The Inequality, Economic Growth, Climate Change and Natural Disasters Nexus: Empirical Evidence

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Outline

Motivation	Empirical evidence	Contribution	Data
Empirical strategy	Descriptive statistics	Results	Conclusion

What is the current situation?

Motivation

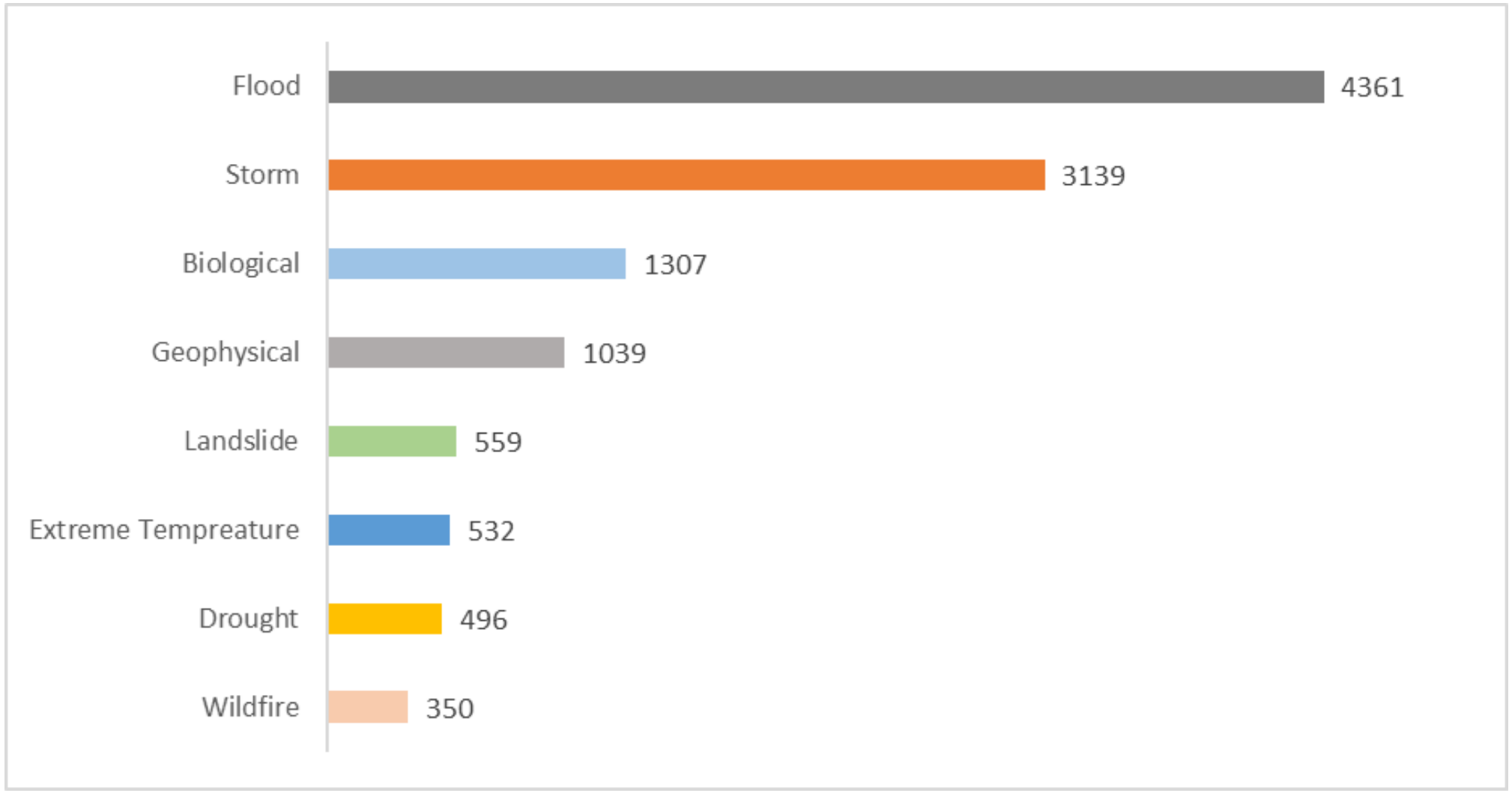

Figure 1: Number of Events per disaster 1990-2020

Source: authors' calculations based on data from EM-DAT database (2022).

What is the current situation ?

Motivation

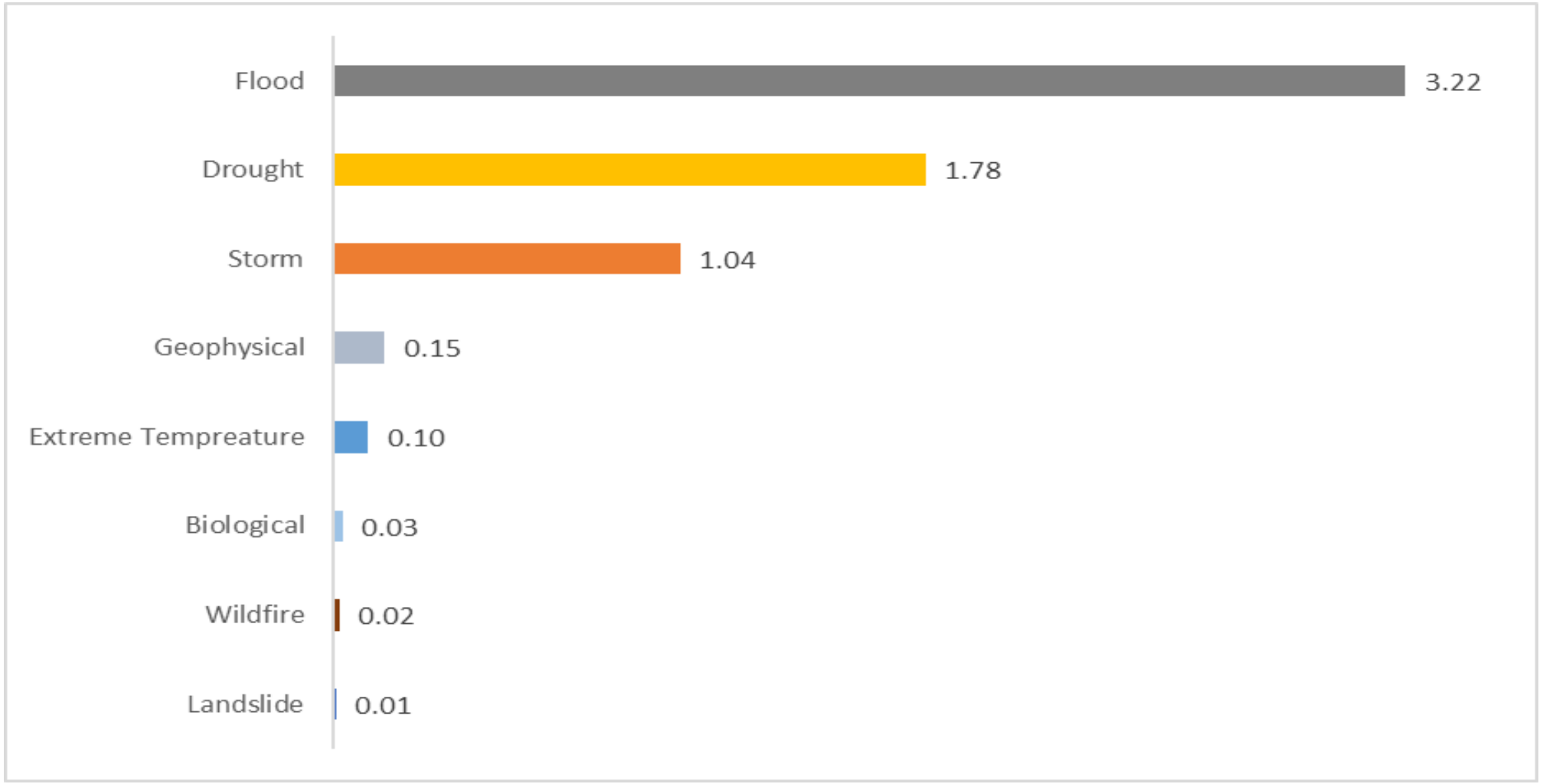

Figure 2: Number of persons hit by disaster 1990-2020 (in Billions)

Source: authors' calculations based on data from EM-DAT database (2022).

What is the current situation ?

Motivation

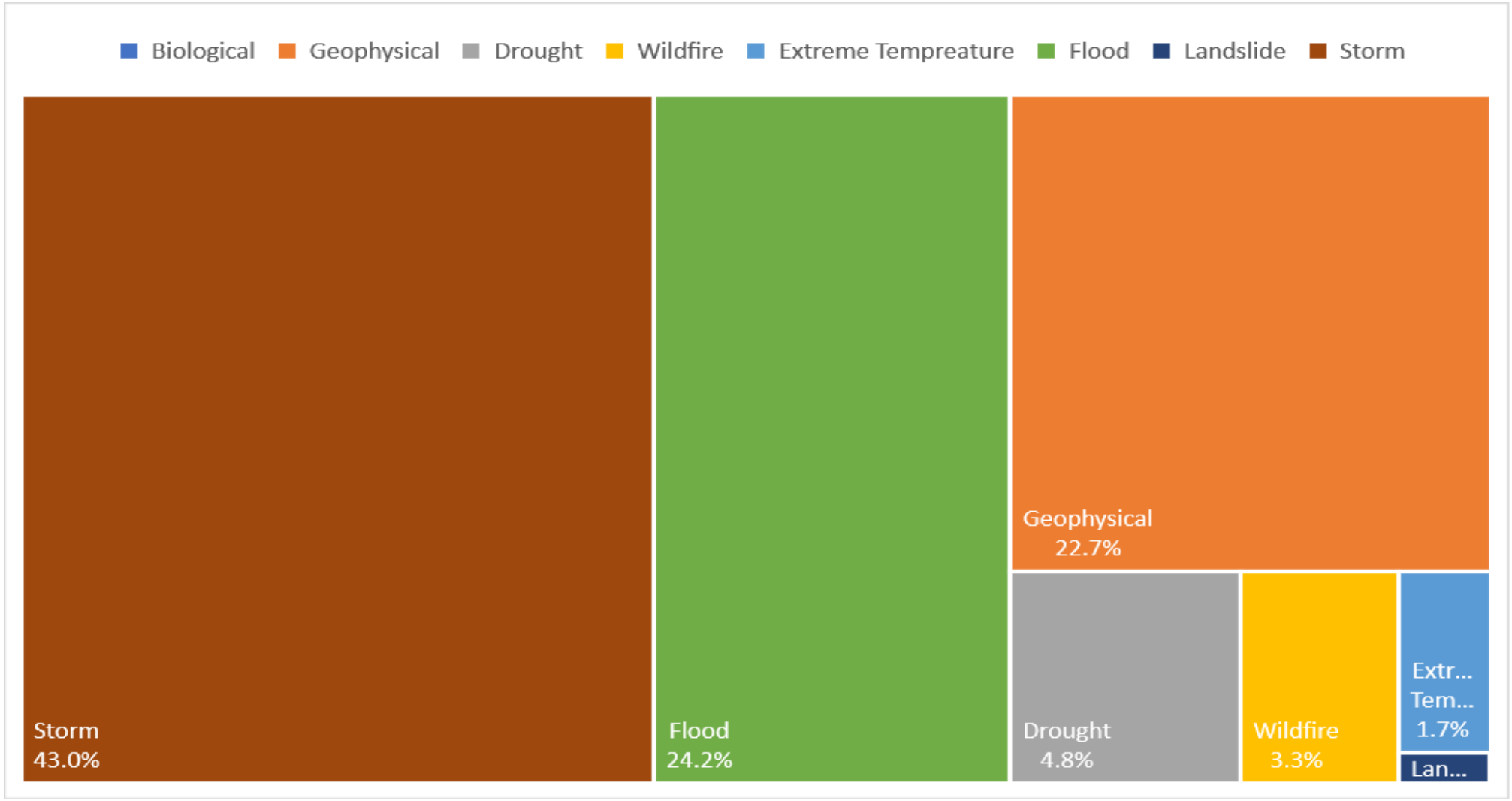

Figure 3: Adjusted total damage distribution per disaster 1990-2020 [Total = 4.6 billion dollars]

Source: authors' calculations based on data from EM-DAT database (2022).

How are these disasters behaving over time?

Motivation

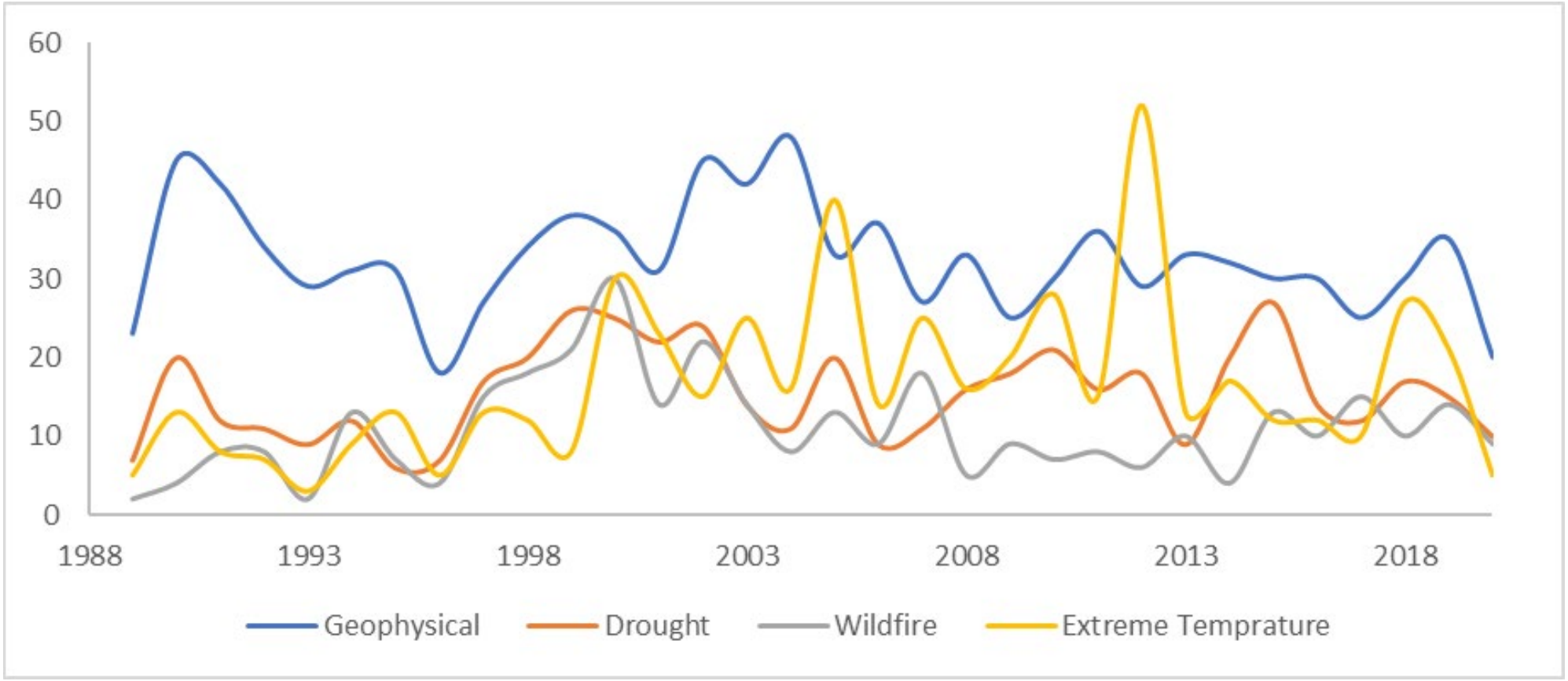

Figure 4: Time series for dry disasters count – Categorized

Source: authors' calculations based on data from EM-DAT database (2022).

How are these disasters behaving over time?

Motivation

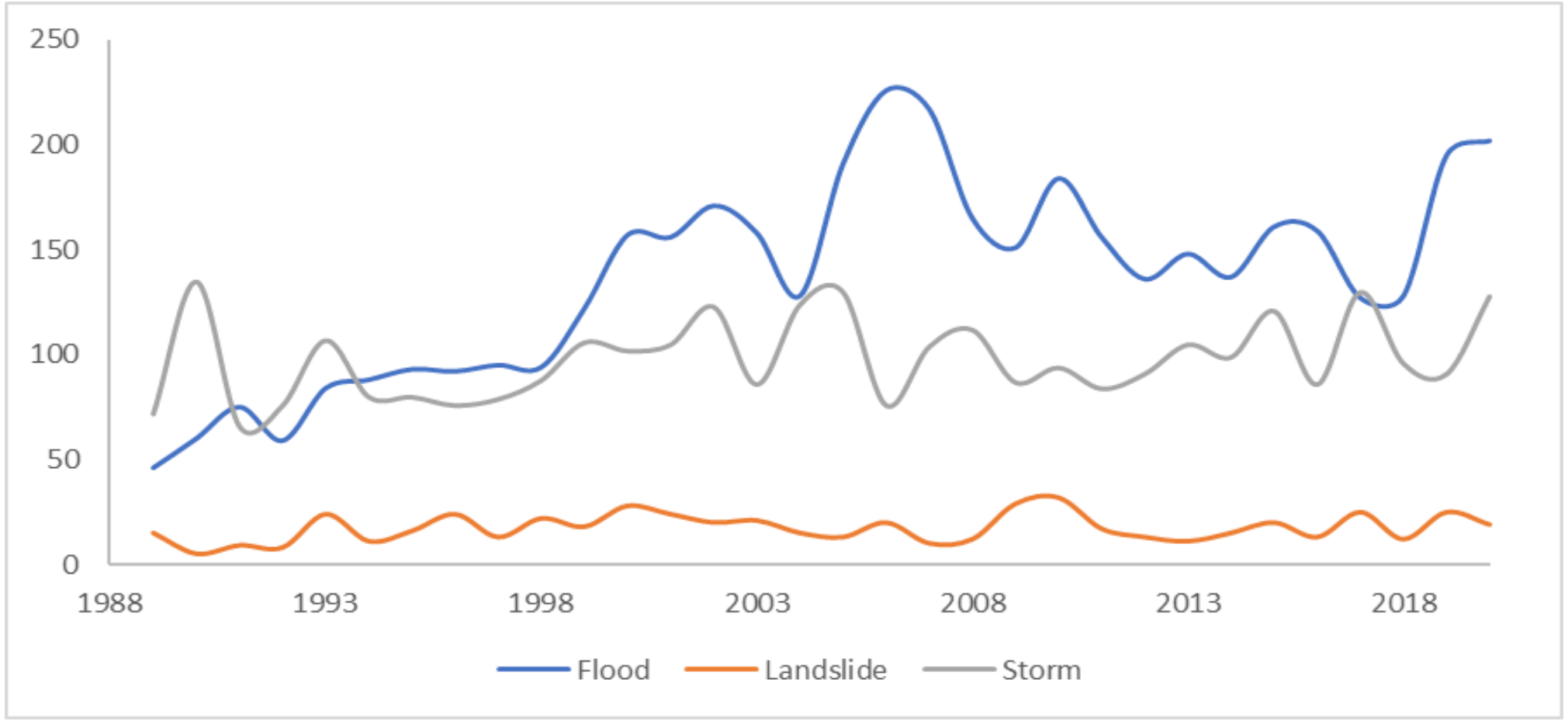

Figure 5: Time series for wet disasters count – Categorized

Source: authors' calculations based on data from EM-DAT database (2022).

How are these disasters behaving over time?

Motivation

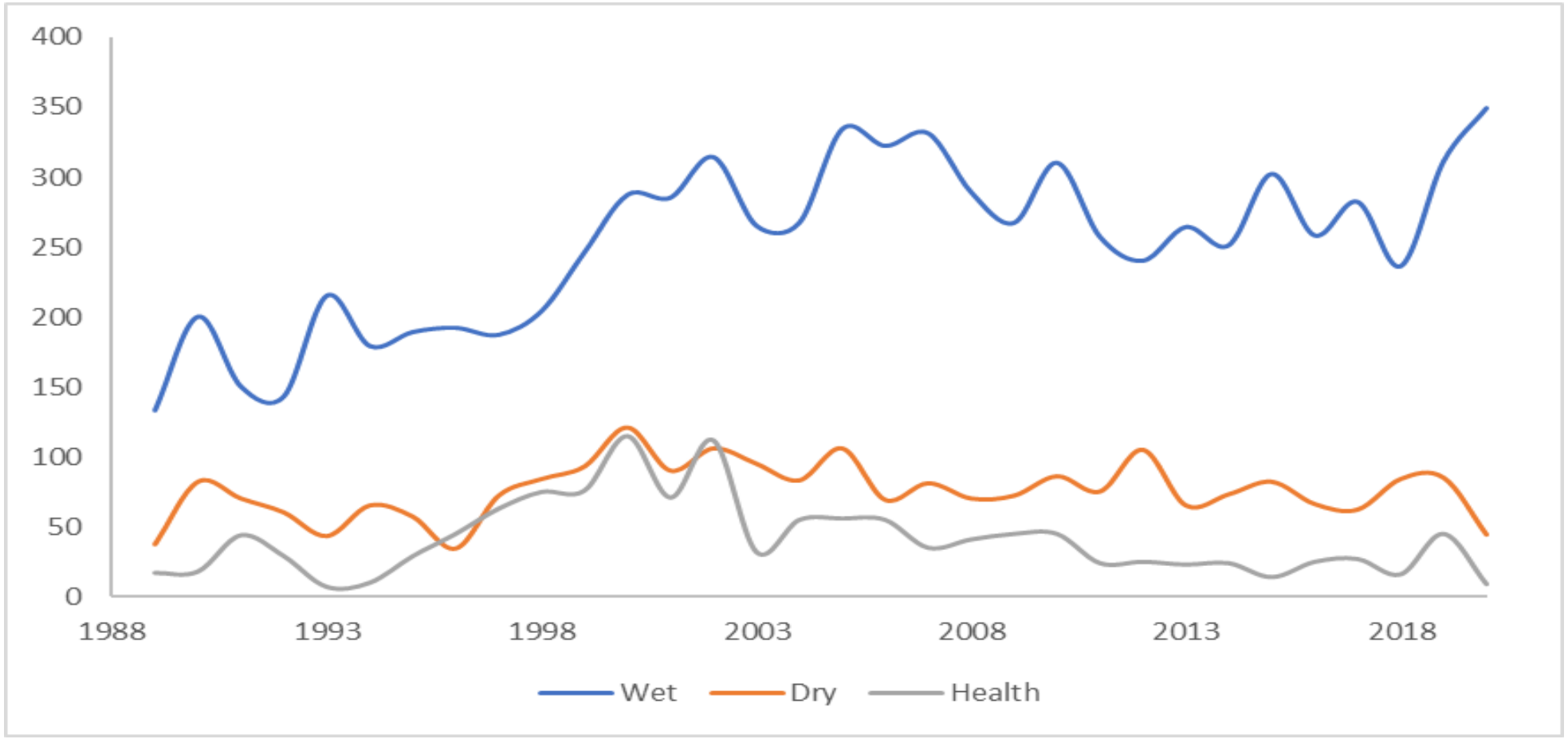

Figure 6: Time series for disasters count – Categorized

Source: authors' calculations based on data from EM-DAT database (2022).

Motivation

What is the current situation by continent ?

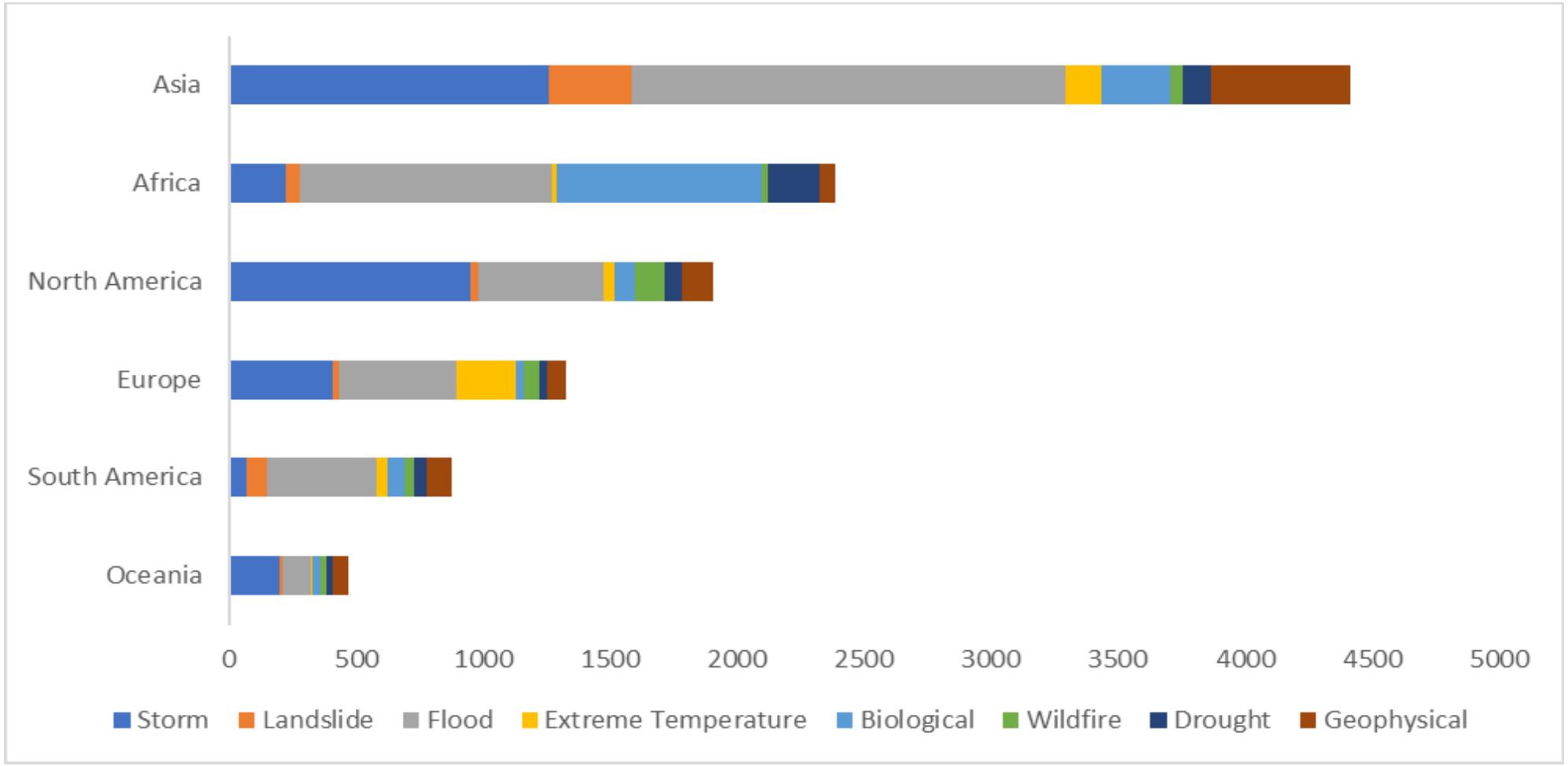

Figure 7: Number of disasters by continent 1989-2020

Source: authors' calculations based on data from EM-DAT database (2022).

Motivation

What is the current situation by continent and time ?

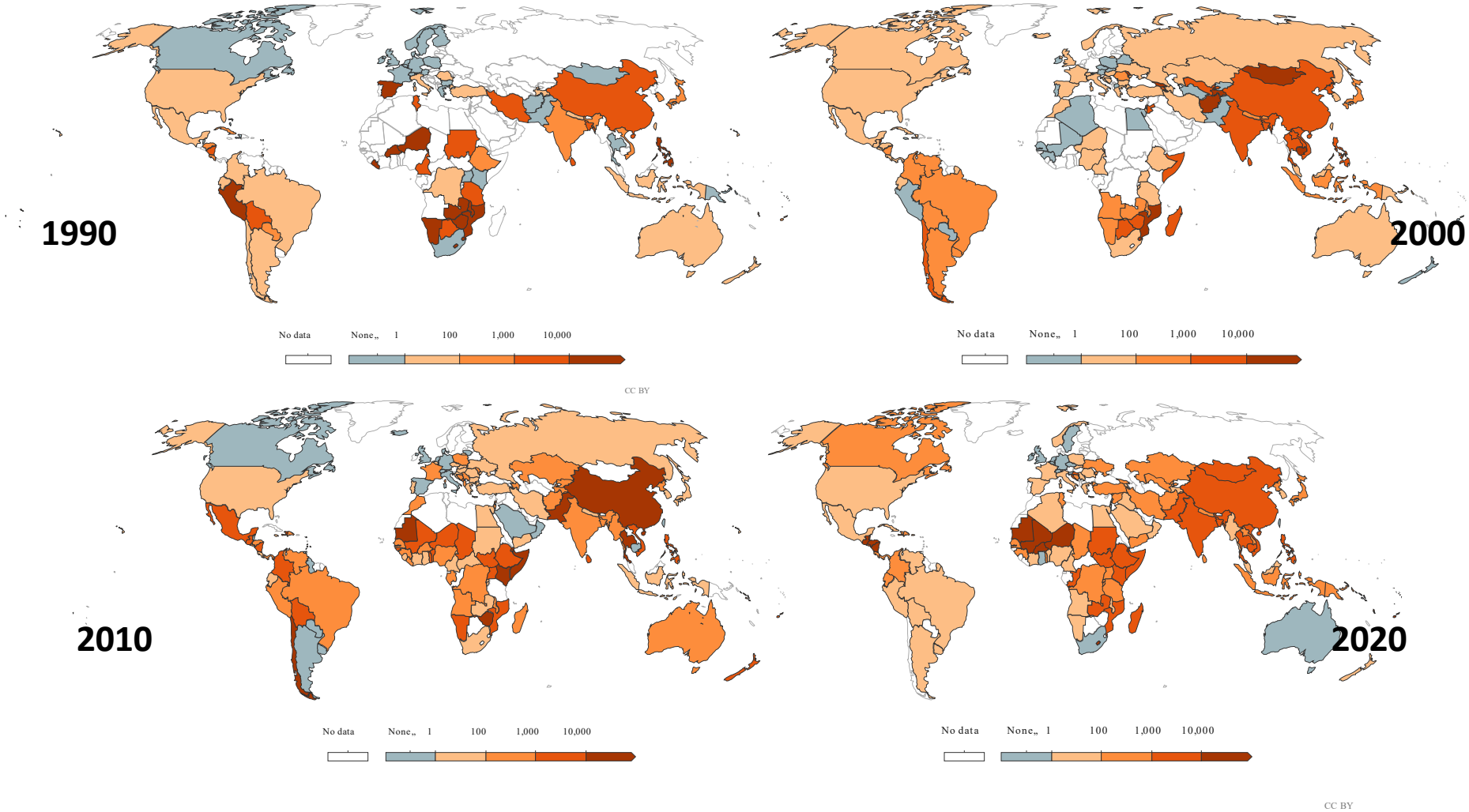

Figure 8: Total number of persons hit by disaster 1990-2020 (in Billions)

Source: EM-DAT database (2022).

N.B. For watching the change from year 1900 till year 2020 please check https://ourworldindata.org/natural-disasters.

Motivation

How is global temperature behaving over time?

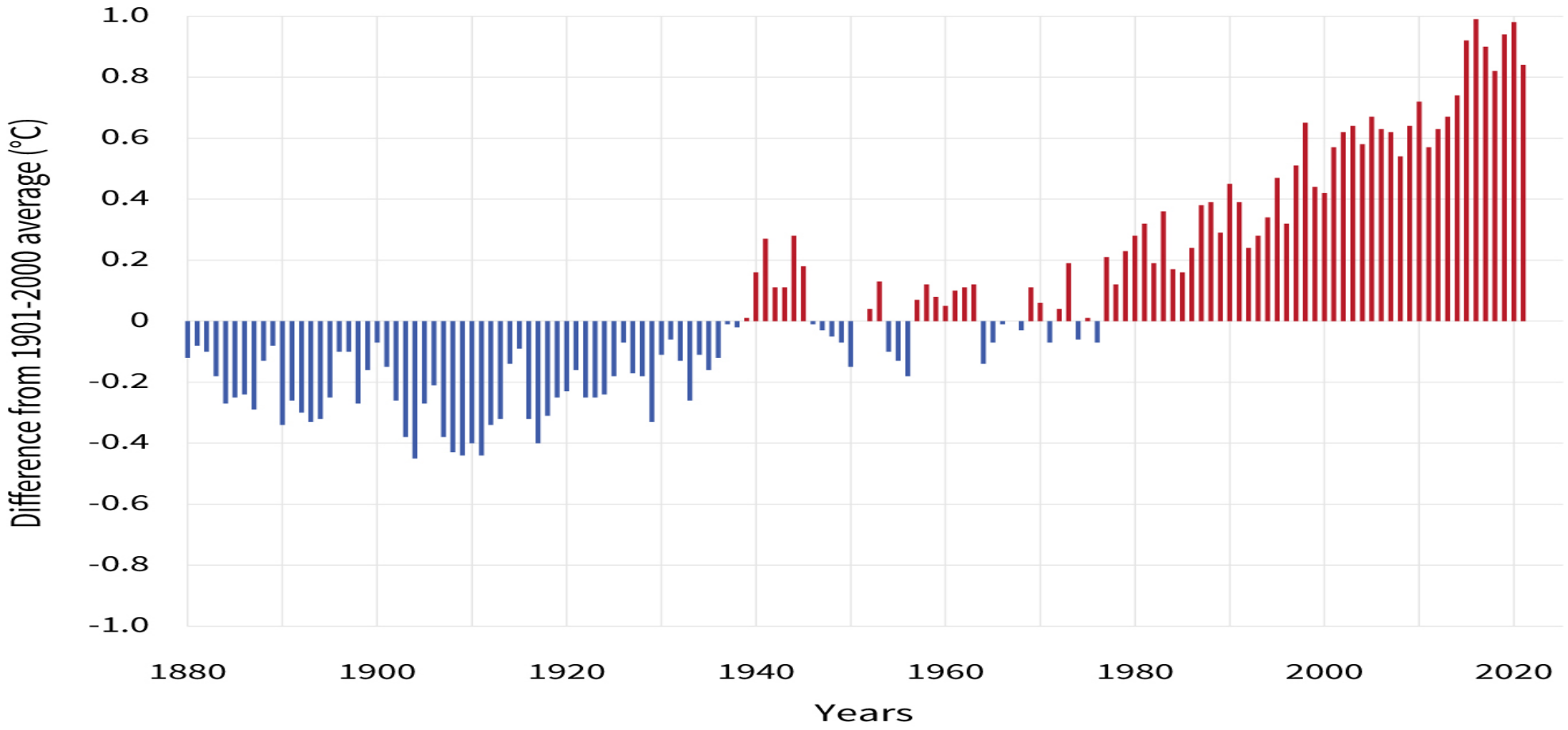

Figure 9: Global warming: monthly temperature anomaly

Source: NASA, GISS (2022).

Motivation

What is the interaction between disaster vulnerability and income?

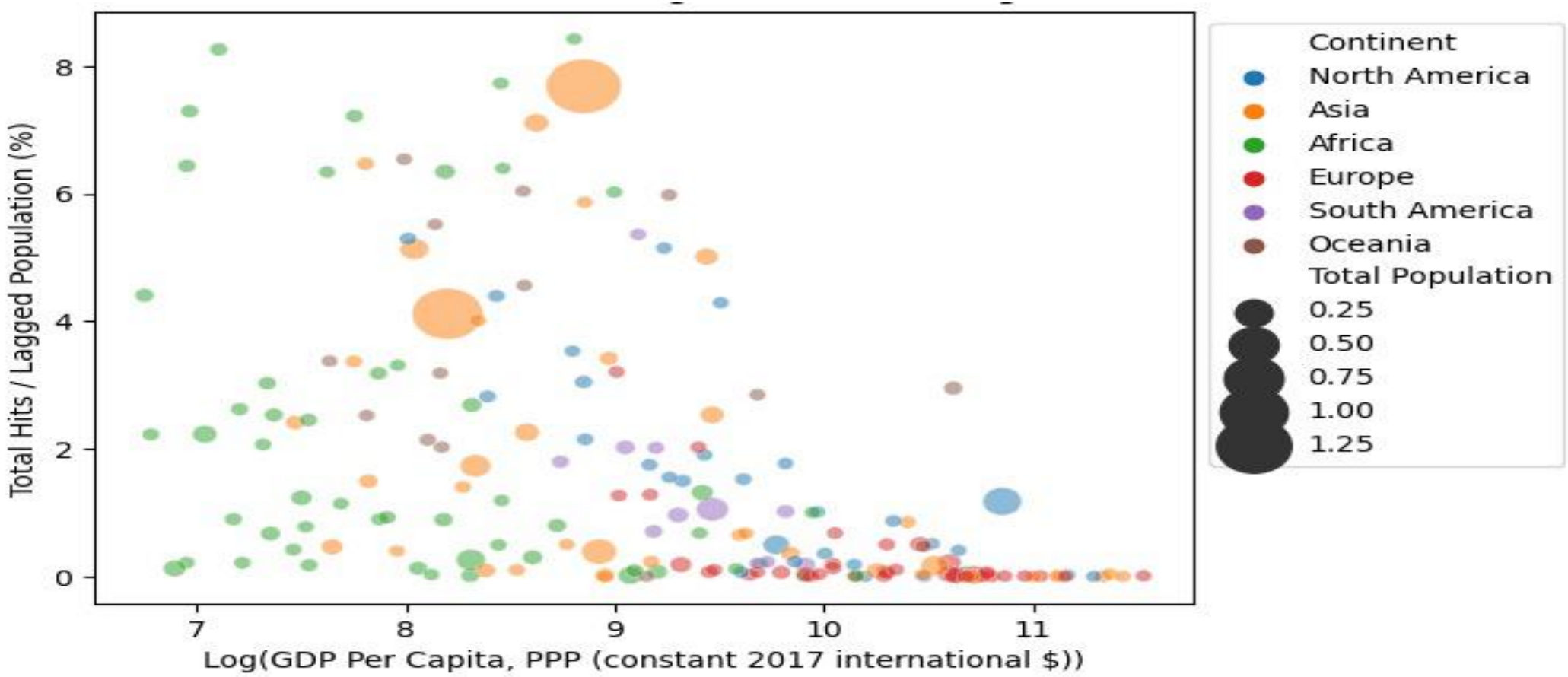

Figure 10: The relationship between the number of persons hit by disaster 1990-2020 (in Billions) and income per capita.

Source: authors' calculations based on data from NASA, GISS (2022).

Empirical evidence: What do we know so far?

- The interrelationship relationship between economic growth, income inequality, climate change and environmental degradation is a complex one (Cappelli, Costantini, and Consoli, 2021).

- Higher levels of inequalities within a country can increase the country's vulnerability to catastrophic events, and hence reduce its adaptability and mitigation capacities (Klomp & Valckx, 2014).

Our contribution

- The purpose of the present paper is to disentangle the mechanisms that connect economic growth, disasters, inequality and vulnerability by accounting for both directions of causality.

- Thereby, the existence of reverse causality between all the three variables is studied. We do so by means of a simultaneous equations approach on a panel of 166 countries from 1990 to 2020.

- The panel analysis brings to the fore the dynamic character of these phenomena, whereby the cumulative impacts of repeated disasters on some locations trigger a vicious cycle, that we label disaster-inequality trap.

Data

❖A panel database from year 1990- 2020 was constructed by matching different country-level datasets from

1- World Income Inequality Database (WIID),

2- Climate Change Knowledge Portal, World Bank Group,

3- World Bank Development Indicators (WDI) database,

4- Georeferenced Emergency Events Database (EM-DAT).

Empirical strategy

This paper investigates the integrated paradigm of inequality, economic growth, climate change and natural disasters through a system of simultaneous equations. Following the work of Kahn et al. (2019) and Aiyar & Ebeke (2020), GDP growth equation is as follows:

$$EG_{it} = \alpha_0 + \alpha_1 Gini_{it-1} + \alpha_2 Hit_{it-1} + \alpha_3 GDP_{it-1} + \alpha_4 Invest_{it} + \alpha_5 edu_{it} + \alpha_6 urban_{it} + \alpha_7 climate_{it} + \alpha_8 climate_{it-1} + \alpha_9 instit_{it} + u_{it}$$

- Following the work of Cappelli et al. (2021), Inequality equation is as follows:

$$Gini_{it} = \gamma_0 + \gamma_1 Hit_{it-1} + \gamma_2 GDP_{t-1} + \gamma_3 HDI_{t-1} + \gamma_4 Exp_{t-1} + \gamma_5 Inst_t + v_{it}$$

and Natural disasters equation is as follows:

$$Hit_{it} = \beta_0 + \beta_1 Gini_{it-1} + \beta_2 GDP_{it-1} + \beta_3 HDIi_{t-1} + \beta_4 Exp_{it-1} + \beta_5 Inv_{it-1} + \beta_6 No.of\ disaster_{it} + \beta_7 No.of\ disaster_{it-1} + \beta_8 land_{it} + \beta_9 Rural + e_{it}$$

Different econometric techniques will be adopted namely error components two-stage least squares, and error components three stage least squares as potential estimation techniques for the simultaneous equations, along

Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
hit_pop_ratio	6,715	0.02	0.07	0.00	1.20
giniindex	1,728	38.33	9.01	20.70	65.80
GDPgrowth	5,796	3.30	6.35	-64.05	149.97
GDPPC2017PPP	5,705	18065.54	20465.88	436.72	161971.50
hdi	5,220	0.66	0.17	0.20	0.96
govtexp	5,216	16.89	8.86	0.91	147.72
invest	5,225	23.56	8.58	-12.88	79.40
govtexpedu	3,106	14.80	5.16	0.83	47.28
ruralpop %	6,871	43.09	24.55	0.00	94.66
urbanpop %	6,871	56.91	24.55	5.34	100.00
prim_enroll	4,749	100.63	17.20	20.88	165.65
prim_sec_enroll	3,646	0.96	0.11	0.00	1.23
fem_ml_LFPR	5,518	68.96	20.23	9.00	108.37
landareasqkm	6,820	608844.80	1760118.00	2.03	16400000.00
quality_score	1,408	12.43	0.74	8.00	13.00
n_total	7,744	0.87	1.17	0.00	7.00
n_dry	7,744	0.23	0.53	0.00	4.00
n_wet	7,744	0.52	0.74	0.00	3.00
temp_anom	5,888	0.00	8.50	-39.52	10.63
precip_anom	6,016	0.00	820.80	-1145.22	3521.20
El_Nino	7,744	0.28	0.45	0.00	1.00
La_Nina	7,744	0.25	0.43	0.00	1.00

Preliminary Results

	Separate Equations					
	Fixed Effects			Random Effects		
	HIT	Gini	GDPgrowth	HIT	Gini	GDPgrowth
Gini index	-0.0002	-0.0002	0.1337**	0.0004	0.0004	0.0239
	0	0	-0.041	0	0	-0.021
L.lnGDPpc	-0.0255*	-0.0255*		-0.0099	-0.0099	
	-0.011	-0.011		-0.006	-0.006	
L.HDI	-0.0364	-0.0364		0.0601	0.0601	
	-0.144	-0.144		-0.083	-0.083	
L.HDI sqrd	0.0835	0.0835		-0.0304	-0.0304	
	-0.101	-0.101		-0.063	-0.063	
L. Govt cons.	-0.0004	-0.0004		-0.0001	-0.0001	
	0	0		0	0	
L.N_DRY	-0.0038	-0.0038		-0.0024	-0.0024	
	-0.002	-0.002		-0.002	-0.002	
L.N_WET	-0.0003	-0.0003		0.0013	0.0013	
	-0.002	-0.002		-0.002	-0.002	
L.HIT_POP_RATIO			-1.8877			-3.9394
			-2.927			-2.379
Initial GDPPC			0			-1.0993***
			(.)			-0.316
L. Investment			-0.0091			0.0244
			-0.023			-0.018
Urban pop(%)			-0.0699			-0.0189
			-0.037			-0.013
Government Effectiveness			-0.7248			-0.1085
			-0.562			-0.259
Precipitation anomaly			0.0003			0.0002
			-0.001			0
Temperature anomaly			-0.6273**			-0.0957***
			-0.224			-0.028
Constant	0.2528**	0.2528**	1.2347	0.065	0.065	13.1232***
	-0.097	-0.097	-3.48	-0.042	-0.042	-2.733
r2	0.0079	0.0079	0.0366			
chi2				31.2783	31.2783	75.7812
p	0	0	0	0.0001	0.0001	0

Preliminary Results

	2SLS			3SLS		
	HIT	Gini	GDP growth	HIT	Gini	GDP growth
Gini index	0.0114***		1.3708***	0.0114***		1.3708***
	-0.002		-0.227	-0.002		-0.227
L.log GDPpc($2017, PPP)	0.0061	-1.7255*		0.0061	-1.7255*	
	-0.011	-0.693		-0.011	-0.693	
L.HDI	0.2488***	-14.5636***		0.2488***	-14.5636***	
	-0.075	-4.037		-0.075	-4.037	
HDI squared	-0.509			-0.509		
	-0.462			-0.462		
L.Govt. Exp as a share of GDP	0.0008	-0.0949*		0.0008	-0.0949*	
	-0.001	-0.041		-0.001	-0.041	
L.# Dry disasters (annual)	-0.0005			-0.0005		
	-0.001			-0.001		
L.# Wet disasters (annual)	0.0007			0.0007		
	-0.001			-0.001		
HIT to pop ratio		55.1408***			55.1408***	
		-14.306			-14.306	
Government effectiveness		0.1158	-0.0358		0.1158	-0.0358
		-0.343	-0.784		-0.343	-0.784
L.HIT to pop ratio			-0.046			-0.046
			-2.95			-2.95
Initial GDPPC			-0.7869***			-0.7869***
			-0.126			-0.126
L.Investment, (% GDP)			0.0751**			0.0751**
			-0.026			-0.026
Urban Pop (%)			0.1031*			0.1031*
			-0.051			-0.051
Precipitation anomaly			-0.0002			-0.0002
			0			0
Temperature anomaly			-0.0943***			-0.0943***
			-0.02			-0.02
Constant	-0.0023	0.2468*	7.6136***	-0.0023	0.2468*	7.6136***
	-0.002	-0.098	-1.153	-0.002	-0.098	-1.153
r2	-0.5766	-0.5683	-0.6599	-0.5766	-0.5683	-0.6599
chi2	33.9237	132.173	134.5159	33.9237	132.173	134.5159
p	0	0	0	0	0	0

Conclusions

- The results of this research will provide unique insight into the complex and intertwined relationships between growth, inequality and natural disasters.
- Each of those causes the other, while at the same time, being affected by it and therefore meaningful policy recommendations must involve a concerted effort to affect all three at once.
- Reducing inequality may hinder growth but can also boost it depending on the incentive structures and institutional regulations.
- Climate change is slowing down growth but can boost it if we emphasis on green technologies that may ultimately be even more labor intensive, and hence more equitable.
- Lower inequality will ultimately reduce the intensity of economic losses from natural disasters, sparing countries even more severe losses as the frequency of such events intensifies.

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