Towards a Business Case for Funding Humanitarian Disaster Relief and Development

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City University London
The world as a whole and certain countries in particular face a twofold ‘problem’

1. How should governments (and international bodies like World Bank, Red Cross, etc.) allocate funds across humanitarian efforts and development?
   • What’s the business case for a holistic approach to disasters in terms of prevention, preparedness, response and rehabilitation?
   • To build humanitarian supply chains, we need to consider the flow of funds just like other supply chains

2. Impact of natural disasters appears to be increasing exponentially when we consider the world as a whole (or Asia as a continent) – why?
Several researchers have pointed out the problems associated with finding funds for humanitarian reasons

- “CNN” disasters (Tomasini and Van Wassenhove 2010): Funding available only as a disaster unfolds in the media
- Problems associated with funding
  - Amount may be inadequate
  - Timing: available funds may be too late
  - Funding is earmarked for a specific cause (excess, shortage)
  - Cannot plan ahead
  - Cannot invest in prevention
- Need a business case.
A deeper issue may be how to justify investment for risk management...governments face this problem just like individual donors

• Apprehension without action (Sodhi and Tang 2012): Managers report awareness of supply chain risk but also admit no action is being taken
• What would be the benefit of preventing a risk that may not have happened anyway – so why be proactive?
• On the other hand, a ‘stitch in time saves nine’; ‘prevention is better than cure’; etc. etc. so funds could be much better used in preventing/mitigating disasters rather than responding to them.
Our approach: Aggregate disasters - ‘rare’ events – over time and across countries to form the basis for a business case...

• Only ‘natural’ disasters: (1) biological: epidemics and insect infestations; (2) climatological: droughts, extreme temperature and wildfires; (3) geophysical: earthquakes, mass movement (dry) and volcanoes; (4) hydrological: floods and mass movement (wet); and (5) meteorological: storms.

• Fifty years: 1963-2012 (data reliability prior to that)
• Worldwide
• Country-level data
• Impact in terms of ‘number of people affected in total’ and ‘property damage’.

…and propose an explanation for exponential growth of disaster impact.
Definition – what’s a disaster?

• CRED* defines ‘disaster’ in terms of impact as follows: it must fit at least one of the following criteria:
  • (a) 10 or more people killed,
  • (b) 100 or more people affected,
  • (c) declaration of a state of emergency, or
  • (d) a call for international assistance.

• ‘Affected’: “people requiring immediate assistance during a period of emergency

• Total affected: No. of people affected+injured+rendered homeless

* Centre for Research on the Epidemiology of Disasters, Université catholique de Louvain
Note: Some disaster types have more impact, which is not uniform across continents.

- Global data
  1963-2012 (50 years)
  – sources: various

‘Affected’+injured+rendered homeless
Agenda for this presentation

Hazards are not the same as disasters (just as likelihood is not impact)

A virtuous cycle for disaster mitigation, economic prosperity and national resilience to disasters

H1. Natural disaster mitigation has a positive impact on a country’s economic prosperity

H2. Growing national prosperity increases resilience to all hazards including disease

H3. Given a rate at which natural hazards occur, higher national resilience leads to less impact (thus mitigating disasters)

Discussion
A virtuous cycle as a conceptual model

+ H1: Disaster mitigation has a positive link to national prosperity

+ H2: National prosperity is positively linked to national resilience

+ H3: Higher resilience is linked to more mitigation, i.e., lower impact
H1. Disaster mitigation (total affected) has a positive impact on national prosperity (PCI, growth)

113 countries, over the period 1963-2012 (unit of analysis is country)

**X variables (natural log):**
- Per capita income in 1962 (control variable)
- *Total affected, normalized by population in 1990*
- Property damage, normalized by GNP in 1990

**Y variables to measure prosperity:**
- Annualized growth of per capita income 1963 to 2012
- (Log) Per capita income in 2012
H1. Disaster mitigation (total affected) has a positive impact on national prosperity (PCI, growth)

Robust regression (very similar results to OLS)

- Total affected negatively impacts growth of PCI and PCI itself
- Decreasing the number affected will positively impact PCI and PCI growth
- In the presence of total affected, property damage has a slightly positive relationship (richer countries have more such damage)

<table>
<thead>
<tr>
<th></th>
<th>Growth of per capita income 2012</th>
<th>Log (per capita income 2012)</th>
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</thead>
<tbody>
<tr>
<td>Log (PCI 1962)</td>
<td>.0044465** (3.19)</td>
<td>1.20885*** (18.31)</td>
</tr>
<tr>
<td>Log (TA-norm)</td>
<td>-.0010009* (-2.08)</td>
<td>-.0471332** (-2.08)</td>
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<tr>
<td>Log (PD-norm)</td>
<td>.0009068* (2.62)</td>
<td>.0430008** (2.63)</td>
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<tr>
<td>Const</td>
<td>.0421733*** (4.91)</td>
<td>2.079503*** (5.11)</td>
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Adj. R-sq 0.1923 0.8202
N 113 113
H2. Growing national prosperity increases national resilience

Children as the canary in the coalmine?

Log (CM5) vs Log (PCI 2012)

Infant mortality under age 5 per 1000 live births

Child mortality under age 5 per 1000 live births

Log (TB) vs Log (PCI 2012)
**H2. Growing national prosperity increases national resilience**

<table>
<thead>
<tr>
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<th>Log(Child mortality-5 in 2012)</th>
<th>Log(TB incidence in 2012)</th>
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<tbody>
<tr>
<td>Log (Per capita income in 2012)</td>
<td>-.66694*** (0.0282)</td>
<td>.71157*** (0.0517)</td>
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<td>Const</td>
<td>8.6868*** (.2439)</td>
<td>9.9503*** (.4461)</td>
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<td>Adj. R-sq</td>
<td>0.7486</td>
<td>.5021</td>
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<td>N</td>
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Log (CM5) vs Log (PCI 2012)

N=188 countries
Same with TB incidence
H3. Given a rate at which natural hazards occur, higher resilience is positively linked to lowering the impact of disasters

Data for 629 earthquakes with at least one death, 78 countries, 50-yr period 1963-2012

Y variable: No. of deaths in an earthquake

X variables:
Child mortality (under age 5) in the country
Population density (control)
Magnitude of earthquake (control)
Depth of earthquake (control)
H3. Given a rate at which natural hazards occur, higher resilience is positively linked to lowering the impact of disasters

Data for 629 earthquakes with at least one death, 78 countries, 50-yr period 1963-2012

<table>
<thead>
<tr>
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<th>Log (Deaths)</th>
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<tr>
<td>Log (Child mortality)</td>
<td>.7389756*** (0.0904)</td>
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<td>Log (Pop density)</td>
<td>.1624118*** (0.0840)</td>
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<tr>
<td>Magnitude</td>
<td>1.192354*** (0.0990)</td>
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<tr>
<td>Depth</td>
<td>-0.0141361*** (0.0027)</td>
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<td>Const</td>
<td>-7.935542*** (0.8216)</td>
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<td>Adj. R-sq</td>
<td>0.2541</td>
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Increasing vulnerability is linked to greater disaster impact...given the same natural hazard
Another way to see the impact of resilience is to note that the disaster impact is concentrated.

80% of total affected in China, India, Bangladesh (1963-2012)
60% of prop damage in US, Japan, China (1963-2012)
Discussion: All three links are significant, so what?

+ H3: Higher resilience is linked to more mitigation, i.e., lower impact

+ H2: National prosperity is positively linked to national resilience

+ H1: Disaster mitigation has a positive link to national prosperity
Disaster impact, occurrence are increasing exponentially at the global scale suggesting a vicious cycle at work.

The trend is linear in logarithmic terms, hence growth is exponential.
How should we fund development and humanitarian relief?

Improve resilience through development of the most vulnerable sections of society

Reduce hazard rate through prevention efforts

Reduce the numbers of people affected: preparation, response, rehabilitation

Improve per capital income through development

National resilience

Disaster mitigation

National prosperity

Poverty

Vulnerability

Disaster impact
Noting that each averted disaster has a quantified benefit...

- Benefit of each occurrence averted anywhere in the world
  1) 10 people affected/10 m global pop/occ
  2) $6000/$1m of global income/occ

<table>
<thead>
<tr>
<th>Year</th>
<th>Total no. of disaster occurrences</th>
<th>Total no. of people affected/10m population/occurrence</th>
<th>Damage $'000/$1m income/occurrence</th>
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...although continents/countries may be different.

Earthquakes as disasters are increasing in Asia...

Asia has high child mortality...

...possibly because vulnerability (as indicated by child mortality rate x population) is very high compared to other continents. (Africa has low hazard rate and Asia has a much larger population).
Summary - The world as a whole and certain countries in particular face a twofold ‘problem’

1. Impact of natural disasters appears to be increasing exponentially when we consider the world as a whole (or Asia as a whole and perhaps India as a country) – why?

2. How should governments (and international bodies like World Bank, Red Cross, etc.) allocate funds across humanitarian efforts and development?
   - Business case for development already made
   - What’s the business case for a holistic approach to disasters in terms of prevention, preparedness, response and rehabilitation?
Limitations and further research

• Analysis by region rather than global
• How to deal with endogeneity
• Quantifying the ‘vicious’/’virtuous’ loop in terms of differential equations
• Studying the last decade of the 50-year period (why is there an apparently different trend)