PRE-DISASTER MULTI-HAZARD DAMAGE AND ECONOMIC LOSS ESTIMATION MODEL

NATURAL DISASTERS AND SECTORAL ECONOMIC DEVELOPMENT: EVIDENCE FROM AUSTRALIA

DR. MUHAMMAD HABIBUR RAHMAN
DEPARTMENT OF ECONOMICS, DEAKIN UNIVERSITY

Date: 30 AUG, 2016
MOTIVATION OF THE RESEARCH
Motivation

- Scenario 1: No Recovery
- Scenario 2: Build Back to Normal
- Scenario 3: Build Back Better
The emerging literature on the nexus between natural disasters and economic development remains inconclusive (Cavallo and Noy, 2010):
Motivation

**NEGATIVE**

**POSITIVE**
Skidmore and Toya (2002), Leiter et al. (2009), Loayza et al. (2012), and Fomby et al. (2013).

**NO EFFECT**
Caselli and Malhotra (2004), Albala-Bertrand (1993), and Cavallo et al. (2013).
Motivation

**Five reasons** behind such mixed findings:

1. **DIFFERENT SAMPLES**
   
   Almost all are at cross-country settings focusing on different regions;

   **All Countries:** Fomby, Ikeda and Loayza (2011); Stromberg (2007); Cavallo et al. (2013); Skidmore and Toya (2002).
   
   **Developed Countries:** Melecky and Raddatz (2014)
   
   **Developing Countries:** Raddatz (2007); Cuaresma et al. (2008).
Motivation

2. DEFINITION OF DISASTERS

Various aggregation of natural disasters

- Geological vs. climatological disasters
- Disaster-specific variables vs. disaster index
Motivation

3. AGGREGATED OUTPUT
mostly disasters hit a particular sector rather than the whole economy;
4. LOCALISED EVENTS

Disasters are local;
5. QUALITY OF DATA

EM-DAT is a outcome-based dataset depending mostly on human casualties. It triggers endogeneity in estimation.
OBJECTIVES
OF THE RESEARCH
Objective of this Research

To estimate the sector-specific income effect of natural disasters in Australia using state level data.
WHY AUSTRALIA?
WHY AUSTRALIA?...
### Why Australia?

Table 2: Significant Natural Disasters in Australia, 1851 - 2014

<table>
<thead>
<tr>
<th>State</th>
<th>Bushfires</th>
<th>Floods</th>
<th>Earthquakes</th>
</tr>
</thead>
<tbody>
<tr>
<td>WA</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>VIC</td>
<td>9</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>TAS</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>SA</td>
<td>2</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>QLD</td>
<td>27</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>NT</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>NSW</td>
<td>24</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>ACT</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Australian Emergency Management Knowledge Hub, 2015;
DATA AND MEASUREMENT
DATA

DATA 1
Data on Natural Disasters (i.e., Floods and Bushfires)

DATA 2
Data on extreme rainfall and extreme temperature

DATA 3
Data on state level sector-specific GDP
Emergency Management Australia revises data in 2014 that provides spatial information as well.

We analyse floods and bushfires in this study.
DATA

Data on State Level
Data on state level sector-specific GDP, 1990-2014: Australian Bureau of Statistics

Economic Sectors
we aggregate 19 economic sectors into four groups:
ESTIMATION MODEL
We use a difference-in-differences (DD) estimation approach with continuous shocks:

\[
\ln GDP_{s,t} = \alpha_i + \rho_t + \phi_t + \beta_1 \text{Climate Extreme}_{s,t} + \beta_2 \text{Disaster}_{s,t} + \beta_3 (\text{Climate Extreme}_{s,t} \times \text{Disaster}_{s,t}) + \epsilon_{s,t}
\]

Where,

- \(\epsilon\) = Disturbance term
- \(\alpha\) = State-specific fixed effect
- \(\rho\) = State-specific time trend
- \(\phi\) = Common time-varying shocks
- \(S\) = State
- \(t\) = Year
RESULTS
Results

Table 1: Effects of natural disasters on economic sectors by ANZSIC 2006 division codes

- Floods, same year
  - Retail: 2.1%
  - Utilities: 0%
  - Construction & Postal: -1.1%
  - Finance & Insurance: 0%
  - Others: 0%

- Floods, next year
  - Agriculture: 3.4%
  - Mining: 0%
  - Manufacturing: 0%
  - Wholesale: 2.3%
  - Retail: 2.4%
  - Construction & Postal: 1.2%
  - Finance & Insurance: 0%
  - Public Safety: 1.6%
  - Others: 0%
Results

Table 2: Effects of natural disasters on economic sectors by ANZSIC 2006 division codes

Bushfires, same year

Bushfires, next year
Results

Table 3: Effects of natural disasters on production, infrastructure, social and cross-cutting sectors

Gross State Product
Production
Infrastructure
Social
Cross-cutting

Floods, same year

Floods, next year

Bushfires, same year

Bushfires, next year
Table 4: Effects of natural disasters on primary, secondary and tertiary sectors

<table>
<thead>
<tr>
<th></th>
<th>Gross State Product</th>
<th>Agriculture Sector</th>
<th>Manufacturing Sector</th>
<th>Services Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floods, same year</td>
<td>(2.0%)</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Floods, next year</td>
<td>0.5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Bushfires, same year</td>
<td>-3.5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Bushfires, next year</td>
<td>-4%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Australia experiences both positive and negative effects of natural disasters. Significant income effects.
Summary of Results

Each type of disasters is unique

Different disasters affect different economic sectors differently. Hence, the insights obtained with over-aggregation can be misleading.
Policies related to disaster risk reduction (DRR) should not be generic, as one policy does not fit all; rather they should be designed in considering their potential effects on the economy by disaster and by sector.
THANK YOU