How Does Globalisation Affect COVID-19 Responses?

Steve J. Bickley  
Queensland University of Technology

Ho Fai Chan (hofai.chan@qut.edu.au)  
Queensland University of Technology  https://orcid.org/0000-0002-7281-5212

Ahmed Skali  
Deakin University

David Stadelmann  
Universitat Bayreuth

Benno Torgler  
Queensland University of Technology

Research

Keywords: Coronavirus, COVID-19, Globalisation, Travel Restriction, Border Closure, Health Screening, Policy Analysis

DOI: https://doi.org/10.21203/rs.3.rs-39311/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Purpose This paper examines the effects of globalisation on the pace of governments implementing international travel restrictions during the recent coronavirus pandemic. Results We find that more globalised countries experienced a longer delay in implementing international travel restriction policies with respect to the date of the first confirmed COVID-19 case. We also find that informational (a subcomponent of social globalisation) and political globalisation have the strongest effects on the observed delays in implementing international travel restriction policies in more globalised countries. Lastly, we do not find evidence that more globalised countries are more likely to adopt a more restrictive international travel policy as the first response to the pandemic. Conclusions The findings highlight the dynamic relationship between globalisation and protectionism when governments respond to significant global events such as a public health crisis.

Background

The level of complexity around containing emerging and re-emerging infectious diseases has increased with the ease and increased incidence of global travel [1], along with greater global social, economic, and political integration [2]. In reference to influenza pandemics, but nonetheless applicable to many communicable and vector-borne diseases, the only certainty is in the growing unpredictability of pandemic-potential infectious disease emergence, origins, characteristics, and the biological pathways through which they propagate [3]. Globalisation of trade and increased international travel have been seen as some of the main human influences on the emergence, re-emergence, and transmission of infectious diseases in the 21st Century [4].

Emerging and re-emerging infectious diseases have been a major challenge for human health in ancient and modern societies alike [5–9]. The relative rise in infectious disease mortality and shifting patterns of disease emergence, re-emergence, and transmission in the current era have been attributed to increased global connectedness, among other factors [10]. More globalized countries and in particular global cities are at the heart of human influence on infectious diseases; these modern, densely populated urban centres, highly interconnected with the world economy in terms of social mobility, trade, and international travel [11, 12]. One might assume that given their high susceptibility to the transmission of infectious diseases, globalised countries would be more willing than less globalised countries to adopt screening, quarantine, travel restriction, and border control measures during times of mass disease outbreaks. However, given their nature, globalised countries would also be assumed to favour less protectionist policies in general; thus, contradicting the aforementioned assumption. Moreover, the costs of closing are comparatively higher for open countries than for already protective ones. Globalisation, after all, is known to promote growth and does so via a combination of three main globalisation dimensions: economic integration (flow of goods, capital and services, economic information and market perceptions), social integration (proliferation of ideas, information, culture and people), and political integration (diffusion of governance and participation in international coordination efforts) [13].
The recent COVID-19 pandemic has highlighted the vast differences in approaches to the control and containment of coronavirus across the world and has demonstrated the varied success of such approaches in minimising the transmission of coronavirus. Restrictive government policies formerly deemed impossible have been implemented within a matter of months across democratic and autocratic governments alike. This presents a unique natural experiment through which to observe and investigate a plethora of human behaviour and decision-making processes. We explore the relative weighting of risks and benefits in globalised countries who balance the known economic, social, and political benefits of globalisation with a higher risk of coronavirus emergence, spread, and extended exposure.

**Methods**

**Data**

The record for each country’s international travel policy response to COVID-19 is obtained from the Oxford COVID-19 Government Response Tracker (OxCGRT) database [14]. The database records the level of strictness on international travel from 1 January 2020 to the present (continual updating), categorised into 5 levels: 0 - no restrictions; 1 - screening arrivals; 2 - quarantine arrivals from some or all regions; 3 - ban arrivals from some regions; and 4 - ban on all regions or total border closure. At various points in time from the beginning of 2020 to the time of writing, 73 countries have introduced screening on arrival policy, 77 have introduced arrival quarantine, 133 have introduced travel bans, and 137 have introduced total border closures.

Covid-19 statistics were obtained from the COVID-19 Data Repository by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University [15]. The dataset consists of records on number of confirmed cases and death on a daily basis for 205 countries since January 2020.

Our measure of globalisation is generated from the 2019 KOF Globalisation Index (of more than 200 countries), published by the KOF Swiss Economic Institute[1]. The KOF Globalisation Index is made up of 44 individual variables (24 de facto and 20 de jure variables) relating to globalisation across economic, social, and political factors[2] (see also [12, 16]. The complete index is calculated as the average of the de facto and the de jure globalisation indices. In this analysis, we focus on the overall index as well as the major sub-components (i.e. Economic (Trade and Financial), Social (Interpersonal, Informational, and Cultural), and Political globalisation). Each index ranges from 1 to 100 (highest globalisation).
We also take into account that a country’s decision to adopt travel restrictions can be affected by the decision made by its (economic) neighbours. We constructed a variable to reflect this by averaging the international travel strictness of each country's ‘neighbours’ weighted by share of international tourism and foreign trade. We obtained inbound tourism data of 197 countries from the Yearbook of Tourism Statistics of the World Tourism Organization [17]. The data consist of total arrivals of non-resident tourists or visitors at national borders or in hotels or other types of accommodations and overnight stays of tourists, broken down by nationality or country of residence, from 1995 to 2018. Due to difference in statistical availability for each country, we take the year 2018 record (or 2017 if 2018 is not available) of arrivals of non-resident tourists/visitors at national borders as the country weights for the computation of foreign international travel policy. If the records of arrivals at national border are not available for these years, we check for the 2018 or 2017 records on arrivals or overnight stays in hotels or other types of accommodation before relying on records from earlier years. To calculate the weighted foreign international restriction policy, for each country, we calculated the weighted sum using the share of arrivals of other countries multiplied by the corresponding policy value ranging from 0 to 4 [3].

Additionally, we check our results using the share of total gross bilateral export or import in 2018 as the weights for constructing the weighted foreign policy variable. The data on trade, broken down by country, was obtained from the World Integrated Trade Solution – World Bank under the UN COMTRADE Standard International Trade Classification, Revision 4 (SITC Rev4) 2018 [18].

For additional control variables, we account for each country’s macroeconomic conditions, political, and geographical characteristics. First, we consider the country’s economic risk assessments taken from the International Country Risk Guide (ICRG), which is a composite rating accounting for factors such as inflation rate, real GDP growth, per capita GDP, balance of payment and current account as a percentage of GDP. From the World Development Indicators, we obtained the latest record of population density and the number of physicians per 1,000 people in the population, which we used to proxy for a country’s health system capability [4]. We also use the Boix-Miller-Rosato (BMR) dichotomous variable to identify democratic and autocratic countries [5] [19]. Lastly, we include continent dummies, whether the country is landlocked, and the land area (in log sq. km), which were obtained from GeoDist (CEPII) [20].

**Empirical strategy**
We hypothesize that more globalised countries are more likely to impose international travel restrictions later than less globalised countries. To test this hypothesis, we use records from the Oxford COVID-19 Government Response Tracker (OxCGRT; [14]) on the timing of restrictions on international travel for each country, COVID-19 case statistics from the Johns Hopkins University Center for Systems Science and Engineering COVID-19 dataset to derive our main dependent variable, namely, the time gap between the first national confirmed case and the first international travel restriction policy was implemented. We also calculate the number of days between the first confirmed case and each level of restriction imposed and test for the robustness of the results. Furthermore, we also conjecture that, as a consequence from the above, countries with higher levels of globalisation should have more confirmed cases by the time the first policy was introduced. Therefore, we also examine the relationship between globalisation and the number of confirmed case (in logs) at the time of policy implementation.

To study relationships between our outcome variables and the level of globalisation, we first present the simple correlations between them. We then apply ordinary least squares (OLS) regression models to estimate the following model:

$$Y_i = \alpha + \beta \text{Globalisation}_i + \mathbf{X}_i\mathbf{Y}_j + \epsilon_i$$  \hspace{1cm} (1)

where $Y_i$ is the number of days passed since the first Covid-19 case in country $i$ to the implementation of travel restriction or the number of cases (in log) at the time of the restriction was implemented, $\beta$ is the KOF globalisation index of country $i$ and $\mathbf{X}$ is a vector of country-specific controls such as the country’s health care capacity, economic risk, population density, geographical characteristics and the number of cases per million people in the population at the time of policy implementation.

Additionally, we examine how a country responds to the international travel policy implemented by those countries that contribute most towards its tourism sector. To do so, for each country, we constructed a variable based on the average strictness of international travel policy weighted by the share of tourists to the country of interest, calculated daily. We therefore include this variable, measured at the time of the focal country’s first implementation of the international travel policy into the regression.
[1] https://kof.ethz.ch/en/forecasts-and-indicators/indicators/kof-globalisation-index.html

[2] See https://ethz.ch/content/dam/ethz/special-interest/dual/kof-dam/documents/Globalization/2019/KOFGI_2019_method.pdf for detailed methods on the calculation of the weights of each component and the overall index

Results

First, we examine whether the level of globalisation of the country is correlated with the timing of international travel restrictions implementation. With a simple correlation analysis, we find that the Pearson’s correlations between the first policy implementation-first case gap and globalisation index is a significantly positive $\rho = 0.357 \ (p < 0.001; \ n = 166)$. Figure 1 also shows that countries which reacted before the first local Covid-19 case tend to adopt screening on arrivals or quarantine rules as the first precautionary measures. One noteworthy case is the United Kingdom, which only enforced quarantine on travellers from high-risk regions on the 8th June 2020, 129 days since Covid-19 first emerged in the country.

We also look at the correlation between the policy-first case gap and globalisation index for each travel restriction policy – in case the country imposed a more restrictive policy first or skipped the less restrictive policy (e.g., impose banning travel from high risk regions first and return to screening arrivals later or did not impose screening at all), we take the date of the earliest imposed more restrictive policy to calculate the gap. Thus, we interpret the gap as the number of days between the date of the first case and the date a country imposes a policy that is at least as strict.

We find the correlations are again positive and significant: 0.396 ($p = 0.0006; \ n = 71$), 0.397 ($p = 0.0005; \ n = 74$), 0.243 ($p = 0.0058; \ n = 128$), and 0.301 ($p = 0.0004; \ n = 131$) for screening, quarantine, banning high risk regions, and total border closure, respectively (see Fig. 2), showing that more globalised countries are more likely to impose international travel restrictions later, relative to the first confirmed case in the country.

We confirm this finding with OLS regressions results (Table 1). We find that the KOF globalisation index is significantly and positively correlated with the gap between the first confirmed case and the introduction of an international travel restriction policy. Specifically, for a one unit increase in the globalisation index (again, values ranging from 1 to 100), the number of days between the first restriction policy and the first case in the country increases by 0.82. We find similar results examining each specific strictness in which one unit increase in the KOF index corresponds to 1.32, 1.08, .94, and .96 days in the duration between the first case and the implementation of screening, quarantining arrivals, banning travels from high risk countries, and border closure, respectively. The coefficient of the KOF globalisation index is robustly estimated when we use bilateral trade (export or import volume) to determine the foreign policy variable (reliance on close trading partners, Table S1) or using the number of hospital beds or nurses and midwives per 1,000 people as proxy for health care capacity (Table S2).
It is noteworthy globalisation index is statistically significant even when including the number of cases per 1,000 people, i.e. globalization plays a role independently of the specific health situation in a country. The number of cases per 1,000 people is itself significantly and positively correlated with the length between the first case and policy introduction. Interestingly, we find that the international travel strictness of close foreign countries is positively correlated with the outcome variable, except for border closure, which might indicate that when neighbouring countries (in terms of tourism export or trade) heighten their travel restriction measures, thus generating positive externalities for their neighbours, there is less of an incentive for a country to impose travel restrictions earlier. We also find that the coefficients for democracy are negative and significant on case lags between first policy, screening, and banning travel from high risk countries. Surprisingly, we find that more population dense countries have a longer lag time between imposing travel restrictions measures and first case, while the economic risk rating and health system capacity have no effect on the timing of travel restriction implementation. Countries who are landlocked and/or smaller in terms of land size tend to have a shorter time gap between the date of travel restriction implementation and first case.
Table 1
Relationship between globalisation and duration of international travel restriction implementation-first confirmed COVID-19 case gap.

| Dependent variable | Days between policy introduction and first case |
|--------------------|-----------------------------------------------|
|                    | First policy | Screening | Quarantine | Ban (high risk) | Border closure |
| KOF Globalisation Index | 0.85*** | 1.31*** | 1.07** | 1.02*** | 1.00* |
|                     | (0.217)     | (0.366)   | (0.392)   | (0.283)       | (0.397)       |
| Case per 1,000 people in population | 0.021*** | 1.26* | 0.019*** | 0.047*** | 0.041 |
|                     | (0.00153)  | (0.516)   | (0.00200) | (0.0113)     | (0.0247)      |
| Democracy           | -12.2**    | -25.9*** | 3.03      | -17.4**       | -9.63†        |
|                     | (4.207)     | (6.904)   | (10.17)   | (5.449)       | (5.456)       |
| Foreign international restriction policy^ | 13.2*** | 39.1*** | 29.3*** | 22.8*** | 8.98 |
|                     | (1.633)     | (7.903)   | (7.353)   | (6.013)       | (9.215)       |
| In(Population density) | 3.55* | 6.78* | 4.14      | 6.69*** | 6.73*** |
|                     | (1.712)     | (2.499)   | (2.648)   | (1.861)       | (1.729)       |
| Economic risk rating | 0.36 | 0.95 | -0.38     | 0.30          | 0.23 |
|                     | (0.338)     | (0.587)   | (0.633)   | (0.436)       | (0.457)       |
| Physicians per 1,000 people | 0.41  | -2.88 | -1.61     | -1.13         | -1.54 |
|                     | (1.541)     | (1.929)   | (3.074)   | (1.483)       | (1.823)       |
| Landlocked          | -9.70*     | -18.3*    | -14.9†    | -4.07         | -2.39 |
|                     | (4.089)     | (7.693)   | (8.101)   | (5.215)       | (4.768)       |
| Continent           |            |            |            |            |
| Africa              | (ref.) | (ref.) | (ref.) | (ref.) | (ref.) |
| America             | 5.85     | 12.4† | -5.44    | -2.56        | 4.85 |
|                     | (6.037)     | (7.194)   | (16.31)   | (6.082)       | (6.017)       |
| Asia                | -2.83 | -3.55 | 17.6     | -9.64         | 8.47 |
|                     | (6.024)     | (7.438)   | (12.76)   | (6.505)       | (7.990)       |

Notes: OLS estimates. Standard errors (robust) in parentheses. † p < .10; * p < .05; ** p < .01; *** p < .001. ^For specific travel restrictions, we calculated the weighted share of countries implemented the same policy at the time of restriction implementation, with weights being the share of arrivals.
Do more globalised countries have more cases at the time the first restriction was introduced? We also find that the levels of globalisation are positively correlated with the number of confirmed cases at the time the country implements its first international travel restrictions (Fig. 1b). Pearson’s correlation between the KOF globalisation measure and the log number of confirmed cases at the time of first international travel policy implementation is 0.443 (p < 0.001; n = 169) and 0.439 (p = 0.0001; n = 71) when removing those with no cases at the time of policy implementation.
Table 2
Relationship between globalisation and number of confirmed COVID-19 cases at the time of international travel restriction implementation.

| Dependent variable | ln(Confirmed case + 1) |
|--------------------|-----------------------|
|                    | First policy | Screening | Quarantine | Ban (high risk) | Border closure |
| KOF Globalisation Index | 0.046* | 0.025 | 0.055 | 0.082** | 0.11** |
|                     | (0.0231) | (0.0228) | (0.0421) | (0.0281) | (0.0379) |
| Share of countries already adapted the policy | 0.82*** | 1.32* | 2.08* | 2.41*** | 1.99* |
|                     | (0.177) | (0.549) | (0.964) | (0.694) | (0.759) |
| ln(Population density) | 0.37† | 0.21 | 0.45 | 0.28 | 0.78*** |
|                     | (0.193) | (0.168) | (0.375) | (0.234) | (0.176) |
| Economic risk rating | 0.066 | 0.010 | 0.14 | 0.043 | 0.056 |
|                     | (0.0456) | (0.0295) | (0.102) | (0.0562) | (0.0466) |
| Physicians per 1,000 people | 0.026 | -0.082 | -0.072 | 0.059 | 0.050 |
|                     | (0.135) | (0.137) | (0.313) | (0.159) | (0.166) |
| Landlocked | -0.30 | -0.31 | -1.48† | -0.87 | -0.21 |
|                     | (0.427) | (0.352) | (0.832) | (0.569) | (0.536) |
| Continent | | | | | |
| Africa | (ref.) | (ref.) | (ref.) | (ref.) | (ref.) |
| America | 0.096 | -0.29 | -0.80 | 0.052 | 0.87 |
|                     | (0.386) | (0.584) | (1.205) | (0.560) | (0.575) |
| Asia | -0.25 | -0.50 | -0.35 | -0.32 | 0.50 |
|                     | (0.490) | (0.439) | (1.316) | (0.631) | (0.739) |
| Europe | 0.67 | -0.025 | 0.46 | 0.45 | 0.050 |
|                     | (0.673) | (0.604) | (1.331) | (0.931) | (1.007) |
| Pacific | -0.35 | 0.37 | -0.42 | -1.69 | -0.77 |
|                     | (0.968) | (0.483) | (0.864) | (1.221) | (0.894) |

Notes: OLS estimates. Standard errors (robust) in parentheses. † p < .10; * p < .05; ** p < .01; *** p < .001.
Likewise, in Table 2, we find strong positive coefficients of the globalisation index on the number of confirmed cases when the travel restriction policy was first introduced. In particular, it shows a 4.5% increase in confirmed cases at the time the first international restriction policy was imposed with a 1 unit increase in globalisation index. For different levels of strictness, we find the effect of globalisation is significant only for ban and border closure, not significant for quarantine, and only weakly significant for screening. For example, with a 1 unit increase in the globalisation index, the number of confirmed cases by the time banning on high risk regions and closing border was implemented, increases by 7.9%, and 10.4%, respectively.

Next, we assess which aspects of globalisation are more important in predicting the outcome by examining the effect of each (sub)components of the globalisation index. We first summarize the regression coefficients for each globalisation component in Fig. S1 by substituting the component with the overall globalisation index. Each regression includes the same set of control variables as those used in Tables 1 and 2. We find that the economic globalisation (and its trade and financial subcomponents) has a very weak effect, which is often not statistically significant, on the outcome variables, whereas social (particularly its informational and cultural subcomponents) have comparable significant effects on the two dependent variables. Political globalisation seems to have a stronger effect on the time duration between the first case and screening and quarantining policy implementation. Then, we include each of the subcomponents of each globalisation measure (i.e., subcomponents of economic and social globalisation and political globalisation) into the unconditional regression model (“horse-race” regression, see Fig. 2) to assess the relative importance of each globalisation aspect. We find that informational globalisation seems to be the strongest factor, followed by political globalisation which has a comparatively smaller but statistically significant effect.

Do more globalised countries impose a more restrictive policy first?

| Dependent variable | ln(Confirmed case + 1) | ln(Area in sq. kms) | Constant | |
|--------------------|----------------------|---------------------|----------|------|
|                    | ln                     |                     |          |      |
| ln(Area in sq. kms) | 0.34†                 | -0.052              | 0.68*    | 0.44* |
|                    | (0.191)               | (0.176)             | (0.307)  | (0.220) |
| Constant           | -10.9**               | -1.94               | -17.7**  | -12.5** |
|                    | (3.470)               | (2.932)             | (6.276)  | (4.178) |
| N                  | 113                   | 48                  | 45       | 83    |
| Prob. > F          | 0.000                 | .                   | .        | 0.000 |
| R²                 | 0.402                 | 0.214               | 0.490    | 0.472 |

Notes: OLS estimates. Standard errors (robust) in parentheses. † p < .10; * p < .05; ** p < .01; *** p < .001.
We address this question by taking the level of strictness of the first international travel policy implemented in each country as the dependent variable and regressing it on the KOF globalisation index (as well as its subcomponents), controlling for the date of policy implementation, number of cases per million, population density, economic risk rating, and physicians per 1,000 people. We use a multinomial logit model, since the dependent variable is categorical (outcome 1 = impose screening as the first policy; 2 = quarantine; 3 = ban travel from high risk regions; 4 = total border closure). We present the regression estimates in Table 2 with the average marginal effects on each outcome (policy choice). We use screening as first travel restriction policy as the reference group for the regression, hence, the parameter estimates (and the corresponding average marginal effects) are relative to the reference group.
Table 2
Choice of first international travel policy to implement in response to COVID-19

| First international travel restriction | Quarantine | Ban (high risk) | Border closure |
|---------------------------------------|------------|----------------|---------------|
| KOF Globalization Index               | -0.034     | -0.0061        | 0.29          |
|                                       | (0.0471)   | (0.0365)       | (0.190)       |
|                                       | -0.0056    | -0.0037        | 0.0094        |
| Date implemented                      | 0.062**    | 0.068***       | 0.81*         |
|                                       | (0.0210)   | (0.0180)       | (0.335)       |
|                                       | -0.0030    | -0.0055        | 0.024         |
| Democracy                             | 1.91†      | 1.40†          | -5.03         |
|                                       | (1.023)    | (0.762)        | (3.397)       |
|                                       | 0.14       | 0.19           | -0.16         |
| Case per 1,000 people in population   | 0.074      | 0.071          | -0.17         |
|                                       | (0.0797)   | (0.0797)       | (0.295)       |
|                                       | 0.0050     | 0.011          | -0.0069       |
| \(\ln(\text{Population density})\)   | -0.84**    | -0.54†         | -2.91*        |
|                                       | (0.320)    | (0.282)        | (1.289)       |
|                                       | -0.041     | 0.0079         | -0.076        |
| Economic Risk Rating                  | 0.077      | 0.048          | -0.037        |
|                                       | (0.0778)   | (0.0600)       | (0.191)       |
|                                       | 0.0060     | 0.0041         | -0.0025       |
| Physicians (per 1,000 people)         | 0.52†      | 0.22           | -1.84         |
|                                       | (0.276)    | (0.252)        | (1.173)       |
|                                       | 0.058      | 0.036          | -0.065        |
| Landlocked                            | -0.57      | 0.24           | -1.10         |
|                                       | (1.006)    | (0.796)        | (1.775)       |

Notes: Multinomial logistic regression estimates with screening as base outcome. Standard errors in parentheses and average marginal effects in italics. † \(p < .10\); * \(p < .05\); ** \(p < .01\); *** \(p < .001\).
| First international travel restriction |
|---------------------------------------|
| -0.074 | 0.098 | -0.035 |

**Continent**

| Continent | (ref.) | (ref.) | (ref.) |
|-----------|--------|--------|--------|
| Africa    | -0.79  | -0.51  | 5.28   |
|           | (1.253)| (1.000)| (3.759)|
| America   | -0.079 | -0.070 | 0.12   |
| Asia      | 1.06   | 1.88†  | 5.99†  |
|           | (1.276)| (1.036)| (3.120)|
| Europe    | -1.89  | -1.79  | 6.91   |
|           | (1.668)| (1.286)| (5.186)|
| Pacific   | -18.8  | 1.04   | 16.8   |
|           | (7692.0)| (1.641)| (10277.7)|
| ln(Area in sq. kms) | -0.067 | -0.27  | -0.47  |
|           | (0.236)| (0.185)| (0.642)|
|          | 0.013  | -0.036 | -0.0095|
| Constant  | -1354.9**| -1501.2***| -17876.5*|
|           | (460.2)| (394.4)| (7375.7)|
| Number of countries | 125 | | |
| Log likelihood | -101.181 | | |
| Prob. > Chi² | 0.000 | | |
| McFadden's pseudo R² | 0.343 | | |

Notes: Multinomial logistic regression estimates with screening as base outcome. Standard errors in parentheses and average marginal effects in italics. † p < .10; * p < .05; ** p < .01; *** p < .001.

In summary, we do not find that globalisation is an important factor in explaining the strictness of the policy adopted in the initial response to the pandemic outbreak (all coefficients of KOF Globalisation
Index are not statistically significant).

Discussion

Non-pharmaceutical interventions such as travel restrictions are an immediate means by which governments can delay infectious disease emergence and transmission [20], particularly during the early stages of a pandemic when pharmaceutical interventions such as vaccines are not available [21]. To our knowledge, this study is the first to explore the effects of globalisation (and its various subcomponents) on the timing and severity of international travel restrictions implemented during the recent COVID-19 pandemic. With a sample of more than 100 countries, we find that more globalised countries (as estimated by the KOF globalisation index) experience a longer delay in implementing international travel restriction policies with respect to the date of their first confirmed coronavirus case and have more confirmed cases by the time a measure was taken. The demonstrated effect size is quite substantial, for instance, we estimated that a 10 point increase in globalisation index (ranges from 1 to 100) is associated with an 8 days delay in the travel restriction response and a 4.5% increase in number of confirmed cases. Further, we find that informational (a subcomponent of social globalisation) and political globalisation have the strongest effects on the observed delays in implementing international travel restriction policies while economic globalisation has no apparent effect. This suggests that policy decisions on international travel restrictions may be less likely driven by the potential economic drawbacks of closing one’s border (from a protectionist viewpoint), rather providing some support that delays in policy implementation are due to global political connectedness and informational integration.

In sum, our findings suggest that the globalisation index (and in particular, the informational and political globalisation measures) may be a suitable proxy for the likelihood of implementing travel restriction policies during a global health crisis such as COVID-19. However, there is no evidence that more globalised countries are more likely to adopt more restrictive policies as the first response to the pandemic.

The benefits of incorporating individual behavioural reactions and governmental policies when modelling the recent coronavirus outbreak in Wuhan, China has been demonstrated [22] and the predictive power of including air travel in the modelling of global infectious disease transmission is proven [23, 24]. Further, empirical evidence points to a small yet significant positive relationship between the implementation of international travel restriction and the time delay in infectious disease emergence and transmission in the focal country [25–27]. Our results indicate that it could be reasonable to assume that global infectious disease forecasting could be improved by including the globalisation index as a proxy for a countries’ likelihood to implement travel restriction policies and hence, to predict the likely time delays in disease emergence and transmission across national borders. However, it is important to note that travel restriction policies do not typically completely mitigate the emergence of infectious diseases, instead delaying the importation of infectious diseases and potentially minimising the overall severity of outbreak [20, 25]. Geographical regions which are known hotspots for the emergence and re-emergence of infectious agents [28, 29] could be considered as early candidates for inbound country-specific travel restrictions in the event of mass disease outbreaks.
Due to the on-going state of COVID-19 transmission and continued enforcement of travel restriction policies, we are not yet unable to fully explore the relationship between globalisation and the easing of travel restrictions over time. As this data becomes available in the coming months, we will be able to explore various phenomena related to globalisation and the easing of international travel restrictions such as in the case of nations which open up too early (i.e., are these nations overconfident in their health system capability?) or the sequence of travel restriction easing events (i.e., do more globalised countries lift restrictions entirely in one go or do they go from strict to less strict?). To this end, further research is required to assess the drivers behind a nation’s decision to (not) close its border in a timely fashion despite their level of globalisation. It would therefore be interesting to explore other factors which could serve as effective moderators such as governance quality or the inclination to hear and act on advices from relevant health experts.

Conclusion

The recent COVID-19 pandemic highlights the vast differences in approaches to the control and containment of infectious diseases across the world and demonstrates their varied degrees of success in minimising the transmission of coronavirus. This paper examines the effects of globalisation on the timeliness of government interventions in the form of international travel restrictions. We find that more globalised countries experience a longer delay in implementing international travel restriction policies with respect to the date of the first confirmed COVID-19 case. We also find that informational and political globalisation have the strongest effects on the observed delays in implementing international travel restriction policies in more globalised countries. Nevertheless, we did not find substantial evidence that more globalised countries are more likely to adopt a more or less restrictive travel policy to first counter the pandemic. These findings highlight the relationship between globalisation and protectionist policies as governments respond to significant global events such as a public health crisis as in the case of the current COVID-19 pandemic.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials
Data and materials used in the study are available online on Open Science Framework (Center for Open Science; see https://osf.io/qg6kc/?view_only=414f0fa8c8a344c59bbdaa2c0f43153a).

**Competing interests**

There is no competing interest to declare.

**Funding**

There is no funding support for the study.

**Authors’ contributions**

SJB, HFC and BT designed the research; HFC extracted the data; SJB, HFC and BT analysed the data and draft the paper. AS and DS revised the manuscript and provided substantial inputs. All authors read and approved the final manuscript.

**Acknowledgements**

Not applicable.

**References**

1. Lim, P. L. (2014). Travel and the globalization of emerging infections. *Transcripts of the Royal Society of Tropical Medicine and Hygiene, 108*(1), 309-310. https://doi.org/10.1093/trstmh/tru051.

2. Lindahl, J. F., & Grace, D. (2015). The consequences of human actions on risks for infectious diseases: a review. *Infection Ecology & Epidemiology, 5*(1), 30048. https://doi.org/10.3402/iee.v5.30048.

3. Kilbourne, E. D. (2006). Influenza Pandemics of the 20th Century. *Emerging Infectious Diseases, 12*(1), 9-14.

4. Blake, D., Betson, M., Jones, B. A., Betson, M., & Pfeiffer, D. U. (2017). Eco-social processes influencing infectious disease emergence and spread. *144*(1), 26-36. https://doi.org/10.1017/S0031182016001414.

5. Armelagos, G. J., & McArdle, A. (1975). Population, Disease, and Evolution. *Memoirs of the Society for American Archaeology*(30), 1-10.

6. Barrett, R., Kuzawa, C., McDade, T., & Armelagos, G. (1998). Emerging and re-emerging infectious diseases: The third epidemiologic transition. *Annual Review of Anthropology, 27*, 247-271.
7. Cockburn, T. A. (1971). Infectious Diseases in Ancient Populations. *Current Anthropology, 12*(1), 45-62. https://doi.org/10.1086/201168.

8. Elinor, K. K., Dominic, P. K., & Pardis, C. S. (2014). Natural selection and infectious disease in human populations. *Nature Reviews Genetics, 15*(6), 379. https://doi.org/10.1038/nrg3734.

9. Spencer Larsen, C. (2018). The Bioarchaeology of Health Crisis: Infectious Disease in the Past. *47*(1), 295-313. https://doi.org/10.1146/annurev-anthro-102116-041441.

10. Kock, R. A. (2013). Will the damage be done before we feel the heat? *Infectious disease emergence and human response. 14*(2), 127-132. https://doi.org/10.1017/S1466252313000108.

11. Ali, S. H., & Keil, R. (2006). Global Cities and the Spread of Infectious Disease: The Case of Severe Acute Respiratory Syndrome (SARS) in Toronto, Canada. *Urban Studies, 43*(3), 491-509. https://doi.org/10.1080/00420980500452458.

12. Keil, R., & Ali, H. (2007). Governing the Sick City: Urban Governance in the Age of Emerging Infectious Disease. *Antipode, 39*(5), 846-873. https://doi.org/10.1111/j.1467-8330.2007.00555.x.

13. Dreher, A. (2006). Does globalization affect growth? Evidence from a new index of globalization. *Applied Economics, 38*(10), 1091-1110. https://doi.org/10.1080/00036840500452458.

14. Hale, T., Webster, S., Petherick, A., Phillips, T., & Kira, B. (2020). Oxford COVID-19 Government Response Tracker.

15. Dong, E., Du, H., & Gardner, L. (2020). An interactive web-based dashboard to track COVID-19 in real time. *The Lancet infectious diseases, 20*(5), 533-534. https://doi.org/10.1016/S1473-3099(20)30120-1.

16. Gygli, Savina, Florian Haelg, Niklas Potrafke and Jan-Egbert Sturm (2019): The KOF Globalisation Index – Revisited, Review of International Organizations, *14*(3), 543-574 https://doi.org/10.1007/s11558-019-09344-2.

17. World Tourism Organization (2020), Yearbook of Tourism Statistics, Data 2014 – 2018, 2020 Edition, UNWTO, Madrid. https://doi.org/10.18111/9789284421442.

18. UN COMTRADE (2020). United Nations Commodity Trade Statistics Database. United Nations Statistical Division (New York: United Nations).

19. Boix, C., Miller, M., & Rosato, S. (2013). A complete data set of political regimes, 1800–2007. *Comparative Political Studies, 46*(12), 1523-1554. https://doi.org/10.1177/0010414012463905.

20. Mayer, T. & Zignago, S. (2011). Notes on CEPII’s distances measures : the GeoDist Database CEPII Working Paper 2011-25.

21. Ryu, H. Gao, J. Y. Wong, E. Y. C. Shiu, J. Xiao, M. W. Fong, et al., "Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings-International Travel-Related Measures," *Emerging infectious diseases, vol. 26*, 2020.

22. C. Chong and B. C. Ying Zee, "Modeling the impact of air, sea, and land travel restrictions supplemented by other interventions on the emergence of a new influenza pandemic virus," *BMC Infectious Diseases, vol. 12*, p. 309, 2012.
23. Lin, S. Zhao, D. Gao, Y. Lou, S. Yang, S. S. Musa, et al., "A conceptual model for the coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China with individual reaction and governmental action," International Journal of Infectious Diseases, vol. 93, pp. 211-216, 2020.

24. Hosseini, S. H. Sokolow, K. J. Vandegrift, A. M. Kilpatrick, and P. Daszak, "Predictive Power of Air Travel and Socio-Economic Data for Early Pandemic Spread (Predicting Pandemic Spread)," PLoS ONE, vol. 5, p. e12763, 2010.

25. Hufnagel, D. Brockmann, and T. Geisel, "Forecast and control of epidemics in a globalized world," Proceedings of the National Academy of Sciences of the United States of America, vol. 101, p. 15124, 2004.

26. Mateus, H. Otete, C. R. Beck, G. P. Dolan, and J. Nguyen-Van-Tam, "Effectiveness of travel restrictions in the rapid containment of human influenza: a systematic review," Bulletin Of The World Health Organization, vol. 92, pp. 868-+, 2014.

27. Caley, N. G. Becker, and D. J. Philp, "The Waiting Time for Inter-Country Spread of Pandemic Influenza (Delaying Pandemic Importation)," PLoS ONE, vol. 2, p. e143, 2007.

28. M. Epstein, D. M. Goedecke, F. Yu, R. J. Morris, D. K. Wagener, and G. V. Bobashev, "Controlling Pandemic Flu: The Value of International Air Travel Restrictions (Controlling Pandemic Flu)," PLoS ONE, vol. 2, p. e401, 2007.

29. A. Murray, N. Preston, T. Allen, C. Zambrana-Torrelio, P. R. Hosseini, and P. Daszak, "Global biogeography of human infectious diseases," Proceedings of the National Academy of Sciences, vol. 112, p. 12746, 2015.

30. F. Smith, D. F. Sax, S. D. Gaines, V. Guernier, and J. F. Guégan, "GLOBALIZATION OF HUMAN INFECTIOUS DISEASE," Ecology, vol. 88, pp. 1903-1910, 2007.

Figures
Figure 1

Correlation between the globalisation level of a country and a) the number of days between the first international travel restriction policy implemented and the first confirmed case; and b) the number of confirmed cases (log scale) at the time of first policy being implemented. The colours represent the four international travel restriction implemented first in each country.
Figure 2

Correlation between international travel restriction policy-first confirmed case gap and globalisation.
Figure 3

Horse race between Economic, Social, and Political globalization on a) late international travel restriction policy implementation and b) number of cases at policy implementation. Coefficients estimates obtained using OLS with robust SEs, controlling for number of confirmed case at time of implementation, population density and economic risk rating. † p < .10; * p < .05; ** p < .01; *** p < .001.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementaryInformation.docx