INTERNATIONAL MONETARY FUND

Corruption Kills: Global Evidence from Natural Disasters

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WP/23/220

2023
OCT

WORKING PAPER

 WP/23/220

IMF Working Paper

European Department

Corruption Kills: Global Evidence from Natural Disasters

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Authorized for distribution by Bernardin Akitoby

October 2023

Abstract

Natural disasters are inevitable, but humanitarian and economic losses are determined largely by policy preferences and institutional underpinnings that shape the quality of public infrastructure (including emergency responses and healthcare services) and govern business practices and the adherence to building codes. In this paper, we empirically investigate whether corruption increases the loss of human lives caused by natural disasters, using a large panel of 135 countries during the period 1980–2020. The econometric analysis provides convincing evidence that corruption increases the number of disaster-related deaths, after controlling for economic, demographic, healthcare and institutional factors. That is, the higher the level of corruption in a given country, the greater the number of fatalities as a share of population due to natural disasters. Our results show that the devastating impact of corruption on loss of human lives caused by natural disasters is significantly greater in developing countries, which are even more vulnerable to nonlinear effects of corruption.

JEL Classification Numbers:	D31; D73; H41; P16; Q54
Keywords:	Corruption; institutions; natural disasters; fatalities
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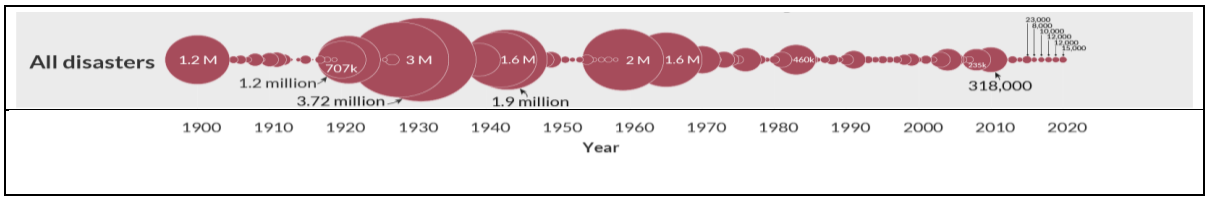
[1] The authors would like to thank Azar Sultanov for helpful comments and suggestions.

I. INTRODUCTION

Natural disasters are inevitable, resulting in significant economic losses and tens of thousands of deaths in most years across the world. In high fatality years, which tend to be those with major earthquakes or cyclones, the number of deaths caused by natural disasters may reach hundreds of thousands (Figure 1).[2] Over the course of modern history, there has been a continuous reduction in the number of fatalities caused by natural disasters owing to better living standards, more resilient physical infrastructure, better early warning indicators and stronger emergency response systems (Figure 2). However, there are still important disparities across countries in humanitarian and economic losses. For example, an earthquake measuring 7 on the Richter scale devastated Haiti and killed more than 200,000 people in 2010, while earthquakes of similar magnitude (7.2 on the Richter scale) caused only minor fractures and injuries in Mexico and New Zealand. Could geographic and socioeconomic factors alone explain such a striking difference in disaster outcomes? We think not. The impact of natural disasters, in our view, is also attributable to policy preferences and institutional underpinnings that determine the quality of public infrastructure, the effectiveness of emergency responses and healthcare services and govern business practices and the adherence to building codes.

This is not the first attempt in the literature to analyze economic, institutional and social factors in determining losses associated with natural disasters (Albala-Bertrand, 1993; Tol and Leek, 1999; Haque, 2003; Anbarci *et al*., 2005; Kahn, 2005; Skidmore and Toya, 2007; Kellenberg and Mobarak, 2008; Raschky, 2008; Noy, 2009; Padli and Habibullah, 2009; Schumacher and Strobl, 2011; Loayza *et al*., 2012; Cavallo *et al*., 2013; Klomp, 2016; Taghizadeh-Hesary *et al*., 2019). Corruption—commonly defined as the abuse of entrusted power for private gain—is shown to have detrimental effects on economic development, social cohesion and trust, and political stability and effective governance (Mauro, 1995; Tanzi, 1998; Mo, 2001; Alesina and Weder, 2002; Habib and Zurawicki, 2002; Pellegrini and Gerlagh, 2004; Meon and Sekkat, 2005; Rose-Ackerman, 2006; Aidt *et al*., 2008; Hodge *et al*., 2011; D'Agostino *et al*., 2016; Huang, 2016; Chang and Hao, 2017; Farzanegan and Witthuhn, 2017; Cieślik and Goczek, 2018; Gründler and Potrafke, 2019; Uberti, 2022). Most closely related to this paper, Escaleras *et al*. (2007) find that corruption is positively related to earthquake-related deaths in 75 countries over the period 1975–2003. This reflects a multitude of channels through which corruption determines losses associated with

Figure 1. Natural Disaster-Related Deaths Across the World



Source: Our World in Data based on the EM-DAT database.

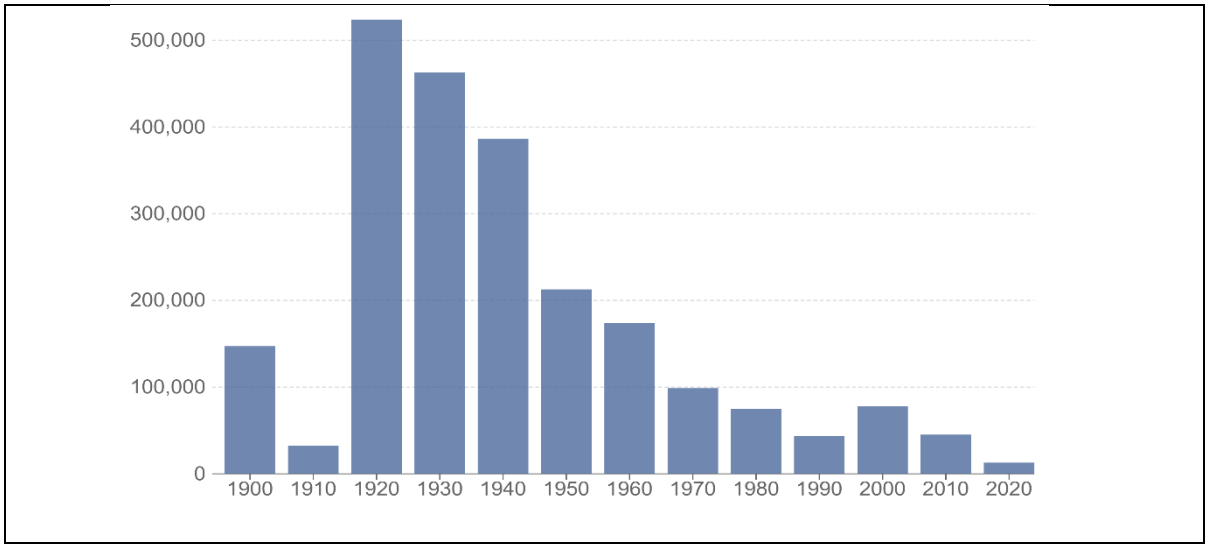
[2] Our World in Data provides a concise presentation of disasters based on the EM-DAT database, which is used in this paper: https://ourworldindata.org/century-disaster-deaths.

natural disasters: (i) inadequate infrastructure, weak building codes and unsafe construction (Brinkerhoff, 2008; Alam and Vennemo, 2014; Iqbal, 2018); (ii) slow and inefficient emergency responses, relief distribution and healthcare (Akhtaruzzaman, 2011; Klomp and de Haan, 2013); (iii) disproportionate impact on vulnerable groups of the society due to inequalities in disaster preparedness and response and access to information, resources, and support (Gupta *et al*., 2002; Lehoucq and Molinas, 2002); and (iv) lack of accountability and transparency in governance (Shah, 2006; Heywood, 2007).

In this paper, we use a large panel of 135 countries during the period 1980–2020 and focus on the role of corruption in determining the loss of human lives caused by natural disasters. Corruption is a complex phenomenon that affects all countries, but its economic, institutional, political and social causes and consequences show great variation across countries. The econometric analysis provides convincing evidence that corruption increases the number of disaster-related deaths, after controlling for economic, demographic, healthcare and institutional factors. Hence, we can infer that the higher the level of corruption, the greater the number of fatalities per population in natural disasters. To put this empirical finding into perspective, the difference between the least and most corrupt countries in our sample implies a sixfold increase in the number of deaths per population caused by natural disaster in a given year.

Our results also show that the devastating impact of corruption is greater in developing countries than in advanced economies and there are nonlinear effects with higher levels of corruption resulting in an even larger number of deaths from natural disasters, especially in developing countries. In our view, this reflects the low quality of buildings and infrastructure and the weakness of health and risk management systems due to widespread corruption. These empirical findings are robust to various regression specifications and sample heterogeneity, which we use to obtain a granular analysis of the impact of corruption on loss of human lives

Figure 2. Annual Average of Natural Disaster-Related Deaths Across the World



Source: Our World in Data based on the EM-DAT database.

caused by natural disasters. All in all, the empirical results presented in this paper highlight the critical relationship between economic development and institutional capacity in strengthening good governance. Promoting anti-corruption measures to strengthen institutions and create a conducive environment for greater transparency in governance and appropriate use of public resources is, therefore, paramount in this regard.

The remainder of this paper is organized as follows. Section II describes the data used in the empirical analysis. Section III introduces the salient features of our econometric strategy. Section IV presents and discusses the empirical results, including a series of robustness checks. Finally, Section V offers concluding remarks including policy implications.

II. DATA OVERVIEW

We put together a panel dataset of annual observations covering 135 countries over the period 1980–2020. The dependent variable is the number of deaths per population due to natural disasters in a given year, which is obtained from the Emergency Events Database (EM-DAT) compiled by the Centre for Research on the Epidemiology of Disasters (CRED) at the Université Catholique de Louvain in Belgium. The EM-DAT provides data on the occurrence and effects of over 22,000 large-scale natural disasters across the world from 1900 to the present day and offers information on different categories of natural disasters including geophysical (earthquake, mass movement and volcanic activity), meteorological (extreme temperature, fog and storm), hydrological (flood, landslide and wave action), climatological (drought, glacial large outburst, wildfire), and biological (epidemic, insect infestation and animal accident).[3]

- Geophysical: A hazard originating from solid earth. This term is used interchangeably with the term geological hazard.
- Meteorological: A hazard caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days.
- Hydrological: A hazard caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater.
- Climatological: A hazard caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability.
- Biological: A hazard caused by the exposure to living organisms and toxic substances (e.g. venom, mold) or vector-borne diseases.

The number of deaths per population and per event varies on average according to the type of natural disaster (Figure 3). Weather-related disasters such as droughts and floods caused extremely large number of deaths in the first half of the 20th century but have become less impactful in terms of humanitarian losses over time, owing to improvements in infrastructure and

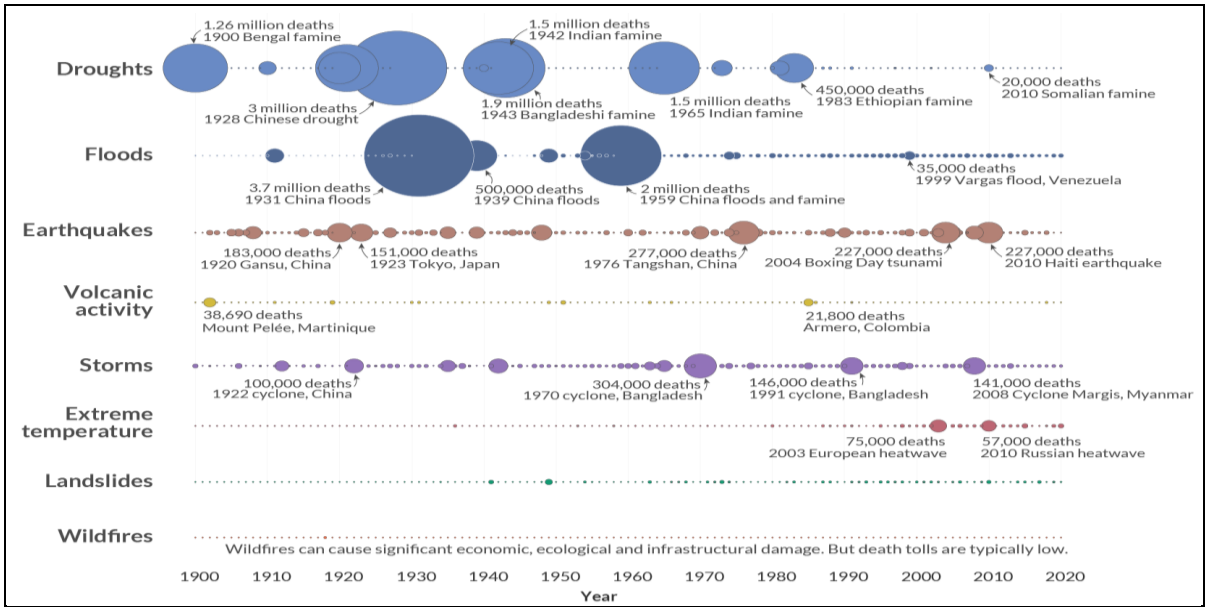
[3] We exclude extraterrestrial disasters caused by asteroids, meteoroids, and comets as they pass near-earth, enter the earth's atmosphere, and/or strike the earth, and by changes in interplanetary conditions that effect the earth's magnetosphere, ionosphere, and thermosphere.

emergency management including international aid. Natural disasters caused by climate change such as extreme temperature and storms, on the other hand, have become more pronounced over the past half century. Large-scale earthquakes have always resulted in significant economic and humanitarian losses, especially in countries with weak institutional and physical infrastructure.

The main explanatory variable of interest is corruption, which is measured by the corruption index constructed by the International Country Risk Guide (ICRG). Corruption is defined as "the extent to which public power is exercised for private gain, including petty and grand forms of corruption, as well as capture of the state by elites and private interests." The survey-based corruption index ranges from 0 (highest potential risk) to 6 (lowest potential risk).[4] We invert the index so that the new variable is increasing in the degree of corruption. The ICRG dataset provides the most comprehensive coverage across countries and over time, starting in 1984. To maximize the sample size of natural disasters, we use the 1984 value of the corruption index (as well as other institutional variables described below) for the period 1980–1983. Although this is a strong assumption, the corruption index and other institutional factors used in the analysis are slow-moving variables.[5]

Following the literature, we introduce several control variables, including real GDP per capita, trade openness as measured by the share of exports and imports in GDP, urbanization as measured by the share of urban population in total, and the number of hospital beds per

Figure 3. Global Deaths from Natural Disasters Across the World, by type



Source: Our World in Data based on the EM-DAT database.

[4] The ICRG database is available at https://www.prsgroup.com/explore-our-products/icrg/.

[5] Our baseline estimation results remain unchanged when we alternatively use the period 1984–2020.

population, which are drawn from the World Bank´s World Development Indicators database. We also include additional variables to control for broader institutional characteristics, which could influence both the level of corruption and the humanitarian cost of natural disasters.[6] Specifically, we use composite indices of bureaucratic quality, democratic accountability and government stability, which are obtained from the ICRG database. Bureaucratic quality measures the institutional strength and the level of expertise to govern without drastic changes in policy or interruptions in government services. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions. Democratic accountability is a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government would fall, peacefully in a democratic society, but possibly violently in a non-democratic one. In general, the lowest risk point is assigned to alternating democracies, while the highest risk point is assigned to autarchies. Government stability is an assessment both of the government's ability to carry out its declared programs as well as its ability to stay in office.

Descriptive statistics for the variables used in the empirical analysis are presented in Table 1. There is a significant degree of dispersion across countries in the number of disaster-related fatalities and considerable heterogeneity in economic and institutional factors between countries and within and between income groups. For example, advanced economies, on average, have a lower level of corruption and experience fewer natural disasters than developing countries. Correspondingly, the number of deaths caused by natural disasters in advanced economies is significantly lower than in developing countries.

Table 1. Summary Statistics

Variable	Observations	Mean	Std. dev.	Minimum	Maximum
Natural disaster-related deaths per population	7,944	1.3	31.3	0.0	2,331.5
Corruption	4,737	3.0	1.4	0.0	6.0
Real GDP per capita	7,126	11,023	16,130	166	114,048
Trade openness	6,512	83.8	52.6	0.0	442.6
Urbanization	7,913	53.3	23.9	4.3	100.0
Healthcare (hospital beds)	3,415	4.5	3.4	0.1	19.9
Bureaucratic quality	4,800	2.2	1.2	0.0	4.0
Democratic accountability	4,800	3.9	1.6	0.0	6.0
Government stability	4,800	7.4	2.0	0.0	12.0

Source: EM-DAT; ICRG; World Bank; author's calculations.

III. Econometric Strategy and Empirical Results

The objective of this paper is to empirically investigate the role of corruption in disaster-related fatalities in 135 countries over the period 1980–2020. Taking advantage of the panel structure in the data, we estimate the following baseline reduced-form empirical specification:

[6] The exclusion of these institutional variables may lead to a potential omitted variable bias.

$$Deaths_{it} = \beta_1 + \beta_2 Corrupt_{it-1} + \beta_3 X_{it-1} + \eta_i + \mu_t + \varepsilon_{it} \quad (1)$$

where $Deaths_{it}$ is the logarithm of the number of deaths per population due to natural disasters in country i and time t, which are winsorized at 5th and 95th percentiles to mitigate the effects of extreme outliers; $Corrupt_{it}$ is an indicator of corruption—the main variable of interest in this analysis measured from less to more corruption by inverting the original scale; X_{it} denotes a vector of control variables including the logarithm of real GDP per capita, trade openness, urbanization, the logarithm of hospital beds, and measures of bureaucratic quality, democratic accountability and government stability (which are rescaled for higher values to indicate higher risk). All explanatory variables including corruption are lagged by one period to reduce potential reverse causality concerns. The η_i are country-fixed effects to capture unobserved heterogeneity across countries, and time-unvarying factors such a geographical variable and μ_t are time-fixed effects to control for global shocks (such as the global business cycle or commodity price shocks). ε_{it} is an idiosyncratic error term satisfying usual assumptions of zero mean and constant variance. We use the Driscoll-Kraay (1998) robust standard errors, which assume the error structure to be heteroskedastic, autocorrelated up to some lag and possibly correlated between the groups.

The empirical analysis—robust to various sensitivity checks—provides consistent evidence that corruption has a statistically significant effect on fatalities caused by natural disasters across the world. First, we estimate the spatially correlated consistent model for the number of deaths per population due to natural disasters in a given year. These results, presented in Table 2, demonstrate a consistent picture with the signs of all estimated parameters corresponding to their expected values across different specifications. Corruption—the main explanatory variable of interest in this analysis—is significantly and positively associated with a higher number of natural disaster-related deaths in our sample of 135 countries during the period 1980–2020. The estimated coefficient on corruption is statistically significant across all specification, thereby implying that a 1 percent increase in corruption leads to an increase of about 2.1 percent in the number of deaths per population caused by natural disaster, after controlling for other economic, demographic, healthcare and institutional factors. Hence, we can infer that the higher the corruption index in a given country, the greater the number of fatalities as a share of population due to natural disasters. To put this finding into perspective, the difference between the least and most corrupt countries in our sample implies a sixfold increase in the number of deaths per population caused by natural disaster in a given year.

With regards to control variables, we obtain consistent and intuitive estimation results. The level of real GDP per capita is inversely correlated to natural disaster-related deaths, suggesting that disasters tend to result in fewer fatalities in countries with higher levels of income. The coefficient on real GDP per capita is larger in magnitude (than that on corruption) but statistically insignificant across all specifications. Likewise, we find that trade openness—a measure of international economic integration and development—does not appear to have statistically significant effect on natural disaster deaths. Both urbanization and healthcare conditions are crucial factors in determining cross-country differences in the number of deaths per population

caused by natural disasters. The coefficients on urbanization and healthcare indicate a strong and statistically significant negative relationship between the share of population living in urban areas and the strength of the healthcare system and natural disaster-related deaths per population. Finally, we introduce a series of institutional and political variables, which do not alter the results, but provide more information on factors affecting the humanitarian impact of natural disasters. All three measures—bureaucratic quality, democratic accountability, and government stability—contribute to a decline in the number of deaths per population caused by natural disasters, but with varying degrees of statistical significance. In other words, countries with higher bureaucratic quality, greater democratic accountability and more stable governments tend to have lower mortality from natural disasters.

For robustness and to obtain a better understanding of how the level of economic development shapes the impact of corruption on natural disaster deaths, we estimate the model separately for different income groups—advanced economies and developing countries—and present these results in Table 3. This disaggregation reveals a striking contrast in the impact of corruption on

Table 2. Determinants of Natural Disaster-Related Deaths

(Dependent variable: Annual number of deaths per population)

Specification	(1)	(2)	(3)	(4)
Sample of countries	ALL	ALL	ALL	ALL
Corruption	**0.0203*** **	**0.0207** **	**0.0204** **	**0.0205** **
	(0.007)	**(0.008)**	**(0.008)**	**(0.008)**
Income	-0.0675	-0.0718	-0.0988	-0.0939
	(0.046)	(0.055)	(0.065)	(0.068)
Openness	0.0323	0.0158	0.0135	0.0039
	(0.028)	(0.024)	(0.023)	(0.024)
Urbanization	-0.3405	-0.6330*	-0.6978*	-0.6220*
	(0.311)	(0.351)	(0.370)	(0.347)
Healthcare	-0.0695**	-0.0877*	-0.0897*	-0.0877*
	(0.033)	(0.049)	(0.049)	(0.051)
Bureaucratic quality		-0.0714*		
		(0.037)		
Democratic accountability			-0.0080	
			(0.012)	
Government stability				-0.0108
				(0.008)
Observations	1,812	1,509	1,509	1,509
Countries	117	88	88	88
R2_weighted	0.0412	0.0663	0.0595	0.0614
Country Effects	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes

Note: Driscoll-Kraay estimation. Standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. A constant term is included but omitted in the table. Country and time effects are included but not shown for reasons of parsimony.

natural disaster-related fatalities across countries with varying levels of economic development. While corruption has no significant effect in advanced economies, it has a statistically highly significant effect in developing countries. The estimated coefficient on corruption is statistically significant across all specification, thereby implying that a 1 percent increase in corruption leads to an increase of almost 2.5 percent in the number of natural disaster-related deaths per population in developing countries of our sample. This finding, in our view, confirms the critical relationship between economic development and institutional capacity in strengthening good governance and combating corruption, which undermine the quality of physical and institutional infrastructure and thereby lead to an increase in the number of deaths from natural disasters. Finally, we split the sample by the median level of corruption and estimate the model separately for countries with high and low levels of corruption. These results, presented in Table 4, validate the deleterious effects of widespread corruption, especially in developing countries. We find that the impact of corruption on natural disaster-related deaths is nonlinear—increasing with the level of corruption.

Table 3. Determinants of Natural Disaster-Related Deaths

(Dependent variable: Annual number of deaths per population)

Specification	(1)	(2)	(3)	(4)
Sample of countries	ALL	AE	EM	LIC
Corruption	**0.0207****	**0.0190**	**0.0267****	**0.9558*****
	(0.008)	**(0.014)**	**(0.011)**	**(0.000)**
Income	-0.0718	0.0031	-0.0858*	-1.0629***
	(0.055)	(0.081)	(0.043)	(0.000)
Openness	0.0158	0.0065	-0.0377	6.7233***
	(0.024)	(0.019)	(0.058)	(0.000)
Urbanization	-0.6330*	-0.4655	-1.5045***	0.0000
	(0.351)	(0.348)	(0.507)	(0.000)
Healthcare	-0.0877*	-0.0689	-0.1054	-0.0551***
	(0.049)	(0.059)	(0.088)	(0.000)
Bureaucratic quality	-0.0714*	-0.0966**	-0.0687	-0.4330***
	(0.037)	(0.039)	(0.044)	(0.000)
Observations	1,509	749	760	25
Number of groups	88	29	59	7
R2_weighted	0.0663	0.1266	0.1405	1.0000
Country Effects	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes

Note: Driscoll-Kraay estimation. Standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. A constant term is included but omitted in the table. Country and time effects are included but not shown for reasons of parsimony.

Table 4. Determinants of Natural Disaster-Related Deaths

(Dependent variable: Annual number of deaths per population)

Specification	(1)	(2)	(5)	(6)
Level of Corruption	High	Low	High	Low
Sample of countries	All	All	EM	EM
Corruption	**0.0147***	**0.0209**	**0.0225****	**0.0001**
	(0.008)	**(0.015)**	**(0.010)**	**(0.018)**
Income	-0.1458*	-0.1223	-0.1296	-0.0658
	(0.086)	(0.104)	(0.089)	(0.128)
Openness	-0.0383	0.0519	-0.0471	-0.0286
	(0.043)	(0.039)	(0.040)	(0.328)
Urbanization	-0.4721	-0.1351	-3.0012*	-0.6349
	(0.423)	(0.352)	(0.442)	(1.596)
Healthcare	-0.2220**	-0.0672*	-0.2425**	0.0647
	(0.086)	(0.037)	(0.093)	(0.095)
Bureaucratic quality	-0.0900**	-0.0675**	-0.0928**	-0.0460
	(0.041)	(0.033)	(0.042)	(0.042)
Observations	492	819	427	147
Number of groups	37	34	33	10
R2 weighted	0.1881	0.1030	0.1990	0.4173
Country Effects	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes

Note: Driscoll-Kraay estimation. Standard errors in parenthesis. *, **, *** denote statistical significance at the 10, 5 and 1 percent levels, respectively. A constant term is included but omitted in the table. Country and time effects are included but not shown for reasons of parsimony.

IV. Conclusion

Natural disasters are inevitable, resulting in significant economic losses and tens of thousands of deaths in most years across the world. While there has been a continuous reduction in the number of fatalities caused by natural disasters over the past century owing to better living standards, more resilient physical infrastructure, better early warning indicators and stronger emergency response systems, there are still significant disparities across countries in humanitarian and economic losses caused by natural disasters.

This is not the first attempt in the literature to analyze economic, institutional and social factors in determining losses associated with natural disasters that contribute to losses associated with natural disasters, but we use a large panel of 135 countries over a long period spanning from 1980 to 2020 and particularly focus on the role of corruption. The empirical analysis provides convincing evidence that widespread corruption increases the number of disaster-related deaths, after controlling for economic, demographic, healthcare and institutional factors. Hence, we can infer that the higher the level of corruption, the greater the number of fatalities per population in natural disasters. To put this empirical finding into perspective, the difference between the least

and most corrupt countries in our sample implies a sixfold increase in the number of deaths per population caused by natural disaster in a given year.

Our results show that this impact is stronger in developing countries than in advanced economies, highlighting the critical relationship between economic development and institutional capacity in strengthening good governance and combating corruption. We also find evidence of nonlinear effects with higher levels of corruption resulting in an even larger number of deaths from natural disasters, especially in developing countries. These findings are robust to various econometric specifications and sample heterogeneity, which we use to obtain a granular analysis of the impact of corruption on loss of human lives caused by natural disasters.

Corruption is a complex phenomenon that affects all countries, but its economic, institutional, political and social causes and consequences show great variation across countries. Empirical findings presented in this study show that developing countries tend to be more vulnerable to the deleterious impact of corruption in natural disasters. In our view, this reflects the low quality of buildings and infrastructure and the weakness of health and risk management systems due to widespread corruption. Our results therefore highlight the importance of promoting anti-corruption measures to strengthen institutions and create a conducive environment for greater transparency in governance and appropriate use of public resources.

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