THE BENEFITS OF DISASTER RISK REDUCTION AND THEIR EFFECTS ON LOSS TRENDS

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Abstract

Trends in economic losses from weather related disasters have often been attributed to changes in exposure as well as to changes in weather extremes. Exposure is generally expressed as the number of people, or the economic value of capital, that are put at a certain risk. The reduction of disaster risk may affect exposure, but is often ignored. In this short paper I argue that effective disaster risk reduction may change exposure over time. Studies that do not consider disaster risk reduction may overestimate the effects of socio-economic factors that drive loss trends, such as population growth and the accumulation of capital. These studies may also underestimate the impacts of historic and future changes in climate and extreme weather events.

1. Introduction

Worldwide direct economic losses from natural disasters have been increasing considerably over the last (e.g. Munich Re, 2005). Time-series analysis of loss records has shown that this increase for some weather related hazards in the US can largely be explained by changes in socio-economic factors, most importantly population growth and the accumulation of capital in areas that are at risk from natural hazards (e.g. Pielke and Landsea, 1998; Changnon, 2003). These factors together have resulted in an increasing exposure. Some other scholars however have argued that climate change and consequent shifts in extreme weather events may have an important contribution to the increase in losses from weather related disasters (e.g. Mills, 2005).

Another important factor that may also affect losses is often ignored in the analyses of loss trends. That factor consists of efforts aimed at reducing risks from natural hazards. Increased efforts to reduce risks over time may decrease losses that result from extreme events. These efforts may consist of land-use planning, constructing dikes, improving and enforcing building codes, as well as the implementation of forecasting and early warning systems.

The Intergovernmental Panel on Climate Change (IPCC) stated in 2001 in its Summary for Policymakers of Working Group II: "The costs of weather events have risen rapidly despite significant and increasing efforts at fortifying infrastructure and enhancing disaster preparedness" (McCarthy *et al.,* 2001). It appears therefore that the many efforts around the world to reduce risk have not been able to curb the impacts from increasing exposure. At the same time, many efforts have been put in place over time, and may in recent times have mitigated the increasing losses to some extent.

The goal of this paper is first to argue how risk reduction may influence the impacts from weather related disasters, and to present some examples. Secondly, it aims to argue why it is important to consider these effects.

2. Definition and benefits of disaster risk reduction

Disaster risk reduction can be defined as "The conceptual framework of elements considered with the possibilities to minimize vulnerabilities and disaster risks throughout a society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development" (http://www.unisdr.org/eng/library/lib-terminology-eng%20home.htm).

Disaster risk reduction may address the extreme event itself, as well as the vulnerability to losses associated with that event. For example, one may try to reduce the peak height of a flood in a river basin, by implementing flood mitigation measures, such as the building of weirs, or by promoting afforestation of uplands. As a result, the probability of the extreme event (high water levels/flooding) may decrease. But additionally, one can make sure that the consequent losses are reduced while the extreme event still has the same probability of occurrence, for instance by improving the construction of houses. This makes disaster risk reduction simply one of the many factors that affect risk (Table 1).

Natural factors	Socio-economic factors
- Frequency of extreme event - Intensity of extreme event - Duration of weather events	- Increasing population - Habitation of particularly vulnerable areas (coastal zones, flood plain areas) - Increasing wealth (more expensive construction of buildings, larger amount of increasingly expensive goods, larger stocks, larger number of increasingly expensive vehicles) - Increasing urbanisation - Change in management of rivers and coastal zones - Land use change (environmental deterioration, changed agricultural techniques, vegetation cover) - Changing or negligence of building codes and construction methods - Improving forecast, warning, and evacuation schemes - Increasing awareness of population

Table 1. Factors that may influence natural disaster risk (from Bouwer and Vellinga, 2002).

It is important to note that risk reduction may affect the impacts of different natural disasters in different ways. For instance, in a particular region one may be successful in reducing the risks of storm damage by enforcing building codes, but one may be less successful in reducing the risks of damage resulting from heavy rainfall due to the low-lying nature of the area.

Also, disaster risk reduction may act as a two-edged sword: while it will largely reduce risks, it may also create a false sense of security that can result in reluctance to further reduce losses and may even lead to increasing development, thereby again increasing the risk of high losses.

3. Some examples of successful risk reduction

3.1 Loss of life from natural disasters

One clear example of the success of mitigating disaster risk is the reduction of the number of worldwide fatalities due to natural disasters (Figure 1). This reduction is likely to be due to a combination of increasing understanding of processes behind natural disasters, the ability to create structural as well as non-structural mitigation measures, such as the implementation of early warning systems and education of populations at risk.

The more extensive analysis in the white paper by Indur Goklany shows that this decline is largely due to a reduction in mortality resulting from

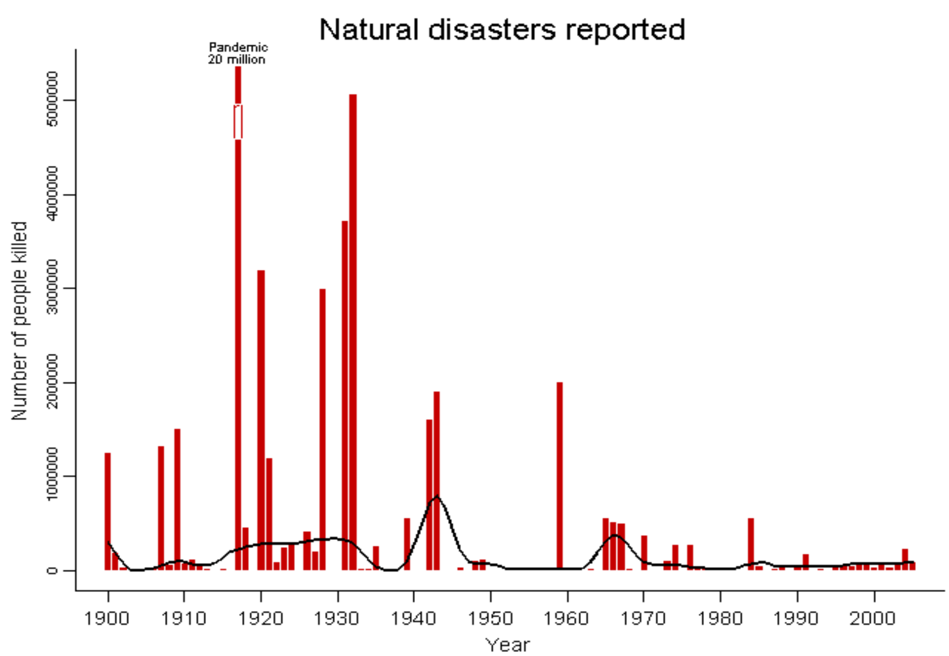

Figure 1. Number of fatalities from natural disasters, including diseases (source: CRED, EM-DAT database, http://www.em-dat.net).

droughts and floods. The analysis by Jonkman (2005) using the same EM-DAT database from CRED shows that there may be a slight upward trend in the number of people killed per event over the period 1975-2002, but he concludes that it is difficult to determine trends with certainty. At the same time, it is important to note that the estimated number of people that are affected by natural disasters appears to have increased over recent years (IFRC, 2002).

3.2 Windstorm losses

Building codes and consequent building construction are important factors in determining the vulnerability of assets at risk from storms. Over time, codes and construction may change. The effects of construction codes on building vulnerability are also explicitly used in vulnerability models, in order to decide on the costs and benefits of retrofitting (e.g. Englehardt and Peng, 1996; Stewart, 2003).

An analysis of the improvement of building codes in Florida (USA) has shown that these codes were rightfully developed, as they help to reduce direct economic losses, as well as reduce the risk of casualties (Englehardt and Peng, 1996). However, how the actual vulnerability of the building stock has changed needs to be assessed separately.

It has been shown that during hurricane Andrew buildings constructed decades ago performed better than buildings constructed more recent, mainly due to the style of houses (Pielke and Pielke, 1997). On the other hand, a survey in Florida, USA, found that buildings that were constructed according to the new 2002 state-wide building code performed much better in the 2004 hurricane season than older buildings (American Re, 2005: p. 26). Similarly, in Australia, improved building codes are estimated to have reduced vulnerability up to 65% (Ryan Crompton, personal communication).

3.3 Flood losses

The reduction of the amount of losses from extreme events is an important prerequisite for implementing risk reduction measures. For instance, cost-benefit analyses are being performed for justifying investments in flood control and determining the optimal design of the measures (Brouwer and Kind, 2005; Pearce and Smale, 2005). Within such evaluation of costs and benefits of risk reduction measures, the avoided damages are an important benefit, next to other indirect and often non-priced benefits, such as public safety.

An analysis of flood losses in the 2002 flood in Germany showed that local household protection measures may influence losses to a considerable extent (Kreibich *et al.,* 2005).

In The Netherlands, improving protection against storm surges and river floods was motivated by the benefit of protecting the assets present in the areas that lie below sea-level or close to the rivers. Over centuries, the flooding frequency has varied considerably, depending on climatic factors, but according to Tol and Langen (2000) above all depending on factors such as technological developments, institutional change, and risk perception (Figure 2).

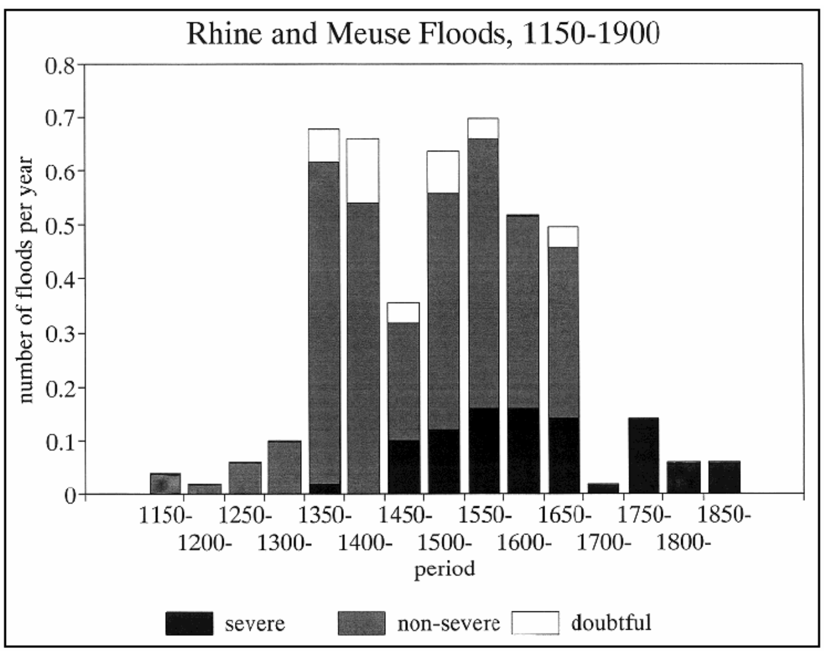

Figure 2. Flooding frequency in The Netherlands (from: Tol and Langen, 2000).

Awareness can be an important factor, as people may be able to better anticipate to floods, and prevent damage from occurring if they prepare for a disaster. This can for instance be illustrated by the two Rhine floods in Germany that occurred in December 1993 and January 1995. As these two floods quickly followed one another, the population living along the river was prepared for the next flood. People cleared their belongings to above the 1993 flood level, and consequently the damage of the second flood was reduced. The costs reflected this, as the flood in 1995 in Cologne caused about half the damage of the flood in 1993 (1202 and 617 million DM total economic losses, respectively), despite the same water level (Bavaria Re, 1994; Bavaria Re, 1995).

4. The importance of analysis of risk reduction benefits

Analyses of benefits of risk reduction are not commonplace, and are probably unknown for most locations around the world. Many efforts have been made to reduce risks from natural hazards (ISDR, 2004), although the exact number of the total amounts of investments, let alone their direct benefits, is lacking. A good understanding of the effects and effectiveness of risk reduction is missing as well.

Tools to determine the benefits of natural disaster risk reduction are available, but may need to be further improved and applied more widely. For example, some of the tools used by development agencies could be used to assess risks and benefits of risk reduction (Benson and Twigg, 2004). A proper analysis of the global effects of risk reduction would need to discriminate between different world regions, as risk reduction may have been implemented differently and at different times in the various regions.

It appears that a good understanding of the effects of risk reduction is not present at this time. There is a need to further analyse the benefits of risk reduction, for a number of reasons. First of all, the analyses of the success of risk reduction may help to gain further support for the reduction of the impacts from natural disasters. Secondly, it may show that part of the effects of increasing exposure due to population growth and increases in wealth and the amount of capital may have been curbed, for some hazards, in some areas.

Such analyses may have implications for disaster risk reduction policy and efforts in development cooperation, as it shows to what extent the efforts are successful. It may further show that there are opportunities for integrating climate change adaptation into efforts aimed at reducing risks from weather related disasters (e.g. Bouwer and Vellinga, 2005; Sperling and Szekely, 2005; Thomalla *et al.,* 2006). Along similar lines, the financing of climate change adaptation could also largely tap into funds aimed at disaster risk reduction, as current funds under the UNFCCC are limited (Bouwer and Aerts, 2006).

These analyses may also have implications for our understanding and analyses of historic disaster losses. Loss records that are only adjusted for population growth and increases in wealth and the amount of capital may show a decrease in losses over time that is the result of risk reduction efforts. Adjusting for risk reduction effects may still show a climate signal in the record, that is, the effects of interannual climate variability, but it could reverse the long-term trend of losses and thereby show the impact of other environmental factors, such as climate change.

Acknowledgements

The contents of this paper benefited from the comments and suggestions from the workshop participants, in particular from those from Ryan Crompton, Eberhard Faust and Roger Pielke Jr. All errors and opinions are those of the author.

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