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Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
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JEL Classification: D72, C30, P16, I19

Keywords: COVID-19, educational development, Political regimes, vaccination

Vu M. Ngo - vunm@ueh.edu.vn
University of Economics Ho Chi Minh City

Klaus F. Zimmermann - klaus.f.zimmermann@gmail.com
Global Labor Organization (GLO), UNU-MERIT & Maastricht University, Bonn University and CEPR

Phuc V. Nguyen - p.nguyen@massey.ac.nz
Massey University

Toan Luu Duc Huynh - toanhld@ueh.edu.vn
University of Economics Ho Chi Minh City

Huan H. Nguyen - huannguyen@ueh.edu.vn
University of Economics Ho Chi Minh City

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Vu M. Ngo[1] Klaus F. Zimmermann[2] Phuc V. Nguyen[3] Toan L.D. Huynh[4] Huan H. Nguyen[5]

Draft: November 11, 2021

Abstract

Since vaccination is the decisive factor for controlling the COVID-19 pandemic, it is important to understand the process to vaccination success. We identify a variety of factors playing a crucial role including the availability of vaccines, pandemic pressures, economic strength (GDP), educational development and political regimes. Examining the speed of vaccinations across countries, we find that initially authoritarian countries are slow in the vaccination process, while education is most relevant for scaling up the campaign and financial strength of the economies drive them to higher vaccination rates.

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[1] University of Economics Ho Chi Minh City (Vietnam). Email: vunm@ueh.edu.vn

[2] UNU-MERIT & Maastricht University, Netherlands & Centre for Economic Policy Research (CEPR), United Kingdom & Global Labor Organization (GLO), Germany. Email: klaus.f.zimmermann@gmail.com; corresponding author. ORCID ID: 0000-0003-2804-5692

[3] Massey University (New Zealand) & Global Labor Organization (GLO, Germany). Email: p.nguyen@massey.ac.nz

[4] University of Economics Ho Chi Minh City (Vietnam) & WHU – Otto Beisheim School of Management (Germany) & IPAG Business School (France) & Global Labor Organization (GLO, Germany). Email: toanhld@ueh.edu.vn

[5] University of Economics Ho Chi Minh City (Vietnam). Email: huannguyen@ueh.edu.vn

1. Introduction

Vaccination is the dominant strategy to fight the COVID-19 disease. Access to vaccines, the effectiveness of vaccination campaigns and the acceptance among populations are determined by many factors like the political regime, the state of the health system, the financial resources and the educational conditions of the respective countries. Top priority is to reinstate normalcy after high numbers of deaths, overloaded sanitary systems, and huge economic burdens. Challenges are high for countries with incompetent health systems and hygiene facilities as well as aging populations (Boodoosingh et al., 2020). However, vaccine availability does not equate to vaccines accessibility. '*Vaccine nationalism*' became popular amongst rich nations thereby exacerbating the vaccine shortage (Burki, 2021; Alaran et al., 2021).

Recent literature on COVID-19 suggests that democratic countries suffered more through higher infections but had lower case fatality rates (Karabulut et al., 2021). While vaccine acceptance was highest in authoritarian countries (China, Vietnam), cash is used for vaccination promotion in some democratic countries like the US, Serbia, Greece, and Canada (Wouters et al., 2021). Vaccination hesitancy of the population across policy regimes could lead to large differences in vaccination speed. Further, political-related anti-vaccine conspiracy theories that have been prevalent since the start of the COVID-19 pandemic are also strongly associated with reduced vaccination intentions (Jolley and Douglas, 2014). Moore (2018) also points out that conspiracy theorists are more prevalent amongst the poor and poorly educated.

Trust in science and confidence in vaccinations are strongly related. Social consensus on trust in science is substantially stronger in countries with higher levels of formal education. Studying data collected before the COVID-19 pandemic, Sturgis et al., (2021) document that people are more confident about vaccination in countries where trust in science is high. Based on large-scale, longitudinal, and representative surveys for 12 countries during the pandemic in 2020, also employing experimental data, Algan et al. (2021) confirm that acceptance of non-pharmaceutical interventions as well as vaccinations during COVID-19 are strongly related to perceived trust in scientists as the key driving force.

There is a large expectation that better education in general leads to a stronger vaccination acceptance rate among populations, although direct evidence in the economics literature is missing. For instance, Mayuko et al. (2012) for the US and Damiani et al. (2007) for Italy find that the lower educated were less likely influenza vaccinated. Lu et al. (2009) document that among adults aged 60 years or older, the better educated were more likely to receive herpes zoster vaccination than others. Khattak et al. (2021) reveal that parents in Pakistan who had no education were more likely to refuse vaccination of their children. A major contribution of our study therefore is to provide extra knowledge on the effects of educational development on vaccination performance.

To understand the factors affecting the success of the COVID-19 vaccination campaign better, this study reveals the relative strength of the effects of education, political regimes, vaccination policies and countries' specific demographic factors on how they implement and scale up vaccination campaigns in the context of diverse COVID-19 infection challenges. The larger the pressure from infections, the stronger vaccination efforts of a country should be.

2. Data and Methodology

We investigate the success of the COVID-19 vaccination campaign by studying the number of days countries needed since its respective start to reach certain shares among populations: Daysto1%/5%/10%/20%/30%. The major driving factors considered are political, educational and economic backgrounds. The countries' classifications of political regimes include full democracy, flawed democracy, hybrid, and authoritarian regimes provided by the 2020 *Economist* democracy report (EIU, 2020) based on their democratic score (1 to 10) calculated using key criteria such as electoral process and pluralism, functioning of government, political participation, political culture, and civil liberties. Compared

to the well-known Freedom House index (Freedomhouse, 2021), the EIU index covers more democratic features such as political culture and participation. The expected years of schooling index (UNDP, 2020) proxies development of the educational system (YearsofSchooling), and GDP per capita, economic development and capacity (GDPpercapita). Other control variables are population density (PopulationDensity), population shares of age of 65 and older (Aged65older), vaccines purchased (VaccinesPurchased), vaccine policies, average daily new infected COVID-19 cases (January 2020 to October 11, 2021; AverageNewCases) to capture relevance of societal pressures, and continent dummies. Estimation method is weighted least squares using population size as weight with robust standard errors. We also calculate the Owen–Shapley R^2-decomposition to judge the contributions of key variables (Huettner and Sander, 2012). The Appendix provides explanations of data, sources, descriptive statistics and a number of robustness investigations.

3. Results

Table 1 shows the findings for vaccination levels 1%, 5%, 10%, 20%, and 30%, respectively, with rising R^2's from 0.556 for 1% to 0.730 for 30%. They reveal a negative association with democracy with authoritarian country as the reference group. While estimated parameters are typically negative for the three types (full, flawed and hybrid), significance and size vary. For thresholds 1%, 5% and 10% they are significant at least at the 10% level. 14.2% points of the R^2=0.556 explanatory power in column (1) comes from these three political variables; political regimes explain 14.2% of the total variance of the Daysto1% total variance. This remains fairly stable in the vaccination process and is 14.8% points of R^2=0.730 for threshold Daysto30%.

Educated countries exhibit also a negative but throughout statistically significant effect on the duration to vaccination. The percentage contribution of *YearsofSchooling* to the explained variation is 24.1% for Daysto1%, but are somewhat smaller but robust (19.1%, 15.1%, 18.7% and 17.8%) in the next steps. Education is always more relevant for speeding up the process than political regimes.

The *GDPpercapita* effect is negative but small at the beginning, and becomes large and strongly significant with rising vaccination thresholds. The Owen-Shapley decomposition allocates the highest contributions for Daysto10%, Daysto20% and Daysto30% with 17.7%, 34.5% and 34.7%, respectively. *GDPpercapita* provides also the strongest contribution among all variables including the group of political regime variables from the 10% threshold level on.

AverageNewCases has throughout negative and 1% statistically significant coefficients. The pandemic provides extra incentives for countries to intensify the vaccination campaign. Measured by the Owen-Shapley contributions this pressure is strongest for 1% and 5%. *VaccinePolicy* matters for Daysto1%, and *VaccinesPurchased* speeds up vaccinations for the 5% and 10% thresholds significantly. *PopulationDensity* and *Aged65older* are mostly not statistically significant.

Extensions and robustness tests are documented in the Appendix. Using the Freedom House democracy classifications (Free, Partial Free, Not Free) to capture political regimes provides no conflicting results (Table A4). Using standard OLS instead of WLS for estimation keeps the core story, but at a much lower level of significance and explanatory power (Table A5), which confirms the WLS choice. Taking *AverageNewCases, VaccinesPurchased* and *VaccinePolicy* out of the regressions leads to stronger and all significant effects for *GDPpercapita,* and more negative and more significant estimates for the *Political Regime* variables, but the qualitative story remains again (Table A6). YearsofSchooling has just somewhat weaker and less significant effects. Obviously, those factors are also associated with the pandemic and vaccine-related control variables. A Cox proportional hazard model with failure event of reaching 30% vaccination uptake rate shows consistent findings to our main results.

4. Conclusions

The two most potent variables explaining the speed of the COVID-19 vaccination campaign are countries' education level and GDP per capita. More democratic countries have an initial advantage. Infection intensities support early vaccinations.

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Table 1: Speed of COVID-19 vaccinations

	(1) Daysto1%	(2) Daysto5%	(3) Daysto10%	(4) Daysto20%	(5) Daysto30%
Democracy (reference: authoritarian)					
Full	-21.869*	-18.624**	-21.015**	-12.673	-20.985
	(11.448)	(8.307)	(10.253)	(13.496)	(17.132)
Flawed	-19.927**	-23.632**	-15.869*	-2.844	0.571
	(8.799)	(9.930)	(9.234)	(10.824)	(12.519)
Hybrid	-17.589*	-30.058*	-35.121**	-19.774	-6.077
	(8.919)	(16.314)	(17.600)	(15.779)	(15.624)
YearsofSchooling	-5.444***	-7.946***	-7.382***	-6.859***	-3.949*
	(1.800)	(2.137)	(2.600)	(2.193)	(2.076)
AverageNewCases	-0.176***	-0.132**	-0.144***	-0.215***	-0.267***
	(0.065)	(0.059)	(0.054)	(0.074)	(0.080)
GDPpercapita	-0.152	-0.584*	-0.735**	-0.887***	-1.063***
	(0.196)	(0.304)	(0.296)	(0.293)	(0.301)
PopulationDensity	-1.622	0.141	-1.282	-0.816	-2.045
	(1.778)	(2.301)	(2.504)	(2.508)	(3.143)
Aged65older	0.697	1.122*	1.073	-0.351	-0.870
	(0.501)	(0.608)	(0.666)	(0.778)	(0.942)
VaccinePurchased	-0.004	-0.098***	-0.148***	-0.033	0.006
	(0.024)	(0.028)	(0.037)	(0.044)	(0.045)
VaccinePolicy	-5.691**	0.079	3.241	-3.948	-4.603
	(2.702)	(5.339)	(4.314)	(4.839)	(5.628)
Asia	-16.017*	-19.581**	-15.352*	-8.441	-4.375
	(8.419)	(7.836)	(8.217)	(9.161)	(10.659)
Africa	-3.605	25.273	18.766	-10.509	4.491
	(14.512)	(17.434)	(23.461)	(38.434)	(44.365)
Europe	-0.053	-18.168**	-16.788*	19.524	33.205**
	(7.684)	(7.635)	(8.648)	(11.823)	(14.080)
Oceania	19.805*	11.121	11.945	33.513*	32.039
	(11.823)	(15.993)	(17.448)	(18.360)	(20.200)
SouthAmerica	-0.047	-14.673	-19.106*	-8.486	-5.601
	(7.359)	(9.390)	(9.738)	(11.635)	(11.756)
Constant	157.727***	238.800***	250.561***	288.770***	277.442***
	(24.146)	(36.732)	(37.928)	(33.151)	(30.602)
Number of countries	118	109	104	96	91
Adj.R^2	0.556	0.678	0.697	0.696	0.730
Owen–Shapley R-squared-decomposition (%R^2):					
Political regimes	14.214	14.739	14.935	10.940	14.790
AverageNewCases	19.208	14.789	10.154	10.566	12.349
YearofSchooling	24.086	19.079	15.110	18.740	17.775
GDPpercapita	10.568	11.880	17.699	34.495	34.728

Notes: Weighted least squares with population size. Daysto 1/5/10/20/30%: number of days until 1%/5%/10%/20%/30% vaccination levels (total number of vaccine doses to total population); AverageNewCases: Average daily new infected COVID-19 cases per million of people since the first infected case recorded to the date of 1%/5%/10%/20%/30% vaccinated levels; YearsofSchooling: average number of years in formal education a person can expect to receive with the current enrolment rate at all levels of education; GDPpercapita: GDP per capita ($1000); PopulationDensity: population density index (1,000 people/km^2); Aged65older: share of populations with age 65 and over (%); VaccinePurchased: number of vaccine doses contracted from COVID-19 vaccine manufacturers (10 millions units); VaccinePolicy: average score of the COVID-19 vaccination policy chosen by countries overtime (0-5), the higher the score, the broader vaccination targets. Asia/Africa/Europe/Oceania/SouthAmerica: continent dummies. Robust standard errors in parentheses: *p< 0.10, **p< 0.05, ***p< 0.01.

Appendix

Table A1. Countries and Codes

Countries	Codes	Countries	Codes	Countries	Codes
Afghanistan[2]	AFG	Hungary	HUN	Panama	PAN
Angola[3]	AGO	India	IND	Papua New Guinea[1]	PNG
Argentina	ARG	Indonesia	IDN	Paraguay	PRY
Australia	AUS	Iraq[3]	IRQ	Peru	PER
Austria	AUT	Ireland	IRL	Philippines	PHL
Bahrain	BHR	Israel	ISR	Poland	POL
Belarus	BLR	Italy	ITA	Portugal	PRT
Belgium	BEL	Jamaica[4]	JAM	Qatar	QAT
Benin[1]	BEN	Japan	JPN	Romania	ROU
Bolivia	BOL	Jordan	JOR	Russia	RUS
Bosnia and Herzegovina	BIH	Kazakhstan	KAZ	Rwanda[4]	RWA
Botswana[4]	BWA	Kenya[2]	KEN	Saudi Arabia	SAU
Brazil	BRA	Kuwait	KWT	Senegal[3]	SEN
Bulgaria	BGR	Kyrgyzstan[4]	KGZ	Serbia	SRB
Burkina Faso[1]	BFA	Laos	LAO	Singapore	SGP
Cambodia	KHM	Latvia	LVA	Slovakia	SVK
Cameroon[1]	CMR	Lebanon	LBN	Slovenia	SVN
Canada	CAN	Libya[4]	LBY	South Africa	ZAF
Chile	CHL	Lithuania	LTU	South Korea	KOR
Colombia	COL	Luxembourg	LUX	Spain	ESP
Costa Rica	CRI	Malaysia	MYS	Sri Lanka	LKA
Croatia	HRV	Mali[1]	MLI	Sweden	SWE
Czechia	CZE	Malta	MLT	Switzerland	CHE
Denmark	DNK	Mauritius	MUS	Tajikistan	TJK
Dominican Republic	DOM	Mexico	MEX	Thailand	THA
Ecuador	ECU	Moldova	MDA	Togo[3]	TGO
Egypt[3]	EGY	Mongolia	MNG	Trinidad and Tobago	TTO
El Salvador	SLV	Morocco	MAR	Turkey	TUR
Estonia	EST	Mozambique[3]	MOZ	Uganda[2]	UGA
Fiji	FJI	Namibia[3]	NAM	Ukraine	UKR
Finland	FIN	Nepal	NPL	United Arab Emirates	ARE
France	FRA	Netherlands	NLD	United Kingdom	GBR
Gabon[2]	GAB	New Zealand	NZL	United States	USA
Georgia	GEO	Nicaragua[3]	NIC	Uruguay	URY
Germany	DEU	Niger[1]	NER	Venezuela	VEN
Ghana[2]	GHA	Nigeria[1]	NGA	Vietnam	VNM
Greece	GRC	Norway	NOR	Yemen[1]	YEM
Guatemala	GTM	Oman	OMN	Zambia[1]	ZMB
Honduras	HND	Pakistan	PAK	Zimbabwe	ZWE
Hong Kong	HKG				

Note: This table describes the full names and codes of 118 countries in model (1) in Table 1.

[1]: Countries that are not available for analyses in models (2), (3), (4), and (5) because they have not reached the vaccination rates of 5%, 10%, 20%, and 30%.

[2]: Countries that are not available for analyses in models (3), (4), and (5) because they have not reached the vaccination rates of 10%, 20%, and 30%.

[3]: Countries that are not available for analyses in models (4), and (5) because they have not reached the vaccination rates of 20%, and 30%.

[4]: Countries that are not available for analyses in model (5) because they have not reached the vaccination rates of 30%.

Table A2. Data and Sources

Variables	Description	Sources
Daysto1% Daysto5% Daysto10% Daysto20% Daysto30%	Number of days needed to achieve the 1%/5%/10%/20%/30 % COVID-19 vaccination levels (total number of doses to total population)	Ritchie et al. (2020)
YearsofSchooling	The average number of years in formal education that a person can expect to receive with the current countries' enrolment rates at all levels of education	UNDP (2020)
Democracy classifications according to countries' democracy index score from The Economist	***Full democracy:*** all areas such as basic political freedoms, civil liberties, political culture, government functioning are at high level. ***Flawed democracy:*** free and fair elections, basic civil liberties respected but suffered from problems in government functioning, underdeveloped political cultures and weak political participant ***Hybrid regime:*** substantial irregularities in election, more prevalent problems in government functioning, underdeveloped political cultures, rule of law is weak, corruption is widespread, no independent judiciary ***Authoritarian:*** state political plurals is absent, outright dictatorship, election is not free and fair and infringements of civil liberties, no independent judiciary	The Economist Intelligence Unit (2020)
Democracy classifications according to countries' democracy index score from The FreedomHouse	Democracy index score based on the aggregate score of two main dimensions: Political rights (0-40) and Civil liberties (0-60). The total Political Rights and Civil Liberties scores are equally weighted in this calculation and based on that classifications (***Free/Partial Free/Not Free***) are decided	Freedom House (2021). 'Freedom in the world 2021'
AverageNewCases (1%/5%/10%/20%/30 %)	Average daily new infected COVID-19 cases to the date of 1%/5%/10%/20%/30% vaccinated levels	Ritchie et al. (2020)
PopulationDensity (1,000 people/km2)	Population density index	World Bank national accounts data
Aged65older (%)	Share of populations with age 65 and over	World Bank national accounts data
GDPpercapita ($1,000)	Gross domestic product per capita	

		World Bank national accounts data
VaccinePurchased (10 millions of units)	Number of vaccines doses that countries have contracted to purchase from COVID-19 vaccine manufacturers	Duke Global Health Innovation Center (2021)
VaccinePolicy (1%/5%/10%/20%/30 %)	Countries are grouped into six categories: 0: No availability 1: Availability for ONE of following: key workers/ clinically vulnerable groups / elderly groups 2: Availability for TWO of following: key workers/ clinically vulnerable groups / elderly groups 3: Availability for ALL of following: key workers/ clinically vulnerable groups / elderly groups 4: Availability for all three plus partial additional availability (select broad groups/ages) 5: Universal availability Average score of Vaccine policies calculated based on the changes of vaccine policies since the beginning of the vaccine program to the 1%/5%/10%/20%/30 % vaccination level (total doses/total population)	Ritchie et al. (2020)

Note: This table shows the description and sources of variables used in this study.

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UNDP (2020). *Human Development Index (HDI) | Human Development Reports*. Human Development Reports. http://hdr.undp.org/en/content/human-development-index-hdi

Table A3. Descriptive statistics of variables used

Variable	Obs	Mean	Std. Dev.	Min	Max
Daysto1%	118	35.95763	28.23328	0	129
Daysto5%	109	73.58716	44.02908	0	214
Daysto10%	104	93.69231	42.89071	4	222
Daysto20%	96	116.3333	40.39298	14	193
Daysto30%	91	134.5385	43.72752	24	229
AverageNewCases (to 1%)	118	67.7721	64.57344	0.0185814	254.0549
AverageNewCases (to 5%)	109	79.80594	69.7637	0.1911751	295.0323
AverageNewCases (to 10%)	104	87.68681	72.05924	0.4018115	340.575
AverageNewCases (to 20%)	96	100.0747	74.98198	0.6498013	361.3624
AverageNewCases (to 30%)	91	106.2103	77.77639	1.142303	356.5833
Full democracy	118	0.1779661	0.3841153	0	1
Flawed democracy	118	0.3728814	0.4856331	0	1
Hybrid regime	118	0.1864407	0.3911227	0	1
Authoritarian regime	118	0.2627119	0.441984	0	1
Free	118	0.4152542	0.4948672	0	1
Partial Free	118	0.3305085	0.4724022	0	1
Not Free	118	0.2542373	0.4372885	0	1
YearsofSchooling	118	14.15666	2.79901	6.47145	21.95433
GDPpercapita ($1,000)	118	22.76324	21.19165	0.926	116.9356
PopulationDensity (1,000 people/km2)	118	0.2758711	0.9824308	0.00198	7.915731
Aged65older (%)	118	10.09064	6.72996	1.144	27.049
VaccinePurchased (10 million units)	118	7.05846	27.32845	0	234.5
VaccinePolicy (1%)	118	1.797115	0.884347	0	4
VaccinePolicy (5%)	109	2.14452	0.7986983	0.6292135	4.664122
VaccinePolicy (10%)	104	2.34739	0.7963662	0.78	4.864865
VaccinePolicy (20%)	96	2.492691	0.7428048	0.7719298	4.864865
VaccinePolicy (30%)	91	2.638591	0.7204832	1	4.876543

Table A4: Robustness test with Freedom House democracy index

	(1) Daysto1%	(2) Daysto5%	(3) Daysto10%	(4) Daysto20%	(5) Daysto30%
Democracy (Not Free is the base group):					
Free	-20.487	-14.548	-13.072	3.442	-3.734
	(14.787)	(10.487)	(13.118)	(16.944)	(18.826)
Partial Free	-15.284**	-29.659***	-11.445	-1.165	-0.118
	(6.643)	(11.225)	(13.510)	(12.519)	(12.790)
YearsofSchooling	-6.447***	-8.761***	-6.388***	-5.687***	-3.933**
	(1.679)	(1.791)	(2.160)	(1.712)	(1.643)
AverageNewCases	-0.163***	-0.192***	-0.170***	-0.235***	-0.214***
	(0.050)	(0.061)	(0.063)	(0.063)	(0.059)
GDPpercapita	-0.076	-0.572**	-0.618**	-0.909***	-1.178***
	(0.205)	(0.270)	(0.256)	(0.288)	(0.300)
PopulationDensity	-1.804	1.474	-3.124	-1.154	-1.026
	(2.005)	(2.925)	(3.778)	(3.433)	(3.948)
Aged65older	0.945	0.846	0.862	-1.108	-1.504
	(0.849)	(0.930)	(0.951)	(1.189)	(1.329)
VaccinePurchased	-0.007	-0.073***	-0.116***	-0.000	0.017
	(0.018)	(0.019)	(0.029)	(0.024)	(0.024)
VaccinePolicy	-3.241	2.257	6.062	-4.952	-5.969
	(3.303)	(4.807)	(4.678)	(5.060)	(5.982)
Asia	-19.029**	-26.848***	-19.752*	-9.758	-6.454
	(8.958)	(10.175)	(11.552)	(10.884)	(12.142)
Africa	-3.425	15.263	21.918	-13.260	3.075
	(13.073)	(21.405)	(29.764)	(43.730)	(48.036)
Europe	-1.265	-16.693*	-16.201*	24.215*	33.108**
	(8.609)	(8.851)	(9.378)	(12.799)	(14.388)
Oceania	21.954**	7.764	-3.099	20.730	26.961
	(10.438)	(14.902)	(13.545)	(14.955)	(16.907)
SouthAmerica	0.324	-17.001	-16.721	-7.510	-8.243
	(8.211)	(10.629)	(10.176)	(11.842)	(11.559)
Constant	161.860***	252.907***	225.113***	275.490***	283.982***
	(24.395)	(37.276)	(34.474)	(33.264)	(31.316)
Number of countries	118	109	104	96	91
Adj. *R*2	0.551	0.694	0.666	0.680	0.719
Owen–Shapley R-squared decomposition (% R2):					
Political regimes	14.129	13.797	11.099	10.600	15.123
AverageNewCases	19.313	14.520	10.288	9.828	10.718
YearOfSchooling	23.046	19.271	15.034	18.947	18.088
GDPpercapita	9.202	11.130	16.072	34.036	35.109

Notes: Weighted least squares with population size as weight. Daysto 1/5/10/20/30%: number of days until the 1%/5%/10%/20%/30 % COVID-19 vaccination levels (total number of vaccine doses to total population); AverageNewCases: Average daily new infected COVID-19 cases per million of people since the first infected case recorded to the date of 1%/5%/10%/20%/30% vaccinated levels; YearsofSchooling: the average number of years in formal education that a person can expect to receive with the current enrolment rate at all level of education; GDPpercapita: GDP per capita ($1000); PopulationDensity: population density index (1,000 people/km2); Aged65older: share of populations with age 65 and over (%); VaccinePurchased: number of vaccines doses which countries have contracted to purchase from COVID-19 vaccine manufacturers (10 millions units); VaccinePolicy: average score of the COVID-19 vaccination policy chosen by a countries overtime (0-5), the higher the score, the broader vaccination targets are. Asia/Africa/Europe/Oceania: dummy continent control. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A5: Speed of COVID-19 vaccination programs *(standard OLS regression)*

	(1) Daysto1%	(2) Daysto5%	(3) Daysto10%	(4) Daysto20%	(5) Daysto30%
Democracy (Authoritarian is the base group):					
Full	-4.009	-7.786	-12.665	-3.682	-7.794
	(9.763)	(13.368)	(13.427)	(16.260)	(18.225)
Flawed	-10.284	-16.398	-18.784*	-8.194	-7.502
	(8.885)	(11.794)	(11.054)	(14.526)	(16.051)
Hybrid	-7.632	-15.165	-21.218	-9.167	2.172
	(9.865)	(15.311)	(15.058)	(17.614)	(16.323)
YearsofSchooling	-4.265***	-5.838***	-4.322*	-3.509	-3.410
	(1.586)	(2.148)	(2.244)	(2.340)	(2.377)
AverageNewCases	-0.088***	-0.118***	-0.077	-0.077	-0.116*
	(0.032)	(0.042)	(0.047)	(0.053)	(0.062)
GDPpercapita	-0.104	-0.322	-0.533**	-0.643***	-0.666**
	(0.152)	(0.201)	(0.207)	(0.241)	(0.266)
PopulationDensity	-1.564	-2.396	-1.597	-1.592	-1.721
	(1.753)	(2.769)	(2.985)	(3.182)	(3.758)
Aged65older	0.440	0.464	0.780	-0.197	-0.451
	(0.551)	(0.927)	(0.930)	(1.136)	(1.402)
VaccinePurchased	0.025	-0.001	-0.026	0.031	0.110
	(0.029)	(0.052)	(0.055)	(0.085)	(0.089)
VaccinePolicy	-0.894	1.658	6.215	0.530	-0.624
	(3.102)	(5.326)	(5.087)	(6.677)	(8.432)
Asia	-4.805	-2.791	-11.421	-6.463	-2.858
	(8.362)	(11.104)	(11.625)	(14.465)	(16.656)
Africa	7.083	28.614	22.964	8.783	9.671
	(11.632)	(17.610)	(17.960)	(23.235)	(33.506)
Europe	1.644	3.517	-8.848	6.938	24.548
	(8.019)	(12.670)	(13.138)	(16.084)	(18.842)
Oceania	13.289	-15.239	-24.625	-16.433	-10.125
	(21.171)	(31.686)	(29.959)	(34.243)	(44.277)
SouthAmerica	8.818	5.637	-5.206	-3.966	1.139
	(9.370)	(11.472)	(12.540)	(16.213)	(17.484)
Constant	106.247***	173.544***	173.142***	200.492***	219.318***
	(22.559)	(34.997)	(32.932)	(37.935)	(37.462)
Number of countries	118	109	104	96	91
Adj. *R*2	0.283	0.383	0.388	0.172	0.175

Notes: Daysto 1/5/10/20/30%: number of days until the 1%/5%/10%/20%/30 % COVID-19 vaccination levels (total number of vaccine doses to total population); AverageNewCases: Average daily new infected COVID-19 cases per million of people since the first infected case recorded to the date of 1%/5%/10%/20%/30% vaccinated levels; YearsofSchooling: the average number of years in formal education that a person can expect to receive with the current enrolment rate at all level of education; GDPpercapita: GDP per capita ($1000); PopulationDensity: population density index (1,000 people/km2); Aged65older: share of populations with age 65 and over (%); VaccinePurchased: number of vaccines doses which countries have contracted to purchase from COVID-19 vaccine manufacturers (10 millions units); VaccinePolicy: average score of the COVID-19 vaccination policy chosen by a countries overtime (0-5), the higher the score, the broader vaccination targets are. Asia/Africa/Europe/Oceania: dummy continent control. Robust standard errors are in parentheses. * p < 0.10, ** p < 0.05, *** p < 0.01

Table A6: Speed of COVID-19 vaccination programs *(without pandemic and vaccine-related control variables)*

	(1) Daysto1%	(2) Daysto5%	(3) Daysto10%	(4) Daysto20%	(5) Daysto30%
Democracy (Authoritarian is the base group):					
Full	-18.858*	-20.372*	-24.861**	-11.532	-15.092
	(10.331)	(10.671)	(12.274)	(15.041)	(18.637)
Flawed	-24.279***	-38.909***	-39.235***	-18.208	-13.563
	(8.015)	(9.922)	(10.429)	(11.118)	(14.210)
Hybrid	-17.810*	-30.312**	-35.158*	-25.636*	-18.920
	(9.381)	(15.084)	(19.223)	(15.203)	(16.575)
YearsofSchooling	-4.885**	-6.714***	-5.620	-6.075**	-4.478*
	(1.873)	(2.396)	(3.471)	(2.567)	(2.305)
GDPpercapita	-0.534**	-0.854***	-1.049***	-1.335***	-1.620***
	(0.213)	(0.298)	(0.325)	(0.297)	(0.312)
PopulationDensity	0.547	0.052	-1.432	0.713	1.623
	(2.435)	(3.669)	(5.765)	(4.504)	(4.748)
Aged65older	1.041*	1.044	0.780	-0.168	-0.614
	(0.550)	(0.685)	(0.840)	(0.888)	(1.035)
Asia	-10.400	-13.102	-7.109	-2.420	0.730
	(9.869)	(11.514)	(12.826)	(11.717)	(12.424)
Africa	0.627	35.592*	31.758	-6.658	5.652
	(15.184)	(19.997)	(25.209)	(38.172)	(40.703)
Europe	-8.365	-14.905	-8.125	9.215	17.116
	(9.125)	(10.114)	(10.572)	(11.191)	(12.652)
Oceania	28.158**	19.618	24.757	41.887**	48.170**
	(12.664)	(16.729)	(20.495)	(18.299)	(18.397)
SouthAmerica	-10.884	-11.432	-11.191	-18.550	-23.561*
	(11.569)	(12.851)	(12.262)	(13.103)	(12.902)
Constant	134.481***	216.246***	228.183***	264.914***	270.952***
	(24.583)	(34.889)	(47.471)	(36.488)	(34.319)
Number of countries	118	109	104	96	91
Adj. *R*2	0.513	0.635	0.603	0.647	0.691

Notes: Weighted least squares with population size as weight. Daysto 1/5/10/20/30%: number of days until the 1%/5%/10%/20%/30 % COVID-19 vaccination levels (total number of vaccine doses to total population); YearsofSchooling: the average number of years in formal education that a person can expect to receive with the current enrolment rate at all level of education; GDPpercapita: GDP per capita ($1000); PopulationDensity: population density index (1,000 people/km2); Aged65older: share of populations with age 65 and over (%). Asia/Africa/Europe/Oceania: dummy continent control. Robust standard errors are in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A7: Cox proportional hazards model with failure event of reaching 30% vaccination uptake rate

	Hazard Ratio	Standard Error	z-statistic	95% Confidence interval	p-value
Democracy (reference: authoritarian):					
Full	1.440	0.745	0.71	(0.522-3.969)	0.481
Flawed	1.312	0.499	0.71	(0.621-2.768)	0.476
Hybrid	1.145	0.493	0.32	(0.492-2.666)	0.753
YearsofSchooling	1.162**	0.085	2.05	(1.006-1.343)	0.041
AverageNewCases	1.003**	0.001	2.02	(1.000-1.007)	0.043
GDPpercapita	1.025***	0.009	2.68	(1.006-1.044)	0.007
PopulationDensity	1.030	0.036	0.86	(0.961-1.105)	0.392
Aged65older	1.123	0.149	0.87	(0.865-1.458)	0.383
VaccinePurchased	1.000	0.003	0.11	(0.993-1.007)	0.909
Asia	1.237	0.503	0.52	(0.557-2.746)	0.6
Africa	0.149	0.103	-2.74	(0.038-0.583)	0.006
Europe	0.527	0.258	-1.3	(0.201-1.379)	0.192
Oceania	0.552	0.429	-0.76	(0.120-2.536)	0.446
SouthAmerica	1.287	0.622	0.52	(0.498-3.323)	0.601

Test of proportional-hazards assumption: Chi-Square (χ^2): 6.39; p-value : 0.956

Number of subjects (countries in analysis): 118

Number of failures (countries reach 30% vaccination uptake rate): 91

Notes: Breslow method for ties. AverageNewCases: Average daily new infected COVID-19 cases per million of people since the first infected case recorded to the date of 1%/5%/10%/20%/30% vaccinated levels; YearofSchooling: the average number of years in formal education that a person can expect to receive with the current enrolment rate at all level of education; GDPpercapita: GDP per capita ($1000); PopulationDensity: population density index (1,000 people/km2); Aged65older: share of populations with age 65 and over (%); VaccinePurchased: number of vaccines doses which countries have contracted to purchase from COVID-19 vaccine manufacturers (10 millions units); Asia/Africa/Europe/Oceania: dummy continent control. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

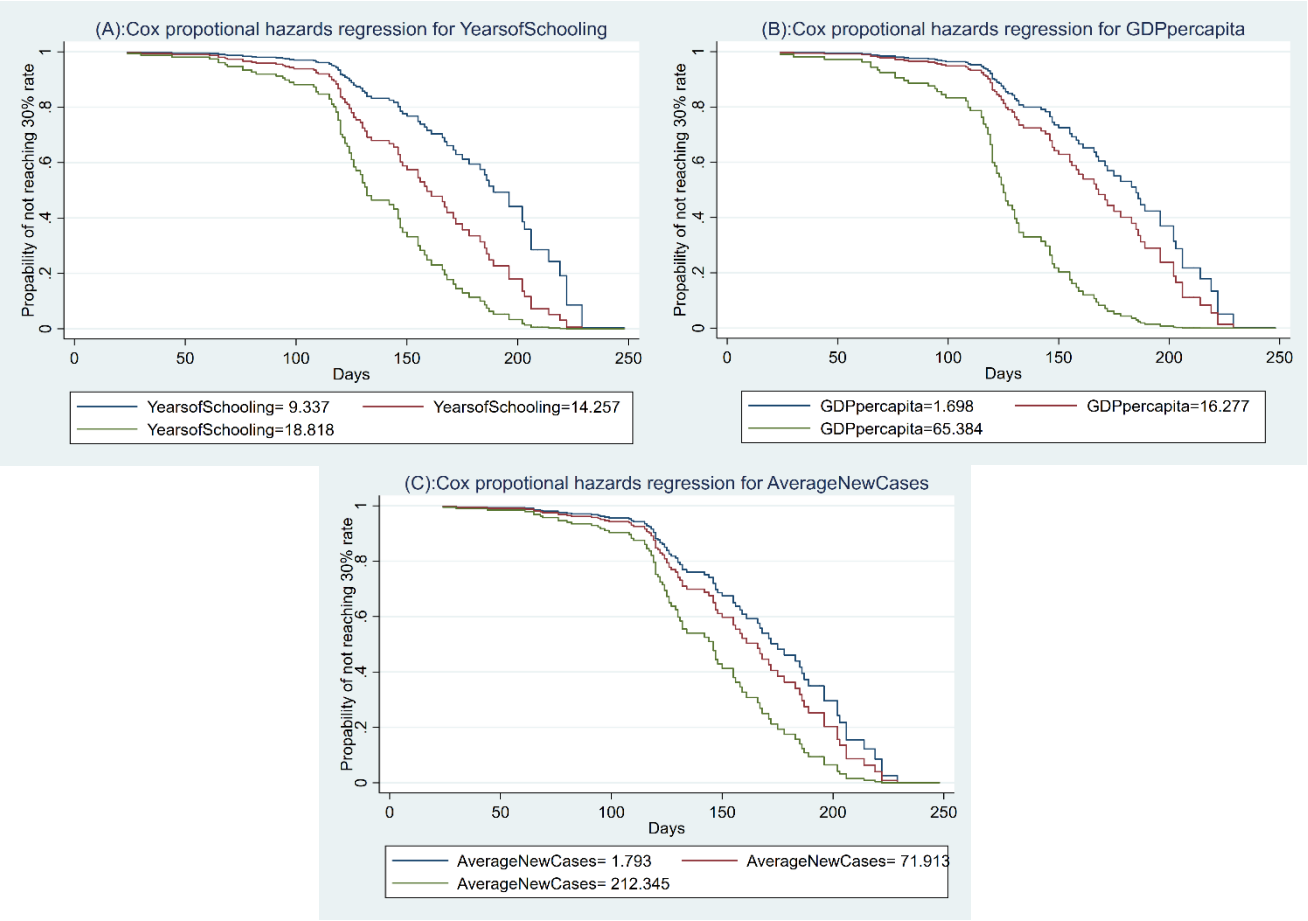

Figure A1. Predicted 250 days of reaching 30% vaccination uptake rate by YearsofSchooling, GDPpercapita, and AverageNewCases *(at 5th, 50th and 95th percentiles values)*

Note: AverageNewCases: Average daily new infected COVID-19 cases per million of people since the first infected case recorded to the date of 1%/5%/10%/20%/30% vaccinated levels; YearsofSchooling: the average number of years in formal education that a person can expect to receive with the current enrolment rate at all level of education; GDPpercapita: GDP per capita ($1000). Panel (A), (B), (C) show that the probability to reach 30% vaccination uptake rate is higher (survival probability is smaller) for a country with higher values of YearsofSchooling, GDPpercapita and AverageNewCases at a given time under the analysis.