Replication of:
“Economic Development and the Impacts Of Natural Disasters”
(Economics Letters, 2007)

by

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Abstract

This study replicates the empirical findings of Toya and Skidmore (2007), henceforth TS, and performs a variety of robustness checks. Using an extensive data set of international disasters, TS report that a number of economic development variables are significantly related to mitigation of adverse disaster consequences. We are able to exactly replicate their findings. Our robustness checks consist of two parts. Firstly, we update TS's original data set, both with respect to variable values and years of coverage. We then address a number of estimation and specification issues. With one exception, our robustness checks fail to find strong evidence that economic development variables (income, educational attainment, size of government, economic openness, and financial sector development) are statistically related to either fatalities or economic damages. The exception is that we find that wealthier countries experience smaller economic losses (as a share of GDP) from natural disasters.

Keywords: Economic development; Natural disasters, Replication study

JEL classification: O1; Q54; C1

I. Introduction

This paper replicates and performs robustness checks on Toya and Skidmore (2007), henceforth TS. TS investigate the extent to which the impact of natural disasters is mitigated by economic development. In addition to reporting that national income is an important determinant in reducing deaths and damages from natural disasters, TS find that higher educational attainment, greater economic openness, a strong financial sector and smaller government are also important.

Interest in natural disasters has increased due to the scope of recent weather events such as Hurricane Sandy in the US and Japan's tsunami in 2011. Policymakers are interested in learning more about what can be done to lessen the associated adverse consequences. Within this context, TS has been an influential contribution to the literature. It has been cited over 35 times in Web of Science as of April 2013, and over 180 times in Google Scholar. For these reasons, this study is interested in replicating TS and determining the extent to which its findings are robust.

Overview of TS. TS investigate two measures of impact from natural disasters: (i) disaster-related deaths, and (ii) dollar value of economic damages as a share of GDP. While we investigate both sets of results, we follow TS's example and focus on deaths because the data are more reliable. TS take their data from the OFDA/CRED International Disaster Database (EM-DAT, 2004). Their sample includes observations from every recorded natural disaster in 151 countries over the years 1960–2003. OFDA/CRED define a natural disaster as any event in which "ten or more people [were] killed, 100 or more people were affected/injured/homeless, significant damages were incurred, a declaration of a state of emergency and/or an appeal for international assistance [was made]" (TS, page 21).

TS's main findings center on pooled OLS regressions of the following form:

(1) $Y_{jit} = \beta_0 + \beta_1\, pcgdp_{it} + \beta_2\, hc_{it} + \beta_3\, open_{it} + \beta_4\, fin_{it} + \beta_5\, gov_{it} + \beta_n\, z_{it} + e_{jit}$

where Y_{jit} is either (i) the log of the total number of disaster-related deaths or (ii) the log of the ratio of economic damages to GDP associated with disaster *j* in country *i* at time *t*; *pcgdp* is the log of real per capita GDP; *hc* measures educational attainment (total years of schooling attainment in the population aged 15 and over); *open* measures economic openness ([exports+imports]/GDP); *fin* measures the development of the financial sector (M3/GDP); *gov* measures the size of the government sector (government consumption including transfers/GDP); *z* is a vector of control variables consisting of log of population, log of land area, and dummy variables for disaster type; and *e* is an error term.

TS estimate Equation (1) for an aggregated sample of OECD and developing countries, as well as for each of the two subsamples. Note that a country *i* can experience more than one disaster-event *j* in year *t*, and that there may be multiple years when a country experiences no disaster events.

<u>Overview of replication methodology</u>. TS graciously provided the original data used in their study. Using these data, we were able to exactly replicate their published results for both fatalities and economic damages. The first robustness check consisted of updating all variable values and extending the data set to include the most recent data available (2009). We then investigated the robustness of the results to alternative estimation procedures, the use of fixed effects, and a more flexible specification of the error variance-covariance matrix.

<u>Sample characteristics</u>. While TS do not report sample characteristics, it is useful to describe their data in more detail. From TABLE 1 we see that developing countries suffer more disaster-related deaths per event, have lower incomes and educational achievement, larger government sectors, greater openness, and their financial sectors are less developed. While not reported in TABLE 1, they also suffer greater economic damages (as measured as a share of GDP).

TABLE 2 reports the distribution of deaths per disaster. The distribution of deaths is heavily skewed towards fewer deaths: approximately 60 percent of disasters in OECD countries, and 40 percent in developing countries, are associated with 20 or fewer deaths. While only a small percent of disasters have more than 1000 deaths, in a very few cases the number of deaths is extremely large, exceeding 100,000. While not reported, the distribution of economic damages displays similar skewness.

This brief description of TS's data highlight two econometric issues: Firstly, there is truncation bias because many disasters are not included in the sample. Given that developed countries are more likely to prevent disaster-related deaths, we should expect the estimated effects of variables associated with economic development (e.g. income, education, financial development, etc.) to be biased towards zero. Secondly, the existence of a large number of observations with very few deaths, and a few observations with extremely large numbers of deaths, suggests that one should be careful that the results are not disproportionately influenced by observations at either end of the distribution. As discussed below, we use interval regression to address both issues.

2. Replication of Toya and Skidmore (2007) Study

The authors made their original data available to us and we were able to replicate their results exactly. The results found by TS, which we replicated, are shown in TABLE 3.[1]

These results (particularly those for ALL COUNTRIES) form the basis of TS's main conclusion: "The contribution of this paper is to show that income is not the only important measure of development in reducing disaster related deaths and damages/GDP. Rather, higher educational attainment, greater openness, a strong financial sector and smaller government are also important" (TS, page 24).

[1] While not reported, we note that we were also able to exactly replicate TS's results on economic damages.

3. Robustness Checks

Part I. The first robustness check consists of investigating whether TS's results are sustained when the data are updated. We used the same sources from which TS drew their data (Barro, 2010; CRED, 2012; Heston, Summers, and Aten, 2011; International Monetary Fund, 2011; The World Bank Group, 2012). In doing so, we learned that some of the disaster observations from the OFDA/CRED database that were available to TS were dropped from the most recent version of the OFDA/CRED database.

Column (2) of TABLE 4A reestimates Equation (1) for the ALL COUNTRIES sample using these updated data. In order to compare like-to-like, we also reestimate Equation (1) with the TS data, but only include disaster observations currently available in the OFDA/CRED database. In other words, we use TS's original data values, but select the observations to be identical to the observations used in Column (2). These latter results are reported in Column (1) for comparison's sake. Dropping the 157 observations that are excluded from the current database does not change any of the coefficient estimates significantly or change the conclusions about statistical significance.

Using the updated data, we find that all of the estimated coefficients have the same signs as reported by TS. However, the income variable becomes smaller and statistically insignificant at the 5 percent level. In contrast, the *Size of Government* coefficient increases in size and attains statistical significance. The other coefficients are largely unchanged. Almost all of the differences between these columns can be attributed to changes in the values of two variables: *Total Schooling Years* and *Size of Government*.[2]

TABLES 4B and 4C repeat the exercise for the OECD and DEVELOPING COUNTRIES subsamples. It is clear that the diminished size and significance of the income

[2] The variable that changes the most from updating is the educational attainment variable (cf. Appendix 1). While we don't report the results, we found that when the estimating equation from Column (2) replaces the updated variables values for the two variables (i) *Total Schooling Years* and (ii) *Size of Government* with their original values, we obtain results virtually identical to Column (1). This demonstrates that differences in Columns (2) and (1) results are due entirely to updated values for these two variables.

coefficient noted above is driven by the DEVELOPING COUNTRIES subsample. The estimated coefficients for the other variables largely confirm TS's original findings with one interesting reversal: *Size of Government* is positive and significant in TS's original findings for OECD COUNTRIES, but insignificant using the updated data. Conversely, *Size of Government* is positive and insignificant in TS's original findings for DEVELOPING COUNTRIES, but much larger and statistically significant using the updated data.

The original study by TS, and the results from Column (2) of TABLES 4A-4C, use data from 1960 to 2003. Column (3) reports the results of updating the data to include all disasters through the end of calendar year 2009. This results in the addition of 10 to 20 percent more observations. A comparison of Column (3) with Column (2) finds very small changes in the coefficient estimates and no change in the statistical significance of the variables when the dataset is extended to include more recent years.

In summary, updating and extending of the disaster dataset set generally supports TS's findings, with two exceptions: Firstly, the estimated negative effect of income on disaster-related fatalities is smaller and statistically insignificant for the ALL COUNTRIES sample and the DEVELOPING COUNTRIES subsample. Secondly, while the estimated effect of *Size of Government* on fatalities is similar in the ALL COUNTRIES sample, there are substantial differences in the two subsamples.

<u>Part II</u>. This section checks robustness across a number of different econometric specifications. As noted above, two econometric concerns with TS are (i) truncation, and (ii) skewness in the dependent variable. If economic development variables are successful in mitigating loss of life from natural disasters, then these events may be omitted from the disaster sample in higher-income countries. This will cause the impact of economic development variables to be underestimated, resulting in "truncation bias."

There exist empirical treatments for truncation bias. Unfortunately, they cannot be implemented in our study because there are no defined threshold values below which observations are excluded from the data set. As noted above, OFDA/CRED define a natural disaster as any event in which there were "ten or more people killed, 100 or more people were affected/injured/homeless, significant damages were incurred, a declaration of a state of emergency and/or an appeal for international assistance." Even so, there are hundreds of observations in the sample for which there are fewer than 10 fatalities. This illustrates the difficulty with identifying the threshold value(s) that determine the exclusion of observations from the sample. Since truncation is along (unknown) multiple dimensions, standard tobit-like procedures cannot be used.

Our approach is to treat all low-fatality observations as censored. The nature of truncation bias is that the conditional mean of the error term is positive for low-fatality observations. Or to phrase it differently, low-fatality observations follow a different data-generating process (DGP) than other observations. In our analysis, we treat observations having 5 or fewer deaths – approximately 17 percent of the sample – as censored. In the absence of truncation bias, this approach will still produce consistent coefficient estimates, albeit with some loss in precision. However, if low-fatality observations are characterized by truncation bias, this approach will generate improved coefficient estimates. Categorizing these observations as censored provides the estimation procedure with flexibility to attribute fatality values that are more consistent with the uncensored observations.

At the other end of the distribution, some observations have exceptionally large fatalities/damages associated with them. From TABLES 1 and 2, we see that there are 86 observations for which the number of fatalities is greater than a 1000. Sixteen of these have 10,000 or more fatalities, with the maximum number of deaths associated with a single natural disaster being 138,865. In least squares regression, spurious correlation between the associated error terms and the explanatory variables can substantially impact regression estimates, even if they represent only a small percent of the total sample size.

There are methods designed to deal with the problem of outliers (such as least absolute deviations regression) but these are difficult to implement while simultaneously addressing truncation bias. Our approach is to again use censored regression. In our analysis, we lump together as censored all observations having 1000 or more deaths – approximately 3 percent of the sample. If high-fatality observations follow the same DGP as lower-fatality observations, censored regression will still produce consistent coefficient estimates, with some loss in precision. However, if they don't, then categorizing high-fatality observations as censored gives the maximum likelihood procedure the capacity to attribute fatality values that are more consistent with the uncensored observations. While our use of interval regression is admittedly *ad hoc*, it has the advantage of simultaneously addressing both truncation bias and the effect of large outliers, and should result in improved estimates if either of these are a problem.

Our robustness checks address a number of other issues. The TS study covers 30-plus years of disasters, and our extended dataset updates this to include 40 years of data. One would expect increases in the technology of disaster preparedness and response to improve over time. Accordingly, we include time fixed effects in the subsequent empirical analyses. TS calculate standard errors to incorporate general heteroskedasticity. In contrast, we use a more general specification of the error variance-covariance matrix (robust cluster). Unless otherwise noted, our reported t-statistics use standard errors that are robust to both general forms of heteroskedasticity and within-country error dependence.

We also investigate the robustness of TS's findings to the inclusion of country fixed effects. Firstly, country fixed effects control for unobserved differences between countries. For example, some countries are prone to disasters because of their geography, and the prevalence of disasters may impede development. Secondly, by isolating "within-country" variation, estimates using country fixed effects may give a more accurate estimate of the likely impact of policy changes for a given country. As noted by TS, "Policymakers engaged in preparedness may find it useful to know the number of lives that are likely to be saved as a result of development" (TS, page 24). The effects of past changes in income within a country over time may give a better picture to policymakers of how future changes in income could mitigate disaster-related deaths. A similar argument holds for the non-income variables.

The first column of TABLES 5A-5C reproduces the OLS results from TABLES 4A-4C/Column (3) for the purpose of comparison. The next three columns report the results of our robustness checks. The specification for the pooled, interval regressions adds time fixed effects to the previous set of explanatory variables, and calculates standard errors using the more general, robust cluster specification of the error variance-covariance matrix. The final two columns report country fixed effects, OLS regressions with either a minimum of 5 or 10 observations per country, again with robust cluster standard errors and time fixed effects.[3,4]

There is little in TABLES 5A-5C to encourage the idea that the original TS findings are robust. Most of the coefficient estimates vary substantially in size across the respective columns, and experience sign changes. Most importantly, none of the economic development variables are statistically significant at the 5 percent level in any of the interval or fixed effects OLS regressions.

A closer look at the estimated impact of income. A statistically significant, negative relationship between disaster-related fatalities and national income has been reported by other researchers (Kahn, 2005; Raschky, 2008). While we generally estimate a negative effect, we find that income is always statistically insignificant. We want to better understand what

[3] While not reported, the time fixed effects demonstrated a negative trend over time and were jointly highly significant in the respective estimating equations.

[4] We also estimated fixed effects models with two or more observations per country ($N \geq 2$). We obtained qualitatively identical results to the more restrictive cases where $N \geq 5$ and $N \geq 10$, and therefore do not report these.

drives our results. Is it the country fixed effects, the time fixed effects, truncation bias, skewness in the dependent variable, or some combination of these?

TABLE 6 repeats the estimation procedures of TABLE 5A (the ALL COUNTRIES sample), with the goal of identifying the responsible factors. The first three columns employ interval regression. The next two use fixed effects OLS. To identify the impact of sample differences, we consider three samples: (i) all observations, (ii) only those observations for which 5 or more disasters are observed for each country, and (iii) only those observations for which 10 or more disasters are observed for each country.

The first row of TABLE 6 uses the same variable specification as TS's original study, which we call the Base Specification (BS). The second row uses this specification plus time fixed effects. The third row uses the Base Specification and adds country fixed (FEs) rather than time fixed effects. The last row uses the Base Specification plus both time and country FEs. Each cell reports the corresponding estimates for the income variable, *Ln(GDP per Capita).* We note that all of the Baseline Specification coefficients are statistically insignificant, regardless of estimation procedure or sample.

There is much similarity in the estimated coefficients and corresponding t-statistics across any given row. This suggests that using interval regression or fixed effects OLS has relatively little bearing on the final results. Interestingly, including either time or country fixed effects increases the estimated impact of income. But when both are added, the estimated effect of income diminishes and once again becomes statistically insignificant.

TABLE 6 demonstrates that the lack of robustness of the income variable is not due to estimation procedure. The fact that the income coefficient is insignificant in both (i) the Baseline Specification and (ii) the specification with both time and country fixed effects, indicates that it's not driven by a particular fixed effects configuration. We conclude that the negative relationship between income and disaster-related fatalities reported by other studies is inherently fragile due to correlations with other included variables.

While we do not report it here, we undertook a similar, TABLE 6-type analysis for the other economic development variables. For example, *Size of Government* is consistently positive in all the robustness checks of TABLES 5A-5C. Yet it never achieves statistical significance in any of TABLE 6-type specifications.[5] In summary, we find no compelling evidence that any of the economic development variables are statistically related to disaster deaths. A variable-specific summary of these results is provided in the first column of TABLE 8.

The effect of economic development variables on disaster-related damages. TABLES 7A-7C repeat the analyses of TABLES 5A-5C when the dependent variable is economic damages, *Ln(Damages/GDP)*.[6] TS note that the OFDA/CRED data on damages suffer from a number of deficiencies that limit their reliability (cf. TS, page 22). We report our associated empirical findings with this caveat in mind.

Our major finding is that we consistently estimate a negative impact of national income on disaster-related economic damages. The estimated impacts are substantially larger in size than TS, and usually statistically significant, even when they are not significant in the original TS study. For example, using the ALL COUNTRIES sample, TS report that a 10 percent increase in income is associated with a 1.15 percent decrease in the ratio of Damages to GDP (though their estimate is not statistically significant). In contrast, we estimate coefficients that are more than an order of magnitude larger (cf. TABLE 7A).[7] The coefficients for the other economic development variables are often statistically insignificant,

[5] These results are available from the authors upon request.
[6] While not reported, we note that we were also able to exactly replicate TS's results on economic damages.
[7] Unlike for fatalities, multicollinearity of the income variable with the time trend and country fixed effects does not appear to constitute a serious problem in the estimating equations for economic damages (cf. Appendix 2).

switch signs across estimation procedure and/or sample, and are not robust. The second column of TABLE 8 summarizes the results for the determinants of economic damages.

4. Conclusion

This study replicates the empirical findings of Toya and Skidmore (2007), henceforth TS, and performs a variety of robustness checks. We were able to exactly replicate the findings reported by TS. Our robustness checks consisted of two parts. Firstly, we updated TS's original data set, both with respect to variables values and years. We then addressed a number of estimation issues: (i) truncation bias, (ii) the effect of severe skewness in the disaster data, (iii) country and time fixed effects, and (iv) allowance for a more generalized error structure.

We generally find a lack of robustness in the relationship between economic development variables and disaster-related fatalities and economic damages. Our analysis determines that this is due to collinearity with other variables. The single exception is that we always estimate a negative relationship between income and economic damages. The estimated impacts are substantially larger in size than TS, and are often statistically significant, even when they were not significant in the original TS study.

Why would greater income be successful in mitigating economic damages from disasters, but not fatalities? One hypothesis is that disaster-related fatalities are largely a function of the severity of the disaster. To the extent that income can affect fatalities via the provision of medical care and supplies, international aid efforts may be able to compensate for a country's deficiencies. In contrast, wealthier countries are able to build higher quality infrastructure, and this can serve to minimize the material damage associated with disasters. Further investigation of this hypothesis is a topic for future research.

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TABLE 1
Description of Toya and Skidmore (2007) Original Data

Variable	Observations	Mean	Median	Std. Dev.	Min.	Max.
Dataset = ALL COUNTRIES						
Number of Deaths	3210	289.612	25	3136.824	1	138865
GDP per Capita	3210	6996.321	3694.314	7927.806	330.276	33308.240
Total Schooling Years	3210	5.783	5.289	2.781	0.150	12.049
Size of Government	3210	0.186	0.172	0.073	0.054	0.517
Openness	3210	0.489	0.341	0.297	0.048	3.096
M3/GDP	3210	0.531	0.433	0.375	0.057	2.370
Dataset = OECD COUNTRIES						
Variable	Observations	Mean	Median	Std. Dev.	Min.	Max.
Number of Deaths	588	56.456	14.000	302.599	1	5297
GDP per Capita	588	21498.070	21516.600	7022.185	4656.875	33308.240
Total Schooling Years	588	10.015	10.344	1.891	4.875	12.049
Size of Government	588	0.121	0.126	0.040	0.054	0.257
Openness	588	0.247	0.211	0.159	0.072	1.175
M3/GDP	588	0.831	0.665	0.414	0.224	1.996

Variable	Observations	Mean	Median	Std. Dev.	Min.	Max.
			Dataset = DEVELOPING COUNTRIES			
Number of Deaths	2622	341.899	29	3465.787	1	138865
GDP per Capita	2622	3744.214	3076.353	2854.266	330.276	26703.230
Total Schooling Years	2622	4.834	4.866	1.936	0.150	10.837
Size of Government	2622	0.200	0.192	0.071	0.054	0.517
Openness	2622	0.457	0.390	0.307	0.048	3.096
M3/GDP	2622	0.464	0.370	0.331	0.057	2.370

NOTE: The number of observations for each of the samples corresponds to the number of observations used in TS's original regressions where multiple economic development variables are included (cf. Tables 1-3 in TS).

TABLE 2
Distribution of Fatalities in Toya and Skidmore (2007) Original Data

Dataset = ALL COUNTRIES		
Number of Deaths	Number of observations	Percent of total
1-10	939	29.25
11-20	499	15.55
21-100	1133	35.26
101-1000	553	16.92
1001-	86	3.02
Total Observations	3210	---
Dataset = OECD COUNTRIES		
Number of Deaths	Number of observations	Percent of total
1-10	243	41.33
11-20	109	18.54
21-100	182	30.95
101-1000	51	8.67
1001-	3	0.51
Total Observations	588	---
Dataset = DEVELOPING COUNTRIES		
Number of Deaths	Number of observations	Percent of total
1-10	696	26.54
11-20	390	14.87
21-100	951	36.27
101-1000	502	19.15
1001-	83	3.17
Total Observations	2622	---

NOTE: The number of observations for each of the samples corresponds to the number of observations used in TS's original regressions where multiple economic development variables are included (cf. Tables 1-3 in TS).

TABLE 3
Replication of Toya and Skidmore (2007) Original Results (Fatalities)

Variables	Original Results/Replicated Results		
	Countries = ALL	Countries = OECD	Countries = DEVELOPING
Ln(GDP per Capita)	-0.152 (-2.22)	-1.533 (-5.37)	-0.166 (-2.16)
Total Schooling Years	-0.092 (-4.28)	0.002 (0.03)	-0.079 (-3.06)
Size of Government	0.978 (1.88)	6.824 (4.09)	0.319 (0.58)
Openness	-0.820 (-6.27)	-0.830 (-1.50)	-0.611 (-3.53)
M3/GDP	-0.364 (-3.50)	0.260 (1.12)	-0.456 (-3.05)
Observations	3210	588	2622
Adjusted R^2	0.154	0.334	0.112

NOTE: Original results are taken from Tables 1-3 in TS. The replicated results are identical. The dependent variable is *Ln(Deaths)*. Estimates are derived from OLS estimation of Equation (1) in text. Numbers in parentheses are t-values based on the White (1980) heteroskedasticity-consistent covariance matrix. Other explanatory variables not reported here are *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type.

TABLE 4A
Checking for Robustness (Fatalities) – Part I

Dataset = ALL COUNTRIES				
Variables	Original TS Results	Using comparable observations (1)	Using updated data (2)	Extending dataset to 2009 (3)
Ln(GDP per Capita)	-0.152 (-2.22)	-0.158 (-2.23)	-0.097 (-1.43)	-0.095 (-1.52)
Total Schooling Years	-0.092 (-4.28)	-0.094 (-4.27)	-0.115 (-5.34)	-0.129 (-6.33)
Size of Government	0.978 (1.88)	1.148 (2.08)	1.591 (3.07)	1.397 (2.92)
Openness	-0.820 (-6.27)	-0.794 (-5.68)	-0.724 (-5.23)	-0.710 (-5.85)
M3/GDP	-0.364 (-3.50)	-0.328 (-2.96)	-0.330 (-3.03)	-0.291 (-3.06)
Observations	3210	3053	3053	3544
Adjusted R^2	0.154	0.154	0.157	0.166

NOTE: The dependent variable is *Ln(Deaths)*. Estimates are derived from OLS estimation of Equation (1) in text. Numbers in parentheses are t-values based on the White (1980) heteroskedasticity-consistent covariance matrix. Other explanatory variables not reported here are *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. Column (1) uses the original TS data, but deletes observations not included in the current OFDA/CRED database. Column (2) updates the values of the respective explanatory variables, using the same observations as Column (1). Column (3) extends the sample from 2006 to 2009.

TABLE 4B
Checking for Robustness (Fatalities) – Part I

Dataset = OECD COUNTRIES				
Variables	Original TS Results	Using comparable observations (1)	Using updated data (2)	Extending dataset to 2009 (3)
Ln(GDP per Capita)	-1.533 (-5.37)	-1.543 (-5.39)	-1.722 (-6.03)	-1.596 (-5.75)
Total Schooling Years	0.002 (0.03)	0.001 (0.01)	-0.063 (-1.08)	-0.073 (-1.28)
Size of Government	6.824 (4.09)	6.594 (3.94)	1.907 (1.30)	1.733 (1.35)
Openness	-0.830 (-1.50)	-0.808 (-1.48)	-0.672 (-1.14)	-0.747 (-1.32)
M3/GDP	0.260 (1.12)	0.262 (1.11)	0.066 (0.31)	-0.062 (-0.36)
Observations	588	584	584	708
Adjusted R^2	0.334	0.324	0.313	0.289

NOTE: The dependent variable is *Ln(Deaths)*. Estimates are derived from OLS estimation of Equation (1) in text. Numbers in parentheses are t-values based on the White (1980) heteroskedasticity-consistent covariance matrix. Other explanatory variables not reported here are *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. Column (1) uses the original TS data, but deletes observations not included in the current OFDA/CRED database. Column (2) updates the values of the respective explanatory variables, using the same observations as Column (1). Column (3) extends the sample from 2006 to 2009.

TABLE 4C
Checking for Robustness (Fatalities) – Part I

Dataset = DEVELOPING COUNTRIES				
Variables	Original TS Results	Using comparable observations (1)	Using updated data (2)	Extending dataset to 2009 (3)
Ln(GDP per Capita)	-0.166 (-2.16)	-0.165 (-2.05)	-0.090 (-1.17)	-0.083 (-1.20)
Total Schooling Years	-0.079 (-3.06)	-0.085 (-3.17)	-0.106 (-4.12)	-0.125 (-5.27)
Size of Government	0.319 (0.58)	0.439 (0.74)	1.336 (2.41)	1.340 (2.56)
Openness	-0.611 (-3.53)	-0.608 (-3.27)	-0.536 (-2.96)	-0.600 (-3.73)
M3/GDP	-0.456 (-3.05)	-0.381 (-2.29)	-0.434 (-2.69)	-0.295 (-2.00)
Observations	2622	2469	2469	2836
Adjusted R^2	0.112	0.108	0.112	0.125

NOTE: The dependent variable is *Ln(Deaths)*. Estimates are derived from OLS estimation of Equation (1) in text. Numbers in parentheses are t-values based on the White (1980) heteroskedasticity-consistent covariance matrix. Other explanatory variables not reported here are *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. Column (1) uses the original TS data, but deletes observations not included in the current OFDA/CRED database. Column (2) updates the values of the respective explanatory variables, using the same observations as Column (1). Column (3) extends the sample from 2006 to 2009.

TABLE 5A
Checking for Robustness (Fatalities) – Part II

Dataset = ALL COUNTRIES				
Variables	TABLE 4A: Column (3)	Interval Regression – Pooled	Fixed Effects OLS	
			$N \geq 5$	$N \geq 10$
Ln(GDP per Capita)	-0.095 (-1.52)	-0.252 (-1.89)	-0.107 (-0.58)	-0.142 (-0.74)
Total Schooling Years	-0.129 (-6.33)	-0.061 (-1.60)	0.070 (1.10)	0.078 (1.21)
Size of Government	1.397 (2.92)	0.838 (0.84)	1.018 (0.89)	1.010 (0.85)
Openness	-0.710 (-5.85)	-0.149 (-0.57)	0.325 (1.21)	0.305 (1.10)
M3/GDP	-0.291 (-3.06)	-0.269 (-1.76)	-0.062 (-0.33)	0.021 (0.11)
Observations	3544	3544	3474	3354
Countries	103	103	69	50
Adjusted R^2	0.166	---	0.116	0.117

NOTE: The dependent variable is *Ln(Deaths)*. The first column reproduces the OLS results from TABLE 4A, Column (3) above. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever the number of disaster-related fatalities was 5 or less (617 observations), or 1000 or more (93 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more ($N \geq 5$), or (ii) 10 or more ($N \geq 10$) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

TABLE 5B
Checking for Robustness (Fatalities) – Part II

Dataset = OECD COUNTRIES				
Variables	TABLE 4B: Column (3)	Interval Regression – Pooled	Fixed Effects OLS	
			$N \geq 5$	$N \geq 10$
Ln(GDP per Capita)	-1.596 (-5.75)	-0.343 (-0.76)§	-0.179 (-0.15)	0.053 (0.05)
Total Schooling Years	-0.073 (-1.28)	0.033 (0.39)§	0.007 (0.05)	0.032 (0.25)
Size of Government	1.733 (1.35)	1.500 (0.59)§	1.756 (0.47)	1.431 (0.36)
Openness	-0.747 (-1.32)	0.685 (0.66)§	-0.638 (-0.24)	-0.054 (-0.02)
M3/GDP	-0.062 (-0.36)	0.208 (0.82)§	0.260 (0.98)	0.180 (0.60)
Observations	708	708	696	675
Countries	15	15	10	7
Adjusted R^2	0.289	---	0.282	0.280

NOTE: The dependent variable is *Ln(Deaths)*. The first column reproduces the OLS results from TABLE 4B, Column (3) above. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever the number of disaster-related fatalities was 5 or less (176 observations), or 1000 or more (4 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more ($N \geq 5$), or (ii) 10 or more ($N \geq 10$) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

§ The standard errors for this equation could not be estimated in Stata assuming a robust (serial correlation + heteroskedasticity) error variance-covariance matrix. Accordingly, the equation was re-estimated assuming only a robust form of heteroskedasticity. The reported t-statistic is the t-value from that estimating equation.

TABLE 5C
Checking for Robustness (Fatalities) – Part II

Dataset = DEVELOPING COUNTRIES				
Variables	TABLE 4C: Column (3)	Interval Regression – Pooled	Fixed Effects OLS	
			$N \geq 5$	$N \geq 10$
Ln(GDP per Capita)	-0.083 (-1.20)	-0.216 (-1.42)	-0.201 (-1.01)	-0.202 (-0.98)
Total Schooling Years	-0.125 (-5.27)	-0.022 (-0.52)	0.112 (1.54)	0.132 (1.77)
Size of Government	1.340 (2.56)	0.234 (0.19)	0.526 (0.36)	0.582 (0.37)
Openness	-0.600 (-3.73)	-0.364 (-1.10)	0.409 (1.40)	0.408 (1.36)
M3/GDP	-0.295 (-2.00)	-0.124 (-0.39)	-0.149 (-0.53)	-0.030 (-0.10)
Observations	2836	2836	2778	2679
Countries	88	88	59	43
Adjusted R^2	0.125	---	0.088	0.088

NOTE: The dependent variable is *Ln(Deaths)*. The first column reproduces the OLS results from TABLE 4C, Column (3) above. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever the number of disaster-related fatalities was 5 or less (441 observations), or 1000 or more (89 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more ($N \geq 5$), or (ii) 10 or more ($N \geq 10$) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

TABLE 6
Further Analysis of the Relationship between Income and Fatalities

	INTERVAL REGRESSION			FIXED EFFECTS OLS	
VARIABLES	All	N ≥ 5	N ≥ 10	N ≥ 5	N ≥ 10
Base Specification (BS)	-0.117 (-0.77)	-0.135 (-0.84)	-0.194 (-1.15)	-0.210 (-1.54)	-0.269 (-1.92)
BS + Time FEs	-0.252 (-1.89)	-0.255 (-1.82)	-0.275 (-3.32)§	-0.320 (-3.12)	-0.355 (-3.33)
BS + Country FEs	N/A	-0.664 (-3.34)	-0.700 (-3.39)§	-0.591 (-2.15)	-0.637 (-2.24)
BS + Time & Country FEs	N/A	-0.046 (-0.20)	-0.070 (-0.30)§	-0.107 (-0.57)	-0.142 (-0.74)
Observations	3544	3474	3354	3474	3354

NOTE: The dependent variable is *Ln(Deaths)*. The first three columns employ interval estimation where observations are categorized as censored whenever the number of disaster-related fatalities was 5 or less, or 1000 or more. The last two columns use fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more (N ≥ 5), or (ii) 10 or more (N ≥ 10) disaster-events during the respective time period. The "Base Specification" is represented by Equation (1) in the text. The second, third, and fourth rows respectively add time fixed effects, country fixed effects, and both time and country fixed effects to the Base Specification. Numbers in cells are the estimates of the coefficient for *Ln(GDP per Capita)* in the respective estimating equation, along with its associated t-statistic. t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

§ The standard error for *Ln(GDP per Capita)* could not be estimated in Stata assuming a robust (serial correlation + heteroskedasticity) error variance-covariance matrix. Accordingly, the estimating equation was re-estimated assuming only a robust form of heteroskedasticity. The reported t-statistic is the t-value from that estimating equation.

TABLE 7A
Checking for Robustness (Economic Damages) – Part II

Dataset = ALL COUNTRIES					
Variables	TS	Using Updated/Extended Data	Interval Regression – Pooled	Fixed Effects OLS	
				N ≥ 5	N ≥ 10
Ln(GDP per Capita)	-0.115 (-0.81)	-1.641 (-6.64)	-1.939 (-2.42)	-3.473 (-2.45)	-4.021 (-2.39)
Total Schooling Years	-0.170 (-3.95)	0.241 (3.04)	0.092 (0.30)	0.620 (2.46)	0.726 (2.55)
Size of Government	0.772 (0.65)	-3.238 (-1.75)	-5.764 (-1.18)	-2.497 (-0.69)	-3.350 (-0.80)
Openness	-1.23 (-4.88)	-0.040 (-0.09)	-1.574 (-1.24)	-1.100 (-0.69)	-2.100 (-1.18)
M3/GDP	0.323 (1.65)	1.400 (4.97)	1.603 (1.29)	-0.090 (-0.06)	0.508 (0.35)
Observations	1655	1599	1599	1518	1392
Countries	81	88	88	51	32
Adjusted R^2	0.301	0.214	---	0.122	0.135

NOTE: The dependent variable is *Ln(Damages/GDP)*. The first column repeats the original findings from TS. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever *Ln(Damages/GDP)* was either less than or equal to -11.776 (148 observations) or greater than or equal to -2.351 (181 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more (N ≥ 5), or (ii) 10 or more (N ≥ 10) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

TABLE 7B
Checking for Robustness (Economic Damages) – Part II

Dataset = OECD COUNTRIES					
Variables	TS	Using Updated/Extended Data	Interval Regression – Pooled	Fixed Effects OLS	
				$N \geq 5$	$N \geq 10$
Ln(GDP per Capita)	-2.326 (-3.54)	-2.700 (-2.63)	-7.068 (-4.39)§	-0.695 (-0.48)	-1.008 (-0.49)
Total Schooling Years	-0.258 (-2.30)	0.107 (0.66)	0.191 (1.16)§	0.023 (0.06)	0.066 (0.16)
Size of Government	-3.140 (-1.00)	-3.211 (-1.14)	-0.867 (-0.17)§	-0.789 (-0.16)	0.797 (0.19)
Openness	1.178 (1.28)	-1.836 (-1.51)	-3.976 (-3.02)§	2.749 (1.09)	2.393 (0.83)
M3/GDP	-0.191 (-0.47)	3.408 (8.01)	3.058 (6.30)§	0.320 (0.56)	0.628 (0.92)
Observations	588	510	510	501	478
Countries	14	14	14	10	6
Adjusted R^2	0.346	0.471	---	0.096	0.101

NOTE: The dependent variable is *Ln(Damages/GDP)*. The first column repeats the original findings from TS. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever *Ln(Damages/GDP)* was either less than or equal to -11.776 (69 observations) or greater than or equal to -2.351 (19 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more ($N \geq 5$), or (ii) 10 or more ($N \geq 10$) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

§ The standard error for *Total Schooling Years* could not be estimated in Stata assuming a robust (serial correlation + heteroskedasticity) error variance-covariance matrix. Accordingly, the estimating equation was re-estimated assuming only a robust form of heteroskedasticity. The t-statistic for *Total Schooling Years* that is reported in this table is the t-value from that estimating equation.

TABLE 7C
Checking for Robustness (Economic Damages) – Part II

Dataset = DEVELOPING COUNTRIES					
Variables	TS	Using Updated/Extended Data	Interval Regression – Pooled	Fixed Effects OLS	
				N ≥ 5	N ≥ 10
Ln(GDP per Capita)	-0.227 (-1.25)	-1.129 (-3.15)	-1.617 (-3.28)	-5.566 (-3.05)	-7.289 (-3.46)
Total Schooling Years	-0.150 (-2.65)	0.216 (2.26)	-0.184 (-0.75)	0.153 (0.50)	0.222 (0.64)
Size of Government	0.341 (0.26)	0.704 (0.31)	-1.384 (-0.20)	-3.097 (-0.74)	-5.990 (-1.26)
Openness	-1.106 (-3.43)	1.415 (2.44)	0.055 (0.03)	-2.402 (-1.51)	-3.605 (-2.08)
M3/GDP	0.385 (1.28)	-1.034 (-2.23)	-1.813 (-1.36)	-1.754 (-1.30)	-0.617 (-0.47)
Observations	1067	1089	1089	1017	914
Countries	67	74	74	41	26
Adjusted R^2	0.247	0.121	---	0.214	0.255

NOTE: The dependent variable is *Ln(Damages/GDP)*. The first column repeats the original findings from TS. The second column estimates the same specification using interval regression, where observations are categorized as censored whenever *Ln(Damages/GDP)* was either less than or equal to -11.776 (79 observations) or greater than or equal to -2.351 (162 observations). The third and four columns are fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more (N ≥ 5), or (ii) 10 or more (N ≥ 10) disaster-events during the respective time period. All four estimating equations include *Ln(Population)*, *Ln(Area)*, and a series of dummy variables to indicate disaster type. The latter three estimating equations also include time fixed effects. Numbers in parentheses are t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

TABLE 8
Summary of Robustness Check Results

Variables	***Dependent Variable:***	
	Fatalities	***Economic Damages***
Ln(GDP per Capita)	Estimated income effects are generally insignificant, though almost always negative.	We always estimate a negative impact of income on disaster-related economic damages. The estimated impacts are substantially larger in size than TS, and usually statistically significant, even when they were not significant in the original TS study.
Total Schooling Years	Coefficient estimates are generally statistically insignificant. Estimates vary in sign across equations.	Coefficient estimates are frequently statistically insignificant, and vary in sign across equations.
Size of Government	We consistently estimate a positive impact of *Size of Government* on fatalities. However estimates are almost always insignificant.	*Size of Government* is usually estimated to have a negative effect on economic damages (generally opposite of TS). However, all of the estimates are insignificant.
Openness	Coefficient estimates are generally statistically insignificant. Estimates vary in sign across equations.	We obtain different sign estimates for this variable, depending on the sample. Our estimates are almost always statistically insignificant.
M3/GDP	Like TS, we obtain different sign estimates for this variable, depending on the sample. Coefficient estimates are generally statistically insignificant.	Like TS, we obtain different sign estimates for this variable, depending on the sample. However, the coefficient estimates are generally statistically insignificant.

NOTE: This table summarizes the empirical results from TABLES 5A-5C, 6, and 7A-7C.

APPENDIX 1
Comparison of Sample Characteristics for Data Used in Columns (1) and (2) of TABLE 4A

Column (1) Sample

VARIABLE = Ln(Deaths)

	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	1.09861	0	Obs	3053
25%	2.19722	0	Sum of Wgt.	3053
50%	3.2581		Mean	3.310178
		Largest	Std. Dev.	1.790837
75%	4.36945	10.30895		
90%	5.54126	10.59663	Variance	3.207096
95%	6.35784	11.10937	Skewness	.448733
99%	8.45297	11.84126	Kurtosis	3.684408

VARIABLE = Ln(GDP per Capita)

	Percentiles	Smallest		
1%	6.62711	5.79993		
5%	6.91238	6.05038		
10%	7.09492	6.05038	Obs	3053
25%	7.61014	6.13931	Sum of Wgt.	3053
50%	8.22589		Mean	8.358773
		Largest	Std. Dev.	.9939237
75%	8.91961	10.41356		
90%	9.97658	10.41356	Variance	.9878843
95%	10.18194	10.41356	Skewness	.3650889
99%	10.41356	10.41356	Kurtosis	2.362819

Column (2) Sample

VARIABLE = Ln(Deaths)

	Percentiles	Smallest		
1%	0	0		
5%	0	0		
10%	1.09861	0	Obs	3053
25%	2.19722	0	Sum of Wgt.	3053
50%	3.2581		Mean	3.310178
		Largest	Std. Dev.	1.790837
75%	4.36945	10.30895		
90%	5.54126	10.59663	Variance	3.207096
95%	6.35784	11.10937	Skewness	.448733
99%	8.45297	11.84126	Kurtosis	3.684408

VARIABLE = Ln(GDP per Capita)

	Percentiles	Smallest		
1%	6.51052	5.79993		
5%	6.91975	6.05038		
10%	7.09492	6.05038	Obs	3053
25%	7.60654	6.13931	Sum of Wgt.	3053
50%	8.22871		Mean	8.359033
		Largest	Std. Dev.	.9949594
75%	8.91961	10.41356		
90%	9.97658	10.41356	Variance	.9899442
95%	10.18362	10.41356	Skewness	.3583871
99%	10.39582	10.41356	Kurtosis	2.355537

Column (1) Sample	Column (2) Sample

Column (1) Sample

VARIABLE = Total Schooling Years

	Percentiles	Smallest		
1%	.91	.1496		
5%	2.0002	.1772		
10%	2.4508	.1876	Obs	3053
25%	3.83	.198	Sum of Wgt.	3053
50%	5.289		Mean	5.808954
		Largest	Std. Dev.	2.814613
75%	7.4034	12.049		
90%	10.4364	12.049	Variance	7.922045
95%	11.772	12.049	Skewness	.6123218
99%	12.049	12.049	Kurtosis	2.716353

VARIABLE = Size of Government

	Percentiles	Smallest		
1%	.057705	.053713		
5%	.069293	.053713		
10%	.096061	.053713	Obs	3053
25%	.13565	.053713	Sum of Wgt.	3053
50%	.17078		Mean	.1836001
		Largest	Std. Dev.	.0717243
75%	.23963	.5067		
90%	.27641	.50783	Variance	.0051444
95%	.3012	.51695	Skewness	.5135195
99%	.35329	.51695	Kurtosis	3.393919

Column (2) Sample

VARIABLE = Total Schooling Years

	Percentiles	Smallest		
1%	.94	.1496		
5%	2.0002	.1772		
10%	2.4522	.1876	Obs	3053
25%	3.8914	.198	Sum of Wgt.	3053
50%	5.4864		Mean	5.907884
		Largest	Std. Dev.	2.854682
75%	7.5218	12.829		
90%	10.56	12.829	Variance	8.149207
95%	11.772	12.829	Skewness	.5821597
99%	12.747	12.829	Kurtosis	2.691398

VARIABLE = Size of Government

	Percentiles	Smallest		
1%	.0567	.0451		
5%	.0695	.0451		
10%	.096	.0451	Obs	3053
25%	.131	.0451	Sum of Wgt.	3053
50%	.1655		Mean	.1795361
		Largest	Std. Dev.	.0705106
75%	.2349	.5067		
90%	.2736	.5078	Variance	.0049718
95%	.2966	.517	Skewness	.5845332
99%	.3533	.517	Kurtosis	3.487057

Column (1) Sample

VARIABLE = Openness

	Percentiles	Smallest		
1%	.081119	.048087		
5%	.11446	.052076		
10%	.14243	.05309	Obs	3053
25%	.20712	.060131	Sum of Wgt.	3053
50%	.33684		Mean	.4102056
		Largest	Std. Dev.	.2889859
75%	.53494	2.50224		
90%	.77414	2.65137	Variance	.0835129
95%	.91619	2.90569	Skewness	2.451141
99%	1.31162	3.04849	Kurtosis	15.16423

VARIABLE = M3/GDP

	Percentiles	Smallest		
1%	.1062	.056989		
5%	.16761	.056989		
10%	.20411	.060338	Obs	3053
25%	.28412	.060338	Sum of Wgt.	3053
50%	.42059		Mean	.5165938
		Largest	Std. Dev.	.3594713
75%	.6297	1.99466		
90%	.94009	1.99563	Variance	.1292196
95%	1.38727	1.99563	Skewness	1.932154
99%	1.85073	2.23726	Kurtosis	6.998821

Column (2) Sample

VARIABLE = Openness

	Percentiles	Smallest		
1%	.0811	.0481		
5%	.1145	.0521		
10%	.1424	.0531	Obs	3053
25%	.2085	.0601	Sum of Wgt.	3053
50%	.3451		Mean	.4105598
		Largest	Std. Dev.	.2901526
75%	.5308	2.5022		
90%	.7664	2.6514	Variance	.0841885
95%	.9509	2.9057	Skewness	2.480014
99%	1.3196	3.0485	Kurtosis	15.10885

VARIABLE = M3/GDP

	Percentiles	Smallest		
1%	.1062	.057		
5%	.1647	.057		
10%	.202	.0603	Obs	3053
25%	.2837	.0603	Sum of Wgt.	3053
50%	.4146		Mean	.5136354
		Largest	Std. Dev.	.3587416
75%	.6208	1.9613		
90%	.9342	1.9956	Variance	.1286955
95%	1.4044	1.9956	Skewness	1.927674
99%	1.8507	2.2373	Kurtosis	6.902559

NOTE: This table compares the original TS variable values with their updated values (cf. Columns 1 and 2 in TABLE 4A and the associated discussion in the text). This allows one to determine which variables are responsible for the different estimates in these two columns. As Footnote 1 above reports, virtually all of the differences can be explained by updated values of the variables *Total Schooling Years* and *Size of Government.*

APPENDIX 2
Further Analysis of the Relationship between Income and Economic Damages

	INTERVAL REGRESSION			FIXED EFFECTS OLS	
VARIABLES	All	N ≥ 5	N ≥ 10	N ≥ 5	N ≥ 10
Base Specification (BS)	-3.015 (-2.32)	-3.066 (-2.14)	-1.822 (-1.11)	-2.325 (-3.22)	-2.129 (-2.52)
BS + Time Trend	-2.717 (-2.29)	-2.961 (-2.30)	-2.054 (-1.38)	-2.297 (-3.24)	-2.244 (-2.75)
BS + FEs	N/A	-3.169 (-4.09)[§]	-3.465 (-4.17)[§]	-2.994 (-2.32)	-3.408 (-2.41)
BS + Time Trend + FEs	N/A	-3.782 (-4.65)[§]	-4.107 (-4.69)[§]	-3.240 (-2.39)	-3.731 (-2.37)
Observations	1599	1518	1392	1518	1392

NOTE: The dependent variable is *Ln(Damages/GDP)*. The first three columns employ interval estimation where observations are categorized as censored whenever *Ln(Damages/GDP)* was either less than or equal to -7 or greater than or equal to 0.7. The last two columns use fixed effects OLS regressions where observations are included only if the associated country has either (i) 5 or more (N ≥ 5), or (ii) 10 or more (N ≥ 10) disaster-events during the respective time period. The "Base Specification" is represented by Equation (1) in the text. The second, third, and fourth rows respectively add a linear time trend, country fixed effects, and both a linear time trend and country fixed effects to the Base Specification. Numbers in cells are the estimates of the coefficient for *Ln(GDP per Capita)* in the respective estimating equation, along with its associated t-statistic. t-values based on cluster-robust standard errors (robust to country-specific serial correlation and heteroskedasticity).

[§] The standard error for *Ln(GDP per Capita)* could not be estimated in Stata assuming a robust (serial correlation + heteroskedasticity) error variance-covariance matrix. Accordingly, the estimating equation was re-estimated assuming only a robust form of heteroskedasticity. The reported t-statistic is the t-value from that estimating equation.