“On Shaky Ground: The Effects of Earthquakes on Household Income and Poverty”

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An increase in the frequency of natural disasters worldwide ...

Source: Calculations based on EM-DAT: The OFDA/CRED International Disaster Database, Catholic University of Louvain. Taken from Baez and Mason (2008)

Notes: It includes disasters that meet at least one of the following criteria: (1) 10 or more people reported death, (2) 100 people reported affected, (3) declaration of a state of emergency, (4) call for international assistance
... also when looking only at the number of earthquakes and ...

Source: USGS Earthquake Hazards Program
Notes: Number of earthquakes magnitude 6 $M_L$ or greater
... their intensity

Source: USGS Earthquake Hazards Program
Notes: Estimated total annual earthquake energy release (magnitude 8 earthquake = 1 = 1,000 magnitude 6 earthquakes) in red; 7-year average in grey
This paper

• **Question**: effects of two earthquakes that hit El Salvador in 2001 on income and poverty

• **Empirical strategy**: exploits variation in
  1. The timing of the events and location of households
  2. Geological parameters (depth and energy released) and soil types of villages

• **Data**:
  – Two rounds of rural panel data (DD framework)
  – Geological records from three accelerograph networks and 31 stations
  – Units of analysis: rural households

• **Outcomes**: household income and poverty measures
Earthquakes in 2001 (I)

- January 13 (7.7 M$_L$; depth 60km) & February 13 (6.6 M$_L$; depth 10km)
- Around 300,000 dwellings affected (approximately 32% of the existing housing stock in the country)

Notes: The red (largest) oval represents the area primarily affected by the January 13 earthquake, while the blue (smallest) circle indicates the zone hardest hit by the February 13 seism.

Natural experimental groups

• Shock measure
  – “shaking” determined by the magnitude, depth, duration, spectral distribution of movements, distance to epicenter, local soil, and quality of dwellings (attenuation relationship)
  – measured as a percentage of gravity acceleration

• Two definitions of treatment intensity
  1. Treated if belongs to top half of the distribution ($T = 0.7g, C = 0.32g$)
  2. Continuous definition of treatment
Summary of the findings (1)

- **Balancing tests**: T and C comparable at baseline

- **Shock (‘treatment’) indicator relevant** → positively correlated with self-reported losses
  - An ↑ of a σ in the PGA (0.08 PGA) associated with an ↑ of
    - (i) 7pp in the probability of reporting a loss and
    - (ii) the amount of losses (≈ 1/3 of monthly income per capita)
Summary of the findings (2)

- **A negative effect on income per capita**

  - A fall of 20 percent of the pre-shock level – equivalent to 40% of the gains in income achieved in the 1990’s
  
  - An increase of a $\sigma$ in the ground shaking reduced income per capita by 8.5 percent (marginally significant)

Note: Y-axis measures monthly household income per capita in *colones* of 2000
Summary of the findings (3)

- Effects on poverty?

- Headcount ↑ by 4.7-5.1 pp– but point estimates not significant (only “switchers” allow identifying effects)

- Effects higher for households in 3rd and 5th quintiles
Summary of the findings (4)

• **Mechanisms**: looks at impact heterogeneity (but limited statistical power!)
  
  • Larger losses for households:
    • Highly dependent on agricultural production, own businesses and off-farm income
    • Remotely located from key infrastructure and markets
Robustness analysis

- **Attrition**
  - very low
    - 4.7% (1998-2000); 3.4% (2000-2002).
  - There is not evidence that it was endogenous

- **Use non-parametric methods**
  - Relax linearity assumptions of D-D
    - Results: very similar

- **Differential pre-trends?**
  - A placebo test for a pre-shock period (1998-2000) where all households were controls
    - Evidence of no treatment effect