Build back better? Long-lasting impact of the 2010 Earthquake in Haiti.

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Motivation

- Worldwide acceleration of global climate change and increasing intensity and frequency of natural and environmental disasters.
- Up to 325 million extremely poor people will be living in the 49 most hazard-prone countries in 2030 (Sheperd et al., 2013).
- The effects of natural disasters on the accumulation of individuals' human capital: key issue for its economic and social relevance.

Disaster = natural hazard * vulnerability (IPCC, 2012)

Haitian Context

- Latin America and the Caribbean (LAC) region is one of the more disaster-prone area of the world and suffers the lowest level of insurance coverage (Grislain-Letrémy, 2013).
- Haiti is the poorest in LAC and among the poorest in the world.
- Statistic black hole
- First attempt to measure empirically and in a quantitative way the economic consequences of the 2010 earthquake.

Research questions

- Identify the long-lasting impact of the 2010 earthquake on household's wealth in Haiti.
- Delve into different channels at play explaining why some households cope better than other from the initially negative shocks.

Literature

- Not clear to what extent the immediate negative shock on production and welfare persist over time or whether affected housholds recover, or even benefit at some point from some post-disaster reconstruction (Skidmore and Toya, 2002; Gignoux and Menendez, 2014).
- Few papers address the impact of a high-magnitude earthquake due to the lack of suitable data (Doocy et al., 2013 for a review; Cole et al., 2016).
- Almost no quantitative evidence on Haiti (Cavallo et al., 2010).
- Some evidence that despite strong mobilization from the international community, the coverage of assistance has been imperfect (United Nation Office, and ECVMAS report by Herrera et al., 2014).

Data

- The **original** 2012 **Post Earthquake Living Condition Survey (ECVMAS)** on 4,951 households (23,775 individuals), including retrospective data (Herrera et all, 2014)

  Numerous challenges and significant fieldwork

- 2009 Rural Census **(RGA)** at communal section level.
  - Covered topics: migration, infrastructure, services, food security, violence, etc.
  - Exhaustive sample of **rural** communal sections (570)

- **U.S Geological Survey**: objective measures of the strength of **ground motion** (i.e. Peak Ground Acceleration (PGA): maximum acceleration experienced by a physical body) obtained from seismographic instruments + mapping of the induced ground shaking. ▸ map

Identification strategy

- Difference-in-Differences approach

$$Y_{it} = \alpha t + \beta^{DID} D_i \cdot t + \eta_i + \epsilon_{it}$$

- The main identification condition is that treated and untreated units would follow a parallel trend without the earthquake
- This is unlikely to hold due here to the specific location of the epicenter ($>$ 20 km away from Port-au-Prince)
- Two strategies :
  - Sample restriction : we take out the too specific households from the *Metropolitan Area*
  - Semi-parametric Difference-in-Differences (Abadie, 2005)

Treatment variable

Not straightforward to measure disaster intensity:

- Damages variables: endogeneity issues (vulnerability).
- Distance to the earthquake: partial measure as earthquake intensity also depends on the geology and topography of the affected area.
- For each PSU in Haiti, we compute the PGAs of the 2010 earthquake and assign to each household the intensity experienced in the PSU where it was living when the disaster occurred.
- Treatment variable : PGA >=18%g, the lower bound of a very strong perceived shaking (different thresholds tested).

Outcome variables

- Main outcome: asset index
  - Recall data on owned assets in the 2012 ECVMAS survey.
  - Asset index considered a good measure of long term wealth (Sahn & Stifel, 2003)
  - The 2010 Earthquake is a landmark event: the risk of measurement error associated to recall is reduced (De Nicola et al., 2014; Dex, 1995).
  - We rely on Multiple Correspondence Analysis (MCA) methodology (Benzecri et al., 1973; Asselin and Anh, 2008), more suited to analyse categorical variables (12 binary indicators of private household asset ownership in 2010 and 2012 and "pooled" weights).
- Second outcome: labour market participation at individual level (>10 years old individuals)

Results: asset index (1/4)

Table: Asset index – DID – With MA

	(1)	(2)	(3)	(4)	(5)
Time	0.06***	0.06***	0.05***	0.06***	0.05***
	(0.02)	(0.01)	(0.01)	(0.01)	(0.00)
Treat	0.77***	0.52***	0.19***		
	(0.07)	(0.05)	(0.05)		
Time x Treat	-0.10**	-0.10**	-0.15***	-0.10***	-0.15***
	(0.05)	(0.04)	(0.05)	(0.02)	(0.04)
Household baseline controls	NO	YES	YES	NO	NO
Communal section baseline controls	NO	NO	YES	NO	NO
Household FE	NO	NO	NO	YES	YES
Observations	9,732	9,722	4,818	9,732	4,818
Number of idmen_panel	4,927	4,922	2,428	4,927	2,428
R^2-within	0.007	0.007	0.025	0.007	0.025
R^2-between	0.125	0.278	0.254	0.121	0.099
R^2-overall	0.116	0.256	0.230	0.049	0.031

Clustered standard errors in parentheses at section communale and year level
p<0.01, ** p<0.05, * p<0.1

Results: asset index (2/4)

Table: Asset index – DID – Without MA

	(1)	(2)	(3)	(4)	(5)
Time	0.06***	0.06***	0.05***	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)
Treat	0.25**	0.19**	0.12***		
	(0.11)	(0.09)	(0.05)		
Time x Treat	-0.05	-0.05	-0.07	-0.05	-0.07
	(0.05)	(0.05)	(0.05)	(0.04)	(0.05)
Household baseline controls	NO	YES	YES	NO	NO
Communal section baseline controls	NO	NO	YES	NO	NO
Household FE	NO	NO	NO	YES	YES
Observations	5,969	5,965	4,240	5,969	4,240
Number of idmen_panel	3,017	3,015	2,135	3,017	2,135
R^2-within	0.017	0.017	0.019	0.017	0.019
R^2-between	0.018	0.166	0.205	0.012	0.055
R^2-overall	0.018	0.152	0.188	0.000	0.006

Clustered standard errors in parentheses at section communale and year level
*** p<0.01, ** p<0.05, * p<0.1

Results: asset index (3/4)

Table: "Falsification" test on asset index

Dependent variable: asset index 2010	**With MA**			**Without MA**		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	0.76***	0.43***	0.09***	0.24**	0.21***	0.07*
	(0.10)	(0.07)	(0.03)	(0.10)	(0.08)	(0.04)
Household baseline controls	NO	YES	YES	NO	YES	YES
CS baseline controls	NO	NO	YES	NO	NO	YES
Observations	4,805	4,787	2,390	2,952	2,937	2,105
R-squared	0.13	0.32	0.32	0.02	0.19	0.25

Note: Standard errors clustered at the communal section level in parentheses *** p<0.01, ** p<0.05, * p<0.1

Results: heterogeneity of the effect (4/4)

Table: Semi-parametric DID and heterogeneity of the effect

	With MA n=2375		Without MA n=2105	
ATT	Coef.	Std error	Coef.	Std error
Treat	-0.103***	(0.035)	-0.032	(0.028)
Treat	-0.095***	(0.033)	-0.045	(0.033)
Treat x wealth 2010	-0.213***	(0.063)	-0.111*	(0.064)
Treat	0.036	(0.025)	0.031	(0.020)
Treat x tercile 2	0.000	(0.054)	-0.012	(0.044)
Treat x tercile 3	-0.419***	(0.093)	-0.262***	(0.102)
Treat	-0.192***	(0.037)	-0.117	(0.039)
Treat x Male-headed HH	0.161**	(0.067)	0.151***	(0.055)
Treat	-0.112**	(0.047)	-0.034	(0.037)
Treat x Head has pre-school educ.	-0.221	(0.148)	-0.303*	(0.157)
Treat x Head has primary educ.	0.072	(0.090)	-0.014	(0.056)
Treat x Head has secondary educ.	-0.038	(0.079)	-0.012**	(0.084)
Treat x Head has superior educ.	0.032	(0.193)	0.659***	(0.319)

Results: Labour market participation (1/2)

Table: Labour market participation DID - With MA

	(1)	(2)	(3)	(4)	(5)
Time	0.03***	0.03***	0.05***	0.03***	0.05***
	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Treat	0.01	-0.01	0.04***		
	(0.01)	(0.01)	(0.01)		
Time x Treat	-0.07***	-0.07***	-0.08***	-0.07***	-0.08***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ind & hh baseline controls	NO	YES	YES	NO	NO
CS baseline controls	NO	NO	YES	NO	NO
Individual FE	NO	NO	NO	YES	YES
Constant	0.56***	-0.54***	-0.46***	0.57***	0.58***
	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)
Observations	36,048	35,882	17,568	36,048	17,568
Number of idmen_panel	18,024	17,941	8,784	18,024	8,784
R2-within	0.006	0.006	0.011	0.006	0.011
R2-between	0.001	0.447	0.436	0.001	0.000
R2-overall	0.002	0.356	0.344	0.002	0.002

Note: Clustered standard errors in parentheses at communale section and year level
*** p<0.01, ** p<0.05, * p<0.1

Results: Labour market participation (2/2)

Table: Labour market participation DID - Without MA

	(1)	(2)	(3)	(4)	(5)
Time	0.03***	0.03***	0.05***	0.03***	0.05***
	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Treat	0.02	0.02**	0.03**		
	(0.01)	(0.01)	(0.02)		
Time x Treat	-0.05***	-0.05***	-0.06***	-0.05***	-0.06***
	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)
Ind & hh baseline controls	NO	YES	YES	NO	NO
CS baseline controls	NO	NO	YES	NO	NO
Individual FE	NO	NO	NO	YES	YES
Constant	0.56***	-0.47***	-0.44***	0.57***	0.58***
	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)
Observations	22,576	22,454	15,740	22,576	15,740
Number of idmen_panel	11,288	11,227	7,870	11,288	7,870
R2-within	0.004	0.004	0.011	0.004	0.011
R2-between	0.000	0.431	0.429	0.000	0.000
R2-overall	0.001	0.339	0.336	0.001	0.002

Note: Clustered standard errors in parentheses at communale section and year level
*** p<0.01, ** p<0.05, * p<0.1

External aid

Table 3: Assistance and visits in camps by impacted* households

	Households that experienced heavy damages on their house			
	Metropolitan Area	Outside MA		
	mean(sd) (n=563)	mean(sd) (n=263)	Difference	Correlation with distance to Port-au-Prince
Assistance				
Any type of assistance	0.85 (0.37)	0.79 (0.41)	*	-0.093***
Any type but information	0.72 (0.46)	0.58 (0.49)	***	-0.176***
Clearing rubble	0.03 (0.16)	0.02 (0.14)	ns	-0.008
Reconstruction	0.07 (0.24)	0.11 (0.31)	**	-0.042
Food	0.47 (0.50)	0.17 (0.38)	***	-0.234***
Material	0.27 (0.44)	0.11 (0.31)	***	-0.169***
Health	0.58 (0.50)	0.41 (0.49)	***	-0.135***
Economic activity	0.04 (0.18)	0.04 (0.19)	ns	-0.043
Rehousing	0.44 (0.50)	0.16 (0.37)	***	-0.266***
Information	0.68 (0.47)	0.62 (0.49)	*	-0.067*
Camp				
Lived in a camp in 10/2012	0.37 (0.48)	0.22 (0.41)	***	-0.270***
At least one member passed by a camp between 01/2010 and 10/2012	0.61 (0.49)	0.28 (0.45)	***	-0.373***
Average number of days spent in camp by household members	438.8 (460.3)	179.1 (355.7)	***	-0.321***

*Note : this table only includes households living in 'treated' areas at the time the earthquake occurred

Summary findings

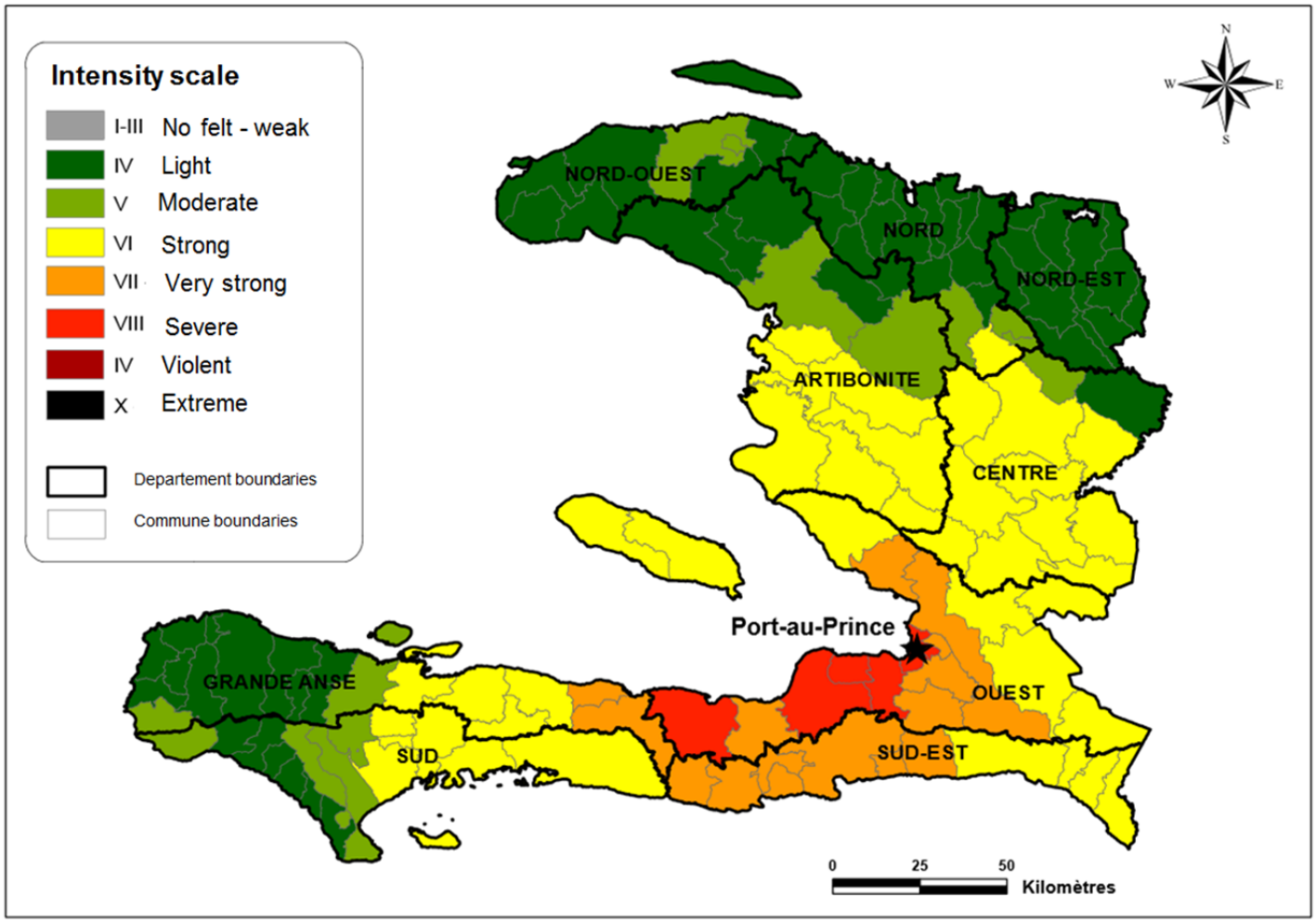
- The impact evaluation analysis reveals an adverse long-lasting impact on asset ownership and labour market participation.
- Limited ex-post coping strategies.
- The disruption of households' livelihood systems reduces the probability to recover from an extreme event without external aid.
- However, empirical evidence suggests that the assistance program's coverage has been imperfect.

Conclusion and next steps

- Not only direct impact on people, buildings and infrastructures but also on capital (heterogeneous effect rich / poor)–> potential structural consequences even more harmful for the most vulnerable.
- Excluding MA and other urban areas, close to the epicenter our results provide a lower bound of the long-lasting impact.
- Trying to better assess the parallel trend (Nighttime Lights Time Series data).
- Additional longitudinal analysis (unreleased panel data on MA)

Thank you!

Figure: 2010 Earthquake intensity



Source: U.S Geological Survey, Authors'calculation

▸ Data