



How does the wealth level of nations affect their COVID-19 vaccination plans?

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Abstract: This study uses global data to examine how vaccination levels correlate with socioeconomic, institutional and political variables across 150 countries. Results demonstrate that as a country's economic development, measured by GDP per capita, increases, so does the percentage of vaccinated people, reaching a peak of 70%. Furthermore, countries with Monarchy and Parliamentary Monarchy exhibit higher vaccination levels among their populations compared to countries with mixed Executives. In this context, manifold countries are implementing restrictions and bureaucratic rules, such as green pass/vaccine reports, to boost vaccination levels by regulating various public and private life aspects that potentially impact individuals' well-being. The discussion elucidates the underlying causes of these sociopolitical phenomena within the context of social insecurity. All these results can provide valuable insights for policymakers, aiding them in crafting sustainable policy responses to address not only COVID-19 but other similar epidemics, all while not adversely affecting nations' economies and social structures.

Keywords: COVID-19 vaccines, vaccine hesitancy, economic development, political system, vaccine



passports, equity, social insecurity, public health ethics

1. Introduction

Coronavirus disease 2019 (COVID-19), an infectious illness caused by the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), emerged in late 2019 (Bontempi *et al.*, 2021; Bontempi & Coccia, 2021; Coccia, 2020, 2020a, 2020b, 2021a). In 2021, COVID-19 continues to circulate, with mutations of the novel coronavirus causing continuous COVID-19 infections and fatalities in numerous countries (Johns Hopkins Center for System Science and Engineering, 2021; Vinceti *et al.*, 2021). The significant numbers of infections and fatalities worldwide caused by COVID-19 have led to the development of various types of vaccines employing viral vectors, protein subunits and nucleic acid-RNA (Abbasi, 2020; MAYO CLINIC, 2021). Countries must evaluate vaccination strategies to effectively control and/or eliminate this novel infectious disease in the population (Aldila *et al.*, 2021; Prieto C. *et al.*, 2021). Vaccination can potentially decrease the spread of COVID-19, ease the non-pharmaceutical measures and maintain a low basic reproduction number; however, it is crucial to clarify the optimal vaccination levels in countries to mitigate the adverse societal effects (Coccia, 2021a). Akamatsu *et al.* (2021) underline the pivotal role of governments in efficiently implementing vaccination campaigns to significantly reduce infections among populations and prevent overloading of the healthcare systems (cf., Coccia, 2021a, 2021b, 2022). Aldila *et al.* (2021) argue that higher vaccination levels can result in the eradication of COVID-19 within a population, reaching herd immunity to safeguard those vulnerable individuals (cf., Anderson *et al.*, 2020; de Vlas & Coffeng, 2021; Randolph & Barreiro, 2020). Herd immunity represents that only a portion of the population needs to become immune and no longer susceptible to a viral agent, either through vaccination or natural infection, to effectively control widespread outbreaks among populations (Fontanet & Cauchemez, 2020). Researchers calculate what proportion of a population needs vaccination to achieve herd immunity, *ceteris paribus* (Redwan, 2021). The threshold is contingent on the basic reproduction number, R_0 – the average number of cases caused by one infected individual in an otherwise fully susceptible population (Coccia, 2020; Kwok *et al.*, 2020). The index R_0 assumes that everyone is susceptible to the virus. However, this level evolves throughout the epidemic as it relies on the changes in the susceptibility of a population, the mitigation and restriction policies executed, the circulation of variants, seasonal factors, etc. (Aschwanden, 2020, 2021; Coccia, 2021a; Dashtbali & Mirzaie, 2021). Kwok *et al.* (2021) posit that the minimum percentage of the total population required to achieve immunity to COVID-19 varies, ranging from 5.66% in Kuwait to 85% in Bahrain. In this context, one of the fundamental challenges amidst the COVID-19 pandemic crisis is determining the maximum level of vaccination that can be achieved without implementing mandatory measures for citizens and whether the maximum level of vaccinated people varies by the type of executives (e.g., mixed executives, monarchy, etc.). The voluntary acceptance of COVID-19 vaccines within countries can serve as a crucial tool for evaluating the maximum level of content within affluent and democratic societies. On the other hand, employing autocratic interventions by nations that curtail individual freedoms to overcome the maximum level of vaccination among populations can result in socioeconomic issues.

In the setting of the COVID-19 pandemic crisis, this study can shed light on certain relationships to craft best practices of crisis management regarding vaccination plans intended to maximize vaccination among individuals, employing reward systems in democratic societies where there is little oversight on public and private life, instead of relying on compulsory regulations that curtail individual freedoms (cf., Coccia, 2020). This study is part of a broader research project that aims to explain the factors influencing the transmission dynamics of COVID-19 and craft effective policy responses to address and/or avert pandemic threats within societies (Coccia, 2020, 2020a, 2020b, 2021, 2021a, 2022).

This study, in the presence of COVID-19 pandemic crisis, can clarify some relations to design best practices of crisis management for vaccination plans directed to increase vaccinated people using rewards systems in democratic settings having a little amount of oversight on public and private life rather than compulsory rules that reduces individual freedoms (cf., Coccia, 2020). This study is part of a large research project to explain the drivers of transmission dynamics of COVID-19 and design effective policy responses to cope with and/or to prevent pandemic threats in society (Coccia, 2020, 2020a, 2020a, 2020b, 2021, 2021a, 2022).

2. Methods

2.1. Source and sample

The sample of this study is $N=150$ countries worldwide.

2.1.1. Measures for statistical analyses

Vaccination is measured by the percentage of the population fully vaccinated against COVID-19 from September to October 2021. The data mainly refer to October 2021; however, due to difficulty in gathering and transmitting information, data from September 2021 are provided by some countries, including Algeria, Afghanistan, Turkmenistan, Madagascar, etc. the data of this study encompasses all types of COVID-19 vaccines utilized in different countries, including those developed by Johnson & Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V and Moderna (Ritchie *et al.*, 2020). It should be noted that every country has adopted a different combination of the available COVID-19 vaccines to safeguard their populations. Source: Our World in Data (2021).

Gross Domestic Product (GDP) per capita in 2020. GDP per capita (constant 2010 US\$). GDP per capita represents gross domestic product divided by midyear population. GDP is the total of the gross value added by all resident producers within an economy, including any product taxes and excluding any subsidies not accounted for in the value of products. It is calculated without making deductions for the depreciation of fabricated assets or for the depletion and degradation of natural resources. Data are reported in constant 2010 US dollars. Source: The World Bank (2021).

Democracy is measured using the Freedom House Methodology, assigning a score to each country or territory based on political rights and civil liberties indicators. The average of a country or territory's political rights and civil liberties ratings is referred to as the Freedom Rating, and the level determines the Freedom status given by:

- Free countries (1.0 to 2.5 Combined Average of the Political Rights and Civil Liberties)
- Partly Free (3.0 to 5.0)
- Not Free (5.5 to 7.0)

Source: Freedom House (2021, 2021a).

2.1.2. Model and data analysis procedure

The level of economic development in countries is categorized using GDP per capita (constant 2010 US\$) in 2020 as follows (The World Bank, 2021):

- HIGH economic development $> \$15,000$
- MEDIUM economic development ($\$2,000-14,999$)
- LOW economic development $< \$2,000$

Countries are further categorized based on the typology of executives as follows (Norris, 2008):

- DIRECT Democracy
- PARLIAMENTARY Monarchy
- PRESIDENTIAL Republic
- MIXED Executives
- MONARCHY
- MILITARY State

Data analysis is conducted using descriptive statistics given by arithmetic mean and standard error of the mean, considering the categorization of economic development, freedom status and type of executives of countries.

The normality of distributions of the variables studied is checked with skewness and kurtosis coefficients. Considering that certain variables are unsuitable for parametric analyses, these are transformed into logarithmic scales to facilitate regression analysis.

Following, quadratic models are employed in the analysis of simple regression since they fit the scatter of data and detect nonlinear effects of relations examined in this study. The specification of the *log-log* quadratic model is given by:

$$\log y_{i,t} = \alpha_0 + \beta_1 \log x_{i,t-1} + \beta_2 \log x_{i,t-1}^2 + u_{i,t} \quad (1)$$

where:

$x_{i,t-1}$ = GDP per capita (constant 2010 US\$) in 2020

$y_{i,t}$ = Share % of people fully vaccinated against COVID-19 over September-October 2021

$u_{i,t}$ = Error term

country $i=1, \dots, n$; $t=time$

Remark 1: The square of GDP per capita in Model (1) is used to consider the possibility of nonlinear effects in the relationship being examined.

Remark 2: Model (1) incorporates a time lag effect between explanatory (t-1) and dependent variable (t) to minimize the endogeneity of the explanatory variable in Model and provide reliable (estimated) parameters.

Finally, the optimization of the estimated relationships (1) is carried out with the perspective of *maximization* of the equation (1) to find the maximum levels of share % of people fully vaccinated against COVID-19 in society. In particular, the estimated relationships (1) are objective functions of one (real) variable given by polynomial functions of second order. These estimated relationships (1) are continuous and infinitely differentiable functions. The calculus applied to functional relation (1) provides the optimal levels of share % of people fully vaccinated against COVID-19 in countries. Model (1) is employed using the Freedom status per country (Free, Partly Free or Not Free) and total number of countries ($N=150$).

Results are detailed in tables and visualized in figures with the estimated relationships and optimal (max) level of share % of people fully vaccinated against COVID-19 in society.

Statistical analyses are conducted using the Statistics Software SPSS® version 26.

3. Results

Table 1 demonstrates that partially free and affluent countries exhibit a higher share of their population fully vaccinated against COVID-19, while free countries with a medium GDP per capita exhibit a higher share of vaccinated people than partially free and not free countries.

Table 1: Descriptive statistics of fully vaccinated people per level of GDP per capita and democracy, N=150 countries

Level of economic development using GDP per capita in 2020	Freedom Status	Fully vaccinated September - October 2021		
		N	Mean (%)	Std. Error
HIGH >\$15,000	▪ FREE	36	63.99	10.39
	▪ PARTLY			
	FREE	3	66.63	11.99
MEDIUM (\$2,000-14,999)	▪ NOT FREE	4	59.65	18.14
	▪ FREE	24	38.31	20.28
	▪ PARTLY			
LOW < \$2,000	FREE	24	28.71	18.36
	▪ NOT FREE	17	23.22	19.19
	▪ FREE	6	7.42	8.32
	▪ PARTLY			
	FREE	22	4.28	5.41
	▪ NOT FREE	14	13.69	19.86

Table 2: Descriptive statistics of fully vaccinated per type of executives, N=150 countries

Type of Executives	Fully vaccinated September - October 2021		
	N	Mean (%)	Std. Error
DIRECT Democracy	2	63.05	2.25
PARLIAMENTARY Monarchy	21	52.01	5.34
PRESIDENTIAL Republic	39	27.21	3.78
MIXED Executives	78	31.32	3.06
MONARCHY	7	46.54	5.99
MILITARY State	3	8.97	3.37

Table 2 indicates that countries with monarchy and parliamentary monarchy have a higher share of people fully vaccinated against COVID-19 compared to countries with mixed executives and presidential republics.

Table 3: Regression analyses of people fully vaccinated in 2021 on GDP per capita 2020 in free, partly free and not free countries (log-log quadratic model [1])

	FREEDOM STATUS IN COUNTRIES (LEVEL OF DEMOCRACY)			
	FREE	PARTLY FREE	NOT FREE	TOTAL COUNTRIES
Constant α	-19.97***	-22.18***	-2.484	-18.66***
(St. Err)	(3.22)	(6.04)	(12.70)	(2.65)
Coefficient β_1	4.50 ***	5.049 **	0.456	4.194 ***
(St. Err.)	(.70)	(1.534)	(3.03)	(.62)
Coefficient β_2	-.209***	-.243*	-.019	-.192***
(St. Err.)	(.037)	(.096)	(.179)	(.035)
R ²	.73	.65	.32	.67
(St. Err. of Estimate)	(.49)	(1.07)	(1.24)	(.904)
F	85.25***	42.17***	6.99**	144.95***

Note: Dependent (response) variable is: Share (%) of people fully vaccinated against COVID-19 in 2021 over September-October 2021. The explanatory variable is the Gross Domestic Product per capita in 2020.

Significance: ***p-value<0.001; **p-value<0.01; *p-value<0.05

FREE Countries

The estimated relationship of FREE countries, based on the results of Table 3, is:

$$j_{i,t} = -19.97 + 4.50w_{i,t-1} - 0.209 w_{i,t-1}^2$$

The function is given by:

$$j = -19.97 + 4.50 w - 0.209 w^2 \quad (2)$$

The necessary condition to maximize the function j is:

$$\frac{dj}{dw} = j'(w) = 4.50 - 0.418w = 0$$

The first derivative equal to 0 is:

$$j'(w) = 0 \Rightarrow w^* = \frac{4.50}{0.418} = 10.76 \text{ level of GDP per capita (in log scale)} = \$47,098$$

If we replace w^* in equation (2), we obtain $j = 4.2525$ (in log scale), which is transformed by $e^j = 70.28\%$ = the max share of people fully vaccinated in free countries. Increasing this share beyond the maximum achievable level in free countries typically requires implementing favourable rewards or restriction policies associated with a high degree of control and regulation over the public and private lives of people, which can result in social and economic issues and adversely impact democratic settings and individual liberties of people (Figure 1).

PARTLY FREE Countries

The estimated relationship of FREE countries, based on the results of Table 3, is:

$$k_{i,t} = -22.18 + 5.049b_{i,t-1} - 0.243 b_{i,t-1}^2$$

The function is given by:

$$k = -22.18 + 5.049 b - 0.243 b^2 \quad (3)$$

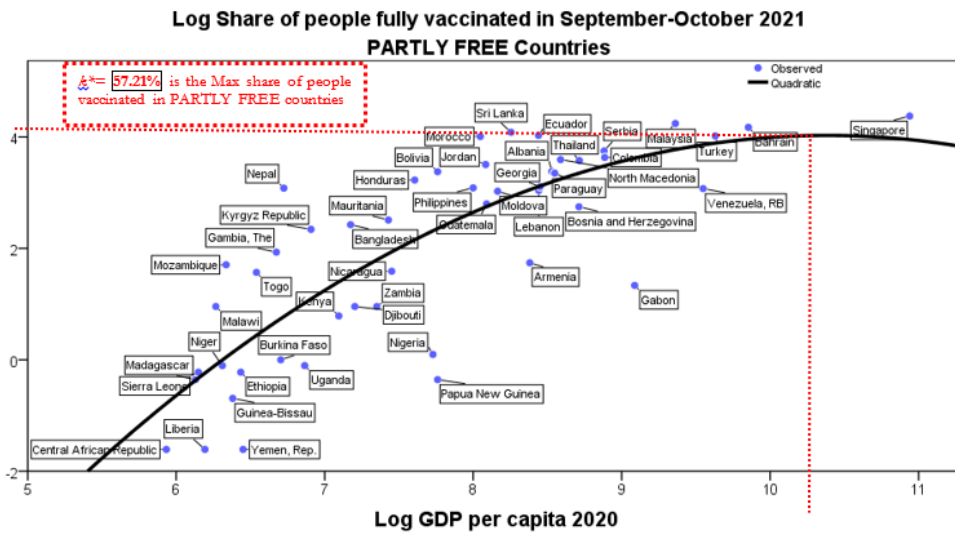
The necessary condition to maximize the function k is:

$$\frac{dk}{db} = k'(b) = 5.049 - 0.486b = 0$$

The first derivative equal to 0 is:

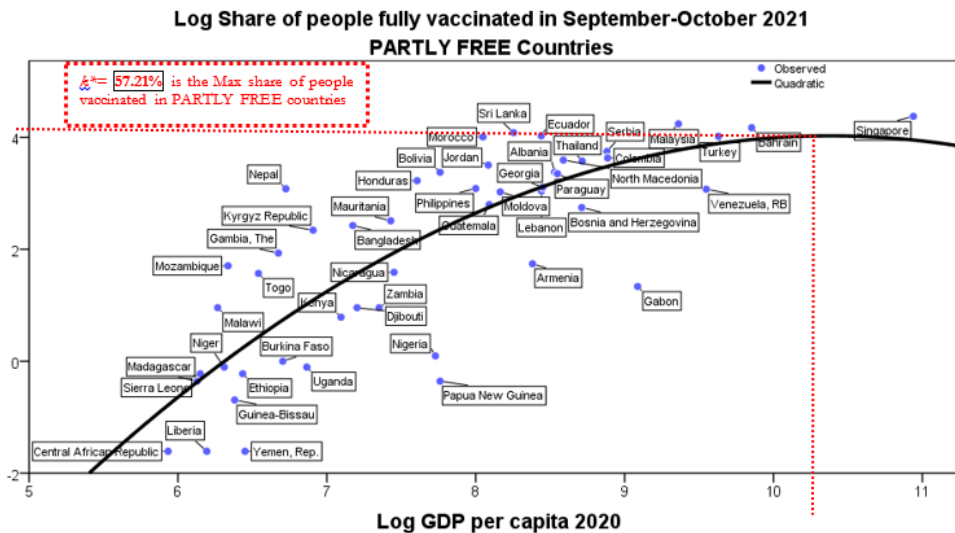
$$k'(b) = 0 \Rightarrow b^* = \frac{5.049}{0.486} = 10.389 \text{ level of GDP per capita (in log)} = \$32,500.15$$

Figure 1: Relationship of share of people vaccinated against COVID-19 (%) on GDP per capita in free countries based on the quadratic Model (1), with the maximum level of vaccinated people



Now, if we replace $b^*=10.389$ in equation (3), we obtain $k= 4.04675$ (in log scale) which is transformed by $e^k= 57.21\%$ = the max share of people fully vaccinated in partially free countries. Increasing this share beyond the maximum achievable level in *partly free* countries typically requires implementing suitable rewards or additional interventions of control and regulation over public and private life that potentially pose social and economic challenges and adversely impact democratic environments and individual freedoms (Figure 1).

Figure 2: Relation of share of people vaccinated against COVID-19 (%) on GDP per capita in partly free countries based on a quadratic Model (1), with the maximum level of vaccinated people



NOT FREE Countries

The estimated relationship in NOT-FREE countries does not show significant parameters, as indicated in Table 3. Therefore, we do not proceed with the optimisation approach as the results are misleading.

TOTAL Countries

The estimated relationship of total number of countries, based on results of Table 3, is:

$$q_{i,t} = -18.66 + 4.194g_{i,t-1} - 0.192 g_{i,t-1}^2$$

The function is given by:

$$q = -18.66 + 4.194 g - 0.192g^2 \tag{4}$$

The necessary condition to maximize the function q is:

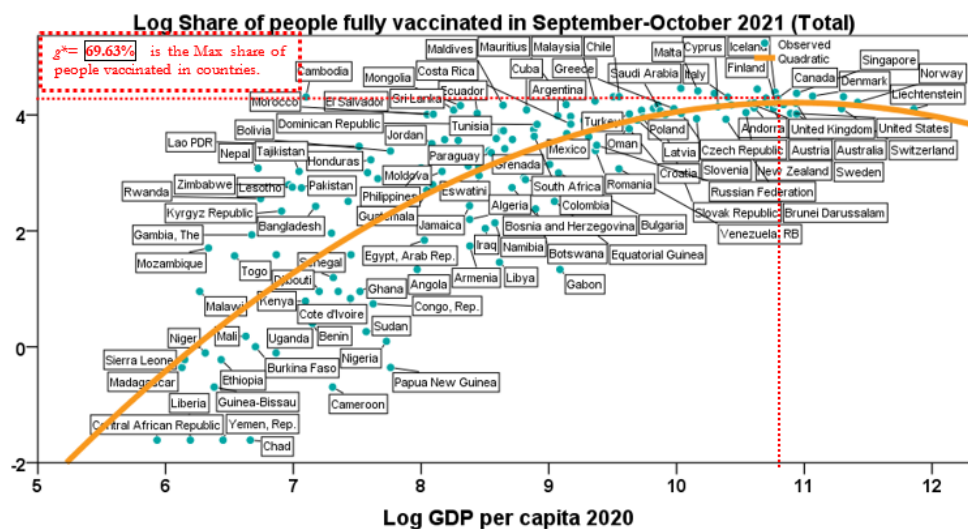
$$\frac{dq}{dg} = q'(g) = 4.194 - 0.384g = 0$$

The first derivative equal to 0 is:

$$q'(g) = 0 \Rightarrow g^* = \frac{4.194}{0.384} = 10.922 \text{ level of GDP per capita (in log)} = \$55,374.53$$

If we replace g^* in equation [4], we obtain $q = 4.2432$ (in log scale) transformed by $e^q = 69.63\%$ = the max share of people fully vaccinated in all countries. The remaining share is linked to a natural hesitancy among people and the emphasis on individual freedoms, typical of affluent and democratic countries. In addition, as previously explained, to increase this share beyond the maximum level in countries, it is typically necessary to implement favourable rewards or restriction policies associated with a high degree of control and regulation over the public and private life of individuals, which can result in social and economic issues and adversely impact democratic environments and individual liberties (Figure 3).

Figure 3: Relation of share of people vaccinated against COVID-19 (%) on GDP per capita in all countries (N=150) based on the quadratic Model [1], with the maximum level of vaccinated people



Overall, the share of people vaccinated against COVID-19 increases with the wealth of nations; however, it reaches a physiological maximum level of approximately 70% among the countries worldwide, while it is somewhat lower in partly free countries.

4. Discussions

Anttiroiko (2021) studies the effects of socioeconomic context, institutional arrangements, culture, and technology level on policy responses of Eastern and Western countries to the pandemic crisis. Research shows that, on average, policy responses by Europe throughout 2020 were less stringent compared to those adopted by those in East Asia (Ritchie *et al.*, 2020). In addition, Anttiroiko (2021) underlines that they have a determined approach in their policy responses addressing the COVID-19 crisis due to the early spread of the pandemic in their regions, facilitating the learning processes. On the other hand, with their different culture, institutions, political systems and mechanisms to deal with crises, European countries also must grapple with issues of privacy and human rights, public protests against government measures like lockdowns, restrictions on vaccine passports, etc. (Coccia & Bellitto, 2018; Coccia & Benati, 2018a). Results of this study demonstrate that the share of people vaccinated against COVID-19 tends to increase in parallel with the wealth of nations, yet it has a physiological limit of around 70% in countries. One of the key challenges faced is vaccine hesitancy among some populations, particularly in affluent and democratic countries, where

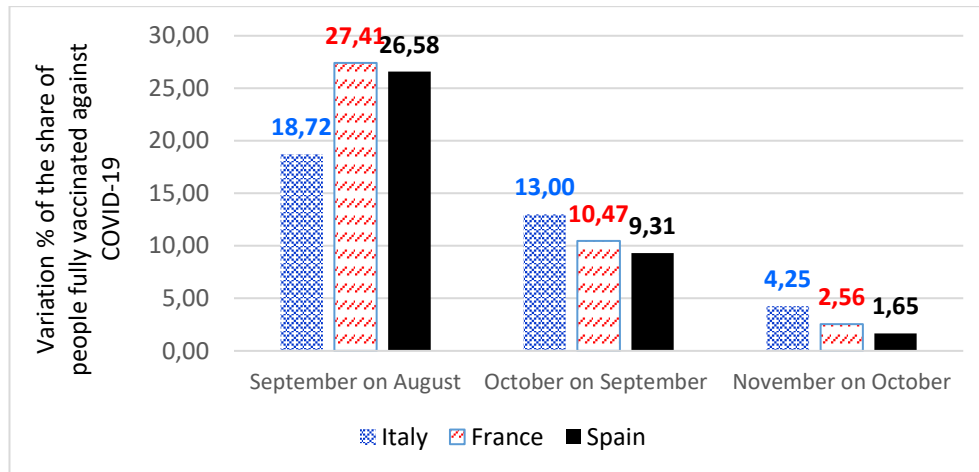
individual liberties are highly valued (cf., Verger & Peretti-Watel, 2021). Murphy *et al.* (2021) found that vaccine hesitancy/resistance was observed in 35% and 31% per cent of the general adult population of Ireland and the United Kingdom, respectively. In their analyses conducted to understand the factors affecting acceptance and refusal of COVID-19 vaccine, Schwarzingler *et al.* (2021) suggest that underlining the benefits of achieving herd immunity can help reduce the hesitancy towards COVID-19 vaccines (cf., Buttenheim & Asch, 2013; Echoru *et al.*, 2021; Kanyike *et al.*, 2021). It is important to note that COVID-19 vaccination is linked to the levels of public trust in governments, which must be built and strengthened, particularly at times of crisis management (cf., Soveri *et al.*, 2021; Vergara *et al.*, 2021). Abuza (2020) claims that the effectiveness of policies in addressing biological threats hinges on leadership and competence instead of the political regimes of countries. Some Western countries have introduced green pass (or vaccine certificate or immunity certificate, which are used interchangeably in this study) as a requirement of access to certain businesses, public spaces and/or use of public transport or going to work (as in Italy) to increase the maximum share of people fully vaccinated, meanwhile stressing democratic society by restricting individual freedoms of people. This bureaucratic tool has ignited heated debates and led to various socioeconomic issues (Brown *et al.*, 2021; Chantler *et al.*, 2019; Dye & Mills, 2021; Phelan, 2020). Brown *et al.* (2021) propose that the practice of immunity passports should be done to maximise their benefits while safeguarding the well-being of individuals. Saban *et al.* (2021) suggest that policymakers should adopt a balanced approach to safeguard public health, all while minimizing infringement of the rights of citizens. Kamin-Friedman & Peled Raz (2021) purport that the 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". 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. ... Green Pass policies might entrench existing discriminatory structures, ensuring equality is vital in moving forward. ... Despite the removal of the Green Pass in Israel, discussions continue regarding its modified reimplementations". In summary, a green pass or vaccine passport was initially introduced as an incentive aiming to support vaccination plans; however, some European countries are utilizing this bureaucratic tool to penalize individuals who are not vaccinated, limiting their liberties, increasing discrimination among people in social, cultural and sport settings, heightening tensions among different social groups, and as a result, decreasing equity, trust and solidarity among people and causing socioeconomic issues as a consequence (Kosciejew *et al.*, 2021; Waitzberg *et al.*, 2021; Wilf-Miron *et al.*, 2021). Persistence in adopting the green pass regime has led to protests and socioeconomic issues, all of which favour authoritarian measures aiming to limit individual liberties while invoking potential health risks (cf., Wong, 1991). The adverse effects of adopting such restrictive policies in countries can be explained with two primary aspects, which are discussed in the sections below.

4.1. Politics of fear

Hobbes (1996) asserts that being able to control the fears of people is to hold power in society. Generally speaking, the interplay between fear and politics is one of the primary fields of interest in scientific studies (Debiec & LeDoux, 2004; Robin, 2004). Gore (2004) asserts that the politics of fear is intended to manipulate the political reality of a nation by instilling fear in societies disproportionately to actual dangers. Indeed, in situations of uncertainty, governments tend to produce administrative policies that are inconsistent, ambiguous and not transparent enough to minimize the government's accountability to the citizens and the public interest. Gore (2004) also claims that under specific circumstances: "there has been a disturbing willingness—even eagerness—to misrepresent the true nature of the policy involved and its real implications". Furthermore, Gore (2004) underlines that the US administration has resorted to politics of fear in economic policy, particularly for fiscal reforms. In numerous European countries, governments utilize politics of fear centring on the COVID-19 pandemic to implement health policies that restrict individual liberties and regulate the public and private aspects of people's lives (cf., Wilf-Miron *et al.*, 2021). Gore (2004), US administration uses fear of the problems of old age to contrive an illusory drug bill that essentially transfers billions from the people to the pockets of the large pharmaceutical companies". Governments are capable of using fear as a tool for purposes that are not made known, and then, fear itself can easily and rapidly turn into an autonomous and unregulated force that undermines the national identity, diverting the focus from real dangers and other issues and

propagating confusion among people (Lupia & Menning, 2009). Consequently, the deliberate use of fear as a tool of manipulating the political process can lead to a range of vulnerabilities within populations, nations and societies.

Figure 4: Percent variation (monthly) of the share of people fully vaccinated against COVID-19 in Italy and France (having Green Pass/vaccine passport regime) vs Spain without green pass certificate from July to November 2021



Note: France introduced Green Pass on 21 July 2021; Italy on 6 August for museums, cultural places and events; 1st September for transportation of long distance; 15 October for all working places and 6th December 2021 also for urban transportation (subway, buses, etc.).

Prewitt (2004) believes that institutional fear constitutes an essential aspect of liberal thought and constitutional democracy. Arato (2004) asserts that Hobbes' formulation of "fear of the state of nature, of the war against all, is what drives us to establish something like the modern state". In addition, Arato (2004) demonstrates the significant and underpinning role that "institutional fear" plays in the social contract in liberal theory. In particular, through a case study of the USA, Arato (2004) argues that liberalism can cause a weak state with poorly regulated emergency powers, leading to the creation of an "emergency regime" largely outside the bounds of the Constitution, thereby creating problematic aspects in society (Prewitt *et al.*, 2004; Robin, 2004). A concrete example is the COVID-19 pandemic crisis. In an effort to increase the maximum share of people vaccinated (as estimated here, beyond 70% of the population), European countries tend to utilize politics of fear closely linked to informal authoritarian rules that stress constitutional principles such as immunity passport, restrict liberties of people and engender socioeconomic issues while offering little benefits in addressing the COVID-19 pandemic. Indeed, Figure 4 demonstrates the effects of the Green Pass regime characterized by authoritarian rules. The green pass regime resulted in a moderate and short-lived increase in the number of vaccinations, yet leads to social challenges such as limiting the individual freedoms of people, increasing discrimination among people in social, cultural and sporting activities, heightening tensions among different social groups, and as a result, decreasing equity, trust and solidarity among people as a consequence (Kosciejew *et al.*, 2021; Waitzberg *et al.*, 2021; Wilf-Miron *et al.*, 2021).

4.2. Strong leaders and authoritarian rules in democracies

The increase in vaccination in affluent and democratic areas, which is achieved through the introduction of restrictions and policies based on vaccine passport, is also closely linked to authoritative leaders backed both domestically and internationally, which can substantially erode the democratic setting (Lavriča & Bieberb, 2021). During a crisis, this power in the hands of strong leaders is amplified by the combination of social insecurity, cultural backlash, and economic problems caused by the pandemic. In other words, the implementation of authoritarian measures in democratic systems can be attributed to the emergence of strong leaders as well as to social and economic insecurity that is backed by authoritarian practices, which are exercised informally (Lavriča & Bieberb, 2021; cf., Coccia, 2019e). Political leaders typically implement restrictive measures in a broader context, in which they are perceived as "pragmatic reformers" and receive domestic and international support in the beginning support (Crowther 2017; Günay & Dzihic 2016; Vladislavljević 2019). Hence, in the face of the pandemic crisis, adopting authoritarian measures in Western countries may be because of the public's increasing support for a strong and influential

political leader, capitalizing on socioeconomic uncertainties and social fear. Such tendencies tend to emerge in institutional settings and countries characterized by weak democratic institutions and a balance of powers during emergencies and crises.

5. Conclusions

The findings of this study show that the share of vaccinated people against COVID-19 increased in parallel with the wealth of nations, yet it has a physiological limit of around 70% in (affluent and democratic) countries. Furthermore, countries with monarchy and parliamentary monarchy have a higher share of people fully vaccinated against COVID-19 than those with mixed executives and a presidential republic. Some Western countries are putting pressure on their democratic society using measures that restrict individual freedoms for the sake of maximizing the share of people fully vaccinated (estimated in this study), which occurs through introduction of restriction policies and vaccine certificates and imposition of penalties as a rule, which create socioeconomic problems like discrimination of people in social settings, tensions among different groups, decrease in equity and trust, etc. (Brown *et al.*, 2021; Chantler *et al.*, 2019; Coccia, 2021a, 2021b; Dye & Mills, 2021; Koscijew *et al.*, 2021; Waitzberg *et al.*, 2021; Wilf-Miron *et al.*, 2021). Mainly, the findings of this study can provide insights into certain abusive practices in democratic countries, which appear to be the result of a combination of the politics of fear and informal authoritarian rules¹ executed by strong leaders in situations characterized by social insecurity.

Despite providing interesting yet tentative results, this study also has various limitations. One limitation is the lack of data on total vaccinations in numerous countries. Secondly, the study does not consider all the possible confounding factors that influence the rates of vaccination, and in the future, such factors must be checked to support the results of this study. Thirdly, the absence of integration of the data with cultural aspects may have affected the results of vaccination across countries, which turns comparative analysis into a challenging approach (Angelopoulos *et al.*, 2020; Coccia, 2020). Fourthly, vaccination and mitigation policies may be affected by country-specific health and social norms. Lastly, the estimated relationships in this study are based on the variables from specific months (based on recent data available); however, to build on this research in the future, the study period needs to be extended. Indeed, caution must be exercised when generalizing the results of this study. Future studies should incorporate new data as it becomes available in order to look into other variables among countries to shed light, over time and space, on the dynamic relationships analyzed in this study and how they interact with vaccination, vaccine certificates, restriction policies and other social norms among countries. Although it has such limitations, this study has results that suggest the maximum sustainable level of people vaccinated in affluent and democratic countries, which is about 70%, and the presence of social and economic challenges linked to the restrictive policies and bureaucratic tools (e.g., immunity passport) utilized to go beyond said physiological limit, using capitalizing on politics of fear and strong leaders.

Therefore, much more extensive research is needed in this field, and this study encourages conducting further investigations, using the lessons learned from the COVID-19 pandemic crisis and considering the interplay between the impacts of restrictions on societies and vaccination campaigns. In summary, numerous Western countries are putting pressure on society through restrictions imposed on individual freedoms aiming at increasing the maximum share of people fully vaccinated (with marginal results) through the introduction of vaccine passports and authoritarian rules that limit the free movement of unvaccinated individuals, which impairs equality and fairness among society. Such measures are implemented through politics of fear and strong leadership fueled by institutional context characterized by weak democracy and vague separation of powers. This is even though constitutions expressly establish that these functions, in democratic settings, must be separate and also strong in order to deal with critical issues of abusive practices of our rulers, our political authorities, who, if left uncontrolled or not called to account, can do greater harm to society than a (pandemic) crisis. In conclusion, it is important to take into account a variety of factors that are related to not only medicine but also social and political sciences in order to provide insights into the effects of the COVID-19 pandemic on society among countries in terms of health, as well as human and civil rights. These parameters should be accurately evaluated to control the detrimental impacts of the pandemic crisis on public health, economy and society in the future. It is worth asking whether the constitutional frameworks in Western and democratic countries remain effective in protecting their people from fear and impactful and concrete erosion of democracy, which can turn into a

¹ Wesołowski (1990) argues some axioms of the authoritarian regime, such as the state's power (state) is the fundamental mechanism of social integration and regulation; the state is an organism which stands above all other forms of social organization and exerts control over them; it uses violence when needed, etc.

hazardous process, similar to the COVID-19 pandemic crisis, that can lead societies into uncharted territories of uncertain social events.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and material

The data are available on request.

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