than that of the countries scoring low on the stringency index and having lower restrictions (that is +0.37). This finding shows that compulsory measures hinder the functioning of socioeconomic systems without being effective in decreasing the negative effects of COVID-19 pandemic crisis in society. In addition, the comparative analysis of the two country groups have shown that the average health expenditure (% of GDP) is nearly identical; however, the share of vaccinated people is of course higher in countries that exercise higher levels of restrictions and compulsory interventions. In some countries,

these measures and restrictions include requirements of immunity passports for work and mandatory vaccination for adults, which limit individual liberties and result in a flawed democracy.

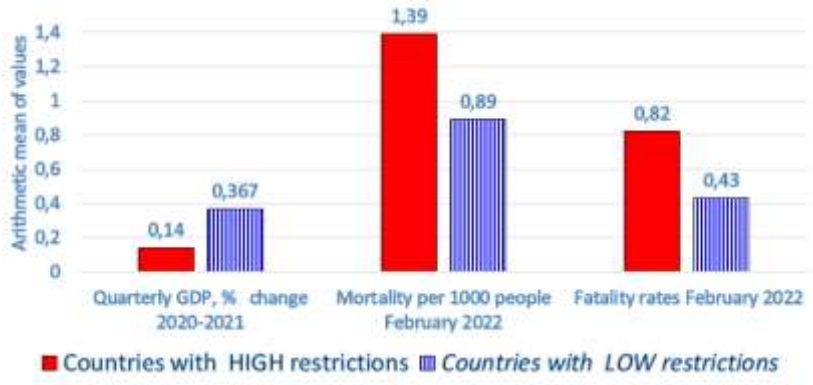

Figure 1. Comparative analysis of economic and health indicators between countries implementing high and low restrictions to cope with COVID-10

Figure 1 illustrates how countries imposing high levels of restrictions and compulsory measures experience deteriorated economic systems and increased adverse effects of the pandemic with the society. This finding can be attributed to the fact that restrictions and mandatory control measures addressing COVID-19 fall short of being an efficient strategy to decrease the adverse effects of the novel coronavirus in societies. This is because there are lots of factors that contribute to the spread and the mortality of this pandemic, even in countries implementing higher levels of restrictions and having high shares of people fully vaccinated against the COVID-19.

Table 2. Correlation

Pearson Correlation	Average Stringency Index 2020-2022	Average GDP Growth Q 2020-2021	Fatality Rate 11 Feb 2022	Total Mortality per 1000, 11 Feb 2022	Full Vaccinated people 11 Feb 2022
Average Stringency Index 2020-2022	1	-0.279	.795**	.543*	0.003

Notes: ** Correlation is significant at the 0.01 level (1-tailed). * Correlation is significant at the 0.05 level (1-tailed).

Table 2 points to a strong positive correlation within the sample between the stringency index and the fatality rate (r=.80, p-value .01) and total mortality (r=.54, p-value .05). These findings are further supported by the partial correlation controlling average health expenditure (Table 3).

Table 3. Partial Correlation

Control variable	Pearson Correlation	Average Stringency Index 2020-2022	Average GDP Growth Q 2020-2021	Fatality Rate 11 Feb 2022	Total Mortality per 1000, 11 Feb 2022	Full Vaccinated people 11 Feb 2022
Average Health Expenditure 2008-2018	Average Stringency Index 2020/2022	1	-0.262	0.796	0.614	-0.005
	Significance (1-tailed)		0.218	0.002	0.022	0.494

Table 4. Independent Samples Test of countries with high vs. low restrictions.

		Levene's Test for equality of variances		t-test for equality of Means				
		F	Sig.	t	df	Sig. 2-tailed	Mean Difference	Std. Error Difference
Average GDP Growth Q 2020-2021	•Equal variances assumed	5.758	0.037	-1.152	10	0.276	-1.383	1.201
	•Equal variances not assumed			-1.152	5.01	0.301	-1.383	1.201
Fatality Rate, 11 Feb 2022	•Equal variances assumed	0.8	0.392	1.893	10	0.088	0.388	0.205
	•Equal variances not assumed			1.893	9.074	0.091	0.388	0.205
Total Mortality per 1000, 11 Feb 2022	•Equal variances assumed	0.069	0.798	0.91	10	0.384	0.497	0.546
	•Equal variances not assumed			0.91	9.939	0.384	0.497	0.546
Full Vaccinated People, 11 Feb 2022	•Equal variances assumed	1.489	0.25	0.77	10	0.459	2.567	3.334
	•Equal variances not assumed			0.77	7.222	0.466	2.567	3.334

Independent Samples Test presented in Table 4 shows a similar arithmetic mean among the countries implementing high and low restrictions (retain null hypothesis). This finding may be explained with the small size of the sample, which reduces the consistency of this statistical analysis. Nevertheless, in general, the statistical evidence above appears to back the hypothesis that increased levels of restrictions and requirements within the society does not positively contribute to the management of COVID-19 pandemic in comparison to the countries exercising little restrictions in terms of reduction of mortality and better operation of economic system that exhibits a low average rate of quarterly growth (2020-2021 period) compared to countries with little compulsory measures in place.

5. Discussions

The key findings of this research indicate that exercising a strong policy of restrictions and obligations does not mitigate the negative effects of COVID-19 pandemic in society, although such practice seems to negatively affect the economic performance of countries in terms of low quarterly growth of GDP (average value over 2020-2021 period). This result can be attributed to the fact that strict containment policies do not prove to be a sufficient strategy to mitigate the adverse impact of the novel coronavirus within society since there are lots of factors that contribute to the spread of the novel coronavirus and the mortality of COVID-19. Numerous countries have enforced strict and pervasive restrictions and mandatory measures, aiming to curtail the spread of the pandemic and contribute to the economic growth; however, this study provides evidence that such policies are not effective. Libman (2018) asserts that economic policies of governments are among the key factors affecting economic growth. Nevertheless, what policy measures governments decide to exercise does not alone determine the containment of COVID-19 pandemic crisis and their growth performance. How these policies are implemented also play a role so much so that ineffective regulatory measures that can undermine even the most reasonable policy measures. Ball (2021) notes that Sweden implemented a much lighter strategy that did not impose lockdowns and treated the public with trust and transparency about the measures that were being taken. At first, in 2020, the results suggested that Sweden experienced much higher fatalities compared to neighboring countries (Ball, 2021). However, the results of 2022 are better for Sweden than for the other countries, which implemented stringent containment measures, in terms of low mortality linked to COVID-19 and high economic growth (Johns Hopkins Center for System Science and Engineering, 2022; Stringency Index 2022). The United Kingdom

has also enforced low levels of restrictions to avoid the potential risk of unpopularity of strict policy responses, and in 2022, the economic performance of the UK is better and the negative effects of COVID-19 is similar to or lower than the countries that implemented more stricter measures (Birch, 2021). Research indicate that countries exercising more restrictions and obligations tend to create unclear and complicated rules. Also, since the rules are constantly changing as the pandemic evolves, this increases the confusion and the social insecurity amongst the public, which has negative impacts on people, institutions and overall socioeconomic systems (Gore, 1994). A key learning from the COVID-19 pandemic would be how scientific advice influence political decision-making and whether the decision made rely on the value of independence and transparency of that advice. In numerous countries, conflicting pieces of scientific advice have caused confusion since most of the initial claims were proved to be false or misleading in the end. Ball (2021, p. 9) suggests that policy responses intended to cope with the COVID-19 should be grounded on certain requirements, such as:

— To establish credibility and generate trust

— Trust can only be generated by openness

— Openness requires recognition of uncertainty, where it exists

— The importance of precautionary measures should not be played down on the grounds that the risk is unproved

— The public should be trusted to respond rationally to openness

— Scientific investigation of risk should be open and transparent, and

— The advice and the reasoning of advisory committees should be made public.

However, countries disregarded many of these tenets during the COVID-19 pandemic as they implemented numerous restrictive measures with uncertainty and inconsistency and delayed containment rules that could not keep up with the evolution of the pandemic, all of which caused reduced effectiveness in mitigating the effects experienced within society. The COVID-19 pandemic demonstrates that the effectiveness of scientific and technological interventions in backing public policies relies on numerous social and institutional factors (Raleigh, 2020). Indeed, if people are unable to adhere to the policy responses of restrictions, they fail to be fully effective (Green et al., 2021). Effective response policies also rely on transparent and truthful communication, as well as an ability to counteract misinformation so that restrictions can be complied with (Ball, 2021). Generally speaking, efficient governance can contribute to the preparedness of the health systems in the face of turbulent settings generated by the pandemic crisis and new needs of the population. Also, countries that make continuous investments in health sector and preparedness can diminish mortality, morbidity and stress among the population in addition to supporting public health and economic recovery following pandemic crisis (Kluge et al., 2020; Coccia, 2021a). Kapitsinis (2020) asserts that health sector investments are among the key public policies designed to reduce the mortality rate linked to COVID-19 and pandemics in the future. Therefore, it is imperative for countries to support investments into the healthcare system in order to expand hospital capacities and investments into R&D and innovative technology so as to develop effective vaccines, antivirals, innovative drugs and high-tech devices that can combat future public health threats of new epidemics like the COVID-19 (Ardito et al., 2021). Sagan et al. (2020) posit that effective governance is key to crafting resilient responses in the face of a crisis. Conversely, bureaucratic rules bringing high level of control and restriction of the public sphere and private life limit individual freedoms, which cause social, psychological and economic challenges without mitigating the negative effect of the pandemic within society (Chantler et al., 2019; Cornell et al., 2020; Dye & Mills, 2021; Phelan, 2020). Brown et al. (2021) proposes that immunity passports, which are one of the key measures of restriction that are implemented across many European countries, should be

implemented to maximize the benefit without adversely affecting public wellbeing. Kamin-Friedman & Peled Raz (2021) argue that green pass: “imposes restrictions on the movement of individuals who had not been vaccinated or who had not recovered, it is not consonant with solidarity and trust building. Implementing the Green Pass provision while advancing its effectiveness on the one hand, and safeguarding equality, proportionality, and fairness on the other hand may imbue this measure with ethical legitimacy despite involving a potential breach of trust and solidarity”. Saban et al. (2021) argue that policymakers should adopt balanced approaches to safeguard public health, all while minimizing the infringement on the rights of citizens. Luster et al. (2021) suggest that: “the Green Pass policy raises practical, legal and ethical concerns.... any privileges or restrictions guided by one's COVID-19 immunization status must be designed with the utmost attention to prevent a disproportionate violation of the human rights of the non-vaccinated and the public at large”.

In summary, restriction policies and compulsory measures are put in place in order to deal with the pandemic and to support economic recovery; however, some European countries are using the requirements to penalize people (such as people that are unvaccinated), limiting freedom of people, heightening tensions among different social groups, and as a result, impairing the perspective needed to sustain economic growth (Kosciejew et al., 2021; Waitzberg et al., 2021; Wilf-Miron et al., 2021). Gore (2004) argues that, in circumstances of uncertainty, governments tend to come up with administrative policies that are inconsistent, ambiguous and not transparent enough so as to minimize their accountability to people and the public interest (cf., Wilf-Miron et al., 2021). Furthermore, being persistent on the use of restriction policies can leverage potential health risks and result in authoritarian rules that limit liberties of individuals and cause socioeconomic issues, while offering insufficient benefits to tackle the COVID-19 pandemic (Wesołowski, 1990) . In general, Ball (2021) asserts that the diverse nature of the pandemic outcomes and the responses across the world makes it difficult to arrive at a conclusion about how science, policy and society can and should interact with one another (cf., Shattock et al., 2022). Ball (2021, p. 9) also argues that: "Politicians, …, should not use science as a shield against making (or accepting responsibility for) difficult decisions, and should acknowledge that scientific advice is likely to be more effective when it is genuinely independent, autonomous and transparent. We cannot expect good public health to be valued and nurtured if political health is poor".

6. Conclusions

Amidst the continuous global threat posed by the COVID-19 pandemic, one of the objectives of countries is to reduce rates of mortality and back economic growth (cf., Coccia, 2020a, 2021a).

The findings of this study appear to be that:

- A strict policy favoring numerous restrictions and requirements does not prove helpful in reducing the negative effects of COVID-19 pandemic in society in terms of lower mortality per 1,000 people and a lower-case fatality rate compared to those countries implementing little restrictions (findings of this study show 1.19 vs. 0.89 and 0.82% vs. 0.43%, for countries implementing high and low restrictions, respectively).

- Countries exercising high levels of restrictions and obligations impair the economic performance in terms of lower average growth of quarterly Gross Domestic Product in comparison to countries practicing little restrictions (0.14% vs. 0.38%, for countries implementing high and low restrictions, respectively).

Although this study has provided interesting yet tentative results, it has several limitations. First, one of the limitations of this study is the lack of data in numerous countries. Second, the study does not take into account all of the potential confounding

factors that influence the policy responses and the mortality associated with COVID-19; and in the future, such factors must be controlled in order to be able to support the findings of this study. Third, the lack of integration of the data with the socioeconomic aspects of the countries may have an affect on the mortality and economic growth findings, which make comparative analysis a problematic approach (Angelopoulos et al., 2020; Coccia, 2018). Fourth, the response policies of countries may be affected by country-specific health investments and need to be checked in the future in order to build on this study. Thus, the generalization of the results of this study should be done with caution.

Future studies should take into account new data regarding countries and examine other variables among countries as well in order to explain the interplay among policy responses, mortality and other socioeconomic factors. So, more detailed research is needed in this field, and this study encourages researchers to conduct further investigations to provide an understanding of complex factors to craft suitable strategies to address the pandemic threat while safeguarding the socioeconomic system. Findings of this study must be bolstered with follow-up research to be conducted on a larger sample of countries so as to be able to provide detailed insights into the relationships among response policies, effects of pandemic on public health and socioeconomic system.

In conclusion, increased mandatory measures may have insignificant effect when it comes to coping with the negative impacts of the pandemic crisis and bettering economic performance; however, such restrictive approaches limit individual freedoms of people, which result in abusive practices in democratic countries due to the implementation of authoritarian rules informally in settings of social precariousness, igniting the fear of the pandemic within society. To sum up, one should ask whether, amidst the pandemic crisis, implementation of uncontrolled health policies that rely on high levels of restriction and enforcement of authoritative rules by political authorities can lead to effects on society that are much more hazardous than the effects of new viral agents, as well as restrictions that neither minimize the effects of COVID-19 pandemic within society nor improve economic growth, but instead, direct countries into flawed democratic settings that will bring along socioeconomic issues in the long run.

References

Angelopoulos, A.N., Pathak, R., Varma, R., & Jordan, M.I. (2020). “On identifying and mitigating bias in the estimation of the COVID-19 case fatality rate”. Harvard Data Science Review. doi. https://doi.org/10.1162/99608f92.f01ee285

Anttiroiko, A.-V. (2021). “Successful government responses to the pandemic: Contextualizing national and urban responses to the COVID-19 outbreak in east and West”. International Journal of E-Planning Research, 10(2): 1-17. doi. https://doi.org/10.4018/IJEPR.20210401.oa1

Ardito, L., Coccia M., & Messeni, P.A. (2021). Technological exaptation and crisis management: Evidence from COVID-19 outbreaks. “R&D Management”, 51(4): 381-392. doi. https://doi.org/10.1111/radm.12455

Ball, P. (2021). “What the COVID-19 pandemic reveals about science, policy and society”. Interface Focus. 11, 20210022. doi. https://doi.org/10.1098/rsfs.2021.0022

Birch, J. (2021). “Science and policy in extremis: the UK’s initial response to COVID 19”. Eur. J. Phil. Sci. 11, 90. doi. https://doi.org/10.1007/s13194-021-00407-z

Bontempi, E., & Coccia, M. (2021). “International trade as critical parameter of COVID-19 spread that outclasses demographic, economic, environmental, and pollution factors”, Environmental Research, 201: 111514. doi. https://doi.org/10.1016/j.envres.2021.111514

Bontempi, E., Coccia, M., Vergalli, S., & Zanoletti, A. (2021). “Can commercial trade represent the main indicator of the COVID-19 diffusion due to human-to-human interactions? A

comparative analysis between Italy, France, and Spain", Environmental Research, 201: 111529. doi. https://doi.org/10.1016/j.envres.2021.111529

Brown, R., Kelly, D., Wilkinson, D., & Savulescu, J. (2021). "The scientific and ethical feasibility of immunity passports" The Lancet. Infectious Diseases, 21(3): e58–e63. doi. https://doi.org/10.1016/S1473-3099(20)30766-0

Buechler, E., Powell, S., Sun, T., (...), Boudet, H., & Rajagopal, R. (2022). "Global changes in electricity consumption during COVID-19", iscience, 25(1): 103568. doi. https://doi.org/10.1016/j.isci.2021.103568

Chantler, T., Karafillakis, E., & Wilson, J. (2019). "Vaccination: Is there a place for penalties for non-compliance?", Applied Health Economics and Health Policy, 17(3): 265–271. doi. https://doi.org/10.1007/s40258-019-00460-z

Coccia, M., Bellitto, M. (2018). "Human progress and its socioeconomic effects in society", Journal of Economic and Social Thought, 5(2): 160-178. doi. https://doi.org/10.1453/jest.v5i2.1649

Coccia, M. (2020). "Factors determining the diffusion of COVID-19 and suggested strategy to prevent future accelerated viral infectivity similar to COVID". Science of The Total Environment, 729: 138474. doi. https://doi.org/10.1016/j.scitotenv.2020.138474

Coccia, M. (2020a). "How (Un)sustainable Environments are Related to the Diffusion of COVID-19: The Relation between Coronavirus Disease 2019", Air Pollution, Wind Resource and Energy. Sustainability, 12: 9709. doi. https://doi.org/10.3390/su12229709

Coccia, M. (2021). "Evolution and structure of research fields driven by crises and environmental threats: the COVID-19 research". Scientometrics, 126(2): 9405-9429. doi. https://doi.org/10.1007/s11192-021-04172-x

Coccia, M. (2021a). "Evolution of technology in replacement of heart valves: Transcatheter aortic valves, a revolution for management of valvular heart diseases", Health Policy and Technology, 10(2): 100512. https://doi.org/10.1016/j.hlpt.2021.100512

Coccia, M. (2022). "Preparedness of countries to face COVID-19 pandemic crisis: Strategic positioning and underlying structural factors to support strategies of prevention of pandemic threats", Environmental Research, 203: 111678. doi. https://doi.org/10.1016/j.envres.2021.111678

Cornell, A, Knutsen, C.H., Teorell, J. (2020). "Bureaucracy and growth". Comparative Political Studies. 53(14): 2246-2282. doi. https://doi.org/10.1177/0010414020912262

Dye, C., & Mills, M.C. (2021). "COVID-19 Vaccination Passports". Science, 371(6535): 1184. doi. https://doi.org/10.1126/science.abi5245

Economic Outlook, (2022). Document, 46(1), 32-34. doi. https://doi.org/10.1111/1468-0319.12603

Gächter, M., Huber, F., Meier, M. (2022). "Shot for the US economy", Finance Research Letters, 47: 102638. doi. https://doi.org/10.1016/j.frl.2021.102638

Gore, A. (2004). "The politics of fear". Social Research, 71(4): 779-798.

Green, D, Filkin, G, Woods, T. (2021). "Our unhealthy nation". Lancet Healthy Longev. 2, E8–E9. doi. https://doi.org/10.1016/S2666-7568(20)30062-3

Gupta, V., Santosh, K.C., Arora, R., (...), Kalid, K.S., Mohan, S. (2022). "Socioeconomic impact due to COVID-19: An empirical assessment", Information Processing and Management, 59(2): 102810. doi. https://doi.org/10.1016/j.ipm.2021.102810

Hale, T., Angrist, N., Goldszmidt, R., Kira, B., Petherick, A., Phillips, T., Webster, S., Cameron-Blake, E., Hallas, E., Majumdar, S., and Tatlow, H. (2021). "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)". Nature Human Behaviour. 5: 529-538. doi. https://doi.org/10.1038/s41562-021-01079-8

Han, Y., Zhao, W., Pereira, P. (2022). "Global COVID-19 pandemic trends and their relationship with meteorological variables, air pollutants and socioeconomic aspects", Environmental Research, 204: 112249. doi. https://doi.org/10.1016%2Fj.envres.2021.112249

Johns Hopkins Center for System Science and Engineering, 2022. Coronavirus COVID-19 Global Cases, accessed in 14 January 2022. [Retrieved from].

Kamin-Friedman, S., & Peled Raz, M. (2021). “Lessons from Israel's COVID-19 Green Pass program”. Israel Journal of Health Policy Research, 10(1): 61. doi. https://doi.org/10.1186/s13584-021-00496-4

Kapitsinis, N. (2020). The underlying factors of the COVID-19 spatially uneven spread. Initial evidence from regions in nine EU countries. Regional Science Policy and Practice, 12(6), 1027-1045. doi. https://doi.org/10.1111/rsp3.12340

Kluge, H.H.P., Nitzan D., Azzopardi-Muscat, N. (2020). “COVID-19: reflecting on experience and anticipating the next steps”. A perspective from the WHO Regional Office for Europe. Eurohealth, 26(2): 135-150.

Kosciejew, M.R.H. (2021). “COVID-19 immunity (or vaccine) passports: a documentary overview and analysis of regimes of health verification within the coronavirus pandemic”. Journal of Documentation, 78(2): 463.484. doi. https://doi.org/10.1108/JD-04-2021-0079

Kufel, T., Kufel, P., Błażejowski, M. (2022). “Do COVID-19 lock-downs affect business cycle? Analysis using energy consumption cycle clock for selected European countries”, Energies, 15(1): 340. doi. https://doi.org/10.3390/en15010340

Lau, H., Khosrawipour, T., Kocbach, P., Ichii, H., Bania, J., Khosrawipour, V. (2021). “Evaluating the massive underreporting and undertesting of COVID-19 cases in multiple global epicenters”. Pulmonology, 27(2): 110-115. doi. https://doi.org/10.1016/j.pulmoe.2020.05.015

Libman A. (2018) “Bureaucracy and Economic Growth”. In: Farazmand A. (eds) Global Encyclopedia of Public Administration, Public Policy, and Governance. Springer, Cham. https://doi.org/10.1007/978-3-319-20928-9_673

Luster, T., Albin, E., Gross, A., Tabenkin, M., & Davidovitch, N. (2021). “Promoting vaccination from a human rights and equity perspective: Lessons from the Israeli “Green Pass””. European Journal of Risk Regulation, 12(2): 308-320. doi. https://doi.org/10.1017/err.2021.36

Mayo, C. (2021). Different types of COVID-19 vaccines: How they work. accessed 6 September 2021. [Retrieved from].

Moore, S., Hill, E.M., Tildesley, M.J., Dyson, L., Keeling, M.J. (2021). “Vaccination and non-pharmaceutical interventions for COVID-19: a mathematical modelling study”, The Lancet Infectious Diseases, 21(6): 793-802. doi. https://doi.org/10.1016/s1473-3099(21)00143-2

Nicoll, A, & Coulombier, D. (2009). “Europe’s initial experience with pandemic (H1N1) 2009 - mitigation and delaying policies and practices”. Euro Surveill. 14(29): pii=19279. doi. https://doi.org/10.2807/ese.14.29.19279-en

OECD Data, (2022). Quarterly GDP. Accessed February 2022. [Retrieved from].

Oshakbayev, K., Zhankalova, Z., Gazaliyeva, M., (...), Otarbayev, N., Tordai, A. (2022). “Association between COVID-19 morbidity, mortality, and gross domestic product, overweight/ obesity, non-communicable diseases, vaccination rate: A cross-sectional study”, Journal of Infection and Public Health, 15(2): 255-260. doi. https://doi.org/10.1016/j.jiph.2022.01.009

Our World in Data, (2022). Coronavirus (COVID-19) Vaccinations - Statistics and Research - Our World in Data. Accessed 25 January. [Retrieved from].

Pedauga, L., Sáez, F., Delgado-Márquez, B.L. (2022). “Macroeconomic lockdown and SMEs: the impact of the COVID-19 pandemic in Spain”, Small Business Economics, 58(2): 665-688. doi. https://doi.org/10.1007/s11187-021-00476-7

Phelan A.L. (2020). “COVID-19 immunity passports and vaccination certificates: scientific, equitable, and legal challenges”. Lancet, 395(10237): 1595-1598. doi. https://doi.org/10.1016/S0140-6736(20)31034-5

Raleigh V.S. (2020). “UK’s record on pandemic deaths”. Br. Med. J. 370: m3348. doi. https://doi.org/10.1136/bmj. m3348

Ritchie, H., Ortiz-Ospina, E., Beltekian, D., Mathieu, E., Hasel, J., Macdonald, B., Giattino, C., Roser, M. (2020). Policy Responses to the Coronavirus Pandemic. Our World in Data, Statistics and Research. July 7. [Retrieved from].

Saban, M., Myers, V., Ben Shetrit, S., Wilf-Miron, R. (2021). "Issues surrounding incentives and penalties for COVID-19 vaccination: The Israeli experience". Preventive Medicine, 153: 106763. doi. https://doi.org/10.1016/j.ypmed.2021.106763

Salisu, A.A., Adediran, I.A., Gupta, R. (2022). "A note on the COVID-19 shock and real GDP in emerging economies". Emerging Markets Finance and Trade, 58(1): 93-101. doi. https://doi.org/10.1080/1540496X.2021.1981854

Shattock, A.J., Le Rutte, E.A., Dünner, R.P., (...), Chitnis, N., Penny, M.A. (2022). "Impact of vaccination and no n-pharmaceutical interventions on SARS-CoV-2 dynamics in Switzerland", Epidemics, 38, 100535. doi. https://doi.org/10.1016/j.epidem.2021.100535

Stringency Index (2022). COVID-19: Stringency Index, accessed February 2022. [Retrieved from].

Taherinezhad, A., Alinezhad, A. (2022). Nations performance evaluation during SARS-CoV-2 outbreak handling via data envelopment analysis and machine learning methods, International Journal of Systems Science: Operations and Logistics, 10(1): 2022243. doi. https://doi.org/10.1080/23302674.2021.2022243

The World Bank (2022a). Data, Population, total. Accessed January 2022. [Retrieved from].

The World Bank, (2022). Current health expenditure (% of GDP), Accessed February 2022. [Retrieved from].

Vinceti, M., Filippini, T., Rothman, K. J., Di Federico, S., & Orsini, N. (2021). "SARS-CoV-2 infection incidence during the first and second COVID-19 waves in Italy". Environmental Research, 197: 111097. doi. https://doi.org/10.1016/j.envres.2021.111097

Waitzberg, R., Triki, N., Alroy-Preis, S., Lotan, T., Shiran, L., Ash, N. (2021). "The Israeli experience with the "Green Pass" policy highlights issues to be considered by policymakers in other countries". International Journal of Environmental Research and Public Health, 18(21): 11212. doi. https://doi.org/10.3390/ijerph182111212

Wesołowski, W. (1990). "Transition from authoritarianism to democracy". Social Research, 57(2), 435-461.

WHO, (2020). Estimating mortality from COVID-19, Scientific Brief. 4 August. Accessed 6 May 2021. [Retrieved from].

Wilf-Miron, R., Myers, V., Saban, M. (2021). "Incentivizing vaccination uptake: The "Green Pass" proposal in Israel". JAMA, 325(15): 1503-1504. doi. https://doi.org/10.1001/jama.2021.4300

Wilson N., Kvalsvig A., Barnard L., et al. (2020). "Case-fatality risk estimates for COVID-19 calculated by using a Lag Time for Fatality". Emerging Infectious Diseases. 26(6): 1339-1441. doi. https://doi.org/10.3201/eid2606.200320

Yao, L., Li, M., Wan, J.Y., (...), Bailey, J.E., Graff, J.C. (2022). "Democracy and case fatality rate of COVID-19 at early stage of pandemic: a multicountry study". Environmental Science and Pollution Research, 29(6): 8694-8704. doi. https://doi.org/10.1007%2Fs11356-021-16250-x