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Economic Aspects of Disasters and Sustainable Development: An Introduction

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Natural disasters threaten sustainable economic development worldwide, representing a considerable challenge for the global community. In the past twenty years, earthquakes, volcanic eruptions, landslides, floods, tropical storms, drought, locust invasions, and other natural calamities have killed 3 million people, inflicted injury, disease, homelessness, and misery on 1 billion others, and caused billions of dollars of material damage—more than \$100 billion in 1991 and 1992 alone.¹ Natural disasters destroy decades of human effort and investments, thereby placing new demands on society for reconstruction and rehabilitation. This halts and, in some cases, reverses economic progress. Large-scale natural disasters can have profound, negative impacts on long-term development, causing distress and increasing dependency.

The developing countries, where two-thirds of the world's population live, suffer the most debilitating consequences due to natural disasters: 90 percent of the natural disasters and 95 percent of the total disaster-related deaths worldwide occur in the developing countries. The per capita losses in the gross national product (GNP) are estimated to be twenty times greater than in industrial countries. Since the 1960s, economic losses have increased at least fivefold. Losses in the industrial countries are also on the rise. In the United States, for example, insurance payouts from natural disasters during 1990–94 are already more than quadruple those accumulated for all of the 1980s, which themselves were quadruple those of the previous decade. These losses are growing largely due to the increasing concentra-

tion of population and investments in vulnerable locations and to inadequate investment in measures to reduce risk (UNCRD 1994).

On May 26, 1994, as a part of the World Conference on Natural Disaster Reduction, held in Yokohama, Japan, the World Bank and the U.S. National Academy of Sciences sponsored a technical session on the economic aspects of disaster prevention for sustainable development (see appendix 2 for the session program). Its purpose was twofold: (1) to explore the relationship between disasters and sustainable development, focusing on the economic aspects, and (2) to begin a dialogue between economic experts and decisionmakers from around the world on the economic tools for reducing vulnerability and managing potential losses in the context of development.

The contributions in this volume seek to provide a better understanding of the economic impacts of disasters in order to promote development that is resilient to the effects of natural disasters and to guide judgments about ex ante expenditures for prevention and mitigation. The chapters introduce the economic aspects of vulnerability and disaster impact on levels ranging from the household to the nation; they also examine two principal ways in which societies cope with potential economic losses and threats to sustainable development before an event occurs: by incorporating disaster risk into decisions on development investment and by sharing disaster risks and costs through insurance arrangements (both formal and informal).

Disasters and sustainable development

Disasters continue to strike with greater frequency, magnitude, and complexity. In most cases, the natural phenomena

triggering the disasters are beyond human control. However, vulnerability to such disasters is a result of our own actions. Earthquakes, for example, are naturally occurring extreme events, but the amount of damage they cause is largely a function of decisions made in the course of development. The uncontrolled growth of cities and the expansion of slums into marginal areas; poor design, building techniques, and supervision of construction; and lack of enforcement of land-use regulations are some of the development decisions that result in significant losses when an earthquake strikes a city. Thus, vulnerability concerns the predisposition of a society to experience substantial damage as a result of natural hazards. Large-scale urbanization, natural resources degradation, poverty, population pressure, and certain patterns of consumption, production, and development are some of the human actions that increase the vulnerability.

Environmental vulnerability and poverty are mutually reinforcing: 80 percent of the poor in Latin America, 60 percent of the poor in Asia, and 50 percent of the poor in Africa live on marginal lands that are characterized by poor productivity and high vulnerability to environmental degradation and natural disasters. Developing countries, which necessarily place high priority on food production and industrial activity, have fewer resources left to reduce disaster risk. Rising economic losses in the industrial countries also suggest that, even there, mitigation efforts are not keeping pace with the factors that are increasing vulnerability.

Many developing countries are also experiencing rapid population growth, accompanied by increasing concentration of their population and investments in vulnerable locations. These trends increase pressures on natural resources and

the environment and raise the consequent risks associated with human activity. In rural areas, rangelands are heavily overgrazed and forestlands are severely degraded by overexploitation and neglect. Acute shortages of firewood have accelerated deforestation, which, together with destruction of the vegetative cover on natural pastures, has increased the threat of floods and the deterioration and desertification of previously fertile land.

The accelerating pace of urbanization and the growing scale of urban-industrial activity is exacerbating environmental stresses in developing-country cities and increasing the vulnerability of urban dwellers to both natural and technological disasters (Kreimer and Munasinghe 1991). The demand for more urban space has pushed the poor onto marginal, environmentally vulnerable terrain. More than half of the world's population now lives within 60 kilometers of the ocean. At the same time, greater demands are being placed on forest resources. The resulting deforestation increases the vulnerability of urban areas to droughts, fires, floods, runoff, landslides, sedimentation of dams and reservoirs, pollutants, and diseases. In many developing countries, overcrowding, congestion, poverty, unemployment, and inadequate infrastructure and services further weaken urban resistance to natural hazards.

Accelerated changes in demographic and economic trends have disturbed the balance between ecosystems. There is some evidence of causal links between environmental degradation and vulnerability to disaster. The same kind of tampering with the natural environment that concerns ecologists, such as deforestation, can also exacerbate the impact of natural disasters on the environment. It is hard to ignore the apparent correlation between the frequency and severity of

natural disasters and growing local and global environmental degradation, especially in the second half of the twentieth century. Environmental degradation intensifies disasters, thereby increasing the potential for secondary disasters: high windstorms are followed by floods and landslides, floods by drought, and drought by pest epidemics and famines. The damage to the environment caused by extreme weather events has escalated, increasing faster than population growth. It is also clear that developing countries are far more vulnerable than industrial countries to both catastrophic events and deterioration of the environment.

As greater vulnerability is linked with poverty, it stands to reason that development helps to diminish the effect of natural disasters. The difference in losses between developing and industrial countries supports this view. Nevertheless, although evidence indicates that development helps to diminish the effects of natural disasters (at least in the aggregate), some of the tenets of development—such as greater use of resources, urbanization, and the use of environmentally harmful technologies—have increased vulnerability. To counter this, sustainable development paths are needed that place emphasis on productive use of natural and other resources to meet the needs of the present while ensuring adequate or enhanced resources to meet the needs of future generations (WCED 1987). Disaster prevention and mitigation are, in this sense, important elements of environmental management and planning for sustainable development.

Policymakers around the world are recognizing that the ability to achieve sustainable development can be increased by reducing the impact of natural disasters. Yet we are lagging in integrating disaster reduction measures into development ac-

tivities. This volume explores some of the ways of improving the cost-effectiveness of investments in mitigation and of making the reduction of vulnerability a routine, explicit objective for development.

Overview of the volume

The contributions in this volume are organized, as was the technical session in Yokohama, to provide an overview of the implications for sustainable development of losses from natural disasters (highlighting the economic aspects), to discuss methods for development investment decisions to take disasters into account, and to highlight issues related to sharing the disaster risks and costs through insurance arrangements.

The consequences of natural disasters and the efforts needed to recover from them are country specific and depend on many factors, such as the proportion of the economy affected and the prevailing economic and social conditions, in addition to the nature and severity of the disaster itself. Using the experience of the Latin American and Caribbean countries, Romulo Caballeros Otero and Ricardo Zapata Martí in chapter 2 outline the impacts of disasters on national economies, such as the disruption of production; increase in foreign debt; the loss of employment, income, and tax revenue; damage to the natural resource base and environment; and the slowing of economic growth and development that results (see figure 1-1).

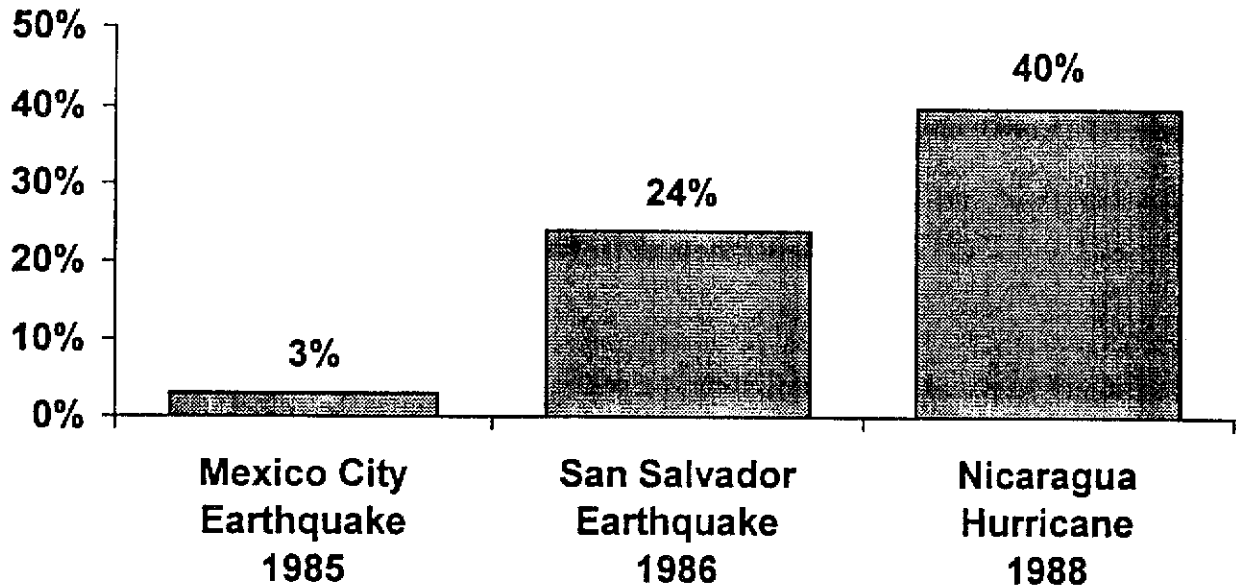
Caballeros Otero and Zapata Martí note that although immediate and short-term impacts of natural disasters may be relatively easy to evaluate in economic dimension, long-term consequences—social impacts in particular—are difficult to assess. They observe that the larger the disaster and the smaller the economy, the more severe are the long-term impacts,

and vice versa. Finally, for the international community to provide assistance, an authentic assessment of the situation is vital, including determination of the most affected sectors and areas; identification of post-emergency projects that require financial and technical assistance; and strengthening of the country's ability to meet the needs following a disaster.

Poorer countries face special challenges when adopting disaster mitigation in the process of sustainable development. Atiq Rahman in box 2-1 of chapter 2 notes that developing countries have a high percentage of poor who are the most vulnerable to natural disasters, weak institutional capacity for confronting disasters, and inadequate market mechanisms that may help to buffer against disasters and spread risks. He notes that reinforcing indigenous coping strategies and self-reliance at the community and national levels is important to improving resiliency to natural disasters.

The international community—the development banks, in particular—should support disaster prevention and mitigation as a means to improve sustainable development. For investment decisions to take disasters into account, risk has to be considered in economic analyses. In chapter 3, Mary Anderson reviews the ways in which our understanding of vulnerability has developed over time. She discusses the trends associated with development that have increased vulnerability and prompted the current focus on sustainable development. Human actions have undermined and continue to undermine the environment, and current government-sponsored development efforts in many countries reinforce the tendencies toward future environmental depletion in an attempt to meet citizens' basic needs such as food, jobs, and housing.

Figure 1-1: Costs of Disasters as a Percentage of Yearly GDP in Mexico, San Salvador, and Nicaragua, Various Years, 1980s



Source: Gavidia 1990.

Vulnerability is complex, dynamic, self-compounding, and cumulative. It is sometimes irreversible and is frequently borderless and uncontainable. Anderson presents a useful framework for assessing vulnerability that can be used by communities and educators to improve the public's understanding of disaster proneness and prevention and by governmental and international bodies to assess risk and to decide which courses of action to take to reduce disaster vulnerability.

By incorporating information about natural disasters and possible mitigation strategies into the planning process, the prospects can be enhanced for a satisfactory outcome from public investments in development projects. According to Randall Kramer, donor agencies and de-

velopment banks seldom include disaster potential in economic analyses that support project design and lending decisions. In chapter 4, he outlines the benefits and limitations of benefit-cost analysis for evaluating investments in mitigation within the project planning cycle. He notes that analysts are constrained by lack of systematic information on the impact of natural disasters and outlines approaches under two scenarios. The limited-information scenario adopts approaches that are not data intensive and may be particularly relevant at the prefeasibility stage of project analysis. The adequate-information scenario that links probability distributions of natural disasters to economic variables may be suitable for more sophisticated feasibility studies of projects.

Kramer discusses several methods for incorporating disaster risk information into benefit-cost analysis, including those used when information is limited. These methods can identify the impacts of disasters on project feasibility. The use of risk-modified, benefit-cost methods can alter investment decisions and suggest means to modify project design.

The Asian Development Bank (ADB) has estimated that the disaster mitigation component of recent recovery projects do generate an economic rate of return that is high enough to warrant investment. In chapter 5, Günter Hecker observes that benefits of disaster management projects are not properly assessed. This is due to the paucity of data, both *ex ante* and *ex post*. Moreover, the absence of predisaster and up-to-date social and economic benchmark indicators impedes attempts to assess the benefits of the project. He observes that project analyses have tended to focus on easily measurable costs and benefits, whereas to assess all economic benefits, it would be necessary to take into account social and environmental concerns as well as those readily measurable in monetary terms.

Hecker highlights the ADB's increasing role in disaster-related projects, emphasizing mitigation, the fostering of self-reliance, and strengthening of institutions. He notes that disasters require very rapid responses to reduce the delays. Implementing disaster recovery projects in two phases—a repair phase and a rehabilitation phase—may allow afflicted communities to recover faster.

The other principal way that societies cope with potential economic losses and threats to sustainable development is by sharing the risks and costs of disasters through insurance arrangements. In market economies, formal insurance mechanisms are well developed for dealing with

a variety of hazards. However, some insurance elements for natural disasters ought to be developed to reduce risk further. Howard Kunreuther in chapter 6 explains how improved insurance mechanisms can provide better incentives for disaster reduction. For example, insurance may be tied to seals of approval for better construction, or differential rates can be applied to reflect different levels of risk in such a way as to encourage homeowners to adopt mitigation measures.

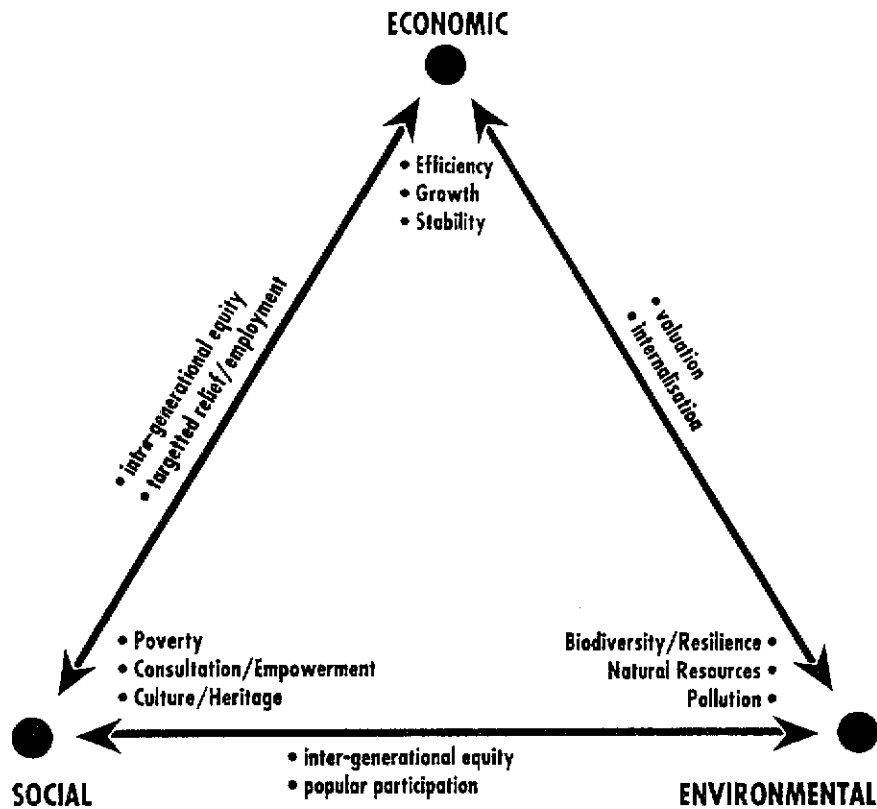
Some conclusions

The general consensus emerging from the papers and discussions in Yokohama is that disaster prevention and mitigation are essential components of the three main elements of sustainable development: economic, social, and environmental (see figure 1-2).²

The economic approach to sustainability is based on preserving the stock of capital (or assets) that yields the maximum amount that a person or community can consume over some time period and still be as well off at the end of the period as at the beginning. Such assets include natural resources and the capacity of the environment to absorb shocks, both technologically induced and natural. Natural and man-made capital may be more complements than substitutes, and natural capital, or the loss of ecological resilience, often plays a crucial role in limiting development. Of course, the degree of loss of productivity that occurs as a result of natural disasters is determined also by the capacity of human societies to adapt and continue functioning in the face of stress and shocks.

Because urbanization, poverty, and environmental deterioration are closely interrelated, the economic approach requires cost-effective methods of preventing and mitigating en-

Figure 1-2: Approaches to Sustainable Development



Source: Munasinghe 1993.

environmental catastrophes. Improving regulatory measures, market-based control mechanisms (such as pricing and taxation), and urban management are critical. In addition to providing more comprehensive environmental protection and basic services, this would alleviate constraints on productivity and economic growth.

In order to determine the level and types of such policies, some awareness of the costs of impacts and the internalization of environmental externalities into benefit-cost analysis are essential. When informa-

Box 1-1: The Role of Benefit-Cost Analysis

Stephen Bender, while moderating the sessions in Yokohama, stated:

“The decisions affecting the creation and continuance of vulnerability are certainly complex but may often be outside of formal project financial transactions and certainly beyond rigorous benefit-cost analysis. Yet it seems fair to assume that all vulnerable populations make, one way or another, some kind of benefit-cost analysis of their situation.”

tion is scarce, benefit-cost analysis should be used in conjunction with multi-criteria analysis (which integrates economic, social, and environmental aspects in a balanced way) to reduce those types of impacts that should be addressed and to identify which measures are the most cost-effective.

Box 1-2: The Increasing Importance of Disaster Insurance

At the Yokohama sessions, Gianfranco de Giusti outlined some recent and innovative proposals aimed at improving the Italian insurance market's capacity to manage disaster risk. Another speaker, Wang Fushan, noted that in China, insurance spending will play a growing role in disaster relief. Approximately 600,000 institutions and 13 million families are participating in insurance schemes. This coverage only represents around 10 percent of the population. Compensation from insurance has never exceeded 5 percent of economic losses in recent disasters. There is great potential for developing and expanding the insurance sector in China.

As the impacts of natural disasters fall disproportionately heavily on the poor, the social view of sustainable development stresses the participation of at-risk communities in devising and implementing effective strategies to reduce vulnerability. The communities must have a voice in identifying site-specific solutions and assessing the efficacy of proposed measures. The implementation of disaster planning is best performed jointly by local communities, the government, and industry. Better community awareness is essential. There is a need to identify and understand people's perception of risk, to develop better channels of communica-

tion and popular consultation, and to rely on local resources. In many cases, the profound changes brought by urbanization have undermined the traditional support system for coping with crisis. Decentralization of decisionmaking is important in the strengthening of organization for disaster preparedness prevention and mitigation, particularly given the need for rapid and localized responses in the face of swiftly occurring catastrophes.

Box 1-3: The Sociocultural Context

At the Yokohama sessions Omar Dario Cardona stated that:

"A reading on the topic of vulnerability and risk presented by geophysicists, hydrologists, engineers, and planners can be quite different from the reading or 'imagery' available to the exposed communities and people. For this reason, it is necessary to seek in-depth knowledge about individual and collective perception of development and risk and to investigate the cultural characteristics and organization of societies, as well as their behavior and relationship with the physical and natural environment, which favor or impede prevention and mitigation and which also favor or restrict preservation of the environment for the development of future generations."

The environmental view of sustainable development emphasizes preserving the resilience and dynamic ability of biological and physical systems to adapt to change. The failure to limit environmental degradation resulting from human intervention increases the vulnerability to risks posed by natural hazards. Manila, Rio de Janeiro, and Jakarta are examples of uncontrolled urban development, combined with deforestation and dumping of wastes into rivers and canals, which have

led to increased runoff and heavy flooding. Many of the same actions that preserve the ability of systems to adapt to change also increase resiliency to external shocks or extremes in the environment such as natural disasters. This interconnection between natural resource degradation and increased vulnerability to natural catastrophe emphasizes the need for preventive measures.

The dialogue that these papers generated among economic experts and decisionmakers gathered in Yokohama in May 1994 highlighted a few additional points of general agreement. Reducing vulnerability, especially of the poor, is a key element of disaster prevention strategy. International assistance dedicated to preventing and mitigating disasters, which has never been great, should be increased. Disaster reduction strategies should also be integrated into the full range of sustainable development projects and policies, especially macroeconomic policies.³ Many insurance techniques should be adapted more systematically in the developing world. However, because of the large number of poor and the absence of well-functioning markets, nonformal insurance mechanisms should also be strengthened, drawing upon knowledge based on ways in which societies traditionally have coped with risk. Finally, to address the need for capacity building, training, and resource mobilization for disaster prevention and mitigation in the context of sustainable development, regional centers should be developed and strengthened, and their ties improved.

Notes

1. A billion is 1,000 million.
2. For further details of the three key aspects of sustainable development (social, environmental, and economic), see Munasinghe (1993).
3. For further details of the links between macroeconomic policies and the environment, see Munasinghe and Cruz (1994).

References

- Gavidia, Jorge. 1990. "The Economic and Social Effects of Recent Natural Disasters in Ecuador and Nicaragua." In UNCRD, *The Socioeconomic Impacts of Disasters*. UNCRD Meeting Report Series 45, Nagoya, Japan. Washington, D.C.: World Bank, December.
- Kreimer, Alcira, and Mohan Munasinghe. 1991. *Managing Natural Disasters and the Environment*. Washington, D.C.: World Bank.
- Munasinghe, Mohan. 1993. *Environmental Economics and Sustainable Development*. Washington, D.C.: World Bank.
- Munasinghe, Mohan, and Wilfrido Cruz. 1994. *Economywide Policies and the Environment*. Washington, D.C.: World Bank.
- UNCRD (United Nations Centre for Regional Development). 1994. *The Socioeconomic Impacts of Disasters*. Nagoya, Japan.
- WCED (World Commission on Environment and Development). 1987. *Our Common Future*. London, England: Oxford University Press.