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International Tourism and Outbreak of Coronavirus (COVID-19): A Cross-Country Analysis

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Abstract

This study examines the relationship between international tourism and COVID-19 cases and associated deaths in more than 90 nations. We use a cross-country regression analysis and find a positive correlation between international tourism and the cumulated level of COVID-19 confirmed cases and death by April 30, 2020. Our regression analyses show that countries exposed to high flows of international tourism are more prone to cases and deaths caused by the COVID-19 outbreak. This association is robust even after controlling for other socioeconomic determinants of COVID-19 outbreak and regional dummies. Based on our estimations, a 1% higher level of inbound and outbound tourism is associated with 1.2% and 1.4% higher levels of confirmed COVID-19 cases and death, respectively, controlling for other factors. When we normalize the number of cases and death by size of population, the statistical significance remains robust, especially for the COVID-19 deaths, while the effect size reduces.

Keywords

coronavirus, global tourism, COVID-19 pandemic, cross-country regression

Introduction

Around mid-December 2019, Wuhan, one of the most popular cities in China, experienced an outbreak of coronavirus (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (Yang, Zhang, and Chen 2020). By April 30, 2020, COVID-19 has affected 3,130,800 people and has caused more than 227,000 deaths worldwide (ECDP 2020). The World Health Organization declared the outbreak as a public health emergency of international concern on January 30, 2020, and a pandemic on March 11, 2020. The negative impacts of COVID-19 are not only limited to the loss of human lives, but they also include short- and long-term social, economic, and political effects. The Organization for Economic Co-operation and Development (OECD 2020), for example, forecasts that a long-lasting and more intensive COVID-19 outbreak is likely to drop global growth to 1.5% in 2020, which is half the projected rate of growth prior to the outbreak, with implications for international tourism. Similarly, the International Monetary Fund forecasts that COVID-19 outbreak will cause a global recession in 2020 that could be worse than the one triggered by the global financial crisis of 2008–2009.

However, the relationship between international tourism and pandemic outbreaks is antipodal. The COVID-19 outbreak will have severe consequences for international tourism, with concomitant effects on the economic growth and prosperity of several nations (Gössling, Scott, and Hall 2020). Recently, Yang et al. (2020) demonstrated that infectious disease outbreaks (including COVID-19) impeded on tourism growth given the industry's reliance on human mobility. At the same time, however, the threats international tourism poses to global public health during a pandemic should also well recognized (Richter 2003). In an era of jet travel, it is easy for an individual incubating COVID-19 to board a plane and travel unnoticed by health and immigration authorities, infecting several people at source as well as in the destination country. Cruise tourism has aggravated the situation as the disease has spread across thousands of cruise

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ship passengers and crew members since the start of the COVID-19 pandemic. Key cruise industry players such as Carnival, Royal Caribbean, and Norwegian have witnessed a rapid rise in COVID-19 cases among passengers and crew members. Mallapaty (2020) provides a thorough discussion on the role of cruise tourism in the outbreak of COVID-19. The news media in many countries has reported many of such cases (Cain, Matousek, and Su 2020). Given that the spread of COVID-19 relies heavily on human-to-human interactions, the movement of people internationally could be a dominant driver of its outbreak and magnitude.

Thus, while an appreciation of the health and socioeconomic consequences of the pandemic is required, it is equally important to understand potential factors explaining the number of COVID-19 cases and death and the role of international tourism within those determinants. In this study, we investigate the factors that may explain cross-country variations in the outbreak of COVID-19 and the associated human loss. The research question of this study is developed as follows: Is COVID-19 outbreak more apparent in countries with higher inbound and outbound international tourism? To answer this research question, we use data for more than 90 countries and multiple regression analysis, where the current cumulated level of COVID-19 cases and death is hypothesized to be explained by cross-country variation in the degree of inbound and outbound tourism as well as other socioeconomic differences. We find a statistically significant positive association between past records of international tourism and cross-country variation in the number COVID-19 cases and death, ceteris paribus. To our knowledge, this research is among the first empirical studies that explores the link between tourism flows and the COVID-19 outbreak.

Data and Methodology

We hypothesize that countries with higher flows of inbound and outbound international tourists have higher levels of COVID-19 outbreak, ceteris paribus. To test this hypothesis, we use confirmed cases of COVID-19 cases and death figures obtained from the European Centre for Disease Prevention and Control (ECDC, 2020). The data provided by ECDC contains the number of new cases and deaths each day. Most presentation of COVID-19 data relates to the total number of cases and deaths per country. We generate the cumulative sum of confirmed cases and deaths of COVID-19 by April 30, 2020.

Equation 1 presents the empirical model of the study:

$$COVID19\,cases\,or\,death_i = \beta_1.International\_tourism_i + \beta_2.Controls_i + \varepsilon_i \quad (1)$$

with $i = 1, \ldots, 92$. The subscript i refers to country i.

The main explanatory variable is *international tourism*, which was measured using the average (log of) number of arrivals and departures of international tourists from 2010 to 2019, provided by the World Bank (2020). International inbound tourists are the number of people who travels to a country other than where they live, for a period less than 12 months. International outbound tourists are the number of departures that people make from their country of usual residence to any other country for any purpose other than a remunerated activity in the country visited. While estimating the different specifications, we control for other possible drivers of COVID-19 cases and death (a discussion of those drivers is provided by Farzanegan, Feizi, and Gholipour 2020). To illustrate the association between international tourism and COVID-19 outbreak, we present the correlation between cumulated COVID-19 confirmed cases (Figure 1) and associated deaths (Figure 2) as at April 30, 2020, and the total international tourism (arrivals and departures). We find that international tourism is positively associated with COVID-19 outbreak cases ($r = 0.78$) and fatalities

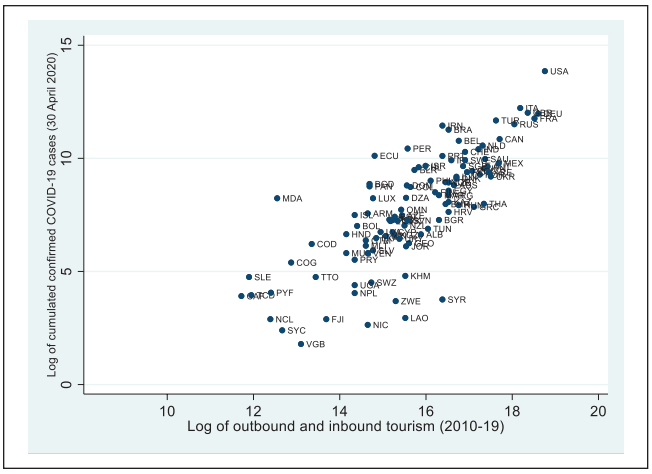

Figure 1. Comovement of international tourism and cumulated COVID-19 confirmed cases (April 30, 2020).

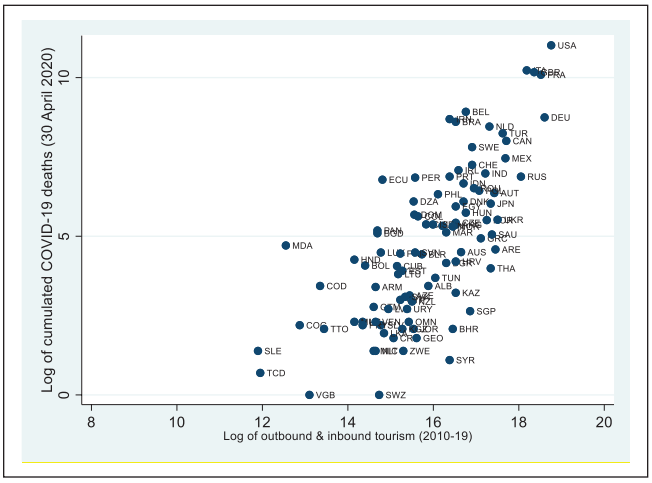

Figure 2. Comovement of international tourism (2010–2019) and cumulated COVID-19 confirmed deaths (April 30, 2020).

Table 1. Regression Results with Confirmed Case of COVID-19 as a Dependent Variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Log of Total Confirmed COVID-19 Cases (by April 30, 2020)							
Log of international tourism (outbound + inbound)	1.242***	1.237***	1.125***	1.210***	1.132***	1.196***	1.216***	1.126***
	(7.67)	(7.59)	(7.24)	(7.54)	(7.03)	(7.29)	(7.48)	(7.08)
Log of population density		0.079						−0.030
		(0.77)						(–0.27)
Log of GDP per capita (PPP, US$)			0.458**					0.317
			(2.31)					(1.02)
Share of population beyond 65 years of age in total population				0.030				−0.034
				(1.01)				(–0.90)
Log of out of pocket spending on health (PPP, US$ per capita)					0.593***			0.599**
					(2.85)			(2.48)
Log of number of nurses per 1,000 population						0.256		−0.295
						(1.02)		(–0.71)
Log of hospital beds per 1,000 population							0.303	0.181
							(1.22)	(0.61)
America dummy	0.388	0.567	−0.089	0.334	−0.258	0.262	0.193	−0.572
	(0.43)	(0.61)	(–0.09)	(0.36)	(–0.26)	(0.26)	(0.21)	(–0.57)
EU & Central Asia dummy	0.084	0.230	−0.576	−0.161	−0.728	−0.367	−0.430	−0.756
	(0.10)	(0.26)	(–0.61)	(–0.17)	(–0.76)	(–0.36)	(–0.49)	(–0.80)
East Asia Pacific dummy	−1.250	−1.144	−1.725*	−1.328	−1.647	−1.490	−1.528	−1.820*
	(–1.29)	(–1.21)	(–1.70)	(–1.33)	(–1.63)	(–1.37)	(–1.52)	(–1.82)
Middle East & North Africa dummy	−0.140	−0.021	−0.748	−0.106	−0.763	−0.348	−0.352	−1.160
	(–0.16)	(–0.02)	(–0.78)	(–0.12)	(–0.80)	(–0.35)	(–0.40)	(–1.26)
Sub-Sahara Africa dummy	−1.521	−1.401	−1.723	−1.523	−1.326	−1.626	−1.767	−1.533
	(–1.41)	(–1.34)	(–1.56)	(–1.41)	(–1.18)	(–1.36)	(–1.64)	(–1.44)
Constant	−11.516***	−11.916***	−13.593***	−11.212***	−12.574***	−10.851***	−11.076***	−14.720***
	(–4.28)	(–4.39)	(–4.19)	(–4.19)	(–4.42)	(–3.95)	(–4.13)	(–3.66)
N	92	92	92	92	92	92	92	92
R-squared	0.66	0.66	0.67	0.66	0.68	0.66	0.66	0.69

Note: Robust *t* statistics are in parentheses. ***, **, * refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Explanatory variables (except of regional dummies) are average values between 2010 and 2019.

($r = 0.72$). To check the robustness of this correlation, we control for other possible determinants of COVID-19 outbreak in multiple regression analysis, which we discuss in the next section.

Results

We use the ordinary least squares estimation method with robust standard errors to estimate the model. In Table 1, we use the logarithm of the cumulated confirmed cases of COVID-19 by April 30, 2020, as the dependent variable. In all models, we include regional dummies which may also explain part of cross country variation in the outbreak of COVID-19. The different specifications control for the various determinants of the outbreak and fatalities of COVID-19. In all specifications, we include the same number of countries as in the general specification. Thus, the changes in the estimated coefficients across the different specifications are not due to inclusion or exclusion of a specific country, facilitating the sensitivity analysis of the tourism effect on COVID-19 outbreak.

Our results show that there is a significant and robust association between international tourism flows (inbound and outbound) of countries and their levels of exposure to COVID-19 (Table 1). International tourism is the strongest predictor of cross-country variations in COVID-19 confirmed cases. Model 8, which includes the full set of control variables, suggests that countries with a 1% increase in inbound and outbound tourism over the last decade is associated with 1.2% increase in the number of COVID-19 confirmed cases. Among all included control variables, only the out-of-pocket spending on health is a significant explanatory variable for COVID-19 confirmed cases. Countries with a 1% higher level of out-of-pocket spending on health (i.e., higher financial costs of health care on individuals) is associated with a 0.6% increase in COVID-19 confirmed cases. More than 65% cross-country variance in log of cumulated confirmed cases is explained by the variables included in our regression model (Table 1).

Table 2 shows the determinants of the logarithm of cumulated deaths related to COVID-19 by April 30, 2020. We cover 85 countries for which we have full data on both the dependent and independent variables (Table 2). Countries with a 1% increase in international tourism in the past decade are associated with 1.4% higher levels of confirmed COVID-19 death. Among the control variables, only the numbers of

Table 2. Regression Results with Death Caused by COVID-19 as a Dependent Variable.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Log of Total Confirmed Deaths of COVID-19 (by April 30, 2020)							
Log of international tourism (outbound + inbound)	1.401***	1.403***	1.399***	1.364***	1.366***	1.401***	1.425***	1.399***
	(7.07)	(7.10)	(7.52)	(6.87)	(6.92)	(6.85)	(6.83)	(6.97)
Log of population density		0.066						−0.000
		(0.46)						(–0.00)
Log of GDP per capita (PPP, US$)			0.012					−0.385
			(0.04)					(–0.90)
Share of population beyond 65 years of age in total population				0.038				0.060
				(0.93)				(1.23)
Log of out of pocket spending on health (PPP, US$ per capita)					0.343			0.587
					(1.29)			(1.40)
Log of number of nurses per 1,000 population						0.003		0.092
						(0.01)		(0.20)
Log of hospital beds per 1,000 population							−0.371	−0.745**
							(–1.24)	(–2.18)
America dummy	0.408	0.576	0.398	0.338	0.052	0.406	0.528	0.204
	(0.45)	(0.60)	(0.41)	(0.36)	(0.05)	(0.44)	(0.67)	(0.21)
EU & Central Asia dummy	−0.269	−0.135	−0.284	−0.584	−0.743	−0.276	0.247	−0.225
	(–0.31)	(–0.15)	(–0.28)	(–0.58)	(–0.69)	(–0.27)	(0.29)	(–0.22)
East Asia Pacific dummy	−1.439	−1.360	−1.454	−1.602	−1.795	−1.444	−1.140	−1.368
	(–1.43)	(–1.29)	(–1.29)	(–1.43)	(–1.52)	(–1.28)	(–1.19)	(–1.29)
Middle East & North Africa dummy	−1.078	−0.965	−1.092	−1.039	−1.438	−1.082	−0.933	−0.976
	(–1.09)	(–0.95)	(–1.01)	(–1.02)	(–1.30)	(–1.02)	(–1.04)	(–1.01)
Sub–Sahara Africa dummy	−2.242*	−2.134*	−2.247*	−2.233*	−2.285*	−2.245*	−1.976*	−1.666
	(–1.90)	(–1.81)	(–1.91)	(–1.91)	(–1.99)	(–1.89)	(–1.71)	(–1.57)
Constant	−17.166***	−17.611***	−17.227***	−16.836***	−18.227***	−17.158***	−17.468***	−16.829***
	(–5.25)	(–5.26)	(–4.29)	(–5.11)	(–4.97)	(–5.10)	(–5.20)	(–3.12)
N	85	85	85	85	85	85	85	85
R-squared	0.58	0.58	0.58	0.58	0.59	0.58	0.59	0.61

Note: Robust *t* statistics are in parentheses. ***, **, and * refer to statistical significance at the 1%, 5%, and 10% levels, respectively. Explanatory variables (except of regional dummies) are average values between 2010 and 2019.

hospital beds per 1,000 population has a statistically significant, but negative association with COVID-19 deaths records: countries with a 1% higher levels of hospital beds per 1,000 population in the past years are recoding a 0.7% lower levels of deaths related COVID-19. We also reestimate our models using per capita levels of cumulated COVID-19 cases and deaths. The results are shown in Tables 3 and 4. We find more robust and significant results for the case of per capita COVID-19 deaths, but with smaller effect size of tourism.

Conclusion

Using data from a sample of more than 90 countries and applying multiple regression analysis, we find a positive and significant association between the past records of international tourism and the current cumulated numbers of confirmed cases and deaths resulting from COVID-19. This association remains robust even after controlling for other socioeconomic drivers of COVID-19 outbreak. Our finding that international tourism has serious consequences for the COVID-19 outbreak has important policy implications, especially for major tourism destinations such as France, Italy, and Spain as well as for countries with high volumes of outbound tourism such as China and the United States. While the economic contribution of international tourism is significant, policy-makers should not underestimate the adverse consequences of tourism arrivals and departures on the magnitude of the pandemic.

Our findings suggest that more controls are needed on the health aspects of the tourism industry and accountability of the main players of this industry with respect of health and safety standards. While there has been several economic evaluations of the effects of border closure (e.g., Boyd et al. 2017), our findings suggest that closing the international borders is an effective strategy for a country to reduce the magnitude of the pandemic. In current time, it is also important for countries where the number of COVID-19 cases is still low to impose stringent health and other sanitary requirements on travellers. More effective coordination between health and immigration authorities, political will, and surveillance of the international borders are also required. Airports, airplanes, cruise terminals, and ships should be disinfected more often to avoid contamination. The airline and cruise tourism industry should put in place a robust and effective pandemic planning strategy. Complacency and denial will only further aggravate the outbreak, making future policy choices less palatable, with serious implications for human lives.

Table 3. Regression Using per Capita Numbers of COVID-19 Death (log).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Log of Total COVID-19 Deaths per Capita (by April 30, 2020)							
Log of international tourism (outbound + inbound)	0.486***	0.491***	0.274**	0.370***	0.383***	0.393***	0.485***	0.258*
	(3.51)	(3.60)	(2.11)	(2.84)	(2.85)	(3.00)	(3.46)	(1.98)
Log of population density		0.193						0.117
		(1.62)						(1.06)
Log of GDP per capita (PPP, US$)			0.965***					0.584**
			(5.26)					(2.14)
Share of population beyond 65 years of age in total population				0.119***				0.091**
				(3.43)				(2.54)
Log of out-of-pocket spending on health (PPP, US$ per capita)					1.006***			0.386
					(5.61)			(1.33)
Log of number of nurses per 1,000 population						0.624***		0.207
						(3.33)		(0.66)
Log of hospital beds per 1,000 population							0.018	−0.896***
							(0.07)	(–3.19)
America dummy	2.625***	3.113***	1.759**	2.403***	1.581**	2.161***	2.619***	1.963***
	(5.37)	(5.60)	(2.59)	(4.56)	(2.17)	(2.83)	(5.24)	(2.88)
EU & Central Asia dummy	3.425***	3.817***	2.143***	2.430***	2.032***	2.154***	3.399***	2.419***
	(7.29)	(7.94)	(3.09)	(4.09)	(2.78)	(2.82)	(6.04)	(3.76)
East Asia Pacific dummy	0.995**	1.227**	−0.198	0.481	−0.049	0.065	0.981*	0.036
	(2.01)	(2.37)	(–0.25)	(0.80)	(–0.06)	(0.08)	(1.80)	(0.05)
Middle East & North Africa dummy	2.021***	2.351***	0.858	2.145***	0.966	1.346*	2.014***	1.335**
	(3.91)	(4.60)	(1.18)	(4.10)	(1.36)	(1.70)	(3.84)	(2.16)
Sub–Sahara Africa dummy	1.024	1.338	0.588	1.053	0.896	0.532	1.011	1.403**
	(0.97)	(1.41)	(0.75)	(1.20)	(1.16)	(0.50)	(0.95)	(2.23)
Constant	−21.846***	−23.142***	−26.881***	−20.802***	−24.960***	−20.334***	−21.831***	−26.302***
	(–9.92)	(–10.36)	(–10.19)	(–9.98)	(–10.60)	(–9.29)	(–9.83)	(–7.98)
N	85	85	85	85	85	85	85	85
R-squared	0.45	0.46	0.57	0.52	0.57	0.49	0.45	0.65

Table 4. Regression Using per Capita Numbers of COVID-19 Confirmed Cases (log).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent Variable: Log of Total Confirmed cases per Capita							
Log of international tourism (outbound + inbound)	0.324***	0.310**	−0.032	0.204*	0.108	0.157	0.257**	−0.035
	(2.78)	(2.61)	(–0.31)	(1.82)	(0.98)	(1.52)	(2.36)	(–0.32)
Log of population density		0.225						0.075
		(1.60)						(0.89)
Log of GDP per capita (PPP, US$)			1.402***					1.302***
			(9.20)					(6.15)
Share of population beyond 65 years of age in total population				0.112***				−0.014
				(3.73)				(–0.46)
Log of out of pocket spending on health (PPP, US$ per capita)					1.172***			0.351**
					(6.43)			(2.11)
Log of number of nurses per 1,000 population						0.944***		−0.162
						(4.71)		(–0.59)
Log of hospital beds per 1,000 population							0.812***	0.028
							(3.49)	(0.13)
America dummy	2.441***	2.955***	0.981	2.238***	1.165	1.976*	1.920***	0.961
	(3.54)	(4.04)	(1.57)	(3.29)	(1.63)	(1.99)	(3.35)	(1.44)
EU & Central Asia dummy	3.617***	4.035***	1.593***	2.694***	2.012***	1.953**	2.242***	1.748***
	(5.77)	(6.46)	(2.67)	(4.05)	(3.03)	(2.09)	(3.57)	(3.05)
East Asia Pacific dummy	1.168	1.472*	−0.286	0.876	0.384	0.282	0.424	−0.154
	(1.48)	(1.96)	(–0.47)	(1.15)	(0.56)	(0.29)	(0.60)	(–0.27)
Middle East & North Africa dummy	2.798***	3.139***	0.937	2.927***	1.568**	2.030**	2.231***	0.910
	(3.90)	(4.57)	(1.55)	(4.18)	(2.19)	(2.07)	(3.71)	(1.57)
Sub-Sahara Africa dummy	0.790	1.132	0.170	0.781	1.176	0.404	0.132	0.488
	(0.73)	(1.07)	(0.24)	(0.81)	(1.16)	(0.33)	(0.15)	(0.70)
Constant	−15.997***	−17.142***	−22.360***	−14.854***	−18.088***	−13.547***	−14.820***	−23.441***
	(–8.24)	(–8.03)	(–11.29)	(–8.03)	(–9.81)	(–6.98)	(–8.45)	(–9.79)
N	92	92	92	92	92	92	92	92
R-squared	0.47	0.49	0.75	0.53	0.64	0.58	0.53	0.76

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