Local Economic Impacts of Extreme Events in the Southwest

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Background

The general focus of our work is to understand the impacts of climate change on the local economy.

- Catastrophic events
- National level (developing countries)
- GDP impacts in the following years
- Impacts on single industries and/or of a specific event
- Long term (10 years after EE)

Open Issues:
- “Small” events
- Economic impacts at “short term” (12 months after)
- Consequences for the public finance of local governments
Our Research Questions

• How have “common” weather events impacted the local economy in short term?

• How have the local communities responded (adapted) to these events?
Our Research: Proxies

• **Economic Impact:**
  Local employment
  - Total
  - By economic sectors, 20 different economic sectors

• **Response:**
  Local government's public finance
  - Municipal bonds
  - Federal transfers
Southwest of the U.S.A:
8 states: CA, NV, AZ, UT, NM, CO, OK, TX.
547 counties

Weather Events:
Drought,
Flood,
Funnel cloud
Tornado
Snow/ices storm
Wildfire

Short term effects:
One year after the event
What is the impact of a Weather Event on the Local Economy in the short term?
EE and Economic Impacts

- **Econometric model**: empirical analysis based on standard econometric techniques using a rich dataset (panel data regression model)

- **Data sources**:
  - **Weather Events**: NCDC
    Storm Events
    From 1993 to 2010, monthly for each county
  - **Employment**: Bureau of Labour Statistics
    Total employment and sector employment (20 economic sectors) by county monthly
EE and Economic Impacts

- **Total Employment**
  - Immediate impact (1-3 months): flood, snow/ice, funnel cloud, tornados
  - Mid term (4-6 months): snow/ice, funnel cloud, tornados
  - Long lasting impact (7-12 months): floods

- **Sector Employment**
  - **Agriculture**
    - Drought
    - Wildfires
  - **Manufacturing**
    - Drought
  - **Retail**
    - Snow Storms
  - **Public Adm**
    - Wildfire, Floods, Funnel Cloud, Snow Storms

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EE and Economic Impacts

- Sector Employment cont ...

- Same EE impacts different sectors in different ways (e.g. wildfire)
- Some EE, which are not highly correlated with the total employment, are highly correlated with the sectorial employment (e.g. drought and wildfire)

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EE and Economic Impacts

- Different types of events have different impacts and the type of impacts (- or +) change in time.
- An event may have different impacts on different economic sectors, even different from the impacts on the aggregate economic output.
- Every kind of events may change the local economic structure, that means going back to the steady state is not sure anymore as predicted by growth models such as Solow’s model.
- Small counties (in terms of population) suffer stronger impacts.
What’s the response of the Local Community to a Weather Event?
The response to EE

• Local Government response to EE

• We use the **public finance at county level** as a proxy for present and future adaptation capability

• After an EE there are two ways to finance the reconstruction:

  - **Federal transfers** (Grants)
  - **Municipal Bonds** (General Obligation and Revenue Bonds)

  - Emissions
  - Risk Premium
Response to EE: (1) Federal Funds

- We study the relation between Federal transfers and EE

- **Data Sources:**
  - **Funds:** Consolidated Federal Funds Report, Census Bureau
    Grants: Block, Grant, Formula Grant, Project Grants and Cooperative Agreements (yearly)
  - **Weather Events:** NCDC Storm Events (as before)

- **Method:**
  - **Econometric model:** panel data regression model
Response to EE: (1) Federal Funds

High correlation between wildfire and tornados and the amount of federal transfers granted to the local governments.
Response to EE: (2) Muni Bonds

- **Method:** Econometric models
  - Estimate the probability of bond emission after EE (Logit regression model)
  - Estimate the effect of EE on muni Risk Premium (difference between the muni interest rate and the rate of the federal treasury bonds) (Regression model)

- **Data Sources:**
  - **Municipal Bonds:** General Obligations and Revenues Bond
    Electronic Municipal Market Access, Municipal Security Rulemaking Boards
  - **Financial indicators:** to sterilize global economy effect on bonds market
    - Nominal Treasury constant maturity, Moody’s seasoned AAA industrial bond rates, Bond Buyer Index (general obligations, 20 y to maturity)
    - Stock Market: Dow Jones Industrial Average
  - **Weather Events:** NCDC Storm Events
Response to EE: (2) Muni Bonds

- Probability of muni emission after EE
  - Drought, Floods, Funnel Clouds & Tornados
  - County size: bigger counties issue more

- Municipal Bond Risk Premium after EE
  - Floods (flood good indicator of structural problems in water management, i.e. proxy for increased risk?)
  - Drought & Snow Storms
Response to EE: (2) Muni Bonds

- **Probability of muni emission after EE**
  - **EE** → **P(\text{emission})**
  - Drought
  - Tornadoes
  - County size: bigger counties issue more

  **Risk Premium** is a proxy for how much risky is it to buy bonds from the county instead of from the federal government.

  It is a proxy for what the market (investors) thinks regarding how much an EE impacts the local economy.

- **Municipal Bond Risk Premium after EE**
  - **EE** → **Risk Premium**
  - Flooding (flood good indicator of structural problems in water management, i.e. proxy for increased risk?)
  - Drought & Snow Storms

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Response to EE: summary

- **Bigger counties** rely more on the *market* (muni), **smaller** ones on *federal transfers*. Both kinds need resources to react upon events.

- The market is unable to incorporate the economic shock due to EE in the risk premium: it does not clearly recognize weather events as threats to issuers' financial reliability.

- **Floods**, which are the events decreasing total employment the most (*m1-m6*), are the ones determining higher risk premium.
Conclusions

• EE have impacts the local economy
• Impacts are different for different types of events and different at different time scales
• Counties respond to the events seeking new funds
• Big counties through municipal bonds, smaller through federal grants
• The investors (the market) do not think that the risk associated to the economic impacts of these events is “big” except in case of flood

This empirical analysis may inform future simulation models to explore the social and economic impacts of climate change