

Maximum Level of COVID-19 Vaccination in Rich and Democratic Countries, and in Other Political Systems

Mario Coccia (✉ mario.coccia@cnr.it)

National Research Council of Italy

Research Article

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Posted Date: December 2nd, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-1131026/v1>

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**MAXIMUM LEVEL OF COVID-19 VACCINATION IN RICH AND DEMOCRATIC COUNTRIES,
AND IN OTHER POLITICAL SYSTEMS**

MARIO COCCIA

CNR -- NATIONAL RESEARCH COUNCIL OF ITALY
Collegio Carlo Alberto, Via Real Collegio, n. 30
10024 - Moncalieri (TO), Italy

Contact E-mail: mario.coccia@cnr.it

Abstract

Coronavirus Disease 2019 (COVID-19) vaccinations play a main role in the immunization program of countries to decrease the numbers of COVID-19 related infected individuals and deaths. However, countries, after a certain share of people vaccinated against COVID-19 have to cope with vaccine hesitancy and resistance in population. One of the fundamental problems is the detection of the max share of people vaccinable between countries without the introduction of any rule that affects basic aspects of individual freedoms of people in public and private life. The study here confronts this problem with a global analysis based on $N=150$ countries, using relationships between socioeconomic, institutional and political variables, and levels of vaccination. Results reveal that the share of people vaccinated increases with the level of development (and democratization) of countries, achieving the maximum level of about 70%; beyond this level, the share of vaccination starts to decrease across countries. Moreover, findings reveal that governments with Monarchy and Parliamentary Monarchy have average share of people vaccinated higher than Mixed Executives. These main findings suggest that in developed and democratic countries the maximum level of vaccination has a physiological limit, but many Western (democratic) countries are applying restriction rules (e.g., green pass/vaccine passport) to overcome this max level reducing and regulating, at the same time, many aspects of public and private life of individuals. Discussion explains these sociopolitical phenomena with aspects of politics of fear, focused on deaths of COVID-19, and of strong leaders having domestic and international support that apply rules in contexts of social insecurity with consequential reduction of equity, trust and solidarity and increase of socioeconomic issues. All these results here could aid policymakers to prepare sustainable policy responses against COVID-19 in society without distressing basics of democracy with rules of autocratic systems that can generate economic and social deterioration, and problems for mental health and economic conditions of people in society.

Keywords: COVID-19 vaccination; Vaccination decision; Vaccine hesitancy; Vaccine resistance; Economic development; Democracy; Public health; Green pass regime; Immunity passports; Vaccine passports; Public health ethics.

Declaration of competing interest

The author declares that he is the sole author of this manuscript, and he has no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

This study has no funders.

GOALS OF THE INVESTIGATION

Coronavirus disease 2019 (COVID-19) is an infectious illness caused by the novel Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), which appeared in late 2019 (Bontempi et al., 2021; Bontempi and Coccia, 2021; Coccia, 2020, 2020a, 2020b, 2021)¹. COVID-19 is still circulating in 2021 with mutations of the novel coronavirus that generate continuous COVID-19 infections and deaths in manifold countries (Johns Hopkins Center for System Science and Engineering, 2021; Vinceti et al., 2021). High numbers of COVID-19 related infected individuals and deaths worldwide have supported the development of different types of vaccines based on viral vector, protein subunit and nucleic acid-RNA (Abbasi, 2020; MAYO CLINIC 2021). The investigation of vaccination plans between countries is a crucial aspect to determine how the novel infectious disease can be controlled and/or eradicated in the population (Aldila et al., 2021; Prieto Cruriel, et al. 2021). Vaccination has the potential effect to reduce the diffusion of COVID-19, to relax non-pharmaceutical measures and maintain low basic reproduction number, but an important point is to clarify the optimal levels of administering of vaccines between countries to reduce negative effects in society (Coccia, 2021a). Akamatsu et al. (2021) argue the vital role of governments to implement an efficient campaign of vaccination to substantially reduce infections in society, and avoid the collapse of healthcare system (cf., Coccia, 2021a, 2021b, 2022). Aldila et al. (2021) maintain that higher levels of vaccination rate can eradicate COVID-19 in population by approaching herd immunity to protect vulnerable individuals (cf., Anderson et al., 2020; de Vlas and Coffeng, 2021; Randolph and Barreiro, 2020). Herd immunity indicates that only a share of population needs to be immune and therefore no longer susceptible to a viral agent (by overcoming natural infection or through vaccination) for controlling large outbreaks (Fontanet and Cauchemez, 2020). Scholars estimate the proportion of a population that needs to be vaccinated to support herd immunity, *ceteris paribus* (Redwan, 2021). The threshold level depends on basic reproduction number, R_0 — the number of cases, on average, spawned by one infected individual in an otherwise fully susceptible (Coccia, 2020; Kwok et al., 2020). The

¹ Cf. also Coccia, 2020c, 2021d, 2021e, 2021f, 2021g, 2021h.

index R_0 assumes that everyone is susceptible to virus, but the level changes as the epidemic evolves, since it depends on changes in susceptibility of the population, mitigation and restriction policies, circulation of variants, season, etc. (Aschwanden, 2020, 2021; Coccia, 2021a; Dashtbali and Mirzaie, 2021). Kwok et al. (2021) argue that the minimum proportion (%) of total population required to confer COVID-19 immunity change, such as it can be 5.66 in Kuwait and 85 in Bahrain. In this context, a fundamental problem in COVID-19 pandemic crisis is the detection of maximum level of vaccinated people between countries without compulsory actions on citizens and if the maximum level of vaccinated people changes according to the types of executives (e.g., mixed executives, monarchy, etc.). The natural acceptance of COVID-19 vaccines between countries can be a main proxy to assess the maximum level of consent in rich and democratic settings, whereas actions of nations for overcoming the max level of vaccinated people with autocratic interventions that reduce individual freedoms can show consequential socioeconomic issues.

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 little amount of oversight on public and private life rather than compulsory rules that reduces individual freedoms (cf., Coccia, 2019g). This study is part of a large research project to explain 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, 2020b, 2020c, 2021, 2021a, 2021b, 2021c, 2021d, 2021e, 2021f, 2021g, 2021h).

MATERIALS AND METHODS

1.1 Source and sample

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

1.2 Measures for statistical analyses

- Vaccination is measured by percent share of people fully vaccinated against COVID-19 over September-October 2021. Data refer mainly to October 2021 but some countries, because of difficulty in the gather and transmission of information, provide data of September 2021, such as Algeria, Afghanistan, Turkmenistan,

Madagascar, etc. The data here considers all types of COVID-19 vaccines used in different countries, i.e., vaccines by Johnson & Johnson, Oxford/AstraZeneca, Pfizer/BioNTech, Sinopharm/Beijing, Sinovac, Sputnik V and Moderna (Ritchie et al., 2020). Of course, every country has been using a different combination of these COVID-19 vaccines to protect the population. Source: Our World in Data (2021).

- Gross Domestic Product (GDP) per capita in 2020. GDP per capita (constant 2010 US\$). GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2010 U.S. dollars. Source: The World Bank (2021).
- Democracy is measured using score of Freedom House Methodology. A country or territory is assessed considering indicators of political rights and civil liberties. The average of a country or territory's political rights and civil liberties ratings is called 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).

1.3 Model and data analysis procedure

- Level of economic development of 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 also categorized using the typology of executives as follows (Norris, 2008):

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

Data are analyzed with descriptive statistics given by arithmetic mean and standard error of the mean, using the categorization of economic development, freedom status and type of executives between countries.

The normality of distributions of variables under study is checked with skewness and kurtosis coefficients and considering that some variables are not appropriate for parametric analyses, they are transformed in logarithmic scale for performing regression analysis.

After that, the analysis of simple regression applies quadratic models because they fit the scatter of data and detect nonlinear effects of relations understudy. The specification of *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 introduced to consider the possibility of non-linear effects in the relation under study.

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

Finally, the optimization of the estimated relationships [1] is performed 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 relations [1] are continuous and infinitely differentiable functions. The calculus applied on functional relation [1] provides the optimal levels of share % of people fully vaccinated against COVID-19 in countries. Model [1] is applied using the Freedom status per countries (Free, Partly Free or Not Free) and total number of countries ($N=150$).

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

Statistical analyses are performed with the Statistics Software SPSS® version 26.

RESULTS

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
	▪ NOT FREE	4	59.65	18.14
MEDIUM (\$2,000-14,999)	▪ FREE	24	38.31	20.28
	▪ PARTLY FREE	24	28.71	18.36
	▪ NOT FREE	17	23.22	19.19
LOW < \$2,000	▪ FREE	6	7.42	8.32
	▪ PARTLY FREE	22	4.28	5.41
	▪ NOT FREE	14	13.69	19.86

Table 1 shows that partially free and rich countries have a higher share of people fully vaccinated against COVID-19, whereas free countries having a medium level of GDP per capita have a higher share of vaccinated people than partially free and not free countries.

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 shows that countries with monarchy and parliamentary monarchy have a higher share of people fully vaccinated against COVID-19 than countries having mixed executives and presidential republic.

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)			TOTAL COUNTRIES
	FREE	PARTLY FREE	NOT FREE	
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 period. Explanatory variable is: 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 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:

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

Now if we replace w^* in equation [2], we have $j = 4.2525$ (in *log* scale) which is transformed by $e^j = 70.28\%$ = the max share of people fully vaccinable in *free* countries. The increase of this share beyond the maximum achievable level in free countries in general it needs the application of suitable rewards or policies of restriction associated with a high degree of control and regulation over public and private life of individuals that can generate social and economic issues, reducing the democratic environment and individual freedoms (Figure 1).

Log Share of people fully vaccinated in September - October 2021 FREE Countries

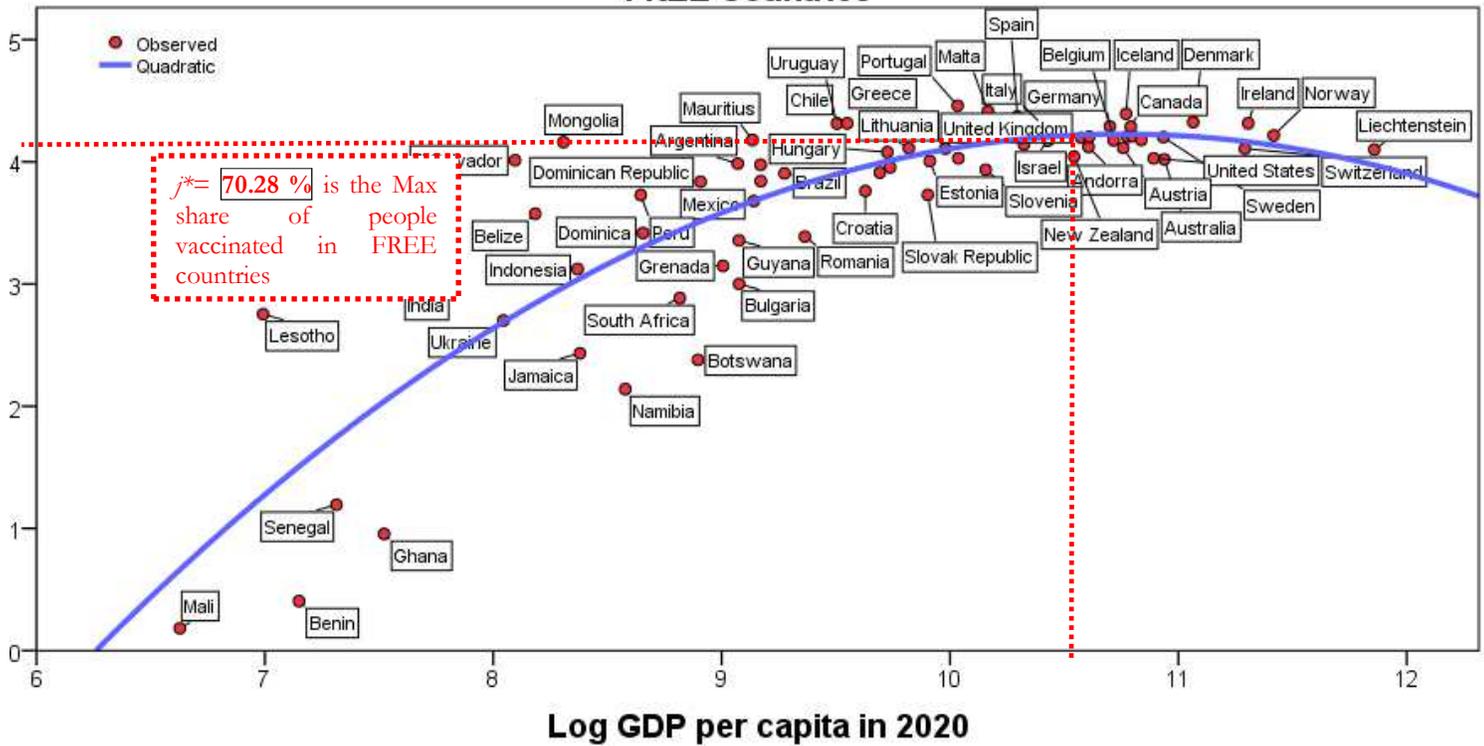


Figure 1. Relation of share of people vaccinated against COVID-19 (%) on GDP per capita in *free* countries based on quadratic model [1], with the maximum level of vaccinated people.

□ *PARTLY FREE Countries*

The estimated relationship of FREE countries, based on 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:

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

Now if we replace $b^*=10.389$ in equation [3], we have $k= 4.04675$ (in *log* scale) which is transformed by $e^k= 57.21\%$ = the max share of people fully vaccinated in partially free countries. The increase of this share beyond the maximum achievable level in *partly free* countries in general it needs the application of appropriate rewards or additional interventions of control and regulation over public and private life that generate social and economic issues, reducing the democratic environment and individual freedoms further (Figure 1).

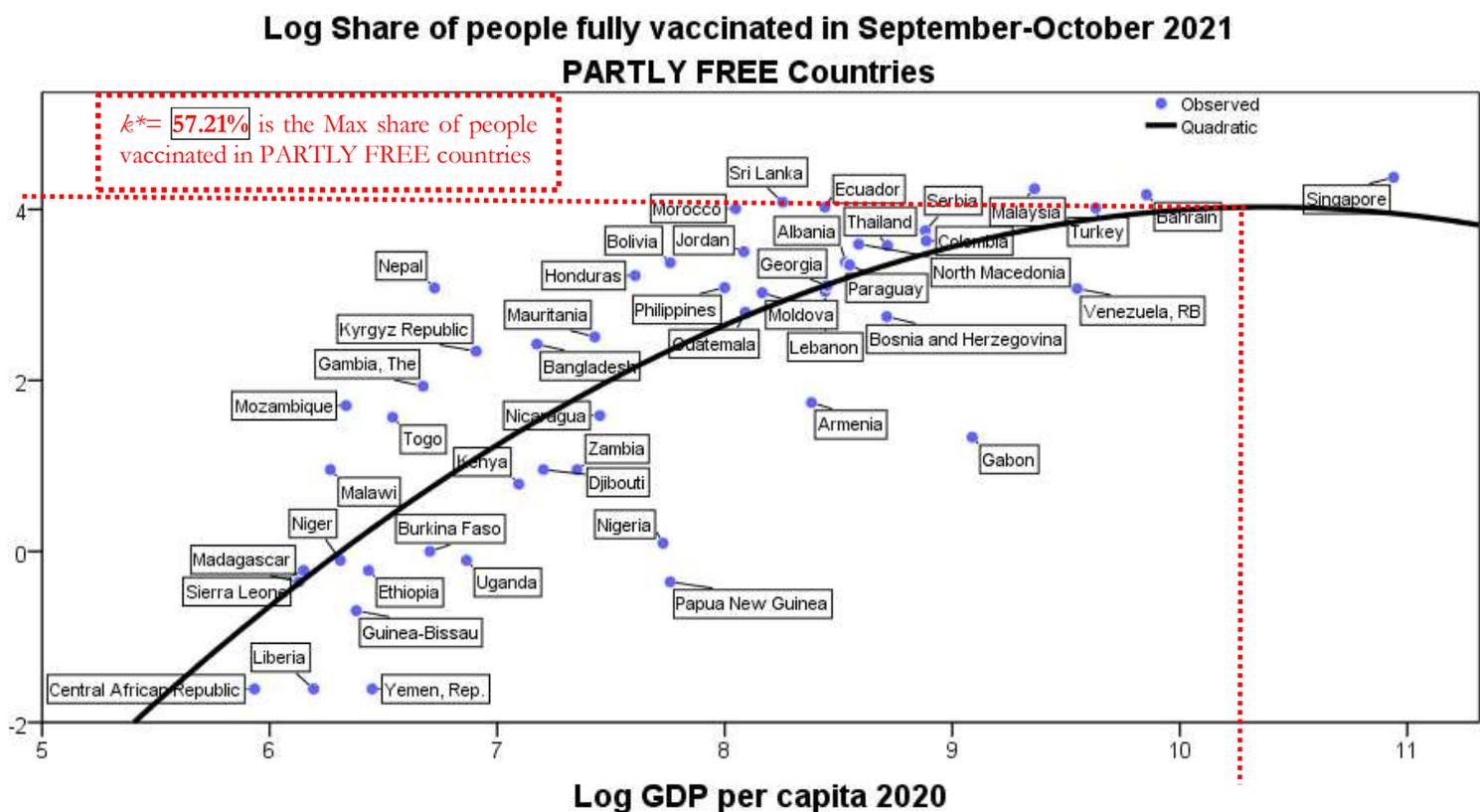


Figure 2. Relation of share of people vaccinated against COVID-19 (%) on GDP per capita in *partly free* countries based on quadratic model [1], with the maximum level of vaccinated people.

□ *NOT FREE Countries*

The estimated relationship in NOT FREE countries has not significant parameters as indicated in table 3 and we do not proceed with the approach of optimization because 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

$$q = -18.66 + 4.194 g - 0.192g^2 \quad [4]$$

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:

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

Now if we replace g^* in equation [4], we have: $q = 4.2432$ (in *log* scale) which is transformed by $e^q = 69.63\%$ = the max share of people fully vaccinated between all countries. The remaining share is associated with a natural hesitancy of people and individual freedoms typical of rich and democratic countries. In addition, as explained before, the increase of this share beyond the maximum level in countries, in general it needs the application of suitable rewards or restriction policies directed to a high degree of control and regulation over public and private life that generate social and economic issues, reducing the democratic environment and individual liberties of people (Figure 3).

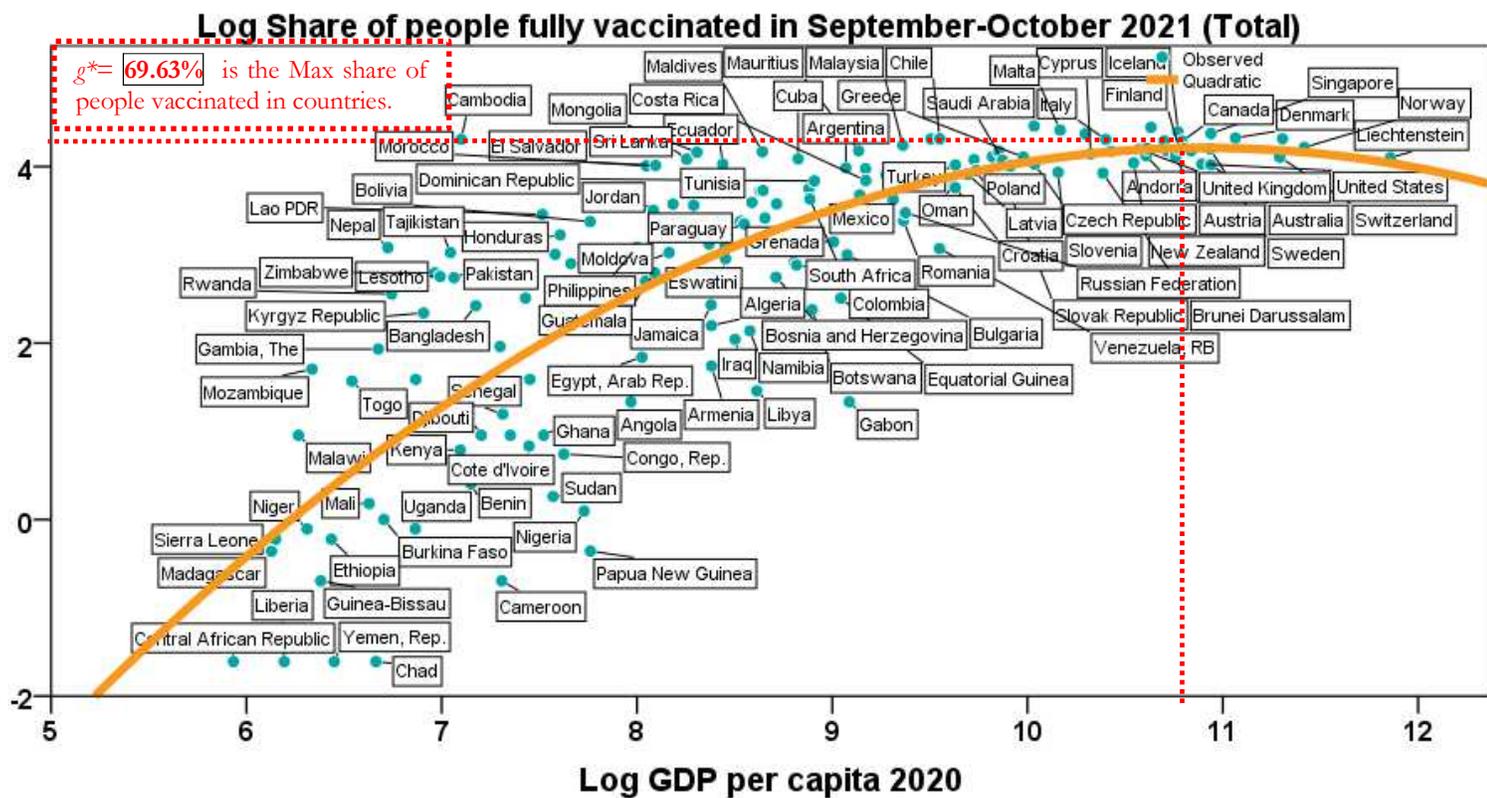


Figure 3. Relation of share of people vaccinated against COVID-19 (%) on GDP per capita in all countries (N=150) based on quadratic model [1], with the maximum level of vaccinated people.

In general, the share of vaccinated against COVID-19 increases with the wealth of nations but it has a physiological maximum level of about 70% between countries at global level (in partly free countries is lower).

DISCUSSIONS ON THE GROWTH OF VACCINATED PEOPLE USING REGULATORY RULES IN DEMOCRATIC SETTINGS

Anttiroiko (2021) analyzes how socioeconomic context, institutional arrangements, culture, and technology level can affect policy responses to the pandemic crisis in Eastern and Western countries². Studies show that in average policy responses in Europe over 2020 tended to be less stringent than countries in East Asia (Ritchie et al., 2020). Moreover, Anttiroiko (2021) highlights that Asian countries have applied with determination policy responses to cope with COVID-19 crisis because of the early diffusion of pandemic in their regions that has supported learning processes. Instead, European countries have different culture, institutions, political systems and approaches to cope with crises and have also to face with privacy and human rights issues, protests against governments for lockdown, restriction measures, vaccine passports, etc. (Coccia, 2005a, 2017, 2017b; 2018a, 2019c, 2019d, 2021i; Coccia and Bellitto, 2018; Coccia and Benati, 2018) Findings here reveal that the share of vaccinated people against COVID-19 increases with the wealth of nations, but it has a physiological limit of about 70% between countries. One of the main issues is the vaccine hesitancy in a portion of population associated with individual freedoms of rich and democratic countries (cf., Verger and Peretti-Watel, 2021). Murphy et al. (2021) found that general adult populations of Ireland and the United Kingdom had vaccine hesitancy/resistance for 35% and 31% respectively. Schwarzinger et al. (2021) analyze the determinants of COVID-19 vaccine acceptance or refusal and suggest that highlighting the benefits in terms of herd immunity can reduce hesitation about COVID-19 vaccines (cf., Bottenheim and Asch, 2013; Echoru et al., 2021; Kanyike et al., 2021). In fact, COVID-19 vaccination is associated with levels of public trust in governments that have to be built and reinforced in the presence of situation of crisis management (cf., Soveri et al., 2021; Vergara et al., 2021). Abuza (2020) argues that the effectiveness of policies in the presence of biological threats is based on

² For role of science and technology for economic and social change see: Ardito et al., 2021; Calabrese et al., 2005; Coccia, 2005; Coccia, 2008, 2014, 105, 2016, 2017a, 2017c, 2017d, 2018b, 2018c, 2019, 2019a, 2019b, 2019f; Coccia, 2020d, 2020e, 2020f, 2020g; Coccia and Cadario, 2014; Coccia and Finardi, 2012, 2013; Coccia and Rolfo, 2000, 2008; Coccia and Watts, 2020; Pagliaro and Coccia, 2021.

leadership and competence, rather than political regimes of countries. Some countries in Western world are stressing democratic society with restrictions to individual freedoms to increase the maximum share of people fully vaccinated (estimated here) by introducing green pass (or vaccine certificate or immunity certificate that here are used interchangeably), as a rule for entering certain businesses and public spheres and/or use public transport or to go to work (as in Italy); this bureaucratic tool is creating a hot debate and manifold socioeconomic issues (Brown et al., 2021; Chantler et al., 2019; Coccia, 2018d; Dye and Mills, 2021; Phelan, 2020). Brown et al. (2021) suggest that the implementation of immunity passports ought to be applied to maximize their benefit without reducing wellbeing of people. Saban et al. (2021) maintain that policymakers should use a measured approach to protect public health, with minimum infringement on citizens' rights. Kamin-Friedman and 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”. Luster et al. (2021) maintain 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 reimplementation”. Overall then, Green Pass or vaccine passport was originated to be an incentive to support vaccination plans, but some countries in Europe are using this bureaucratic tool to penalize people without vaccination, reducing individual freedoms, increasing the discrimination between people in social, cultural and sporting activities, fostering tensions between different social groups, and as a consequence reducing equity, trust and solidarity between people with consequential socioeconomic issues (Kosciejew et al., 2021; Waitzberg et al., 2021; Wilf-Miron et al., 2021). In the presence of persistent green pass regime, protests and socioeconomic issues are opened up, which will support authoritarian rules to reduce

individual freedoms leveraging potential health risks (cf., Wong, 1991). The side effects of this policy of restrictions in countries can be explained with two main aspects that are discussed in following sections.

□ *Politics of fear*

Hobbes (1996) maintains that having control over human fears meant holding power in the society. In general, the interaction between fear and politics is a main field of interest in science (Debiec and LeDoux, 2004; Robin, 2004). Gore (2004) argues that the politics of fear is directed to distort the political reality of a nation by creating fear in population that is disproportionate to actual dangers. In fact, in contexts of uncertainty, governments tend to create administration's policies with inconsistencies, ambiguities and little transparency to reduce accountability to the people and the public interest. Gore (2004) also argues that in specific circumstances: "there has been a disturbing willingness—even eagerness—to misrepresent the true nature of the policy involved and its real implications". In addition, Gore (2004) points out that the U.S. administration has used the politics of fear in economic policy for fiscal reforms; in many European countries, governments use the politics of fear based on COVID-19 pandemic to apply health policies that reduce individual freedoms and regulate the public and private life of people (cf., Wilf-Miron et al., 2021). Gore (2004, square bracket added) also argued that: "[U.S.] 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 can use fear for purposes that are not disclosed, then fear itself can quickly become a self-perpetuating and free-wheeling force that weakens national character, diverting attention from real threats and other problems, sowing confusion (Lupia and Menning, 2009). Hence, the intentional use of fear to manipulate the political process can create many vulnerabilities in population, nation and society.

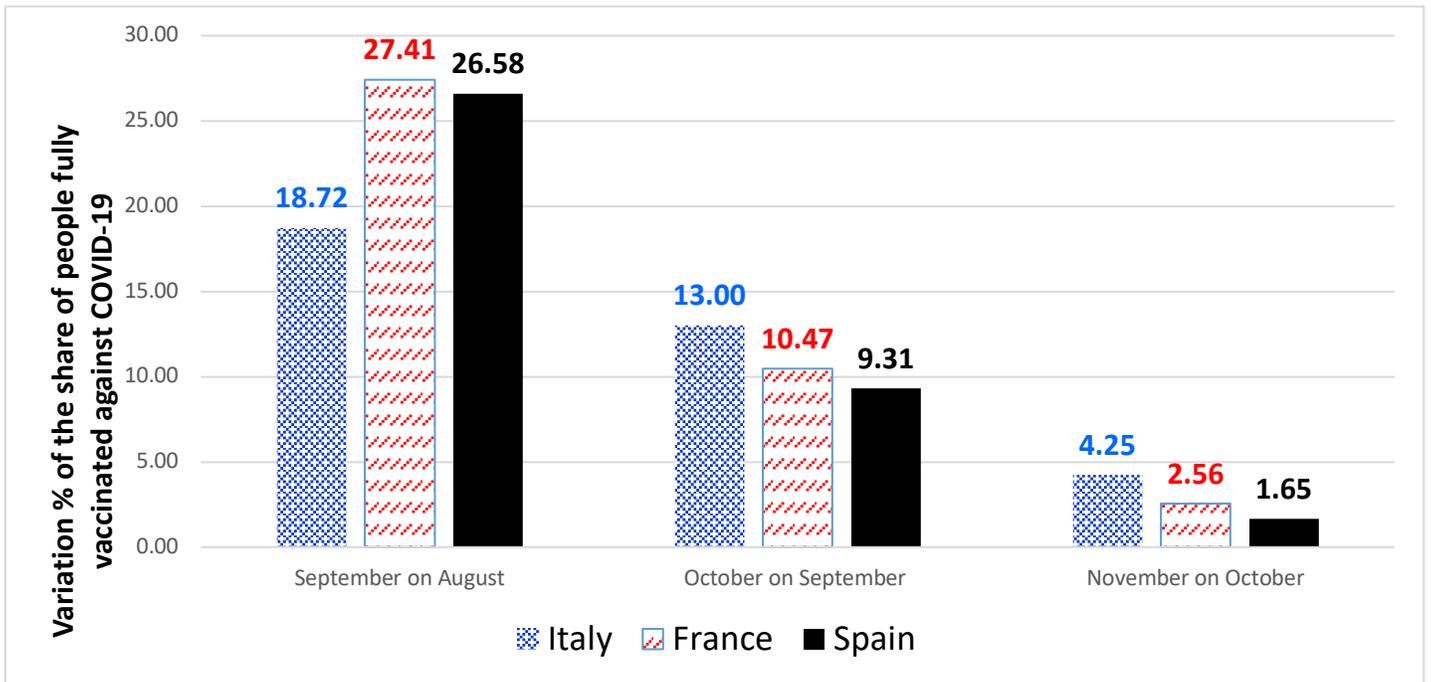


Figure 4. Percent variation (monthly) of the share of people fully vaccinated against COVID-19 in Italy and France (having Green Pass/vaccine passport regime) vs. Spain without green pass certificate from July to November 2021. *Note:* France introduced Green Pass on 21 July 2021; Italy on 6 August for 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) think that institutional fear is a fundamental aspect of liberal thought and constitutional democracy. Arato (2004) argues that Hobbes formulated "a fear of the state of nature, of the war against all, is what drives us to establish something like the modern state". Finally, Arato (2004) shows the important role of "institutional fear" that underpins the social contract in liberal theory. In particular, Arato (2004), focusing on case study of the U.S.A., maintains that liberalism can produce a weak state having a poor regulation of emergency powers, such that the "emergency regime" tends to be constructed largely outside the Constitution generating problematic aspects in society (Prewitt et al., 2004; Robin, 2004). A practical example is the COVID-19 pandemic crisis, and European countries to increase the max share of people vaccinated (as estimated here, beyond 70% of population) tend to apply politics of fear associated with informal authoritarian rules that stress constitutional principles (e.g., immunity passport), reduce the individual freedoms and create socioeconomic problems, with low benefits to cope with

COVID-19 pandemic. In fact, figure 4 shows that the effects of Green pass regime, based on authoritarian rules, generate a moderate growth of vaccinations that disappears in the short-run, but it generates social issues for the reduction of individual freedoms, the increase of discrimination of people in social, cultural and sporting activities, the growth of tensions between different groups, reduction of equity, trust and solidarity too (Kosciejew et al., 2021; Waitzberg et al., 2021; Wilf-Miron et al., 2021).

□ *Strong leaders and authoritarian rules in democracies*

The increase of vaccination in rich and democratic regions, by introducing restrictions and policies based on vaccine passport, is also associated with strong leaders having domestic and international support that can generate a substantial decline of democratic setting (Lavriča and Bieberb, 2021). This tendency of power in strong leaders, in the presence of crisis, is supported by a combination of social insecurity, cultural backlash and economic issues generated by pandemic crisis. To put it differently, the application of authoritarian rules in democratic systems is due to the emergence for strong leaders but also to social and economic insecurity that support authoritarian approaches that are exercised informally (Lavriča and Bieberb, 2021; cf., Coccia, 2019e). In fact, all political leaders guide restrictive interventions in a general framework in which they are considered "pragmatic reformers" and receive initially domestic and international support (Crowther 2017; Günay and Dzihic 2016; Vladisavljević 2019). Thus, the increasing public support to a strong political leader may be one of the causes of the rise in authoritarian rules in the Western countries in the presence of pandemic crisis, leveraging socioeconomic uncertainty and fear in society. These tendencies are generated in an institutional environment and countries having weaknesses of democratic institutions and balance of powers in the presence of emergencies and crisis.

CONCLUSIONS AND PROSPECTS

Findings here reveal that the share of vaccinated against COVID-19 increase with the wealth of nations, but it has a physiological maximum level of about 70% between (rich and democratic) countries. In addition, monarchy and parliamentary monarchy have a higher share of people fully vaccinated against COVID-19 than mixed executives

and presidential republic. Some countries in Western world are straining democratic society with restrictions to individual freedoms to increase the maximum share of people fully vaccinated (estimated here) by introducing restriction policies, vaccine certificate and penalties as a rule that create socioeconomic issues, such as discrimination of people in social activities, tensions between different groups, reduction of equity, trust, etc. (Brown et al., 2021; Chantler et al., 2019; Coccia, 2018a, 2021c; Dye and Mills, 2021; Koscieljew et al., 2021; Waitzberg et al., 2021; Wilf-Miron et al., 2021). In particular, results here can explain some abuses in democratic countries based on a combination of the politics of fear and informally authoritarian rules³ applied by a strong leader under circumstances of social insecurity.

Although this study has provided interesting results, that are of course tentative, it has several limitations. First, a limitation of the study is the lack of data about total vaccinations in manifold countries. Second, not all the possible confounding factors that affect the diffusion of vaccination are taken into consideration and in future these factors deserve to be controlled for supporting results here. Third, the lack of integration of data with cultural aspects may have influenced the results of vaccination across countries making comparative analyses a problematic approach (Angelopoulos et al., 2020; Coccia, 2018). Fourth, country-specific health and social norms may affect the vaccination and mitigation policies. Finally, the estimated relationships in this study focus on variables in specific months (based on recent data available) but an extension of the period under study is needed in future development of the research here. Thus, the generalization of this results should be done with caution. Future research should consider new data, when available, and when possible, to examine also other variables between countries to explain dynamic relationships under study over time and space and their interaction with vaccination, vaccine certificate, restriction policy and other social norms between countries. Despite these limitations, the results presented here suggests the maximum sustainable level of people vaccinated between rich and democratic countries (that is roughly 70%) and

³ Wesolowski (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.

social and economic issues associated with the introductions of policy of restrictions and bureaucratic tools (e.g., immunity passport) to go beyond this limit using politics of fear and strong leaders. Hence, there is need for much more detailed research in these topics and this study encourages further investigations using lessons learned of COVID-19 pandemic crisis, also considering the interaction between effects of restrictions in societies and campaign of vaccination. Overall, then, many Western (democratic) countries are straining society with restrictions to individual freedoms to increase the maximum share of people fully vaccinated (with marginal results) by introducing vaccine passport and autocratic rules that impose restrictions to the movement of individuals who are not vaccinated, reducing equality and fairness between people. These aspects are applied using politics of fear and strong leadership nurtured by institutional context having weak democracy and vague separation of powers, when constitution expressly established that these functions have to be strong to address critical problem of abuse in democracy by our own rulers, our own political authorities who, if uncontrolled or made not accountable, can do great harm to society higher than (pandemic) crisis. To conclude, different factors between countries that are not only parameters related to medicine but also to social and political sciences can explain the effects of COVID-19 pandemic in society not only in terms of health but also in term of human and civil rights that should be accurately assessed to control future negative impact of pandemic crisis on public health, economy and society. It is worth raising the question whether our constitutional ordering of Western and democratic countries is still protecting us from fear and effective tangible democratic reduction that can became a hazardous process, similar to COVID-19 pandemic crisis, that direct future society towards *terra incognita* of uncertain social events.

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