COST IMPLICATIONS OF STORMS, FLOODS, AND DROUGHTS

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Summary

Climate change entails shifts in climatic hazards. An increase in hazards implies higher direct damage and repair costs and higher costs due to insurance and investments in protection and due to a possible reduction of natural endowments. Damage statistics show that damage costs are increasing. Analysis of the origins of this increase is hampered by conceptual and empirical difficulties. Costs, or the negative economic implications in a wider sense, depend on three principal factors: the intensity of the weather event, the stock-at-risk and the vulnerability of that stock at risk. Economic developments that have given rise to an increasing stocks-at-risks explain much about the size of the damage (e.g. windstorms that hit France at the end of 1999 resulted in a death toll of 80 and a damage bill of about €10 billion). Vulnerability of a society to climatic hazards refers both to physical protection from hazards (e.g. dikes, shelters for hurricanes) and to institutions that cope with damage from a disaster (e.g. relief organizations, insurance). Vulnerability can be measured, for instance, as the economic effects of a disastrous weather event in a country vis-à-vis the gross domestic product of that country. In general, a country is less vulnerable the richer it is. Little can be said about the future cost of extreme weather, let alone how that will change with climate. Relative vulnerabilities are clearer, however. In OECD countries, insurance and, to a lesser extent, reinsurance companies are less vulnerable. Instead, any increase in

damage would be borne by the insured and by taxpayers. Globally, poorer countries are substantially more vulnerable than are richer countries. The poor within developing countries are even more vulnerable.

1. Introduction

The impacts of climate change will manifest themselves through changes in weather extremes rather than through changes in the mean. Society is well adapted to normal weather, but extreme weather occasionally wreaks havoc. Changes in extreme weather thus may well cause substantial costs or benefits to society.

	Direct damage	Indirect damage
Tangible	To infrastructure, buildings, stocks, and industrial assets	Loss from interruption to business consequent upon disaster
Intangible	To items of cultural significance and personal memorabilia	Damage to health consequent upon the event; inconvenience and disruption

Table1. Nature of weather disaster damage

This article treats the implications of climate change for the costs caused by storms, both tropical and extratropical, river floods, and droughts. It also discusses the impact on disaster relief. Studying this poses substantial methodological difficulty. Firstly, the most serious storms, floods, and droughts are rare. Data are therefore scarce. Data are not systematically gathered, nor do they cover all types of damage (see Table 1). Secondly, people do not like extreme weather, and try hard to minimize its negative consequences. Weather disasters often lead to a new spur in protective measures. Current vulnerability is thus a function of past events. Thirdly, vulnerability is also strongly influenced by exogenous trends, such as population growth, land-use change, economic growth, institutional change, and so on. Any study of the implications of weather disaster faces these problems. A fourth methodological issue is establishing the scope of costs and damage. Usually information is restricted to direct tangible costs, although it is clear that impacts are wider (see Table 1). Finally, climate change studies are hampered by the difficulty that current climate change models cannot give reliable predictions about how global climate change would change regional and local extreme weather events. Studies of the implications of climate change thus focus on vulnerability rather than on impacts.

The little that is known about climate change, floods, droughts, and storms is treated in the article *Models and Predictions of Global Warming*. This article focuses on the economic implications for society. These implications include death and injury, damage to buildings, infrastructure, crops, and nature, interruptions to daily life and business, and a whole range of knock-on effects. The effects of natural disasters are fairly local. That is, a relatively small number of people are heavily affected. From a national perspective, the economic effects are typically small (except for small countries), but

the effects on individuals are often devastating. An assessment of the effects should therefore take into account whether society is able to redistribute the losses. The redistribution mechanisms vary with type of disaster and with socioeconomic circumstances in the area hit. For instance, storms constitute a type of risk that is insurable since storms tend to strike at random, in contrast to floods and droughts. However, commercial insurance for storm damage seems not viable in low-income areas because the market is frequently too thin and contract law is often not well developed. Commercial insurance covering flood and drought risk make it less viable because of the nature of these risks. So government aid and charity are the main mechanisms for redistribution of the costs. Developed countries have more resources for these mechanisms of coping with hazards. Many developing countries are dependent on relief aid from foreign countries.

The impact of climate change on the insurance industry is discussed in Section 5. Section 6 treats disaster relief. Before that, Section 2 discusses windstorms, Section 3 looks at river floods, Section 4 treats droughts, while Section 7 offers conclusions.

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Bibliography

The following Web sites provide statistical information on disasters: ReliefWeb at *www.reliefweb.int*; and The Centre for Research on the Epidemiology of Disasters (CRED) at *www.md.ucl.ac.be/cred/*. The German reassurance firm MunichRe also provides statistical information via the Web (www.munichre.com). A good portal for U.S. studies is: Environmental and Societal Impacts Group of the National Center for Atmospheric Research (ESIG) at *www.esig.ucar.edu*.

Biographical Sketches

Xander (A.A.) Olsthoorn is senior research fellow at the Institute for Environmental Studies of the Vrije Universiteit, Amsterdam. He has been involved in several climate change studies, on both the origins of climate change (i.e. greenhouse-gas emissions) and the effects of climate change. He was co-editor of *Climate, Change and Risk* (Routledge, 1999).

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