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The Macroeconomic Impact of Earthquakes on Growth: A Tale from Two Datasets

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ABSTRACT: This paper uses two different historical accounts of the occurrence of earthquakes to identify the effects of these shocks on aggregate economic outcomes. We find that the use of a widely popular dataset Emergency Events Database (EM-DAT) that records natural disasters restricted to occurrence with high level of damage points to statistical negative consequences of earthquakes on economic growth. Yet, these results do not hold when using a more comprehensive dataset from the United States Geological Survey (USGS) systematically recording earthquakes irrespective of the associated damage. The two results can be reconciled when isolating case of high-damage earthquakes in the context of poor countries often associated with weaker state capacity. These findings confirm the negative consequences of natural disasters' role on economic development in poor countries and highlight the importance of systematic data collection of natural disasters.

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WORKING PAPERS

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1. Introduction

When a major earthquake strikes, the human tragedy is immediate and unmistakable. Lives are lost, infrastructure collapses, and communities are displaced. But beyond these visible consequences lies a deeper question for economists: what are the long-run effects of earthquakes on economic growth? Do such disasters leave lasting scars on national income, or does reconstruction spur recovery and resilience? The literature has long been divided. Early contributions argued for the potential of creative destruction, while more recent work has emphasized persistent losses. This paper seeks to reconcile these views by turning attention to a more fundamental issue: does the effect of earthquakes on economic growth depend on how we measure the disaster itself?

Our starting point is a simple observation with profound implications, that earthquake data are not all created equal. Most empirical studies rely on Emergency Events Database (EM-DAT), a damage-based disaster database that captures only events surpassing specified thresholds of human or economic impact. As a result, EM-DAT excludes a vast number of lower-intensity earthquakes that may nonetheless disrupt economic activity, especially in vulnerable settings. This truncation, as documented by Panwar and Sen (2020) and Joshi et al. (2024), introduces selection bias that can distort empirical estimates. In contrast, the United States Geological Survey (USGS) provides a systematic geophysical record of all earthquake events, independent of their observed consequences. These data include the universe of seismic activity above a reporting threshold, making them exogenous to local institutional or media capacities.

This paper is the first to explicitly compare the economic growth effects of earthquakes using these two distinct data approaches. We show that the choice of dataset is not an innocuous technicality, as it fundamentally alters our understanding of disasters' economic costs. Using USGS data, we find that earthquake exposure significantly and persistently reduces per capita GDP growth, particularly in low-income countries and following high-intensity events. These effects are entirely absent when the analysis is repeated using EM-DAT data. The implication is striking: past research may have understated the macroeconomic cost of earthquakes not because these shocks are benign, but because the data used to study them were truncated by design.

Our contribution is both methodological and empirical. First, we provide the most comprehensive test to date of how disaster measurement affects macroeconomic inference. Second, we document robust, negative growth effects of seismic activity using a credible, exogenous source of disaster exposure. Finally, we speak to broader debates in climate and disaster economics, reinforcing the emerging consensus that physical hazard data, rather than outcome-based measures, are essential for causal identification.

The remainder of the paper is organized as follows. Section 2 reviews the existing literature on natural disasters and macroeconomic outcomes, with a focus on data credibility and methodological implications. Section 3 presents the data sources and descriptive statistics, highlighting differences between EM DAT and USGS coverage. Section 4 outlines the empirical strategy used to estimate the growth effects of earthquakes. Section 5 presents the main results and robustness checks. Section 6 concludes with implications for research and policy.

2. Literature Review

The economic consequences of natural disasters have long puzzled economists: are these shocks merely transitory blips, or do they leave deeper scars on long-term growth? In early work, Skidmore and Toya (2002) suggested that disasters could foster economic renewal through capital reallocation, a Schumpeterian view of creative destruction. Using EM-DAT, they found a positive association between disaster frequency and growth, implying that adversity might catalyze progress. This optimistic conclusion gained traction, in part because the dataset they used was one of the few comprehensive global sources available at the time.

However, subsequent research began to chip away at this view. Cavallo et al. (2013), through case studies and panel regressions, found that large-scale disasters often had long-lasting negative effects, particularly when they destabilized institutions. Raddatz (2009) provided cross-country evidence that natural disasters induce short-term growth contractions, particularly in low-income countries with limited fiscal space and weak institutions. These studies suggested a more nuanced picture: the macroeconomic effects of disasters depend heavily on state capacity, institutional resilience, and the nature of the shock itself.

A critical insight emerged: it's not just about what happens, it is about what gets recorded. Most of the existing macro-disaster literature relied on EM-DAT, a database that includes only events crossing specific thresholds (e.g., 10 deaths, 100 people affected). Panwar and Sen (2020) showed that EM-DAT systematically underreports small- to medium-scale disasters by comparing it with DesInventar, a more localized database. Joshi, Roberts, and Svensson (2024) further documented the structural incompleteness of EM-DAT, estimating large gaps in disaster reporting that correlate with income and institutional quality. These insights cast doubt on the reliability of many past results and raised a fundamental concern: are we estimating the economic cost of disasters, or the cost of reporting thresholds?

Meanwhile, the climate economics literature, facing similar data limitations, has moved toward using physical indicators of environmental stress. Dell, Jones, and Olken (2012,

2014) advanced this approach by exploiting exogenous variation in temperature and precipitation, finding strong evidence that poor countries are disproportionately harmed by climatic shocks. Burke, Hsiang, and Miguel (2015) pushed this further, estimating that warming will significantly depress global GDP in the long run, with effects concentrated in already-vulnerable regions. Their work underscored the broader lesson: credible identification hinges on the exogeneity and completeness of the underlying data.

In the context of earthquakes, recent studies have followed suit. Lackner (2019) constructed a global panel dataset based on USGS ground-shaking intensity and showed that systematic exposure to seismic activity leads to sustained GDP losses. Unlike earlier work using EM-DAT, his findings revealed larger and more persistent effects, especially in developing countries. Aksoy et al. (2024) applied a synthetic control method to isolate the long-term consequences of severe earthquakes, concluding that disasters reduce growth, increase fiscal burdens, and dampen investment, again reinforcing the message that disasters are not benign.

Our paper contributes to this literature by directly confronting the data issue. While others have raised concerns about EM-DAT’s completeness, we are the first to quantify how data choice affects estimated economic impacts. Our findings align with recent critiques of impact-based databases and provide concrete evidence that measurement error, especially the selective omission of low-visibility disasters, can bias conclusions toward optimism. Using the USGS dataset, we find persistent, negative growth effects following earthquake exposure. These effects are absent or significantly attenuated when using EM-DAT, not because the events are less costly, but because many events are missing altogether.

In doing so, we also engage with the broader debate in macro-disaster research about resilience. Studies that suggest rapid post-disaster recovery may be capturing a selection effect: only large, well-documented events are observed, and many of these occur in places better equipped to recover. By contrast, our results suggest that the true global burden of earthquakes, especially in poorer countries facing frequent, moderate shocks, has been systematically underestimated.

Thus, our contribution is both methodological and substantive. We provide new evidence that the macroeconomic cost of earthquakes is real, significant, and long-lasting, but visible only when using comprehensive, geo-physically grounded data. We build on and extend the recent turn in the literature toward physical indicators of disaster exposure, reinforcing the idea that credible inference in disaster economics requires credible data.

3. Data and Descriptive Statistics

3.1. Data

We construct a new dataset by combining two complementary sources of earthquake information with macroeconomic indicators. The first source is EM-DAT, which records natural disasters globally from 1900 onward. EM-DAT entries are based on reported impacts and include data on the number of people killed, injured, or affected, as well as estimates of economic damage. Crucially, EM-DAT only includes events that meet at least one of four impact-based thresholds: ten or more deaths, 100 or more people affected, declaration of a state of emergency, or a call for international assistance. This inclusion rule systematically omits lower-intensity events, introducing a reporting bias that skews empirical analyses toward high-impact observations.

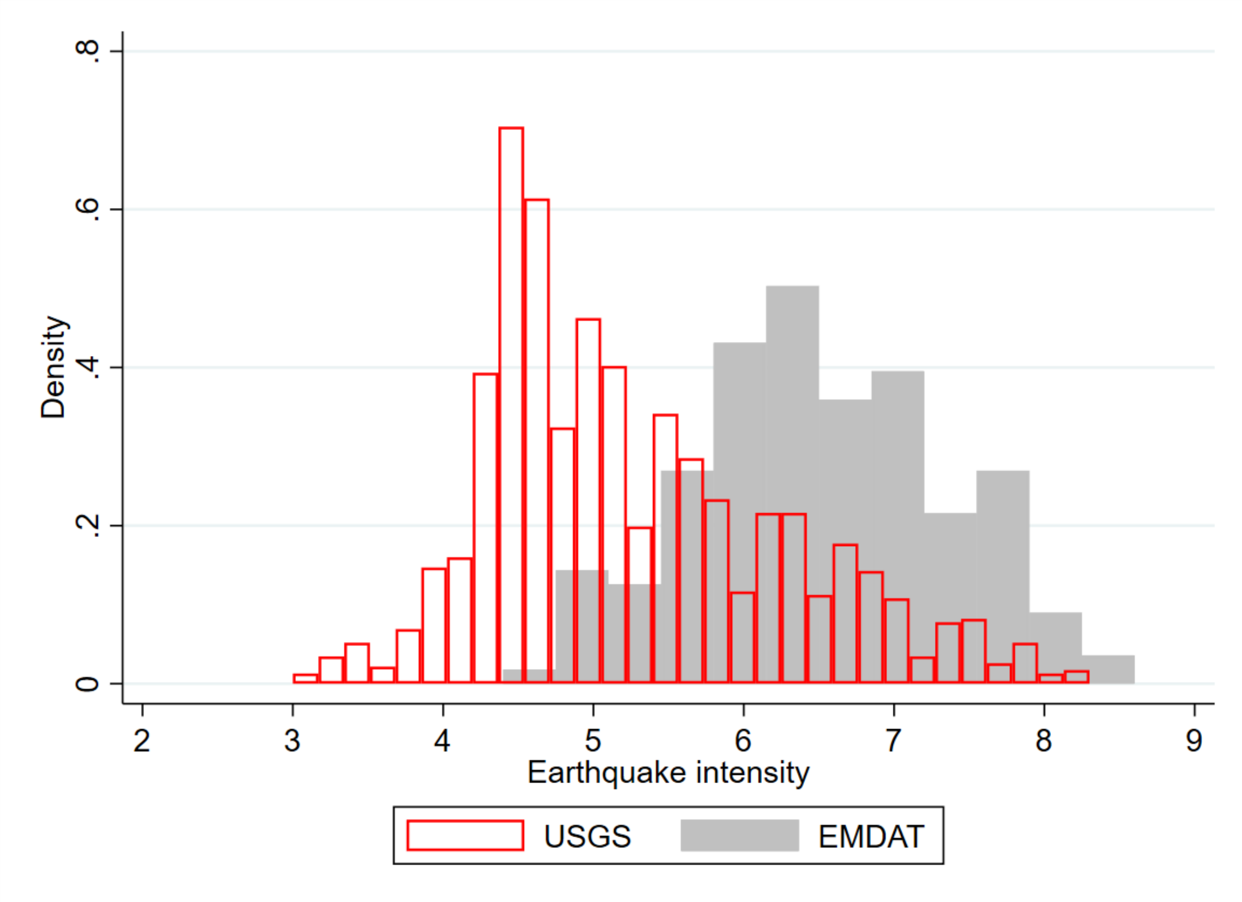
The second source is the United States Geological Survey (USGS), which maintains a comprehensive global record of earthquakes based solely on seismographic detection. The USGS provides detailed geophysical earthquake records from 2012 to 2022, including information on earthquake magnitude, depth, and precise location. The data aggregates information from global seismological networks and government agencies worldwide. This comprehensive dataset includes lower magnitude events, offering a more exhaustive record of earthquake activity. Because this dataset is generated by geophysical instrumentation rather than human reporting, it provides a more complete and exogenous measure of earthquake exposure.

We restrict our sample to the 2012–2022 period, during which both EM-DAT and USGS data are consistently available. For each country-year, we construct parallel measures of earthquake exposure: maximum earthquake magnitude and total number of events recorded. These are computed separately using each dataset, enabling direct comparison of results derived from damage-based versus instrument-based sources.

3.2. Descriptive Statistics

Figures 1 through 3 provide an initial overview of the differences between the EM-DAT and USGS datasets and their implications for cross-country measurement of earthquake exposure. Figure 1 presents the kernel density functions of recorded earthquake magnitudes in each dataset. The USGS distribution is smooth and continuous, capturing a wide spectrum of events including many low- and medium-intensity earthquakes. In contrast, EM-DAT observations are concentrated at the upper end of the magnitude scale, reflecting its threshold-based inclusion criteria.

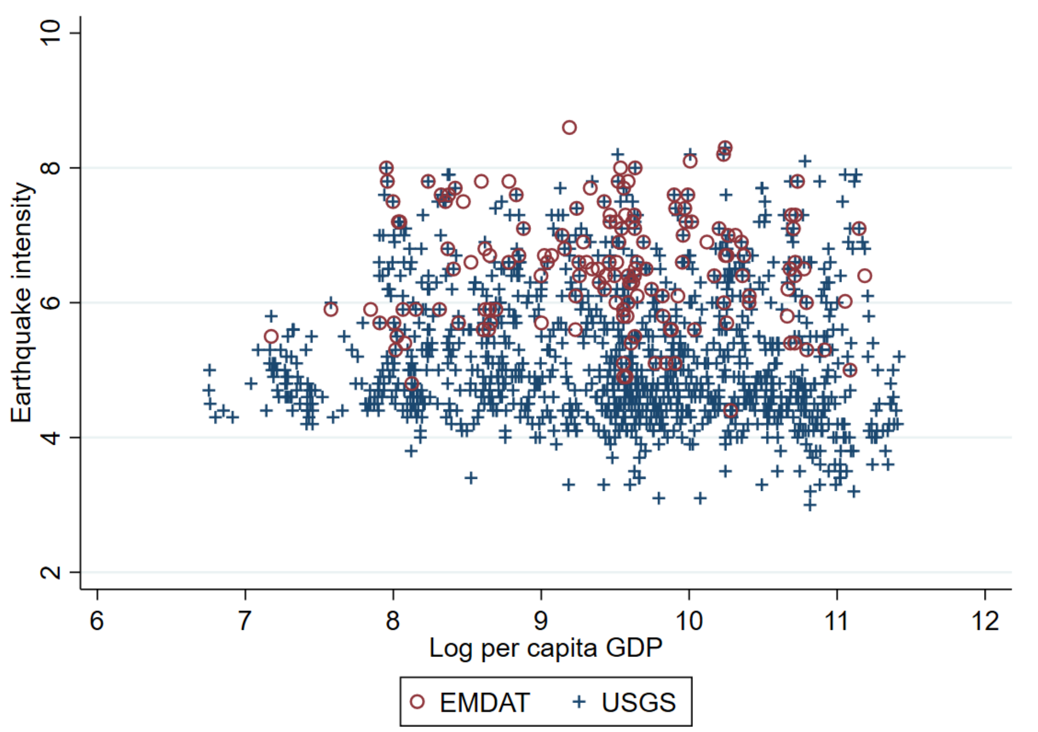
Figure 1. Density function of earthquake intensity



Notes: This figure shows the density functions of earthquake intensity from two different sources: EMDAT and USGS. EMDAT database, compiled by the Centre for Research on the Epidemiology of Disasters, focuses on high-magnitude earthquake disasters and includes data on human and economic impacts. In contrast, the USGS database provides a more comprehensive record of earthquake events, including both high and low-magnitude earthquakes, with data on the geophysical characteristics. The solid histogram represents the distribution of the maximum earthquake intensity at the country-year level over the period 2012-2022, based on data from the USGS. The shaded histogram shows the distribution of the maximum earthquake intensity at the country-year level for the same period, sourced from the EM-DAT. Both distributions capture the intensity of earthquake disasters, with each representing different data reporting standards and coverage.

Figure 2 explores the relationship between earthquake exposure and income. It plots maximum recorded earthquake magnitude against log per capita GDP (PPP) across country-year observations. EM-DAT data show a skewed pattern with disproportionately more entries in low-income countries. This likely reflects the dual influence of vulnerability and reporting dynamics, where even moderate events generate significant damage in low-capacity settings and hence cross EM-DAT's inclusion threshold. USGS data, by contrast, exhibit no such skew, consistent with their exogeneity to socioeconomic conditions.

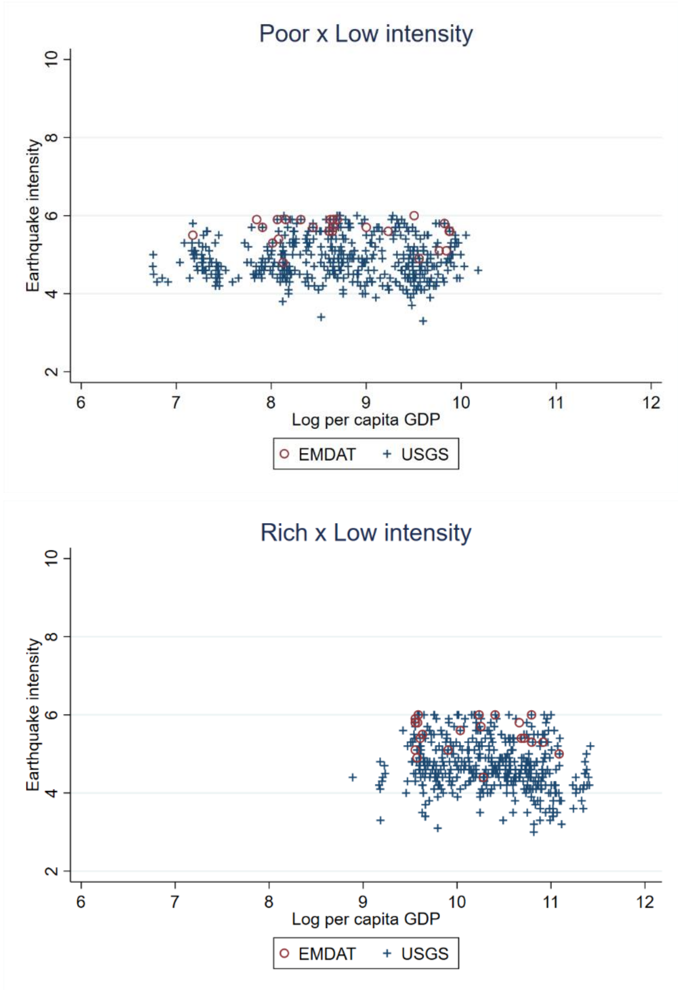
Figure 2. Log of per capita income (PPP constant) and earthquake intensity

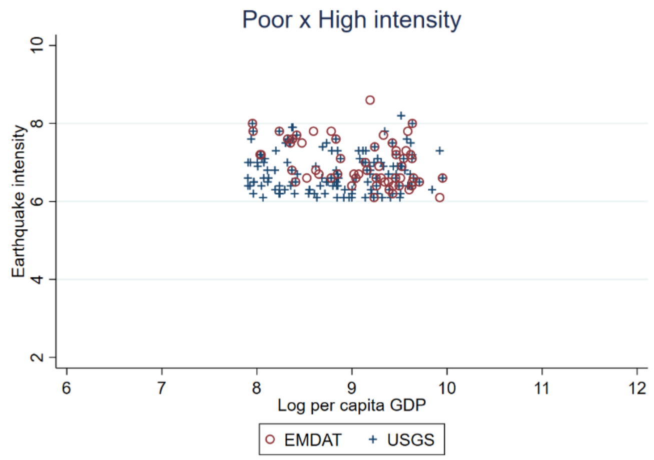


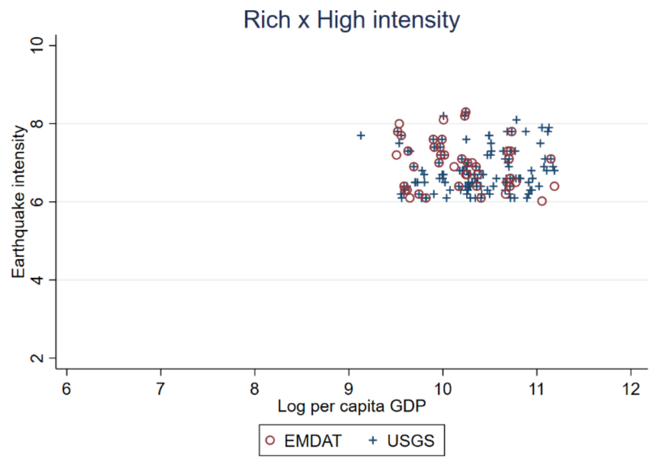
Notes: This graph presents data on earthquake intensity in each country, as a function of GDP per capita, taken from the World Development Indicators (WDI) for the period 2012-2022. For each country-year, the blue circle symbols represent the maximum intensity records provided by the USGS, and the red circle symbols represent the maximum intensity records provided by EMDAT.

To further examine the role of data truncation, Figure 3 disaggregates events by income group and intensity class. Specifically, we distinguish low- and high-magnitude earthquakes (below and above magnitude 6) and compare their frequency across poor and rich countries. Low-magnitude events are largely absent in EM-DAT, especially in higher-income countries, while the USGS captures them comprehensively across the income spectrum. This finding reinforces the argument that EM-DAT's structure leads to systematic underrepresentation of smaller but economically meaningful events.

Figure 3. Log of per capita GDP and earthquake intensity by type of countries and intensity level







Notes: These graphs display country-year level data on earthquake intensity across 178 countries from 2012 to 2022, plotted against the logarithm of GDP per capita (PPP, constant 2021 international $) sourced from the World Development Indicators (WDI). The blue plus symbol represents the maximum earthquake intensity recorded by the USGS for each country-year, while the red symbols indicate the maximum intensity recorded by EM-DAT for the same period. EMDAT database, compiled by the Centre for Research on the Epidemiology of Disasters, focuses on high-magnitude earthquake disasters and includes data on human and economic impacts. In contrast, the USGS database provides a more comprehensive record of earthquake events, including both high and low-magnitude earthquakes, with data on the geophysical characteristics. Low intensity is defined as earthquakes with magnitudes below 6, and high intensity as earthquakes with magnitudes above 6. Countries are categorized as poor or rich based on whether their average per capita GDP for the period 2012-2016falls below or above the median value.

Taken together, these descriptive statistics highlight the fundamental measurement discrepancy between the two datasets. EM-DAT offers a selective view of disaster incidence that is conditioned by both event severity and country-specific vulnerability, while USGS provides an objective and more comprehensive account of seismic activity. This distinction motivates our empirical analysis in the subsequent sections, which estimate the economic consequences of earthquakes using each dataset separately and compare the resulting inferences.

4. Empirical Strategy

Estimating the macroeconomic impact of earthquakes requires an empirical strategy that exploits their exogeneity while carefully addressing measurement and specification concerns. Our approach follows recent work in disaster economics and climate macroeconomics, incorporating fixed effects, distributed lags, and multiple measures of exposure to uncover the dynamic relationship between seismic activity and growth. The unique feature of our study lies in the parallel use of two distinct earthquake datasets, namely EM-DAT and USGS, which allows us to isolate the effects of measurement choice on inference.

Our baseline specification follows a fixed-effects panel regression framework widely used in the macroeconomic literature on natural disasters (e.g., Raddatz, 2009; Felbermayr and Gröschl, 2014; Cavallo et al., 2013):

$$g_{it} = \sum_{j=0}^{L} \beta_j EQIntensity_{it-j} + \alpha_i + \alpha_{rt} + \epsilon_{it} \quad (1)$$

where g_{it} is the growth rate of per-capita output. $EQIntensity_{it}$ is a vector of the magnitude of the strongest earthquake recorded in country i at time t with up to 3 lags included. α_i are country fixed effects, α_{rt} are time fixed effects (interacted separately with region dummies and a poor country dummy in our main specifications), ϵ_{it} is an error term clustered simultaneously by country and region-year (following the two-way clustering of Cameron, Gelbach, and Miller 2011).
The coefficient β captures the average short-run effect of earthquakes on output growth. We estimate the model separately using exposure measures from EM-DAT and USGS. For EM-DAT, $EQIntensity_{it}$ captures the maximum reported earthquake magnitude or the number of reported disaster events in a given year.

For USGS, we use analogous physical measures, maximum magnitude and count of recorded seismic events, ensuring comparability across specifications. Because USGS data are systematically recorded, they provide a more complete and exogenous measure of actual seismic activity, in contrast to the selectively reported EM-DAT entries.

To capture dynamic responses and allow for potential delayed effects, we extend the baseline model with a distributed lag structure (e.g., Klomp, 2016; Cavallo et al., 2013).

This specification allows us to track the temporal evolution of output following earthquake shocks. Prior studies such as Cavallo et al. (2013) and Klomp (2016) suggest that disaster effects may be distributed across multiple years, due to reconstruction delays, fiscal constraints, and slow-moving capital adjustments.

We merge the earthquake data with annual macroeconomic indicators from the World Development Indicators (WDI). Our primary outcome variable is the growth rate of real GDP per capita (constant PPP). The panel includes 178 countries with at least 11 years of non-missing GDP data, yielding sufficient variation across time and geography to support our empirical strategy.

We also test for heterogeneity in treatment effects by interacting $EQIntensity_{it}$ with country income levels and earthquake intensity bins. These interactions allow us to assess whether the macroeconomic costs of earthquakes differ systematically across development levels or by the magnitude of seismic shocks. Given that low-income countries are more vulnerable to infrastructure damage, financing constraints, and institutional fragility, we expect stronger effects in this group.

Potential biases in estimates may arise from attenuation due to measurement error or from omitted variables correlated with both earthquake incidence and growth. To mitigate these concerns, we include controls for investment rates, government consumption, and political instability in robustness specifications. We also conduct placebo tests using pre-treatment years to confirm the absence of anticipatory effects and validate the exogeneity of earthquake timing.

Finally, we report parallel estimates for each exposure measure across both datasets, enabling a direct comparison of coefficients, standard errors, and model fit. This empirical design provides insight not only into the economic consequences of earthquakes, but also into how dataset choice fundamentally shapes the narrative we extract from the data. EM-DAT offers a selective view of disaster incidence that is conditioned by both event severity and country-specific vulnerability, while USGS provides an objective and more comprehensive account of seismic activity. This distinction motivates our empirical analysis in the subsequent sections, which estimate the economic consequences of earthquakes using each dataset separately and compare the resulting inferences.

5. Results

We now present the empirical findings, beginning with the baseline estimates of the effect of earthquake exposure on GDP per capita growth. Table 1 reports results using both EM-DAT and USGS data sources. When exposure is measured using USGS data, we find a statistically significant and economically meaningful negative effect on growth. Specifically, a one-unit increase in earthquake magnitude is associated with a reduction in GDP per capita growth of approximately 0.5 percentage points. This effect is statistically significant at the 5 percent level. In contrast, the corresponding estimates using EM-DAT data are smaller in magnitude and not statistically significant.

Table 1: Growth rate and earthquake intensity

	Growth rate of per capita output							
	EMDAT				USGS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earthquake (intensity)	-0.095*	-0.123**	-0.128**	-0.145**	0.017	-0.009	0.003	-0.031
	(0.055)	(0.056)	(0.062)	(0.066)	(0.140)	(0.113)	(0.133)	(0.110)
L1: Earthquake (intensity)		-0.069	-0.067	-0.071		-0.097	-0.056	-0.023
		(0.055)	(0.059)	(0.072)		(0.112)	(0.111)	(0.137)
L2: Earthquake (intensity)			0.022	0.015			-0.089	-0.048
			(0.060)	(0.066)			(0.076)	(0.102)
L3: Earthquake (intensity)				-0.019				0.094
				(0.072)				(0.129)
Observations	1,958	1,780	1,602	1,424	1,958	1,780	1,602	1,424
R-squared	0.329	0.342	0.359	0.374	0.329	0.342	0.359	0.374
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low state capacity x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All specifications use growth rate of per capita output as dependent variable and include country FE, region × year FE, and low state capacity × year FE. Columns 1 to 4 use EMDAT earthquake data, while columns 5 to 8 use USGS earthquake data. Robust standard errors are in parentheses, adjusted for two-way clustering at country and year-region level. ***, **, ** represent significance at the 1 percent, 5 percent and 10 percent level, respectively.

To assess the persistence of these effects, Table 2 presents results from a distributed lag specification over a five-year horizon. We find that the negative effects of earthquakes persist for up to three years following the event, with the largest impact observed in the second year. The cumulative effect over five years is a reduction in growth of approximately 1.3 percentage points. Again, these effects are detected only when using USGS data; EM-DAT-based estimates remain statistically indistinguishable from zero.

Table 2: Growth rate and earthquake intensity type

	Growth rate of per capita output							
	EMDAT				USGS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earthquake (Low intensity)	-0.270	-0.407	-0.276	-0.468	0.289	0.247	0.356	0.219
	(0.628)	(0.643)	(0.716)	(0.782)	(0.730)	(0.626)	(0.753)	(0.642)
L1: Earthquake (Low intensity)		-0.343	-0.299	-0.204		-0.466	-0.256	-0.078
		(0.530)	(0.545)	(0.588)		(0.479)	(0.475)	(0.601)
L2: Earthquake (Low intensity)			0.054	0.222			-0.301	-0.125
			(0.475)	(0.521)			(0.359)	(0.473)
L3: Earthquake (Low intensity)				-0.131				0.686
				(0.539)				(0.581)
Earthquake (High intensity)	-0.840*	-1.042**	-1.150**	-1.257**	-0.621	-0.804	-0.850	-1.013
	(0.505)	(0.471)	(0.512)	(0.568)	(0.772)	(0.733)	(0.811)	(0.857)
L1: Earthquake (High intensity)		-0.549	-0.601	-0.701		-0.045	0.116	0.147
		(0.436)	(0.496)	(0.619)		(0.615)	(0.619)	(0.753)
L2: Earthquake (High intensity)			0.180	-0.006			-0.595	-0.595
			(0.542)	(0.607)			(0.789)	(0.874)
L3: Earthquake (High intensity)				-0.180				0.391
				(0.610)				(1.014)
Observations	1,958	1,780	1,602	1,424	1,958	1,780	1,602	1,424
R-squared	0.329	0.342	0.360	0.375	0.330	0.343	0.360	0.375
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low state capacity x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All specifications use growth rate of per capita output as dependent variable and include country FE, region × year FE, and low state capacity × year FE. Low intensity is a dummy variable defined as earthquakes with magnitudes below 6, and high intensity as earthquakes with magnitudes above 6. Columns 1 to 4 use EMDAT earthquake data, while columns 5 to 8 use USGS earthquake data. Robust standard errors are in parentheses, adjusted for two-way clustering at country and year-region level. ***, **, ** represent significance at the 1 percent, 5 percent and 10 percent level, respectively.

We then explore heterogeneity in the estimated effects by country income group. Table 3 shows that the adverse impact of earthquakes is more pronounced in low-income countries, consistent with greater structural vulnerability and more limited fiscal capacity to respond to shocks. In high-income countries, the effects are smaller and not statistically significant, suggesting a greater degree of resilience. This finding aligns with earlier work by Cavallo and Noy (2011) and Felbermayr and Gröschl (2014), who emphasize the role of institutional capacity in disaster recovery.

In Table 4, we disaggregate effects by earthquake intensity. We distinguish between low- and high-magnitude events, using a threshold of magnitude 6. Both categories are found to have negative effects on growth, but the magnitude and persistence are larger for high-intensity events. These patterns further support the view that even moderate earthquakes can have economically meaningful consequences, a result only visible when using comprehensive physical data from USGS.

Table 3: Growth rate, earthquake intensity and poor countries

	Growth rate of per capita output							
	EMDAT				USGS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earthquake (intensity) x Poor	-0.074	-0.133	-0.133	-0.134	-0.060	-0.057	-0.043	-0.029
	(0.081)	(0.080)	(0.085)	(0.094)	(0.078)	(0.072)	(0.074)	(0.083)
L1: Earthquake (intensity) x Poor		-0.178**	-0.219**	-0.230**		-0.074	-0.069	-0.054
		(0.085)	(0.090)	(0.107)		(0.141)	(0.150)	(0.212)
L2: Earthquake (intensity) x Poor			0.105	0.077			-0.154	-0.140
			(0.097)	(0.108)			(0.108)	(0.128)
L3: Earthquake (intensity) x Poor				-0.081				-0.115
				(0.097)				(0.147)
Earthquake (intensity) x Rich	-0.062	-0.083	-0.075	-0.103	0.116	0.073	0.094	0.032
	(0.059)	(0.057)	(0.068)	(0.073)	(0.209)	(0.161)	(0.210)	(0.162)
L1: Earthquake (intensity) x Rich		-0.026	0.020	0.012		-0.157	-0.086	-0.031
		(0.082)	(0.090)	(0.104)		(0.140)	(0.141)	(0.158)
L2: Earthquake (intensity) x Rich			-0.026	-0.011			-0.003	0.080
			(0.055)	(0.057)			(0.117)	(0.170)
L3: Earthquake (intensity) x Rich				0.008				0.320**
				(0.088)				(0.135)
Observations	1,958	1,780	1,602	1,424	1,958	1,780	1,602	1,424
R-squared	0.338	0.356	0.375	0.390	0.338	0.356	0.374	0.391
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Poor x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All specifications use growth rate of per capita output as dependent variable and include country FE, region × year FE, and poor × year FE. Columns 1 to 4 use EMDAT earthquake data, while columns 5 to 8 use USGS earthquake data. Countries are categorized as poor or rich based on whether their average per capita GDP for the period 1990-1995 falls below or above the median value. Robust standard errors are in parentheses, adjusted for two-way clustering at country and year-region level. ***, **, ** represent significance at the 1 percent, 5 percent and 10 percent level, respectively.

Table 4: Growth rate, earthquake intensity type and poor

	Growth rate of per capita output							
	EMDAT				USGS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Earthquake (low intensity) x Poor	-0.710	-1.117	-1.011	-0.982	-0.173	-0.122	-0.022	0.045
	(0.742)	(0.709)	(0.768)	(0.880)	(0.400)	(0.363)	(0.338)	(0.374)
L1: Earthquake (low intensity) x Poor		-0.123	-0.319	-0.342		-0.179	-0.089	0.042
		(0.463)	(0.462)	(0.486)		(0.611)	(0.640)	(0.954)
Earthquake (low intensity) x Rich	0.925	0.796	0.920	0.793	0.666	0.591	0.732	0.481
	(1.357)	(1.253)	(1.415)	(1.508)	(1.061)	(0.917)	(1.173)	(0.982)
L1: Earthquake (low intensity) x Rich		-1.092	-0.807	-0.666		-0.822	-0.532	-0.312
		(0.923)	(1.000)	(1.148)		(0.624)	(0.652)	(0.766)
Earthquake (high intensity) x Poor	-0.445	-0.754	-0.769	-0.843	-1.678**	-1.848**	-1.935**	-1.933*
	(0.596)	(0.578)	(0.626)	(0.748)	(0.706)	(0.750)	(0.877)	(1.136)
L1: Earthquake (high intensity) x Poor		-1.574**	-1.868**	-2.046**		0.196	0.135	0.207
		(0.674)	(0.724)	(0.889)		(0.648)	(0.781)	(1.112)
Earthquake (high intensity) x Rich	-1.064	-1.197*	-1.236	-1.382	0.600	0.472	0.485	0.295
	(0.727)	(0.673)	(0.798)	(0.971)	(0.912)	(0.822)	(0.992)	(0.860)
L1: Earthquake (high intensity) x Rich		-0.051	0.158	0.073		-0.450	-0.157	-0.163
		(0.673)	(0.794)	(0.892)		(0.938)	(1.028)	(1.161)
Observations	1,958	1,780	1,602	1,424	1,958	1,780	1,602	1,424
R-squared	0.338	0.357	0.376	0.391	0.339	0.358	0.376	0.393
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Poor x Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: All specifications use growth rate of per capita output as dependent variable and include country FE, region × year FE, and poor × year FE. Columns 1 to 4 use EMDAT earthquake data, while columns 5 to 8 use USGS earthquake data. Columns 4 and 8 include second lag and third lag interactions; these coefficients are removed from the table to save space. Low intensity is a dummy variable defined as earthquakes with magnitudes below 6, and high intensity as earthquakes with magnitudes above 6. Countries are categorized as poor or rich based on whether their average per capita GDP for the period 1990-1995 falls below or above the median value. Robust standard errors are in parentheses, adjusted for two-way clustering at country and year-region level. ***, **, ** represent significance at the 1 percent, 5 percent and 10 percent level, respectively.

Together, these results provide strong support for our central argument: the economic effects of earthquakes are significant and persistent, but only observable when using systematically recorded, geophysical data. Analyses based on EM-DAT alone may understate the true cost of seismic events due to measurement truncation and reporting bias. The next section concludes with a discussion of policy implications and directions for future research. EM-DAT offers a selective view of disaster incidence that is conditioned by both event severity and country-specific vulnerability, while USGS provides an objective and more comprehensive account of seismic activity. This distinction motivates our empirical analysis in the subsequent sections, which estimate the economic consequences of earthquakes using each dataset separately and compare the resulting inferences.

6. Conclusion

This paper revisits the macroeconomic impact of earthquakes through an often-neglected dimension: the credibility and coverage of disaster exposure data. We show that estimates of economic loss hinge critically on how exposure is measured. In particular, while damage-based datasets such as EM-DAT have become standard in the literature, they systematically exclude a large share of smaller-scale events, especially in wealthier or less transparent settings, thus biasing empirical inferences. In contrast, the USGS database offers an exogenous, geophysically anchored measure that captures the full spectrum of seismic activity.

Our side-by-side analysis reveals a stark contrast. Using USGS data, we find strong and persistent negative effects of earthquakes on GDP per capita growth, especially in lower- and middle-income economies. These effects are not apparent when relying on EM-DAT. The divergence reflects not random noise but fundamentally different data-generating processes, one based on reported damage, the other on physical measurement.

This discrepancy has broader implications. First, it reinforces the importance of using hazard-based rather than outcome-based metrics when identifying the economic effects of natural disasters. Second, it highlights the risk of drawing conclusions from incomplete or selective data, a concern with growing relevance for research on climate shocks and resilience.

The findings also matter for policy. If exposure is systematically understated, then disaster risk may be underpriced, leading to insufficient investment in mitigation and miscalibrated fiscal responses. For countries undergoing rapid urbanization in earthquake-prone areas, especially in the middle-income bracket, this misalignment could prove particularly costly. Incorporating objective hazard data into national and global risk frameworks would strengthen early warning systems, improve public investment planning, and enhance the credibility of sovereign risk assessments.

Looking ahead, similar methodological scrutiny should be applied to other disaster types, where data limitations may equally skew results. Ultimately, while earthquakes are acts of nature, the stories we tell about their consequences are shaped by data, and better data can lead to better policy.

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