

Economic Cost of Extreme Events – Some Issues

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What is an Extreme Event?

- ❑ An Extreme Event could be a natural disaster or originate from other sources (for example, geological)
- ❑ A disaster is “a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (UN/ISDR 2004)
- ❑ An extreme event is conceived as occurrences that, relative to some class of related occurrences, is “either notable, rare, unique, profound, or otherwise significant in terms of its impacts, effects, or outcomes” (Sarewitz et al. Forthcoming).

What is an extreme event? (2)

- ❑ Defining an extreme event faces considerable difficulties (SCOPE 27)
- ❑ Should these be defined in terms of physical measurements or in terms of impact on the society?
- ❑ Damage to society depends more on the vulnerability of society than some physical measurement of the event
- ❑ Furthermore, society's level of vulnerability changes overtime; can a history-based physical measure provide an accurate identification of extreme event?

Measurement Issues

- Using the socio-economic yardstick, some issues arise:
 - How should we measure the “Magnitude of damage“?
 - Gentle et al. 2001 used a figure of \$10 million (\$12 million in 2010) to capture an extreme natural hazard
 - How should we measure the change induced by a drought – as a deviation from mean over the past several year period, or deviation from the minimum yield that has been observed over last several years (?)
 - What about the distributional issues ?
 - Lower income groups consistently bear a disproportionate share of the losses (Cochrane, 1975)
 - These people have less resources to make adaptation

Extreme Events in Canada

- Both natural disasters and climate related events are common particularly in Western Canada (Prairie Region)
- One of the major concerns is the comparability of these estimates -- were they estimated using a comparable methodology
- Is there a standard methodology to estimate economic impacts of extreme events in Canada or elsewhere?
 - Simple answer is NO
 - Past attempts have varied in terms of their scope, assumption, and valuation methodologies

Most Expensive Canadian Natural Disasters (Total Estimated Economic Impact >=\$1 billion 2000\$)

[Courtesy: Grace Koshida, Environment Canada]

Date of occurrence	Event	Location	Estimated Total Cost (billion 2000\$)
2001-2002	Drought	Prairies, Ontario, Nova Scotia, PEI	\$5.8
1980	Drought		\$5.8
	Freezing rain	Ontario to New Brunswick	\$5.4
1988	Drought	Prairies	\$4.1
1979	Drought	Prairies	\$3.4
1984	Drought	Prairies	\$1.9
	Flood	Québec	\$1.6
May, 1950	Flood	Manitoba	\$1.1
	Hurricane Hazel	Toronto & Southern ON	\$1.1
1931-1938	Drought	Prairies	\$1.0
1989	Drought	Prairies	\$1.0

What is Economic Cost?

- Immediate question is “What to measure?”
- What is economics?
 - Social science of dealing with production, distribution, and consumption of goods and services and with the management of economies or economic systems (Source: www.dictionary.com)
- What is Economic Cost?
 - Synonymous with Economic Impact (Combination of Positive – benefits, and negative – costs)

What is Economic Cost? (2)

- What is an Economic Impact?
 - Related to an event
 - Defined as “the difference between what did happen and what could have happened without the event regarding the consumption of goods and services and management of resources
- Economic costs are not the same as Financial costs
 - Financial losses typically relate to value of property damage of individuals and businesses without any consideration of their impact on other agents in the economy

What is Economic Cost? (3)

- Economic costs are also not the same as claims made by people for a given damage
 - These are a subset of financial losses depending on rules of insurance policies
- Economic costs are much broader in scope
- They include initial damage, but also flow-on effects of that damage on other sectors of the economy
- Question remains – what to measure?
 - Impacts, Losses, Costs, or Damages
 - Distinction between these is arbitrary (Dore and Etkin, 2000)

Issues in Identifying Economic Costs

- Stocks Vs. Flows
- Time Dimension in Damages -- One-time costs Vs. Total Cost
- Tangible Vs. Intangible costs
- Private Vs. Societal costs
- System Linkages -- Direct and Indirect Economic Costs
- Costs using Local Vs. National approach to accounting
- Costs with and without Mitigation / Adaptation

Issues in Identifying Economic Costs (2)

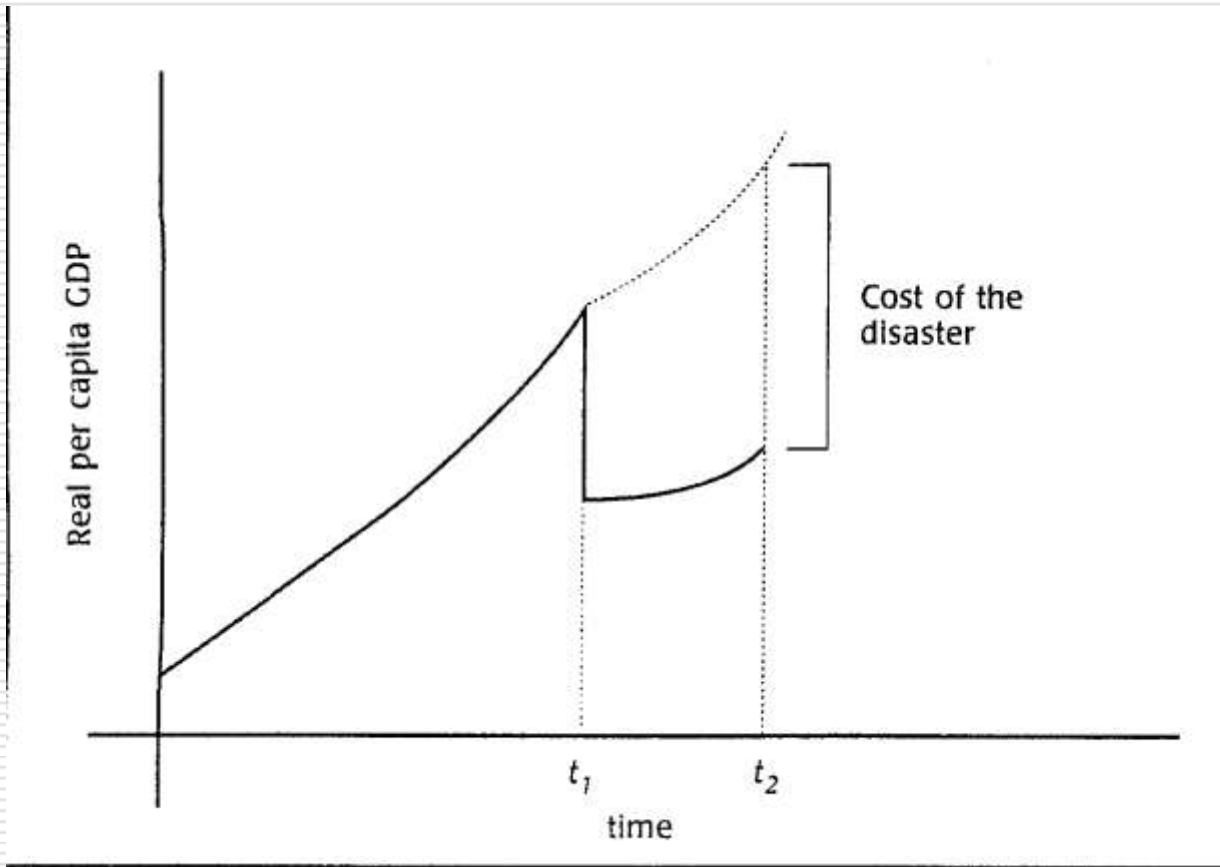
- Economic costs through loss of ecological services
- Behavioral OR Extended Linkages -- Economic costs through changing social behavior (such as stress, sickness, or other psychological impacts affecting change in business or personal practices)
- Cost of Mitigation and /or Remediation -- Long-term cost of people migrating – to People themselves and to the regions receiving them

Stocks Vs. Flows

- ❑ Stocks refers to a quantity at a point in time
- ❑ Flows refers to services or outputs from stocks over time
- ❑ Property damage refers to a change in stocks which may result in a decrease in service flows
- ❑ Measurement of both stocks and flows is justified for measuring economic costs

Cost of a Disaster – Total vs. Single Period

(Dore and Etkins, 2000)



Tangible vs. Intangible Costs

- All losses that can be measured and monetized are called tangible costs depending on the accounting stance of the analyst.
 - Typically these are direct costs.
- Intangible costs are losses not considered as a direct or tangible costs.
 - Typically non-market goods
 - Difficult to estimate
 - No systematic or accepted method of estimation available
 - Health effects, Household disruption, Loss of memorabilia are typical examples

Private Vs. Social Costs

- Damages to individuals and their families are private costs
 - Loss of sales or production may be very significant to the individual
- For the society as a whole, there could be benefits and /or costs to other producers (unless this is not feasible)
 - Reduced supply in one region may trigger higher sales in other regions
 - Producers in other regions may have to find other sources for meeting their input requirements
 - Both of these need to be accounted for in Societal costs
- Cost to tax payers who are not directly affected by the event but have to pay for the costs through higher taxation levels

Direct Vs. Indirect Costs

- Direct costs are the damage done to individual sectors of production or their owners
- Other sectors are affected by extreme events
 - These may include the processors or input supplying firms
 - These costs are impacts of the event on other economic agents in the system

Local Vs. National Accounting Stance

- Depending on the accounting stance of the decision maker, impacts are estimated for a given jurisdiction – Local municipality, Province, Country as a whole
- Major difference between Local and other regions is **‘DISPLACEMENT EFFECT’**
- In a national accounting stance, losses of one economic agent may become benefits to others (in other regions) and therefore, total economic cost to the nation may be lower than that for the local region

Damage Costs only vs. Damage Costs plus Cost of Adaptation

- Human behavior is inherently adaptive
- Expectations of or Onset of an event modifies our behavior – called adaptation
- These actions may produce some benefits or additional costs to the adapter

Economic Costs through Loss of Ecological Services

- According to the Millennium Ecosystem Assessment of the United Nations, “Humans are totally dependent on the nature”
- Nature provides us with four types of services: Provisioning Services, Cultural Services, Supporting Services, and others.
- Since these services enhance individual’s well-being, they place a value on them, called Ecological Goods and Services
- Any reduction in these services reduces social welfare and therefore, need to be accounted for.

Economic Costs through Loss of Human Capital

- Extreme events can potentially provide two types of losses related to human capital:
 - One, loss of human lives is an example of direct loss of human capital
 - Two, Indirect cost to society is through event related stress or sickness, which may affect individual's performance (efficiency in the workplace) and thus a loss to the society (including the individual)

Long-term Cost of Adaptation

- ❑ Adaptations are not without cost to the individuals
- ❑ Sometimes these costs are confined to the period to the extreme events
- ❑ In other cases, these extend over a period of time
- ❑ An extreme adaptation measure is human migration from one region to the other, which may have costs both to the region losing them (through Brain Drain) as well as to the receiving region (additional costs to be incurred)

A Comprehensive Assessment of Economic Cost of Extreme Events

- All assessments should be done from both local and national accounting stances
- From economic theory point of view, the ideal manner in which we could estimate the economic costs to the society of an extreme event (or for that matter, any disaster) is to equate it to:
 - **DISTORTIONS CREATED BY THE EXTREME EVENT TO THE NORMAL DEVELOPMENT AND EXPANSION OF THE ECONOMY**

Sources of Distortion should include

- ❑ Direct Loss of value added due to the extreme event in various sectors of the economy
- ❑ Loss of human capital (Loss of human lives and associated human capital)
- ❑ Indirect economic losses / costs
- ❑ Loss of capital destroyed by the event (To include Man-made private capital, such as buildings, machinery; and Man-made social capital, such roads, bridges)

Measure of Distortion should include

(2)

- Fiscal costs of the government, including effect of changes in fiscal measures (Additional taxes needed)
- Distributional issues of impacts
- Value of lost ecological goods and services – Non-Market Goods
- Economic losses resulting from social impacts of the event
- Cost of adaptation measures (including possible migration)

Challenges faced by Researchers

- Little knowledge of shape of damage function(s)
- What is an appropriate discount rate if impacts are felt over a period of time
- How should we aggregate the tangibles and intangible costs
- Economic methodology to value ecological goods and services is still in somewhat infancy stage

Challenges faced by Researchers (2)

- ❑ Valuation of loss of human capital (either through direct losses or through productivity losses due to health impacts) is challenging
- ❑ Large data requirements
- ❑ Large budgets needed

**Thank you
very much
for your
attention**