DISASTER RISK MANAGEMENT

National Systems for the
Comprehensive Management of Disaster Risk
and Financial Strategies
for Natural Disaster Reconstruction

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Foreword

This report was commissioned as part of the Regional Policy Dialogue on Natural Disasters of the Inter-American Development Bank (IDB) to examine national systems and institutional mechanisms for the comprehensive management of natural disaster risk. Latin America and the Caribbean are only too familiar with the devastating impact of hurricanes, floods, earthquakes, landslides, volcanic eruptions, and other natural disasters. With an average of 40 significant disasters a year, Latin America is second only to Asia in frequency of disasters affecting the region.

Natural hazard policies in much of Latin America and the Caribbean have traditionally focused on establishing efficient disaster response. However, modernization of the systems calls for a more comprehensive vision of disaster risk management that includes an emphasis on prevention and mitigation and strives to involve citizens and the private commercial sector. In this respect, the Regional Policy Dialogue on Natural Disaster commissioned a two-stage study focused on understanding national, integrated disaster risk management systems and the related financing, a report which is based upon literature reviews, case studies, and consultation with experts regarding the existing good practices of natural disaster risk management programs worldwide.

While the first phase of the study discusses the components of a national system, the second focuses on instruments for financing reconstruction after a disaster. The research compares centralized, government-directed management systems with those that are localized and decentralized, and also analyzes the factors affecting the financial and political stability of alternative approaches. As natural disasters may result in major resource gaps for governments facing the task of financing reconstruction, the report presents case studies of four countries—Bolivia, Colombia, the Dominican Republic, and El Salvador—to highlight the various policy options. Alternative sources of ex ante funding are identified, including reserve funds, contingent credit, and insurance. These innovative methods of funding are compared with ex post funding possibilities through international aid, loan diversions and increased external debt, budget reallocations, and tax increases.

In dealing with the management of natural disasters, Latin America and the Caribbean have made a gradual shift from an ex post response approach toward a system concerned with investments in prevention and mitigation. The main challenge facing governments is to incorporate these preventative investments with planning for possible reconstruction as part of the overall strategy for disaster risk management. In this respect, the authors aim to demonstrate the wide range of policy options available, which will prove to be contingent upon the circumstances of each country.

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Executive Summary

National Systems for Disaster Risk Management

This publication presents the results of two interrelated projects completed for the Regional Policy Dialogue on Natural Disasters for Latin America and the Caribbean financed by the Inter-American Development Bank. The first project addresses the sustainability of national risk management systems for coping with natural disasters, and it is primarily a survey of existing practices in Latin America, Asia, the United States and Europe. The work explores important characteristics of national systems that make them sustainable both politically and fiscally. The second project focuses on one characteristic of national risk management systems: the financing of reconstruction on the basis of case studies for Bolivia, Colombia, El Salvador and the Dominican Republic.

Central Government or Community-driven Disaster Risk Management

A national disaster risk management system comprises the formal or informal interaction between institutions, financial mechanisms, regulations and policies. It is commonly believed that for a national disaster system to succeed governments must be active participants in its creation and implementation. Concern exists on focusing natural disaster policy on existing government systems that sometimes enhance narrow power structures and draws away from local concerns and initiatives. Those holding this concern favor reducing natural hazard risk to community-driven projects and programs developed by nongovernmental organizations (NGOs). Such an approach to risk management is not guaranteed to be comprehensive, but applies directly to identifiable needs and the empowerment of local populations.

These two approaches to risk management need not be mutually exclusive. The task facing policymakers is to create effective, integrated national systems that engage senior government policymakers and accommodates and supports local decision-making and private market initiatives.

Two Phases of Disaster Management

The key elements of risk management are divided into two phases: the pre-disaster phase and the post-disaster period. The pre-disaster phase includes risk identification, risk mitigation, risk transfer, and preparedness; the post-disaster phase is devoted to emergency response, rehabilitation and reconstruction. Comprehensive risk management addresses all these seven components. Many countries have developed, or are developing, national programs to partly or fully incorporate these elements of an integrated disaster risk management involving the public sector, civil society, and private sector commercial actors. Each national disaster system reflects the political and economic cultures and conditions of the particular country.

Risk Assessments

Risk assessments are an essential part of the process of integrating natural disaster programs with overall development objectives. These assessments identify sources of risk, vulnerable groups, and potential interventions. In the first stages risk maps can be

integrated with poverty valuations to identify communities most in need of disaster-related mitigation and preparedness projects. This identification process may serve as a cornerstone for all of the initial risk management activities. Risk assessment allows policymakers to specifically define the objectives of the risk management programs and to establish vulnerability reduction targets.

Evolution of the National Systems in the Region

Most national disaster risk management systems in Latin America and the Caribbean consisted initially of government bodies dedicated to emergency response. Some countries still continue to rely almost primarily on civil defense. In other countries, large natural catastrophes over the past decades have highlighted the need for more comprehensive systems that would include prevention, mitigation, preparedness, and provisions for reconstruction and rehabilitation activities with the participation of civil society and market actors. As a result, several countries, such as Argentina, Brazil, Chile, Colombia, the Dominican Republic, El Salvador, Nicaragua, Guatemala, Honduras, and Mexico, have begun to transform their approaches to coping with natural disaster risk. In Central America and the Caribbean, subregional disaster reduction organizations such as the Centro de Coordinación para la Prevención de los Desastres Naturales en América Central (CEPREDENAC) and the Caribbean Disaster Emergency Response Agency (CDERA) have fostered this transition.

Characteristics of Effective National Systems

Drawing from country experiences and recommendations from policymakers involved in national systems, some key guidelines for effective disaster management emerge. First, a national system should rely on an explicit disaster strategy. An appropriate national disaster strategy should be closely integrated with national policies for development and environmental protection. Second, successful national systems should also incorporate key players in the disaster management process. Such players include, among others, the finance ministry, local community leaders, NGOs, and private market actors. Third, successful national systems should have provisions to ensure sufficient resources for key players to carry out their responsibilities.

Financing Reconstruction

One consistent shortcoming in the risk management strategies of developing countries has been the lack of planning and financial protection against disasters. Traditionally, developing countries have relied on emergency transfers from their limited government budgets and reallocation of existing loans, and donations from international agencies to fund their disaster losses. This use of resources for reconstruction financing places an increasing strain on the ability of the countries to fund longer-term economic and social development programs.

In developed economies, considerable reliance is placed on ex ante financing tools to provide needed post disaster reconstruction funding. Is there a meaningful role that these tools can play in assisting developing countries to finance their reconstruction? This issue is subject to considerable debate in the development community.

Financial Planning

By their very nature, ex ante risk management tools are complicated. The benefit of these tools lies in an understanding of probability. These instruments require monies to

be spent today to reduce the consequences of an unknown, but probably occurring, future event. If the future event does not occur, the value of the money spent to protect against the event looks lost. Even worse, the perceived benefit of spending the funds on other important investments is also absent. To use ex ante risk management tools, a policymaker must bridge the psychological gap of weighing the cost of current expenditure against future unknown but predictable consequences. At the country level, the tradeoff is usually framed as a tradeoff between growth (a result of more money being spent now) and stability (a guarantee of funds to pay for future losses). There is a need to establish an appropriate framework for balancing these two competing needs for developing countries with restricted resources and immediate poverty reducing needs.

Filling the Potential Resource Gap

The starting point for addressing the financial problem related to catastrophes is identifying potential funding sources for reconstruction after a disaster in order to fill the "resource gap." The resource gap measures the inability of a country to finance its reconstruction obligations from traditionally available sources after a disaster. The calculation of the resource gap requires three computations. First, the risk of the country to natural hazard events must be estimated. Risk is a function of the hazard (or probability of phenomena of different magnitudes impacting a country) and the vulnerability (or susceptibility of the exposed population and assets to loss). The second calculation concerns financial data that the government assumes to finance the losses not only of its own assets but also its responsibility to cover some private losses (for example, of the poor). Primary losses from natural hazard events may be covered by various parties in addition to the government—industry, businesses, homeowners, and individuals—but the concern here is with government responsibility. Third, the capacity of the government to meet its financial obligations must be calculated. To the extent that the government lacks the resources to fund its obligations, it has a natural disaster resource gap. The required resources may come from the government budget or diversion of resources from other programs, revenues (tax), reserves, insurance proceeds, borrowing, or international aid. All of these alternatives have an associated cost and limitations on availability.

Case Study Results

The analysis of the cases through the modeling exercise suggests that several countries in the region may find it profitable to engage themselves in an in-depth analysis of alternative financial protection schemes especially in preparation for potential large scale natural disasters. Policies directed at reducing risk or guaranteeing post-disaster resources are likely to pay high dividends. More detailed information should be generated for rational risk management decision making since the conditions may vary.

Small countries with historically high incidence of natural disasters may face the possibility of significant shortfalls in their ability to finance post-disaster reconstruction. This is the situation in the Dominican Republic and El Salvador, cases analyzed in this study. For large countries with more modest or diversified disaster risk, the study suggests a greater ability to absorb losses from disasters. This has been the case for Bolivia, which also has had sufficient resources to respond, thanks to traditional access to low interest loans from multilateral institutions. On the other hand, in the similarly geographically diverse but more populous and relatively high per capita income country of Colombia, the government has been able to expand tax revenues to cover disaster losses. But for any country, changes in their vulnerability (increasing urbanization in disaster prone

areas, for example) or economic situation should compel a reexamination of past financial solutions to finance potential future disaster losses.

Recommendations

In examining policies, institutional framework and financial tools available in Latin American and Caribbean countries, the following general conclusions and recommendations can be made:

- *Integrated national systems for risk management*. The countries in the region have been creating national systems for the comprehensive management of disaster risk. These should implement prevention, mitigation and emergency management as well as reconstruction after a disaster has occurred in order to facilitate sustainable development in the region.
- *Risk analysis*. Governments should analyze the risk of natural hazard events. The techniques for evaluating risk exist and most countries have the necessary data to assess hazard exposure and vulnerability. What is lacking is the time and resources to integrate the known information, thus limiting the ability of the government to plan for disasters, instead of only responding to them. The evaluation should be done at the national, regional, and municipal levels especially for all essential infrastructure and buildings. Schools, hospitals, bridges, and roads are all examples of assets for which models can be developed.
- *Government risk*. Each government needs to create a clear inventory of obligations for which it is responsible. If the government is responsible for a risk, this should be made clear and the obligation should be budgeted. If the government does not assume responsibility for some private sector risk, it should examine strategies to assist the private sector to assume that risk on its own behalf.
- *Prevention and mitigation*. Countries should invest in prevention and mitigation to avoid rebuilding exposure after a disaster occurs. Land-use planning, building codes and proper reconstruction standards should be developed before a disaster occurs. If not carried out before, reconstruction after a disaster should provide the opportunity to implement the proper risk reduction measures for the future. Initial investments in prevention and mitigation can significantly and cost-effectively reduce vulnerability to natural disasters. However, the marginal net benefit of such investments diminish gradually. Countries also need to develop alternative ways of loss financing from several internal and external sources.
- *Loss financing*. Countries should evaluate the ways by which they finance losses, be it through reserve funds, calamity funds, contingent credit, insurance or through external credit. The level of use of each instrument should be a result of an integrated risk management strategy. If conversions of existing loans are considered, the criteria for their use should be openly discussed in advance, and not be left to a potentially hasty decision-making process during an emergency. It is noted that in many countries in the region insurance is included as an alternative tool applied by their governments. However, considerable savings or substantial increases in insurance protection could be accomplished if the countries systematically reviewed its insurance purchasing opportunities.

Chapter 1

National Systems for the Comprehensive Management of Disaster Risk

Although disaster response is important, it fails to address the causes of disaster losses. Those causes are rooted in the complex interaction of human settlement and the natural environment. Recurring natural events become disasters because populations exist in harm's way in structures inadequately prepared to withstand anticipated natural hazard events. To protect people and their assets, natural disaster policies must deal with a broad set of issues. In developing countries, those issues are tied to the network of policies addressing economic development. The best protection from natural disasters is an economically viable country with strong democratic institutions. Just as the reduction of poverty requires a comprehensive mix of policies that involve many components of society and government, reducing the toll of natural disasters requires a comprehensive approach that accounts for the causes of a society's vulnerability to disaster. Not only must a comprehensive strategy be articulated, the political and economic will must be created to sustain the new policies.

A national disaster system is composed of the interaction of the institutions, financial mechanisms, regulations, and policies that constitute a country's approach to disaster risk management. This interaction can be formal or informal. It is commonly believed that for a national disaster system to succeed in being comprehensive, national governments must be active participants in the creation and implementation of a formal system. This view is well expressed by the Asian Development Bank in its *Disaster Manager's Handbook* (Carter, 1992).

There is, however, disagreement in the literature regarding the advisability of depending on national governments as the appropriate foundation for a comprehensive program. As described in the classic analysis of the political economy of large disasters by Albala-Betrand (1993), focusing natural disaster policy through existing government systems enhances narrow power structures and draws away from local concerns and initiatives. Those holding this view favor reducing natural hazard risk through community-driven projects and programs developed by nongovernmental organizations. Such an approach to risk management is not guaranteed to be comprehensive, but applies directly to identifiable needs and the empowerment of local populations.

These two approaches to risk management need not be mutually exclusive. The task facing policymakers is to create an effective national system with a comprehensive vision that engages senior government policymakers and accommodates and supports local decision-making and private market initiatives.

While it is helpful to discuss specific programs in terms of both promising and problematic practices, these must be understood in the context of the specific country or region being discussed and the perspective of the policymaker interpreting the practice. For example, a practice that permits the integration of probabilistic risk from catastrophe events into macroeconomic planning models would be a promising practice for those interested in engaging development planners in the dialogue. In contrast,

those interested in creating decentralized projects would consider it problematic to have a complicated macroeconomic modeling process that diverts significant institutional energy and financial resources from locally directed initiatives.

Elements of Comprehensive Disaster Management

In the risk management literature, the key elements of risk management are divided into two phases: the pre-disaster phase and the post-disaster phase. Table 1.1 divides the key components of disaster risk management into two phases: actions required in the pre-disaster phase and actions needed in the post-disaster period. The pre-disaster phase includes risk identification, risk mitigation, risk transfer, and preparedness; the post-disaster phase is devoted to emergency response and rehabilitation and reconstruction. A comprehensive risk management program addresses all these components.

Risk Identification

Risk identification includes hazard assessment, vulnerability studies, and risk analysis. Hazard assessment identifies the probable location and severity of dangerous natural phenomena and the likelihood of their occurring within a specific time period in a given area. These studies rely heavily on available scientific information, including geologic, geomorphic, and soil maps; climate and hydrological data; and topographic maps, aerial photographs, and satellite imagery. Historical information, in the form of written reports and oral accounts from long-term residents, also helps characterize potential hazardous events. To be most successful, hazard assessment requires data and scientific teams trained to evaluate the data. In some countries, the lack of extensive historical data on catastrophic events makes hazard assessment difficult. In the case of floods and landslides, human factors can drastically impact the environment, and historical data may be of little value. For earthquakes and tropical cyclones, the international research community has collaborated significantly to pool resources and scientific knowledge to develop global and regional hazard maps. Much work remains to be done on flood and landslide mapping.

Vulnerability studies estimate the physical, social, and economic consequences that result from the occurrence of a natural phenomenon of given severity. Physical vulnerability studies analyze impacts on buildings, infrastructure, and agriculture. The Applied Technology Council, for example, publishes detailed vulnerability curves for the resistance of 50 different types of structural facilities to earthquake hazards (ATC, 1985). Social vulnerability studies estimate the impacts of especially vulnerable groups, such as the poor, single parent families, pregnant or lactating women, the mentally or physically handicapped, children, and the elderly. Social vulnerability studies take into account the public awareness of risk, the ability of groups to self-cope with catastrophes, and the institutional structures in place to help them cope (Coburn, Spence, and Pomonis, 1991).

Economic vulnerability studies estimate the potential impacts of hazards on economic assets and processes. These studies include indirect losses (such as business interruption) and secondary effects (such as accentuated poverty, higher unemployment, or increases in levels of external debt). The United Nations' Economic Commission for Latin America and the Caribbean (ECLAC) has contributed significantly to this effort by publishing reports since 1972 on the economic impacts of catastrophes in Latin America and the Caribbean (Caballeros and Zapata Marti, 2000).

The risk analysis stage of risk identification integrates information from the hazard assessment and the vulnerability studies in the form of an estimate of the probabilities of expected loss for a given hazardous event. Formal risk analyses are time-consuming and costly, but shortcut methods are available that give adequate results for project evaluation (Bender, 1991). In the United States and Europe, a large part of the funding for risk modeling comes from the private sector; major reinsurance companies commission projects from private modeling firms such as EQECAT (www.eqecat.com) and RMS (www.rms.com). However, these private sector initiatives require a guarantee that investment in risk identification will lead to the development of insurance markets.

Table 1.1. Key Elements of Risk Management

Pre-disaster phase				**Post-disaster phase**	
Risk identification	***Mitigation***	***Risk transfer***	***Preparedness***	***Emergency response***	***Rehabilitation and reconstruction***
Hazard assessment (frequency, magnitude, and location)	Physical/structural mitigation works	Insurance and reinsurance of public infrastructure and private assets	Early warning systems and communication systems	Humanitarian assistance	Rehabilitation and reconstruction of damaged critical infrastructure
Vulnerability assessment (population and assets exposed)	Land-use planning and building codes	Financial market instruments (catastrophe bonds and weather-indexed hedge funds)	Contingency planning (utility companies and public services)	Clean-up, temporary repairs, and restoration of services	Macroeconomic and budget management (stabilization and protection of social expenditures)
Risk assessment (a function of hazard and vulnerability)	Economic incentives for pro-mitigation behavior	Privatization of public services with safety regulation (energy, water, and transportation)	Networks of emergency responders (local and national)	Damage assessment	Revitalization for affected sectors (exports, tourism, and agriculture)
Hazard monitoring and forecasting (GIS, mapping, and scenario building)	Education, training and awareness about risks and prevention	Calamity Funds (national or local level)	Shelter facilities and evacuation plans	Mobilization of recovery resources (public, multilateral, and insurance)	Incorporation of disaster mitigation components in reconstruction activities
Building and strengthening national systems for disaster prevention and response: These systems are an integrated, cross-sector network of institutions addressing all the above phases of risk reduction and disaster recovery. Activities that need support are policy and planning, reform of legal and regulatory frameworks, coordination mechanisms, strengthening of participating institutions, national action plans for mitigation policies, and institutional development.					

Source: IDB (2000b).

In Latin America and the Caribbean, several international partnerships have formed to help provide risk assessment studies. These include a joint World Bank-Organization of American States (OAS) project in St. Lucia, St. Kitts and Nevis, and Dominica (Vermeiren and Pollner, 1994) and a World Bank study on Mexico (Kreimer and others, 1999). The Natural Catastrophes and Developing Countries Project at the International Institute for Applied Systems Analysis (IIASA) also developed a methodology for incorporating natural disasters into macroeconomic projections as a function of a country's underlying social and economic vulnerability, and presented results for Argentina, Honduras, and Nicaragua (Freeman and others, 2001). Although these projects are useful, they are isolated examples and do not diminish the need for national strategies for risk identification.

Some excellent resources on risk identification include Smith (1996) and the brochures produced by Swiss Re and Munich Re, available on their websites (www.swissre.com and www.munichre.com). More details are available in the documentation on the U.S. Federal Emergency Response Agency's (FEMA) HAZUS model, available online at www.fema.gov/hazus/. Resources on vulnerability assessment include Blaike and others (1994) and Coburn, Spence, and Pomonis (1991).

Mitigation

Mitigation refers to policies and activities that reduce an area's vulnerability to damage from future disasters. These structural and nonstructural measures are in place before a disaster occurs.

Structural Mitigation Measures

Structural mitigation reduces the impact of hazards on people and buildings via engineering measures. Examples include designing infrastructure, such as electrical power and transportation systems, to withstand damage. Underground transmission lines, for example, are protected from hurricane damage. Levees, dams, and channel diversions are all examples of structural flood mitigation.

Structural mitigation projects can be very successful from a cost/benefit perspective. In the field of landslide mitigation, experience in the city of Los Angeles, California, indicates that adequate grading and soil analysis ordinances can reduce landslide losses by 97 percent (Petak and Atkisson, 1982). Argentina's Flood Rehabilitation Project invested US$153 million in structural improvements that spared an estimated US$187 million (in 1993 dollars) in damages during the 1997 floods, generating a 35 percent return on investment to date (World Bank, 2000).

However, structural mitigation projects have the potential to provide short-term protection at the cost of long-term problems. In areas in Vietnam, flood control systems have exacerbated rather than reduced the extent of flooding; sediment deposit in river channels has raised the height of river channels and strained dike systems. Now when floods occur, they tend to be of greater depth and more damaging than in the past (Benson, 1997b).

Furthermore, structural mitigation projects have the potential to provide people with a false sense of security. The damages from the 1993 flooding of the Mississippi river in the United States were magnified because of misplaced confidence in structural mitigation measures that had encouraged development in high-risk areas (Mileti, 1999; Platt, 1999; Linnerooth-Bayer and others, 2000). To avoid this problem, structural mitigation

projects should be accompanied by appropriate land-use planning and public awareness programs.

Nonstructural Mitigation Measures

Nonstructural mitigation measures are nonengineered activities that reduce the intensity of hazards or vulnerability to hazards. Examples of nonstructural mitigation measures include land use and management, zoning ordinances and building codes, public education and training, and reforestation in coastal, upstream, and mountain areas. Nonstructural measures can be encouraged by government and private industry incentives, such as preferential tax codes and deductibles, or adjusted insurance premiums that reward private loss-reducing measures. Nonstructural mitigation measures can be implemented by central authorities through legislating and enforcing building codes and zoning requirements, by NGOs initiating neighborhood loss-prevention programs, or by the private sector in providing incentives to take loss-reducing measures. Nonstructural mitigation measures are particularly appropriate for developing countries because they usually require fewer financial resources.

A drawback to such measures, however, is that even when they exist, there is a tendency on the part of the private and public sectors not to enforce the regulations or standards on the books. For example, in Florida, insured property losses from Hurricane Andrew would have been reduced by 25 percent through building code compliance. Studies have found that inspection personnel have insufficient knowledge of the hazard mitigation aspects of the building codes to enforce them effectively. The problem is compounded because of limited staffing so that even competent individuals cannot keep up with the demand for building inspections.

Another controversial area in nonstructural mitigation is land-use planning. Unplanned growth in major cities caused devastating earthquake losses in Turkey's heavily urbanized northeastern region in 1999; in Orissa, India, where cyclones left eight million people homeless; and in Mozambique, where flooding in 1999 devastated the capital city of Maputo (Sanderson, 2000). According to ECLAC, 75 percent of the losses of goods and services during Hurricane Mitch resulted from land-use issues like building too close to rivers or constructing roads and bridges in known vulnerable areas (ECLAC, 1998). On the other hand, land-use planning requires intense political support if it affects property values or involves the relocation of communities. Less costly and less controversial land-use initiatives involve passing hazard disclosure laws for real estate purchases and/or promoting insurance policies with premiums that scale with risk.

The best practices in nonstructural mitigation are those that directly combine with development goals. An innovative model recently developed in the Grau region of Peru identifies hazards, assesses regional development objectives, and integrates a nonstructural approach to disaster mitigation into the overall development program. This "microzonation" approach focuses on land-use planning and infrastructure (Kuroiwa, 1991). The World Bank has tailored neighborhood improvement programs to the needs of the most vulnerable by helping residents of low-income urban areas improve their houses individually or with community help (World Bank, 2000).

A good source on mitigation measures appropriate for each hazard is Smith (1996). FEMA also maintains a very useful website with information on both structural and nonstructural mitigation measures: http://www.fema.gov/fima. The Caribbean Disaster Mitigation Project has published extensively on mitigation practices in that region

(http://www.oas.org/ en/cdmp/publist.htm). Davis and Gupta (1990) identify exemplary mitigation practices in Asia.

Risk Transfer

A fundamental distinction between risk management policies in the developed world and those in developing countries is the role of risk transfer. In developed countries, entities other than the government absorb a portion of the risk of financing reconstruction after a disaster, often an insurance company. The use of insurance, the primary risk transfer tool, has five key advantages: it permits the spreading of risk between parties; it reduces the variance of risk for each person; it allows the segregation of risk; it encourages loss reduction measures; and it provides a tool to monitor and control behavior (Freeman and Kunreuther, 1997).

Insurance is not the only option for transferring risk. In dealing with natural disasters, a recent innovation in transferring risk of loss from catastrophes is a hedging instrument known as catastrophe bonds. Collectively, insurance and catastrophe bonds may be described as "catastrophe hedges." An extensive discussion of the use of catastrophe bonds in developed countries with some insight as to how they may work for developing countries can be found in Andersen (2001).

Risk transfer is a critical component of a comprehensive program for most developing countries. Japan, France, Spain, the United Kingdom, and the United States all use risk transfer to link the various components of their natural disaster risk strategy. Insurance is a major component of the risk management strategy of wealthier countries. In the higher-income countries, 30 percent of the loss from natural hazards is insured. In the poorer countries, insurance covers 1 percent of the losses from natural hazards.

Existing insurance programs have a limited range. For example, they are not used to finance the post-disaster reconstruction of government-owned buildings. In most low-income countries, the government relies on its power of taxation and on borrowing to fund the reconstruction of government-owned facilities. In addition, the government continues to fund the needs of the poor after a disaster, although the poor are not part of formal insurance programs. In most countries in Latin America and the Caribbean, insurance is designed to transfer the risk of property owners and businesses from the government to the insurance program. In countries with a strong middle class and active privately owned businesses, the use of the program can be an effective policy tool to reduce the government's obligation to fund post-disaster needs.

Promising and Problematic Practices of Risk Transfer Strategies

The main attractions of a national risk transfer policy are shifting the risk of post-disaster reconstruction funding away from the government and providing incentives to mitigate risk. There is considerable worldwide activity in promoting different schemes to use the government as a tool to provide catastrophe risk shifting for homeowners and others. The creation of the recent Turkish Catastrophe Insurance Pool is a good example. All existing and future privately owned property is required to contribute to it. The payments made will contribute to a fund that will pay homeowners up to US$28,000 in the event that a catastrophe damages their homes (Gulkan, 2001). Proposals are being explored in Mexico, the Caribbean, Central America, and Africa to engage the government in providing risk transfer options for farmers, homeowners, and businesses in case of natural catastrophe losses (World Bank, 2000). The Caribbean Disaster Mitigation Project commissioned a study to explore insurance options for small states in the

region (Pollner, 2000). The World Bank has proposed the creation of a new insurance program for Honduras, and the Inter-American Development Bank, pursuant to the Puebla-Panama Initiative, is considering regional insurance options for Central America. The most recent *World Development Report* on poverty devotes considerable attention to the role of insurance in enabling countries to better deal with risk, including the risk from natural catastrophes (World Bank, 2000). Insurance also has two key disadvantages. While there are instances where insurance has contributed to loss reduction, there is an associated moral hazard that insured parties will actually take fewer measures to reduce risk. Furthermore, it should be kept in mind that insurance is costly and the funds spent on insurance have an opportunity cost since they could be spent on other social projects, including risk mitigation measures.

The reduction of risk works to the benefit of the developing countries that directly bear the losses from catastrophes and the international aid community whose mission is to assist the long-term development and reduction of poverty in these countries. By harnessing the private sector to cope with catastrophe risk, the international aid community frees itself and its resources to implement its broader agenda of development policies.

Barriers to Supplying Catastrophe Insurance

It is no coincidence that insurance is an economic tool used by wealthy countries. It requires sophisticated financial institutions to operate and a complex series of laws, regulations, and administrative agencies. These include the proper financial structure of insurance companies to ensure their financial capacity to pay future claims, the actuarial science (including the required information base) that underpins the setting of premiums and reserves, legal knowledge about insurance contracts and the protection they provide, the functioning of insurance distribution networks, and claims payment practices and proper legal institutions to enforce sophisticated contractual agreements. In many developing countries, the lack of institutional regulatory structures hinders the ability to acquire insurance.

Designing major institutional reforms to permit the proper operation of financial institutions is difficult. The components needed to implement an adequate regulatory scheme for insurance industries are already known. Guidelines for proper regulatory practices are maintained by appropriate agencies in developing countries. The National Association of Insurance Commissioners in the United States has detailed information on proper regulatory practices (see www.naic.org).

In addition to the regulatory issues, there are concerns related to the fundamental structure of the market for insurance. For example, many countries may be too small to provide adequate risk diversification to properly support a national insurance scheme. Proposals to create regional insurance markets hope to increase risk diversification and potential market size, thereby making the market more attractive for the insurance industry and lowering the cost of insurance. A larger potential market subject to a uniform regulatory scheme may encourage the international insurance industry to help develop viable markets. Regional proposals, like the World Bank's initiative for a Central American insurance market, are based on overcoming barriers to the supply of insurance.

Demand for Insurance in Poorer Countries

One problem with developing risk transfer as an effective policy tool is a lack of demand for catastrophe insurance. In poorer countries, large-scale businesses can and do buy catastrophe insurance. In Mexico, nearly 100 percent of industrial enterprises buy insurance. With the region's small middle classes and medium-sized businesses (the most frequent purchasers of insurance in developed countries), there already exists a small natural clientele.

Professional risk bearers, like insurance companies, are fully capable of modifying their products to adapt to local needs. However, there will be little willingness on their part to do so if no demand exists for the modified products. One approach to creating demand is to make insurance mandatory. Another approach is to demonstrate the benefits of insurance by taking out policies at the government level, for example by insuring government-owned buildings and infrastructure. The World Bank's recent initiatives have focused on insuring government assets as a way to provide protection and stimulate interest in risk transfer (Pollner, 2000). The advantages and limitations of commercial risk transfer are summarized in Box 1.1.

Box 1.1. Advantages and Limitations of Commercial Hazard Insurance

Advantages

• It guarantees the victim some predictable recompense after loss. Such compensation is more reliable than disaster relief and it also appeals to those opposed to excessive government regulation because it depends on the private market.
• If property owners in hazard areas pay premiums that reflect their actual risk and insurance payments fully compensate the victims, then insurance provides an equitable distribution of costs and benefits.
• Although insurance is designed to redistribute losses, it can also be used to reduce hazard impact by encouraging the adoption of measures designed to minimize damages. If residents in hazardous areas pay the full cost of premiums for their risk, insurance provides an economic disincentive for locating in such areas. Once properties have been built, it is possible, in principle, for insurers to offer lower premiums to policyholders who take measures to reduce risks to their property. Such measures might include special construction methods and building materials. In extreme cases, insurers could require property owners to retrofit risk reduction measures before accepting any premium.

Limitations

• In practice, property owners in hazard areas rarely pay premiums that reflect their actual risk. One reason is that for many environmental hazards, the database is insufficient to devise a realistic premium based on predicted average annual losses at a specific site. Unless premium rates are scaled directly according to the risk, hazard zone occupants are not likely to bear the full cost of their location.
• In the private residential sector, a great deal of development is undertaken by speculative builders rather than by the eventual occupants of the property. Only if insurance premiums became sufficiently high to make the properties initially difficult to sell would it be likely that developers would be deterred from building on such sites in the first place.
• Private insurance may be unobtainable in very high-risk areas, although this does not necessarily discourage development.
• Even when commercial hazard insurance is available, there is frequently a low voluntary uptake. When insurance policies are taken out, a significant number of policyholders are underinsured and are unlikely to be fully reimbursed by the company in the event of a loss.
• Although insurance can, in some circumstances, be employed to reduce losses, the existence of moral hazard is thought to increase damages. Moral hazard arises from the tendency of some insured persons to reduce their level of care and thus change the risk probabilities on which the premiums were based. Moral hazard can be lessened by the imposition, and subsequent policing, of local planning regulations designed to strengthen buildings against hazard impact.

Excerpted: Smith (1996).

Because of the relatively high administrative costs associated with insurance for small values, insurance is not an option for the very poor. The main strategy for the poor requires a poverty-sensitive policy that focuses on several key components: helping poor households maintain their consumption; ensuring that the poor do not lose whatever access they have to basic social services; preventing permanent reversals in the accumulation of human and physical capital; and averting self-defeating behavior, such as criminal activity, prostitution, and exploitative forms of child labor (World Bank, 2000). Among the most effective programs are workfare programs introduced or expanded in the disaster area in conjunction with post-disaster reconstruction.

Froot (1999) is a good collection of articles on risk transfer. Pollner (2000) is a good resource describing risk transfer options for the Caribbean.

Preparedness

Preparedness involves building an emergency response and management capability before a disaster occurs. Key disaster preparedness activities include training programs for response personnel, exercises and drills of emergency plans, education programs to inform citizens, hazard detection and warning systems, identification of evacuation routes and shelters, maintenance of emergency supplies and communications systems, establishment of procedures for notifying and mobilizing key personnel, and individual household measures such as clearing attic space to make room for belongings in case of a flood.

In contrast with elements such as mitigation that are often the product of major policy decisions at a national level, preparedness projects tend to be oriented toward the actions of individuals and individual organizations. Programs must therefore focus on the community level and a national system should include mechanisms to coordinate with preparedness projects.

Disaster preparedness also requires significant political will. According to Smith (1996), "it ties up facilities and people that are apparently doing nothing, other than waiting for an event that no one wants and many believe will never happen." It is inherently difficult to maintain impetus for diverting resources into preparedness projects if many years have passed since the last disaster event. Outdated plans and warning systems, however, have the potential of being worse than no provisions at all. Continued public awareness programs are therefore a key ingredient in increasing and maintaining disaster preparedness (Foster 1980; Garb and Eng, 1969). Public awareness is increasingly important as populations become more mobile and newcomers are less aware of local risk conditions and traditional mitigation techniques (UNDHA, UNDP, and MWR 1994).

Many programs can be used to increase public disaster awareness. Broadcasting agencies can contribute to increasing public awareness by designing announcements and disaster-related programs. Inclusion of disaster awareness in school programs is a particularly efficient and economical strategy. Other successful practices include advertising at popular sporting events, on shopping bags, or during community programs; hosting workshops; and organizing national disaster preparedness days.

An excellent resource is FEMA's website on disaster preparedness publications (http://www.fema.gov/library/publicat.shtm), which includes pamphlets on home/family and business/industry disaster plans, disaster supplies, and emergency preparedness checklists.

Emergency Response

Emergency response refers to actions taken immediately before, during, and after the onset of a major disaster or large-scale emergency to minimize the loss of life and harm to people and their property and enhance the effectiveness of recovery. Examples of emergency response activities include hazard detection and warning, evacuation of threatened populations, shelter for victims, emergency medical care, search and rescue operations, security and protection of property, and family assistance. Other examples include the construction of temporary levees, closure of roads or bridges, provision of emergency water or power supplies, and response to secondary hazards such as fire or the release of hazardous materials. The quality and timeliness of disaster response are typically functions of the planning and training done during pre-disaster preparedness.

From decades of experience, it is clear that the best emergency response comes immediately and with sufficient resources to limit the loss of life and property. Experience in numerous disasters reveals the need for a strong, centralized system to mobilize emergency efforts and channel aid resources to victims (Red Cross, 2001).

In his seminal work, Cuny (1983) recommends that the emphasis on speed or "emergency response" should shift to developing a response relevant to needs at an intermediate or advanced phase of recovery. Cuny summarizes other important emergency response lessons, which include considerations of livelihood protection for the poor, education and local participation, the appropriate actors in emergency and relief efforts, and issues related to longer-term rehabilitation. Anderson and Woodrow (1989) provide another excellent work with similar recommendations.

A good resource on emergency response is the website hosted by the Caribbean Disaster Emergency Response Agency (CDERA) at www.cdera.org. For emergency response related specifically to hurricanes, see www.huracan.net.

Reconstruction and Rehabilitation

Reconstruction and rehabilitation refer to programs that provide longer-term assistance for people who have suffered injuries or incurred losses due to a major disaster. The objective is to facilitate the return of these communities to their pre-disaster condition. Rehabilitation encompasses repairing and reconstructing houses, commercial establishments, public buildings, lifelines, and infrastructure; restoring and coordinating vital community services; expediting permit procedures; and coordinating activities among governments. Recovery can take a few weeks or several years, depending on the disaster's magnitude and the reconstruction resources available.

The most important recommendation for reconstruction and rehabilitation projects is that they should proceed in ways that reduce future vulnerability and promote development objectives. It is less costly to incorporate structural mitigation components into new structures than it is to retrofit existing ones. Ideally, mitigation measures are undertaken during reconstruction to avoid recreating prior vulnerable conditions. One good example is the reconstruction and mitigation program undertaken in Peru by the NGO Caritas. In consultation with affected communities, this NGO promoted the use of local earthquake-resistant materials for housing reconstruction. To directly assist the most needy households, Caritas used a work-for-materials program in which locals received materials in exchange for participation in community projects. An earthquake the following year proved the success of the project: most houses built during the Caritas

project withstood the earthquake measuring 6.2 on the Richter scale (Schilderman, 1993).

Successful reconstruction projects involve the cooperation and participation of the local communities and stakeholders. The September 1985 Mexico City earthquake provides a good example of a participatory process for effective reconstruction that reduced future vulnerability. As a part of this approach, social teams represented and included victims in the redesign and reconstruction of housing (Kreimer and Echeverria, 1998).

The reconstruction and rehabilitation process should not ignore the importance of providing for livelihood protection throughout the recovery process. Successful reconstruction and rehabilitation programs simultaneously address both the need to provide income support and the need to reconstruct. After the floods in Gujarat, India, workfare community reconstruction projects provided both needed work and income protection for poor families as well as necessary reconstruction activities (Bhatt, 2001). Similarly, after the 1985 earthquake in Mexico City, workfare programs created more than 175,000 jobs for victims of the event (Kreimer and Echeverria, 1998).

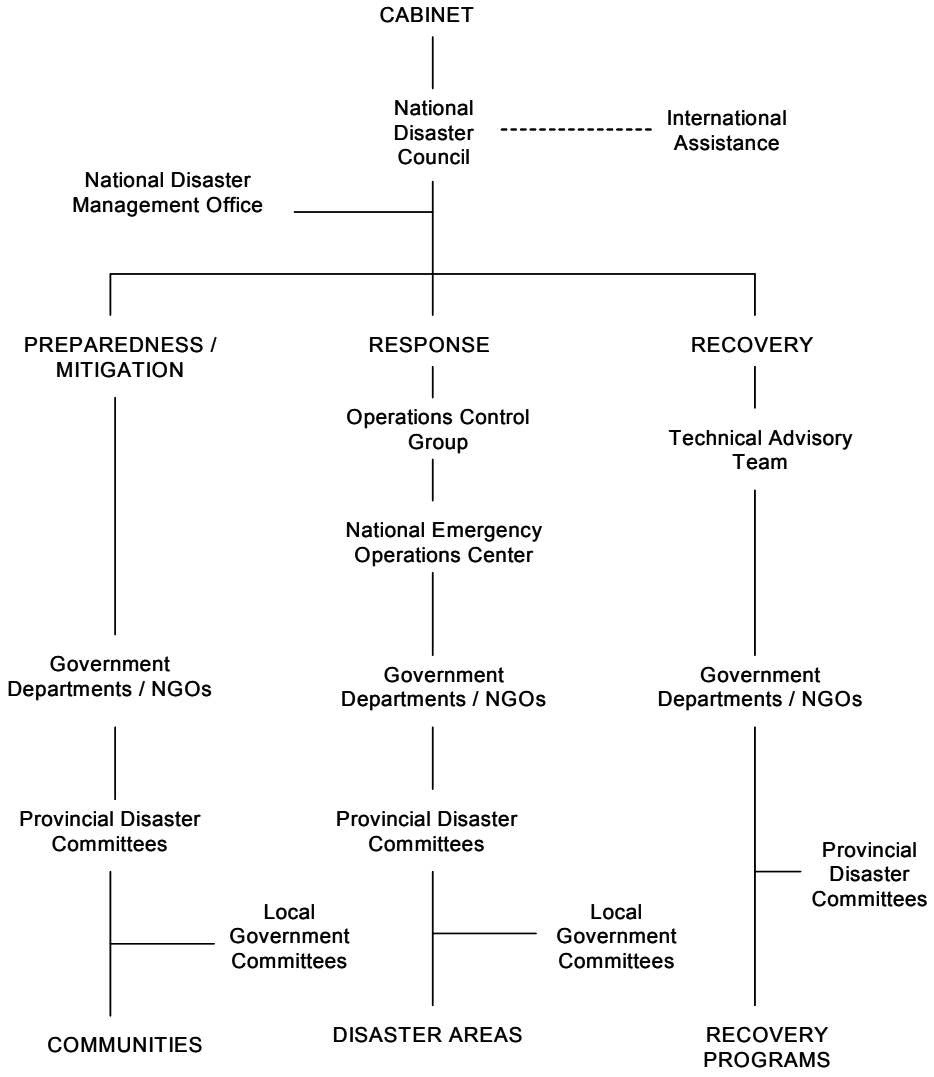
Country Experiences with Disaster Management Systems

Many countries have, or are developing, national programs to partly or fully incorporate the six elements of an integrated disaster risk management program and to involve the public sector, market actors, NGOs, and private sector actors. These national disaster systems reflect the political and economic cultures and conditions of the countries. Each one combines the public sector with private market institutions, as well as incorporates the diverse institutional practices that fall outside either sector.

The Asian Development Bank's *Disaster Manager's Handbook*, based on the experiences of its member countries, suggests recommendations for the design of a national disaster strategy and for supporting legislation (Carter, 1992). The handbook proposes the creation of a formal national disaster strategy and an organizational structure for integrating disaster management efforts. As illustrated in figure 1.1, this organizational structure typically includes a ministry or sub-ministry responsible for disaster affairs, that houses a national disaster management office, some form of national disaster council to identify priorities and channel resources, and an operations control group responsible for preparing and coordinating emergency response. This organizational strategy, which is reflected in a recent program instituted in Nicaragua, is markedly hierarchical in nature. Although the proposed organizational strategy incorporates NGOs and local groups, the participation of market actors (such as insurance companies and other financial institutions) is absent.

While a government-directed program is essential for an integrated disaster management program, it is not the only way in which societies cope with disasters. Private citizens and social groups are managing risks outside of government-directed systems in their choices of where to live, what crops to plant, how to respond to neighbors in need, and how to help with rescue operations. The private industry is also developing and implementing risk management strategies alongside governments, and insurance industries may even be taking the lead in assessing risks and vulnerability.

Figure 1.1. National Disaster Organizational Structure, as suggested by the Asian Development Bank



Source: Adjusted from Carter (1992).

In balancing commitments and values, society needs "clumsy" or responsive institutions to maintain a set of values over time. It is important to develop integrated clumsy programs that include the active participation of all the important institutional players in the process: ministries of finance, health, and education; military organizations (such as civil defense); regional and local government entities; many diverse NGOs active in the risk management system (such as the Red Cross); international aid and finance organizations; private sector actors; and local communities.

This section provides several country-specific reviews of national risk management systems, starting with Latin America and the Caribbean, and extending to Europe, Asia, Japan, and the United States. These examples demonstrate the wide variety of comprehensive systems that address the full spectrum of disaster risk management alternatives.

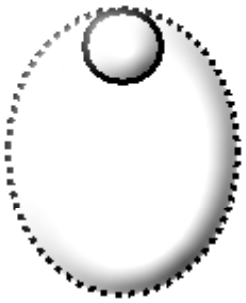
Disaster Management Systems in Latin America and the Caribbean

Most national disaster management systems in Latin America began as government bodies for emergency response. Some countries, like Ecuador, Peru and Venezuela, continue to rely almost exclusively on civil defense.[1] In other countries, large natural catastrophes over the past decades have highlighted the need for more comprehensive systems that would include prevention, mitigation, preparedness, and provisions for reconstruction and rehabilitation activities. As a result, several countries, such as Argentina, Brazil, Chile, Colombia, the Dominican Republic, El Salvador, Nicaragua, Guatemala, Honduras and Mexico have begun to transform their approaches to coping with natural disaster risk.

The past decade has also seen an increasing trend toward regional efforts in disaster management. Several entities have formed to share information and technologies across countries. The Coordination Center for the Prevention of Natural Disasters in Central America was established in 1988 to strengthen the capacity of that region. In the English-speaking Caribbean, CDERA works to improve disaster response and national and regional disaster management. In South America, the Andean Development Corporation, in response to a request from five members, is developing a Regional Andean Program for the Prevention and Mitigation of Risk.

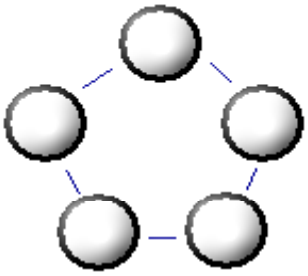
The countries in Latin America and the Caribbean that have broadened the scope of their national disaster systems to encompass preparedness, mitigation, relief and rehabilitation activities, and, in some cases, even attention to pre- and post-disaster financing options, have taken different routes. Figure 1.2 illustrates three broad approaches. Most countries, like Chile and Colombia, have increased the scope of disaster management by expanding the responsibilities of an existing institution such as civil defense. Other countries, like El Salvador, broadened the government's mandate for disaster risk management by creating a parallel institution responsible for mitigation and preparedness. Finally, a third approach, the one taken by Mexico, is to bring in, strengthen, and reinforce a network of key institutions.

Figure 1.2. Approach for obtaining integrated disaster management systems in Latin America and the Caribbean.



The existing organization for disaster management widens the field of action and includes new activities/attention focus.

A new institution is created to facilitate new activities/attention focus, while the previous institution continues monitoring activities such as emergency response.



Tackling the problem as a network links several different institutions responsible for the disaster management system.

[1] DNDC in Ecuador, INDECI in Peru, and Protección Civil in Venezuela.

The strengths and weaknesses of these organizational approaches depend on the larger context in which they operate. Whether centralized, loosely centralized, or networked, public programs should operate in a system with sufficient input, feedback and control from the private sector, including actors in the marketplace and civil society. The Japanese government, for example, has deliberately decentralized its public program to include a network of national institutions. This diffusion of power in the public domain was a reaction to the conditions of martial law in the postwar period. While protecting citizens against their loss of liberties in the case of a national emergency, the diffused system failed to provide a timely and effective response to the Kobe earthquake.

Throughout Latin America and the Caribbean, the key obstacles faced by most nations lie in institutional resistance to moving beyond emergency response, the limited involvement of civil society and the private market, and insufficient ex ante provisions for reconstruction financing.

Argentina

In 1998, Article 99 of the Argentine Constitution established the Federal Emergency System (*Sistema Federal de Emergencias,* SIFEM) to coordinate national efforts to mitigate natural disaster risk, develop a plan for effective emergency response, and aid in efforts to rehabilitate affected regions. Formed under the Chief of the Cabinet of Ministers, SIFEM is the principle federal political body responsible for coordinating the efforts to identify and mitigate the risk of natural disasters at the national, provincial, and municipal levels. Whereas the federal government plays an important role in the mobilization of resources and the coordination of national and international organizations in mitigation and emergency response efforts, provincial governments assume the responsibility for assessing regional vulnerabilities and carrying out mitigation projects to protect against natural catastrophes within their respective provinces. This decentralized approach emphasizes the proactive role of local governments and appears to be a compromise between control at the national level, which is essential for emergencies, tempered with strong decision authority at the provincial level, which has the potential to include local interests and participation.

In recent years, Argentina has invested significantly in mitigation. In 1998, SIFEM dedicated a total of US$420 million in loans from the World Bank to be used for mitigation projects such as zoning regulations, seismic mapping and codes, reforestation, and clearing fire corridors.

Argentina is unique in that it created ex ante an entity at the national level that will be in charge of allocating funds for reconstruction projects. In 1998, Argentina passed National Resolution 496/8 creating the National Advisory Board for the Recuperation of Regions Affected by Natural Disasters (*Consejo Nacional para la Recuperación de Zonas en Emergencia Climática,* CONAREC) to oversee the post-disaster rehabilitation and rebuilding of affected communities. One of CONAREC's principal objectives is to coordinate and distribute funding to provincial and municipal authorities to aid in the rebuilding of infrastructure such as homes, businesses and roads in the aftermath of a disaster. Formed by representatives from several provincial governments, CONAREC serves as a medium between national and provincial efforts. As for funding, there is a limited penetration of insurance firms for disaster risk insurance. Argentina depends heavily on national reserves of credit and international lending organizations to provide needed liquidity in the face of natural disasters.

Brazil

Disaster response in Brazil is highly decentralized and proceeds from the bottom up with minimal coordination from the national government. In the event of a natural disaster, the affected municipality handles its own response. When the scope of the disaster exceeds the municipality's capacity to respond, the regional office is called in, then the state, then the national level. This separation of powers is attributed to the Brazilian legal structure, which ascribes a great deal of autonomy to the state and local governments.

At the national level, the disaster management plan is known as the National Civil Defense System (SINDEC). Coordination of SINDEC falls to the National Secretariat of Civil Defense (SEDEC), which is connected to a branch of the Ministry of National Integration. SEDEC bears responsibility for coordinating disaster management across all levels in Brazil. Beneath SEDEC are multiple entities at the regional, state, municipal and lower levels that are responsible for disaster response and coordination in their areas.

Brazil is another country that enlarged its civil defense organization to include ex ante disaster measures after large-scale floods and landslides struck the state of Rio de Janeiro in 1966. It continues to evolve at the local level through the involvement of NGOs and multilateral organizations.

Chile

Chile is a classic example of a national system that became increasingly comprehensive through the expansion of a single entity's mandate. The Office of National Emergencies (*Oficina Nacional de Emerencia,* ONEMI), the administrator and coordinator of the national system in Chile, was created after the 1965 earthquake in central Chile.[2] In contrast to several other Latin American systems based under ministries of defense, ONEMI has been under the aegis of the Ministry of the Interior since 1970. After the response to the 1965 earthquake, the system grew to incorporate other elements of comprehensive disaster management. It now emphasizes preventive and mitigation strategies, paying attention to vulnerability as a key intervention factor in risk management.

Although it appears centralized and hierarchical, the Chilean system is composed of committees at the community, provincial and regional levels that are responsible for evaluating proposed actions and designing and prioritizing prevention, mitigation and preparedness projects appropriate to each administrative level. In the case of an emergency, all of the available resources in the affected community are used first. If the magnitude of the event exceeds the local capacity, additional resources are mobilized successively from the provincial, regional and national levels.

Colombia

The national disaster system in Colombia was created after the Nevado del Ruiz eruption and the destruction of Armero in 1985. Colombia broadened the disaster management paradigm beyond emergency response by creating the National System for Risk Mitigation and Disaster Preparedness (*Sistema Nacional para la Prevenvión y Atención de Desastres*, SNPAD), led by the Presidency of the Republic. SNPAD encourages participation from a network of scientific, planning, education, and

[2] Oficina Nacional de Emergencia, Ministerio del Interior, www.onemi.cl.

emergency response institutions, and it expands the mandate of provincial and municipal committees. It not only coordinates emergency response, but also helps determine policy with regard to ex ante preventive and mitigation measures. Figure 1.3 shows the interrelationships among the actors in the system.

Colombia's model of expanding an existing institution to embrace more aspects of disaster management has been promoted by many international organizations in Latin America. However, mitigation activities tend to relate to reconstruction rather than to risk reduction, and trying to avoid the perpetuation of vulnerability has been a challenge (Red Cross, 2001). Although not feasible at the present time, the private market could play a role in the future to promote risk reduction activities.

Other important obstacles faced by the Colombian national system are the lack of strategies to finance reconstruction and the historical tendency to channel reconstruction resources in ways that circumvent the national system. After the Paez earthquake in 1999, for example, the Presidency created a new entity, *Fondo para Reconstrucción y Desarrollo Social del Eje Cafetero* (FOREC), to supervise all of the reconstruction efforts.

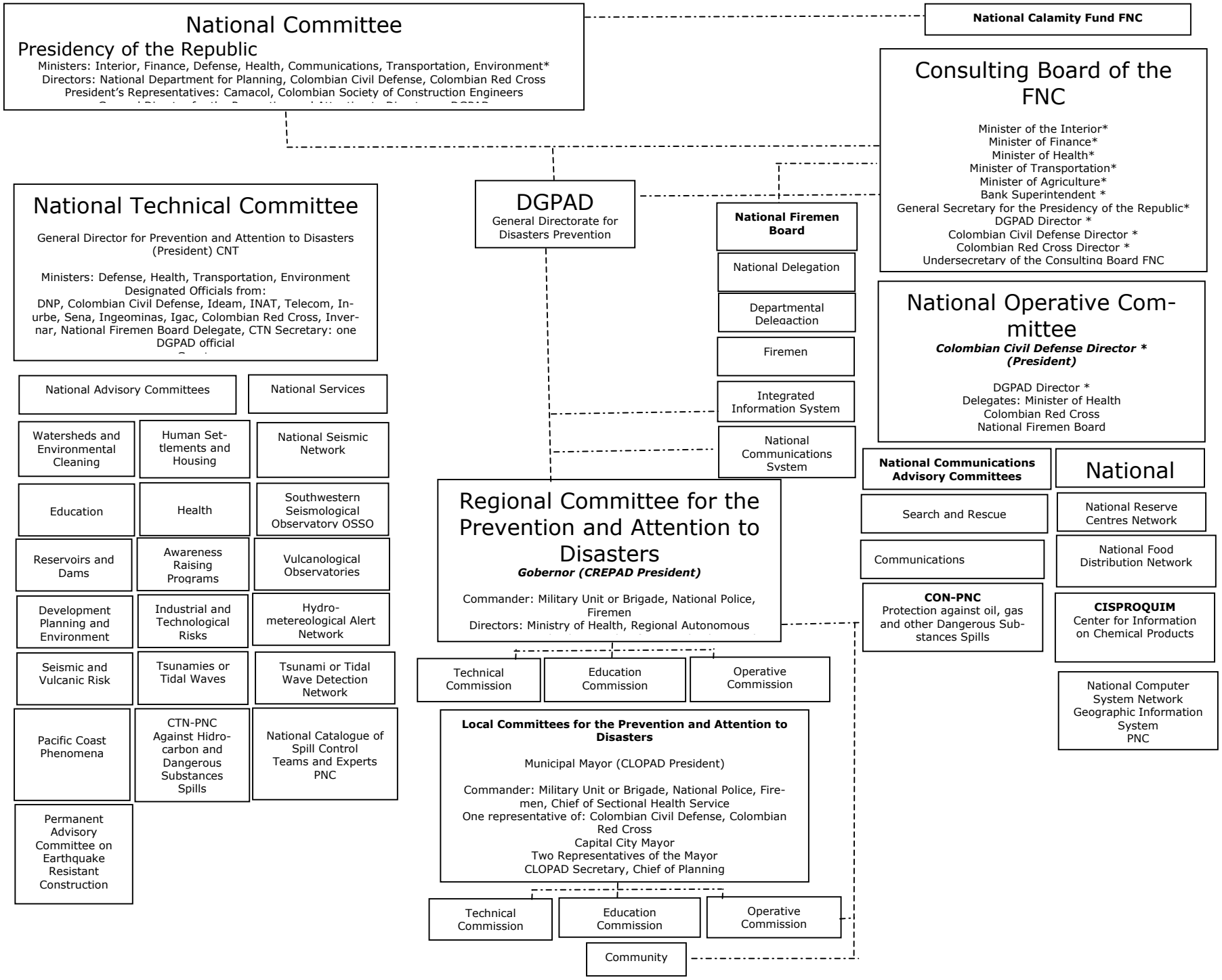
Dominican Republic

In 2000 the IDB and the Secretary of the Presidency of the Dominican Republic began investing close to US$12 million to develop a more comprehensive disaster management system in the country, with a specific focus on mitigation and prevention activities. Prior to this effort, disaster management fell exclusively under the control of the military-based civil defense organization. Proposals for the new Dominican system most closely resemble the system currently in place in Colombia, yet they effectively involve creating a new parallel—if not superior—entity that would act as an ex ante counterpart to the ex post emphasis of the civil defense (Lavell, 2001b). There is considerable institutional resistance to the new proposal. It is still too early to evaluate the successes and shortcomings of the new system that is being developed.

El Salvador

The Committee of National Emergencies (*Comité de Emergencia Nacional*, COEN) has been the principal organization for disaster management, but it has focused almost solely on emergency response, working closely with the Salvadoran Armed Forces and other rescue organizations. Following the 2001 earthquakes, and spurred by interest in risk reduction on the part of the government, NGOs, the United Nations, and municipal associations, El Salvador created a new technical entity for risk management within the Ministry of Environment and Natural Resources. This entity has a broad range of duties, particularly related to mitigation, in coordinating comprehensive disaster management with COEN. In addition, because of its ministerial location, the new entity will be able to impart a broad vision of risk analysis and disaster management to important economic sectors. The success of this vision will be critically dependant on the strength of the ministry, and also on the institutional legal arrangements that provide needed checks and balances on a centralized system. The government should be conscious of the importance of building private sector institutions that can eventually play a parallel or perhaps coordinated role in managing disasters.

Figure 1.3. Organizational Chart of Colombia's Natural Disaster Management System



Guatemala

The National Coordinator for Disaster Reduction (*Coordinadora Nacional para la Reducción de Desastres*, CONRED) was created in 1996. The Higher Council of CONRED involves disaster response organizations, development agencies, and (as an important example to other systems) representatives from civil society. CONRED has a mandate to engage in risk mitigating activities, but lacks the financial backing or human resources to be as effective as other countries in the region. The approach in Guatemala is more comprehensive and integrated than a single institution, but is not yet at the level of a full national system (Lavell, 2001a).

Honduras

Honduras has followed an approach of widening its existing framework beyond emergency response. With the support of the World Bank, the national system in Honduras, the Permanent Commission for Contingencies (*Comisión Permanente de Contingencias*, COPECO), is exploring new disaster management strategies that place greater emphasis on prevention and mitigation. A law has been drafted to expand COPECO's focus, and includes responsibilities on prevention and mitigation implied by its proposed new name, National System for the Prevention, Mitigation and Attention to Emergencies and Disasters. An issue faced in Honduras and other countries attempting this expansion (such as Nicaragua) is to blend the new paradigm of preparedness with the old focus on response. While laws may change the mandate of these systems, dominant actors in responding to disasters (such as civil defense) may make the shift in paradigm difficult to implement. This has been the experience of Nicaragua's civil defense and Institute of Regional Studies, which are both highly effective in emergency response, but less receptive to the newer focus on mitigation and preparedness (Lavell, 2001a).

Mexico

Mexico increased the public sector's role in disaster risk management through a network approach. The government established the National Civil Protection System (*Sistema Nacional de Protección Civil*, SINAPROC) in 1986 as the main mechanism for interagency coordination of disaster efforts. SINAPROC is responsible for minimizing the loss of lives and property and the interruption of essential social services caused by disasters. Responsibility for the system lies with the General Coordinating Body for Civil Protection in the Ministry of the Interior, but the system is networked in that the coordinating body synchronizes the technical work of various ministries, for example, the Ministry of Social Development for Geologic Hazards. In 1990, the National Council for Civil Protection was added to SINAPROC. The council is an advisory, planning, and coordinating committee and is headed by the president of Mexico and made up of 12 ministers plus the mayor of the Federal District of Mexico City. The network also includes the National Center for Disaster Prevention (CENAPRED), a unique institution located on the campus of the National Autonomous University of Mexico that reports directly to the Directorate of Civil Protection of the Ministry of the Interior. CENAPRED serves as a link between research work on natural disasters and policymakers and is involved in both research and information dissemination. The Mexican government allocates budgetary funds for disaster relief and reconstruction efforts by placing them in the Fund for Natural Disasters (FONDEN), which provides for the repair of uninsured infrastructure, immediate assistance to restore the productivity of subsistence farmers, and relief to low-income victims of disasters (Kreimer and others, 1999).

Venezuela

In the mid-1990s, Venezuela began exploring the Colombian disaster management model, but eventually created the National System of Civil Defense instead. The system is similar to a previous approach that focused on municipal emergency response. Municipal fire departments have played a central role in Venezuela's history of disaster management, particularly in Caracas. A principal difference between the old and new systems was a heightened role for civilians vis-à-vis military participation. Since 1999, however, the government has begun to shift involvement back toward the military (particularly during the mudflows in the state of Vargas). After the disaster in 1999 and the constitutional change, the government began exploring a new model with greater emphasis on risk mitigation.

Both the science and technology ministries have participated in disaster management, and their target is to work more in territorial zoning and land-use policy as well as vulnerability reduction. The UNDP has supported these activities, as has the Andean Corporation for Development.

Caribbean States

The English-speaking islands of the Caribbean established the Pan Caribbean Disaster Preparedness Project (PCDPP) in 1981 to improve national and regional disaster management. Although it was conceived as an 18-month project, focused solely on disaster preparedness, the PCDPP operated for almost 10 years (Poncelet, 1997). In 1989, when the project extended its work to the prevention of disasters, its acronym was changed to the Pan Caribbean Disaster Preparedness and Prevention Project (PCDPPP).

Disaster preparedness offices have been created in several locations, such as the Central Emergency Relief Organization in Barbados, the National Emergency Management Agency in Trinidad and Tobago, and the Office of Disaster Preparedness and Emergency Management in Jamaica. In 1991 the Caribbean Community (CARICOM) approved the creation of CDERA to replace the PCDPPP, providing a new agency funded by member states and donor agencies and responsible for mobilizing resources among CARICOM countries (www.cdera.org). CDERA commands a stronger institutional position than the PCDPPP, including the right to mobilize the military (such as the CARICOM Disaster Response Unit). CDERA was created to improve disaster response and national and regional disaster management. Its main focus is disaster preparedness, but it also promotes risk mitigation activities.

Obstacles in Latin America and the Caribbean

Three important issues that affect the success of comprehensive disaster management in Latin America and the Caribbean emerge from this brief discussion. These include a continued concentration on emergency response with institutional obstacles that slow the shift toward a more integrated system, a limited involvement of private market actors and civil society, and limited provisions ex ante for financing reconstruction.

Institutional resistance to moving beyond emergency response. In Latin America and the Caribbean, the primary focus of disaster management—apparent in legislation, program structures, and policy—has been emergency response (Maskrey, 1993; Blaike and others, 1994). It appears difficult to incorporate activities related to prevention and mitigation in the legislation, planning and institutions that deal with territorial and sector issues related to disasters (Lavell, 2001b). The challenge in the region is to find

ways to promote and concentrate on risk mitigation in an environment dominated by institutions created specifically to respond to emergencies rather than to reduce risks. To ensure the success of the transition, new integrated approaches face the challenge of involving rather than antagonizing traditional emergency response actors. The case of Colombia illustrates that institutional structural changes within the government are not, by themselves, sufficient. In addition, there must be political will to carry out the intent of the institutional restructuring, as well as checks and balances originating from outside the government system. Actors in the private sector and NGOs can serve this function; however, they have largely been absent from the restructuring plans in Latin America.

*Limited involvement of civil society and the private sector***.** For most countries in the region, disaster management remains dominated by central government institutions and lacks the opportunities provided by—and constraints imposed by—nongovernmental actors in civil society and the market. Insurance still plays a limited role in Latin America and the Caribbean. Although inroads in regional reinsurance and insurance projects have been undertaken, insurance premiums—according to Vatsa and Krimgold, 2000—are still beyond the disposable income of most of the population. These authors report that most homeowners (excluding those in Barbados), as well as small- and medium-sized businesses, do not carry insurance except when required to do so by lending institutions. The supply of insurance is also a problem. The Caribbean Disaster Management Project carried out by the U.S. Agency for International Development and the Organization of American States (OAS) showed that an issue in improving the insurability of assets is that local insurance companies and agencies in the region retain little of the risk they are insuring (Vermeiren, 2000). The OAS has led an effort to improve underwriting practices in the region, which may improve the participation of market mechanisms in disaster management in the coming years.

Insufficient ex ante provisions for reconstruction financing. Many countries have reserve funds for emergency operations, such as *Fundação Cearense de Apoio ao Desenvolvimiento Científico Tecnológico* (FUNCAP) in Brazil, or the National Calamity Fund in Colombia, but few have designated entities responsible for carrying out reconstruction and relief, let alone for providing funds to do so. Several problems arise from this situation. Some countries may find themselves unable to fully reconstruct their key infrastructure or provide for the very poor after a disaster. This lack of funds for reconstruction and rehabilitation could have a ripple effect both on the national economy and in allowing the poor to drop even further below the poverty line.

Furthermore, mitigation only occurs when the interests of the ultimate risk bearer are aligned with the party incurring the cost of mitigation. If reconstruction financing is left out of the equation, policies directed at reducing risk through a culture of prevention lack the attention they require.

Finally, if there is no ex ante plan for channeling reconstruction and relief funds, their distribution can easily become a highly politicized task appointed to organizations outside the national system, thus undermining the credibility of the system and hindering its ability to later engage in ex ante risk preventing and mitigating activities.

Summary of Latin American and Caribbean Experiences

There are three general approaches to implementing more comprehensive national disaster management programs at the government level: some countries expand the mandate of existing entities, others create parallel institutions, and others strengthen

the network between existing and new institutions. The strengths and weaknesses of these organizational approaches depend on the larger context in which they operate. Whether centralized, loosely centralized, or networked, the success of public programs depends on the input, feedback and control of the private sector, including actors in the marketplace and civil society.

Market-like tools, such as reinsured catastrophe funds (Mexico) and mitigation-focused insurance schemes (Barbados), have been implemented in a few countries. There is an increasing awareness of the importance of including civil society (particularly municipalities, NGOs, and other stakeholders) and private markets in disaster management solutions, and international financial organizations have provided support for pilot programs in the region (Vermieren, 2000). However, governments remain the most important driving force for developing comprehensive disaster management. Difficulties faced by the region include institutional reluctance to engage significantly in pre-disaster mitigation and financing arrangements and organizational obstacles to involving market institutions and civil society.

Disaster Management Systems in Europe

As countries in Latin America and the Caribbean face the challenges of changing their focus from emergency response to broader and more comprehensive disaster management systems, it is instructive to examine the experiences of developed and transition countries in Europe, in this case Hungary, France, and the United Kingdom.[3]

Hungary

Hungary has a system of disaster security for all, which is funded by taxpayers and has only recently involved private insurers. The government has traditionally and obligatorily compensated victims of flooding for up to 100 percent of their losses. Indeed, until the transition from communist governance in 1989, central government control and planning dominated the political landscape in Hungary. A cursory look at the country's recent past raises an important warning against the dominance of the public sector in disaster risk management.

In Hungary, flood mitigation and defense have been the responsibility of the National Water Authority (which today is part of the Ministry for Transport and Water Management) and 12 regional water authorities. Until recently, this centralized state system dominated all activities in mitigating, preparing for, and responding to floods. During the state socialist period, the water management authorities were a large and powerful bureaucracy, with a staff numbering more than 30,000. Not surprisingly, this unchecked authority expanded its resource base by advocating and carrying out extensive and expensive levee-building programs throughout the country. To date, more than 4,000 km of levees protect 97 percent of Hungary's flood risk areas. The overriding management philosophy was to protect the Hungarian territory rather than to institute land-use controls or less costly, nonstructural measures. This goal has motivated the governments of Hungary and many developed countries to invest heavily in structural mitigation measures, especially to reduce losses from flood hazard. With hindsight, many of these measures inadvertently increased flood losses, damaged ecological systems, and led to the loss of credibility of the responsible government authorities. Hungary's experience

[3] The Hungarian case is based on Horváth and others (2001) and Vári, Ferencz, and Linerooth-Bayer (2001); the French case is based on Gilber and Gouy (1998), Michel-Kerjan (2001), and Linnerooth-Bayer and others (2000); and the United Kingdom discussion is based on Linnerooth-Bayer and others (2000).

highlights the dangers of a policy process that excludes conflicting values and critical views.

The recovery process in Hungary, which has also been dominated by the central government, is placing more responsibility on private insurance systems. However, the private insurance option is unpopular among many people who prefer the solidarity of national compensation and are concerned about the effects of privatization on the poor. A clumsy policy approach is developing, which combines the solidarity of government involvement, the personal responsibility established by insurance, and the meaningful participation of NGOs and other actors in civil society.

France

The case of France offers a different perspective. Since 1982 private insurers in France have been required to offer catastrophic natural disaster insurance bundled with property insurance, and to charge a fixed rate set by the French treasury. Since more than 90 percent of all businesses and homeowners carry property insurance, the mandatory bundling of catastrophe insurance guarantees wide distribution. In fact, the insurance operates as a tax on property to fund the French national fund. Because rates are not differentiated by risk level, there are cross subsidies from persons in low-risk areas to persons in high-risk areas. Private insurer risks, in turn, are partly ceded to the French national fund, the Central Reinsurance Fund, to which the state gives its guarantee.

It is widely recognized that the French system provides disincentives for individuals and local communities to take risk reduction measures. A recent and imaginative decree to counter this problem sets a deductible that increases with the number of disasters in the same area. This means that the compensation a household or business receives will continually decrease in high-risk areas, leading to incentives to relocate or take other mitigating measures.

A problem with moral hazard remains from the lack of market-style incentives that accompany risk-based premiums, and the French have dealt with this in a clumsy fashion by relegating mitigation to the government. The government sets land-use restrictions and other mitigation measures. Since 1982, the government has carried out a survey of areas susceptible to natural disasters, and has instituted construction controls in these areas. Still, the required accompanying risk prevention plans have never been successfully implemented. To date, there are only about 5,000 such plans compared with 36,000 French municipalities, many of which are at risk from flooding, earthquakes, subsidence, or avalanches. Two reasons have been given for this: first, the cost is high; second, communities resist risk estimates because they can affect property values.

United Kingdom

The French notion of solidarity contrasts markedly with the disaster management philosophy of the United Kingdom. Without any anticipation of public relief, there is an unusually high penetration of natural hazard insurance in the United Kingdom (some estimate this at close to 70 percent), which is greatly facilitated by the automatic bundling of all-perils coverage into household insurance policies. What is remarkable about this solely private arrangement is that the insurance companies have an unwritten agreement to avoid risk-based premiums in favor of a standard premium for disaster coverage. This has resulted in substantial cross subsidies across regions and perils, making insurance affordable to the poor, who mainly populate high-risk flood plains, and has alleviated the government from political pressure to compensate poor victims after an

event. As efforts intensify within the industry to estimate the risks of disasters, insurers are moving toward risk-based premiums that will inevitably lead to reduced coverage for low-income households and ultimately to demands for more government compensation in the wake of a major disaster.

Disaster Management Systems in Japan and the United States

Like most Latin American countries, Japan and the United States are vulnerable to many types of catastrophic natural disasters, especially earthquakes, windstorms, and flooding.[4] While the countries are culturally diverse, the similarities in the evolution of their disaster management systems are striking. Both countries have comprehensive programs at the national level to manage disaster risks. FEMA is renowned for its efforts at centralizing and coordinating disaster management components at the national level. In Japan, the 1978 Large-Scale Earthquake Countermeasures Act created a national program and also set the institutional conditions for increased private market involvement. The program that emerged in Japan from this law was centralized and bureaucratic. The coordination was set out under the auspices of several national government ministries, and as the Kobe earthquake highlighted, depended on overly diffused responsibility between the authorities involved. It was three days before national civil defense forces reached the site of the earthquake, mainly because authority for sending civil defense troops rested with the provincial governors and not the central authorities. Ironically, Japan has not given the kind of power to its central government for disaster response that the United States has.

Another parallel between Japan and the United States, and perhaps the most innovative, is the creation of public/private insurance systems to further recovery. Both countries have pioneered loss-sharing programs that involve government and private market institutions. In Japan, earthquake risk insurance is offered by private insurers as a part of fire insurance policies; in the United States, a similar but importantly different public/private partnership exists to cover flood losses. The National Flood Insurance Program (NFIP) is unique in that policies are offered by the private sector, but the national government assumes the risks and automatically plays the role of reinsurer. Moreover, the NFIP puts far greater emphasis on deductibles as a way of encouraging policyholders to take loss-reducing measures. Thus, a notable difference in the public/private insurance partnerships of these two countries is the greater emphasis on incentives for individual responsibility found in the United States, as shown in box 1.2.

Government agencies in the United States and Japan also interact with market actors in other important ways. With research support from the government, the private market in both countries is taking initiatives for prevention. For instance, Japan Railway has pioneered UrEDAS (Urgent Earthquake Detection and Alarm System), an information system that detects the arrival of P-waves near the source and estimates the location and magnitude of the earthquake. Similarly, in the United States, FEMA has developed HAZUS, a multihazard tool with models for estimating potential losses from earthquake, wind, and flood hazards, that is an effort to place multihazard risk models in the public domain. The various stakeholders concerned with managing disaster risk in the United States are depicted in figure 1.4, although the basic structure is likely to be the same in most developed countries.

[4] This Japan discussion is based on Elahi (2001) and EQE (1995).

Box 1.2. Examples of Public/Private Insurance in the United States

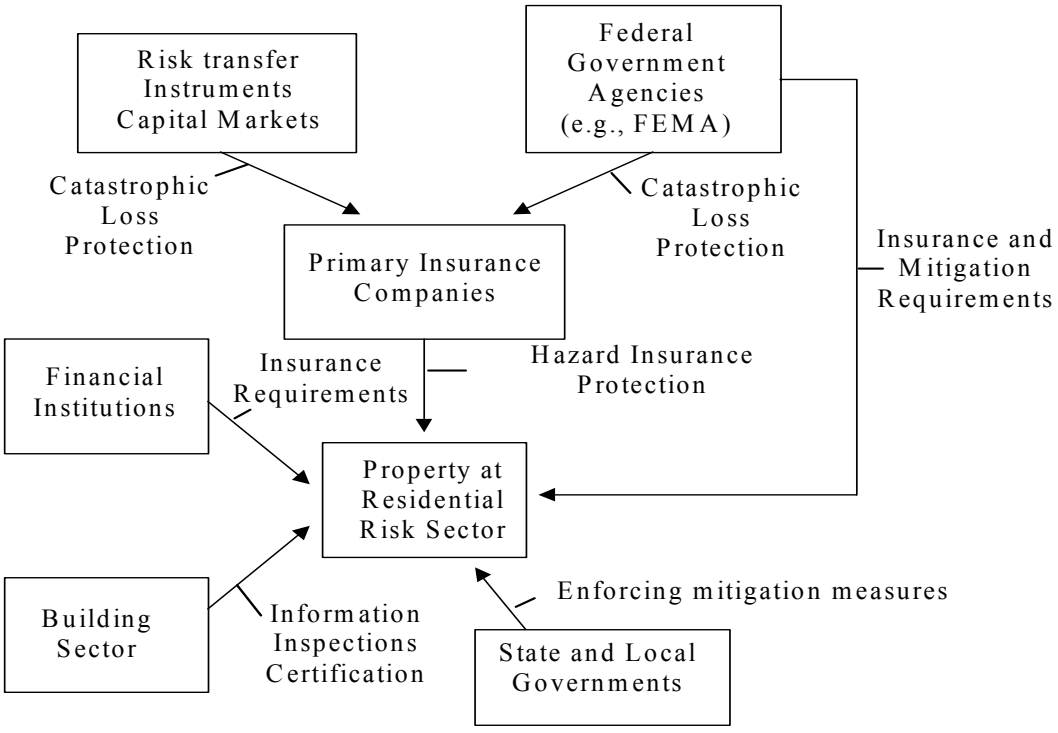
Floods
In 1973 the U.S. Congress passed the Flood Disaster Protection Act, which gave flood-prone communities the choice of participating in the National Flood Insurance Program (NFIP) or forfeiting federally subsidized insurance and all but emergency forms of disaster relief. Once a community agrees to participate in the program, homes and businesses located in the 100-year flood plain are required to purchase flood insurance as a condition for a federally insured mortgage on their property. This increased the demand for flood coverage considerably.

The NFIP has a combination of requirements (for example, land-use regulations and building codes) for communities participating in the program. By restricting the location and design of buildings in relation to the 100-year flood plain to meet NFIP standards, the local communities are taking positive steps to reduce future flood losses. The NFIP requires the cooperation of the federal, state, and local governments with the private property insurance industry. It is the clearest example in the United States of a public/private partnership for dealing with natural disasters.

Earthquakes
Although there has been a series of damaging earthquakes in California since the 1971 San Fernando quake, none of them compare to the January 17, 1994 Northridge earthquake. After Hurricane Andrew, it caused the largest insured damage of any disaster in the United States, with total insured losses of more than US$12.5 billion. The insured damage from Northridge led insurance companies to question whether earthquakes were an insurable event. This concern was heightened by the large increase in demand for earthquake coverage following this disaster. As a result, the state-run California Earthquake Authority (CEA) was established in 1996, whereby private insurers and reinsurers have a maximum loss of US$8 billion with the CEA setting rates, marketing policies, and settling claims.

Elsewhere in the United States, earthquake insurance in all states (except California) is offered as a separate endorsement to an insurance policy. For commercial structures, earthquake protection for property damage coverage is often included as part of a multiperil policy.

Figure 1.4. Major Actors to Manage Disaster Risk in the United States



Disasters Risk Management in Other Countries in Asia

Fiji

Fiji has extensive natural catastrophe exposure from cyclones, floods, droughts, earthquakes, and tsunamis.[5] Fiji's national disaster management program began as an ad hoc government committee for emergency response, but by 1990, the national program was restructured to make it more comprehensive. It now covers prevention, mitigation, preparedness and rehabilitation activities in addition to emergency response. In 1995 the government published the National Disaster Management Plan (Government of Fiji, 1995), which laid out a comprehensive policy and detailed the supporting roles of NGOs in all the functions of disaster management. However, the equally important roles of tourism, industry and commerce did not receive recognition. Fiji has a thriving tourism industry, and it is not surprising that private insurance has a high uptake in the business sector, whereas there is less but still significant insurance coverage for private urban dwellings.

Insurers in Fiji also take a proactive role in mitigation and prevention. After particularly severe cyclones in 1984, the Commissioner of Insurance established the Fiji Building Standards Committee, made up mainly of private insurers. This committee has the responsibility to oversee the preparation of a National Building Code that would set minimum standards to reduce disaster-related losses and help achieve a stable or reduced hurricane insurance premium (Government of Fiji, 1995). Of particular interest is that upgraded homes are inspected by a structural engineer and issued a certificate, which is required to obtain cyclone insurance coverage and mortgages. Most urban areas have adopted the building code (Rokovada and Vrolijks, 1993).

India

By contrast to Fiji, in India market actors are not very involved. Private disaster insurance exists, but there is little reliance on the private market for financing relief (Hoogeveen, 2000). The authorities at the state level take the main responsibility for disaster relief with financial assistance from the central government. A small Calamity Relief Fund (CRF) has been constituted with contributions from both the state and central governments. If a disaster overwhelms the capacity of the state government to respond, the central government will provide financial and other assistance. If such a major disaster occurs, the central government commits itself to pre-fixed reimbursement sums for loss of life, limb, and partial and total loss of housing and productive assets.

Interestingly, India is developing a more loosely networked system with little attention to mitigation at the government level. NGOs play an active role in risk reduction programs in the region. A new innovation in India is the so-called "knowledge network" that involves civil society, the scientific community, and, to a minor extent, the market. The National Natural Disaster Knowledge Network has been designed to facilitate an interactive, simultaneous dialogue with all the players dealing with natural disasters. Indian NGOs, such as the Disaster Mitigation Institute, are also working with the government, as well as the Grameen Bank, in designing tools to address disaster loss and poverty. In addition, India appears to have a great deal of innovation from the private sector. Micro-insurance mechanisms are being designed to reach the poorest groups, build institutional capacity, and form the capital necessary for disaster management targeted toward the poor. Finally, in Gujarat, workfare programs and

[5] The Fiji case is based on Benson (1997a) and Carter, Chung, and Gupta (1991).

community reconstruction projects have provided needed work and income protection for poor families as well as necessary reconstruction activities (Bhatt, 2001).

Lessons Learned from Disaster Management Systems Worldwide

In Latin America, governments are taking important steps to expand their reach from disaster response to include other risk management functions, especially disaster prevention and mitigation activities. However, countries throughout the region are encountering institutional resistance to the implementation and allocation of resources to these broader government programs. Moreover, while the formal systems include NGOs, there is little involvement by market actors such as insurance companies. This is not surprising given the lack of legal institutions in this region to support insurance and other financial services.

The Hungarian case shows that government programs, while essential for coordinating the functions of disaster management, must not be so powerful as to exclude other actors holding conflicting values and views. This example serves as an important warning to Latin American and Caribbean countries as they expand their bureaucracies to encompass more comprehensive disaster risk management functions, and especially as they pursue the laudable goal of shifting resources from post-disaster functions to the prevention of disaster losses. Today, countries like the United States, Japan, and Hungary are taking active steps to incorporate public dialogue and participation in mitigation policies and, more generally, in their disaster management programs.

Alternatively, the United Kingdom illustrates the drawbacks of relying almost exclusively on the private market for transferring risks through its fully private insurance system. As this system evolves toward risk-based premiums, the poor living in high-risk areas will be excluded from social protection. Insurance at the formal level (although it exists informally through family support systems) is currently not realizable in most Latin American and Caribbean countries due to the lack of market structures and institutions in which private financial institutions can operate.

The United States and Japan have perhaps the most structured programs at the national level to manage disaster risks, but they have pioneered loss-sharing programs that involve government and private market institutions. These programs underline the importance of integrating hierarchical and individualistic forms of social organization in a national system, but in ways that reflect national cultures.

Finally, the developing countries in Asia offer additional lessons and insights that are valuable for the design of comprehensive disaster management systems. In India, despite the recently announced formation of a national disaster management authority, the government is active mainly in aiding states in their response to catastrophes. Fiji has moved remarkably toward an integrated, clumsy system for disaster risk management that includes a strong national program and plan, involvement by private insurers, and a keen awareness that NGOs and local efforts are an integral part of the system. Both India and Fiji have moved toward a balance of social cultures in the management of disaster risk.

Designing Effective National Disaster Management Systems

Drawing from country experiences and the recommendations of policymakers involved in national disaster systems, some key guidelines for effective disaster management systems emerge. First, successful national systems have an explicit and appropriate

national disaster strategy. Appropriate national disaster strategies are integrated with national policy on development and environmental protection and are based on vulnerability assessments. Second, successful national systems integrate key players in the disaster management process. Such players include, among others, the finance ministry, local community leaders, NGOs, and private market actors. Third, successful national systems have provisions to ensure sufficient resources for key players to carry out their responsibilities.

Explicit and Appropriate National Disaster Strategy

Involvement of a wide variety of stakeholders and policy tools is needed for developing any disaster management program. Interested parties are brought together and policy tools are combined depending on the nature of the institutional arrangements in the country as well as the types of disasters the country faces. For example, in Turkey it would be difficult to institute a partnership between insurers and financial institutions in promoting mitigation measures because mortgages on property do not exist. Each country must design a national system appropriate to its own circumstances.

Integrating a Strategy with a National Development Policy

Economic development, environmental protection, and disaster management are all intrinsically linked. A large part of the damage caused by Hurricane Mitch in Honduras and Nicaragua can be traced to poor land-use practices and uncontrolled human settlement (Bate, 1999; Olson and others, 2000). The deforestation and rural-urban migration that created such high vulnerability to Mitch were largely due to the extensive poverty in the area. The aftermath of the hurricane further set back the poor. Successful national disaster strategies recognize the linkages between the poor, the environment, and natural disasters. Raising standards of living means not only guaranteeing access to basic needs, but also reducing the risk to natural hazards in people's lives.

Vulnerability Assessment

Vulnerability assessments are an essential part of the process of integrating natural disaster strategy with overall development objectives. These assessments identify sources of risk, vulnerable groups, and potential interventions. In the first stages of establishing the new national system in Nicaragua, the Nicaraguan government and the World Bank commissioned a study from a consulting company to integrate existing hazard maps with poverty maps to identify communities most in need of disaster-related mitigation and preparedness projects. This identification process served as a cornerstone for all of the initial risk management activities. Vulnerability assessment allows policymakers to specifically define the objectives of the risk management programs and to establish vulnerability reduction targets.

Incorporating Key Players

Successful national systems integrate key players into the disaster management process. The most successful systems take advantage of the existing government structure and involve national, provincial, local, and community government as well as ministries and other institutions. Essential institutional players are ministries (such as the ministries of finance, health, and education), organizations (such as military units and civil defense), regional and local government entities, NGOs (such as the Red Cross), international aid and finance organizations, private sector actors, and local communities.

Key to the success of these systems is the interaction between the coordinating bodies and institutional players.

It is essential to understand the values, goals, and objectives of the relevant stakeholders in a national system and recognize that they may conflict with each other. The challenge is to construct a program that is viewed as more desirable than the status quo by these key interested parties. There also needs to be recognition that programs in place prior to a disaster may be greatly modified after a catastrophe occurs.

Finance Ministries

Finance ministries are important players in disaster management systems. The participation of finance ministries helps to ensure funding for the institutional framework, facilitates the incorporation of disaster management into development policy, and provides incentives for financing mitigation projects. Incorporating natural catastrophes into development policies requires including the costs of disasters in macroeconomic projections, future budgets, and the project investment process. Finance ministries are responsible for preparing projections, allocating budgets, and approving investments; they can and should incorporate the costs of natural hazards into each of these stages.

In many developed countries, the finance ministry is engaged in the disaster management process through its responsibility to provide post-disaster reconstruction financing. The need to fund the repair and reconstruction of buildings, housing, and infrastructure focuses attention on pre-disaster risk management practices. Finance ministers are naturally interested in supporting ex ante activity, including mitigation and prevention measures, which reduce their defined obligation to generate more funds for reconstruction. By linking risk prevention to reduced need for post-disaster funding, the finance ministries have an economic stake in maintaining the integrated risk management process. However, not until the finance ministry has the responsibility to manage the government's post-disaster reconstruction funding obligation will it have a strong interest in participating in the risk management process.

Communities

Local communities also play a key role in successful disaster management systems. When political impetus behind the national disaster system in Colombia flagged, local community efforts continued. To allow for feedback from communities into the national level disaster management decision process, there should be an avenue for active participation of NGOs and representatives of civil society in the organizational structure of the national system.

Providing Sufficient Resources

Obtaining sufficient resources for disaster management is hindered by three elements: providing financial resources for the ongoing operation of a national system; providing incentives for funding risk mitigation projects; and financing post-disaster reconstruction.

Funding Ongoing Operations

The creation of a budget for ongoing operations is a component of a national system. Of course, the level of funding and its year-to-year sustainability are directly related to the involvement of the economic planners in the process of creating and implementing the

system in the first place. A well conceived strategy will identify the necessary functions and the resources required to perform those functions. If the finance ministers are not actively involved, the national system will become minimized. As a result, over time funding for the system will be reduced.

Financial Incentives for Mitigation

Mitigation occurs when the interests of the ultimate risk bearer are aligned with the party incurring the cost of mitigation. For example, a homeowner is more likely to take mitigation measures to reduce the exposure of his home to hurricanes if he must pay the cost of reconstructing after the hurricane hits. If the homeowner believes that someone else will pay the cost of reconstruction, he has no incentive to bear the cost of mitigation. Similarly, unless the finance ministers have an economic stake in the cost of disasters in the form of bearing responsibility for providing economic resources for post-disaster reconstruction, it is unlikely they will fund money for mitigation from their resources. Of course, this is true for all levels of government, and emphasizes the need for finance ministries to articulate and bear responsibility for the post-disaster financing needs of a country.

Insurers have also tried to provide economic incentives to encourage residents and businesses to purchase coverage and adopt cost-effective risk mitigation measures, but with limited success. One way to make a premium reduction (which is associated with the property owner undertaking mitigation measures) financially attractive to the property owner is for the bank to provide funds for mitigation through a home improvement loan with a payback period identical to the life of the mortgage. If the annual premium reduction from insurance was greater than the annual loan cost, then the insured homeowner would have lower total payments by investing in cost-effective mitigation than by not doing so.

Financing Losses and Risk Transfer

There is limited activity associated with financing losses and risk transfer in Latin America and the Caribbean. Several policy alternatives are available to encourage the use of risk transfer in those cases where it is a desirable alternative. The most obvious first step is institution building and developing the necessary information to support an insurance program. As discussed in the risk identification section, this entails catastrophe modeling. The second step is creating demand for catastrophe insurance. This report discusses possible policy alternatives to address both the supply and demand for risk transfer. The adoption of these alternatives in specific countries should be a major policy interest.

Another pre-disaster alternative to developing an insurance program is the creation of a disaster fund to meet short-term needs in the post-disaster period. This is also an additional approach used by Mexico and is proposed for Nicaragua. The catastrophe fund avoids the problem of seeking a new budget allocation in the middle of a fiscal year to meet anticipated annual needs. In fact, it is not a tool for transferring risk. Rather, it is a means for guaranteeing funding to meet short-term needs without requesting new appropriations in the middle of a budget cycle. It is an effective tool for focusing policymakers at the national level on the need for consistent funding for disasters. As is now being explored for Mexico, it may provide a tool for exploring risk transfer as a policy option.

Finally, governments should actively explore risk management strategies to cope with the post-disaster needs of the poor. Having a clear strategy on the obligations of the government to meet the needs of the poor after a disaster, as well as a program to address those obligations, is essential. While it is unlikely that risk transfer can play a role in meeting this need, the interest of the government in looking at risk transfer to meet other post-disaster obligations may free resources to help the poor.

Sustainability of National Systems

It is important for national systems not only to function well, but also to survive periods in which relatively few catastrophic events occur and then remain viable during and after major hazard events. To be sustainable, national systems must function effectively and have the continuous provision of political and financial resources. As policymakers know, programs that are sustained have well defined objectives, resources to accomplish these objectives, and well stated goals. Systems that do not meet their objectives will not be sustained.

Political Sustainability

Integration with Overall Development Goals

The more closely a national disaster system is integrated with overall development goals, the easier it will be to maintain political interest in the system. Programs survive changes in the political leadership when they are tied to long-term economic development. Programs not essential to economic development have difficulty maintaining their status in hard economic times. Natural disaster policy must find its place as a problem of economic development demanding the year-in and year-out attention of those concerned with a country's economic well being. The long-term survival of a national system therefore requires that those responsible for development planning be key participants in both the creation and ongoing operation of the system.

Legislation

Supporting a national disaster strategy with legislation increases the likelihood it will be sustainable. Legislation provides a formal basis for counter-disaster action, allocates major responsibilities in legal form, and provides a measure of protection for governments, organizations, and individuals by outlining the limited responsibilities of each in the disaster management process. To the extent that legislation supporting the national disaster strategy is designed as a consensus-building process, it will also increase the likelihood of long-term support from the participants.

The *Disaster Manager's Handbook* includes examples of legislation for the Cook Islands, Papua New Guinea, and Queensland, Australia (Carter, 1992). The Nicaraguan government publishes online the legislation it recently passed to establish its national system (see www.sosnicaragua.gob.ni/Download/).

Continued Perception of Risk

A key problem facing stakeholders concerned with developing a sustainable disaster management program is that prior to a disaster there is little interest on the part of potential victims to protect themselves against the consequences of these events because they feel "it cannot happen to me." Political units sense this lack of concern and hence place natural hazards low on their agenda. Following a major disaster, there will be

sympathy and concern for victims by the general citizenry and a desire by elected officials to offer disaster assistance to those in need. This reaction makes it less likely for those at risk to protect themselves in the future.

At some fundamental level, individuals and governments underestimate natural hazard risk. The failure to recognize the concept of risk means that action tends to be fueled by events, rather than by the probability of the event occurring. For example, every major change in the natural disaster policy of the United States followed a major disaster (Kunreuther and Roth, 1998). Even then, the impetus for policy change tends to be of short duration, with a focus on solving a short-term issue rather than tackling long-term institutional failures.

As discussed in this chapter, various strategies can be used to promote continued public awareness of disaster risk. Successful initiatives involve radio and television broadcasting agencies in designing informative programs and including disaster awareness in school programs. Public awareness of disaster risk is essential to sustaining programs, particularly through periods of few disaster events.

Creation of a Constituency

The sustainability of a national system requires a constituency to maintain disaster management on the political agenda and counteract the reluctance of existing power structures, including civil defense organizations, to change policy. Constituencies also act as a force to prevent the national system from being captured by political groups in times of crisis. One way to develop a natural constituency for disaster management is to frame the process as a poverty issue. Natural disasters impact the poor more than any other group; the research on this issue is compelling. Those concerned about the reduction of poverty need to become advocates for changing national policy toward disasters. This includes the bilateral, multilateral, and NGO community. The advocacy group for a natural disaster system needs to be more than the disaster management professionals. Protection of the poor from the risk of natural disasters should be a mainstream poverty issue.

Accountability

Finally, a key part of political sustainability is providing the structures to make different organizations and individuals accountable for their disaster management responsibilities when events strike. As discussed in the case of ministries of finance, the best way to ensure that a ministry invests sufficient present resources in mitigation projects and prepares a plan for obtaining reconstruction financing is to hold it accountable for the reconstruction process. Legislation is the obvious choice for officially establishing accountability.

Financial Sustainability

Although the key to the financial sustainability of a national system is to ensure the continued political impetus behind the system, other methods include committing to long-term financing contracts with external parties and responding to pressure from the international finance community.

Long-term Contracts

Long-term contracts with reinsurance companies, investors, or international financial institutions are one way to ensure continued financial support for the system. In addition, long-term obligations encourage these parties to invest more fully in measures such as risk identification, which will lead, in the long-run, to lower transaction costs.

International Aid and Financial Institutions

The actions of the international donor community can play a decisive role in the sustainability of national programs. For the poorest countries, the assistance of the international community is critical in their ability to deal with risk. Policies that can make or break the establishment of national programs include funding by the international community for post-disaster reconstruction projects that do not address the exposure of reconstructed structures to hazards (including issues of citing and proper building standards); ignoring hazard risk as a component of developing country assistance strategies; bypassing existing institutional structures in the provision of post-disaster assistance; and providing post-disaster reconstruction funding without holding national governments responsible for some portion of future risk. Much of the current problematic policy related to natural disaster planning is a result of the types of programs the international donor community was willing to fund in the past.

There is considerable policy justification for the international finance community to place this issue on the table. The multilateral financial institutions have long recognized that they are the insurers for poorer countries' losses from natural disasters. As the costs of disasters continue to escalate, the demands on the multilateral community for post-disaster assistance have dramatically increased. For example, in the past four years, the IDB's average annual lending for post-disaster assistance increased by a factor of 10 compared with the previous 15 years. This experience parallels the experience of the World Bank. As noted in IDB (2000b), while the global risk from disasters is increasing, the overall level of assistance available for emergencies has been shrinking since 1992.

Conclusion

This chapter has analyzed the key elements of a comprehensive risk management system. Increasingly, risk management professionals are recognizing that reducing vulnerability to disasters involves a wide range of policy initiatives that engage broad segments of society. The focus of this report has been on the experiences of the international community in forging links at a national level to develop comprehensive national systems.

Two broad approaches emerge from the literature: a centralized, government-directed risk management system, and a more decentralized, locally directed approach. The centralized strategy relies on national legislation that creates an organizational structure to integrate existing government and nongovernmental institutions into the policy process. The most successful programs include reconstruction financing strategies, many of which use insurance to protect against large losses and encourage the adoption of mitigation measures. In practice, the more centrally directed programs rely heavily on structural engineering solutions to risk management and have difficulty implementing nonstructural mitigation measures and finding and maintaining an appropriate role for local institutions in the risk management process.

Decentralized models, on the other hand, rely on national governments and NGOs to provide guidance and support for local initiatives. These locally directed programs have proven effective in implementing nonstructural mitigation measures, but lack the comprehensive approach possible with centrally directed programs.

The best policy outcome is a national system that embodies a measured mix of the two approaches. A comprehensive approach requires the commitment of the national government, and that commitment needs the attention of those directing development policies. In addition, the role of risk transfer as a decentralized market initiative is important and, in the case of high exposure, will rely on a supporting role by the national government. The task is to create an effective national system with comprehensive vision that engages senior government policymakers, accommodates and supports local decision-making and initiatives, engages civil society, and promotes the institutional conditions necessary for the constructive involvement of private market initiatives.

Chapter 2

Financial Strategies for Natural Disaster Reconstruction

Risk transfer is among the least understood components of risk management in developing countries. Three reasons dictate the need for countries to consider risk transfer as a vital component of their risk management strategy. First, if disasters are not anticipated and planned for, the diversion of scarce financial resources to relief and reconstruction efforts causes high opportunity costs as other projects contributing to economic growth and the eradication of poverty cannot continue as planned. Second, the continuing and significant reallocation of post-disaster resources disrupts the budgetary planning process. The annual budget process is often a complicated and politically difficult one. Shifting resources in response to disasters upsets fragile compromises formed in the initial budget plan. For many countries, this shift creates considerable institutional friction (Lewis and Murdock, 1999). Third, poorer countries rely on international assistance to pay for a substantial portion of their losses. The resources available to the international development community are limited and have remained stagnant for nearly 10 years (OECD, 2001).

At the same time, countries should continue their practice of financing post-disaster expenses with traditional financing instruments. The mix of policy options needs to include access to the least cost financing alternatives. To the extent that losses can be paid from aid donations or low cost external borrowing, those resources should be tapped first. As detailed in the following discussion, the tradeoff between access to adequate resources and the cost of those resources should become a component of proper natural disaster planning. This chapter explores tools to illuminate the planning alternatives.

As the cost of disasters increases, the demand on the international financial community to provide needed resources has also increased. For example, the Inter-American Development Bank has increased its average annual disaster-related spending by a factor of 10 in the past five years in comparison to the previous 15 years (IDB, 2000b). In consuming the limited funding available, natural disasters divert resources needed to support longer-term economic and social development objectives. The Organization of American States notes, "Funds intended for development are diverted into costly relief efforts. These indirect but profound economic effects and their drain on the limited funds now available for new investment compound the tragedy of a disaster in a developing country." (Bender, 1991).

To evaluate risk transfer alternatives for financing post-disaster reconstruction, it is necessary to understand the risk of countries to disaster loss as well as their current practice to cope with that loss. Once exposure is understood and existing policy is highlighted, alternatives can be proposed. The problem is addressed here in three stages: estimation of the impact of natural hazard events on the economy of each of four selected countries (Bolivia, Colombia, the Dominican Republic, and El Salvador); review of existing government strategies and practices for financing disaster loss; and a comparison of new policy alternatives for financing disaster loss.

The specific models developed herein for securing post-disaster reconstruction financing are intended to show broad-based tradeoffs between policy options. Core pieces of information required to make these models effective as policy tools do not exist. Rather, estimates based on known data were used to support key assumptions. *The intent is to demonstrate a method to show how tradeoffs in policies could be understood, not to demonstrate the actual tradeoffs for each country.*

Lessons Learned

A comparative study was undertaken in four Latin American and Caribbean countries that had recently experienced major natural disasters: Bolivia, Colombia, El Salvador, and the Dominican Republic. The four selected countries represent a cross section of risk profiles. The main contrast among the four countries is the covariant nature of the risk they face, that is, the likelihood that a natural hazard event would impact the entire country. Both the Dominican Republic and El Salvador face risks that may destroy substantial portions of the country. In Colombia and Bolivia, the risks are localized; if disasters occur, it is unlikely that there will be damage to more than one defined region.

The hazards faced by the countries represented are varied and include such natural phenomena as hurricanes, earthquakes, floods, volcanic eruptions, landslides, droughts, and tsunamis. The focus of the study is to understand the current and prospective mechanisms used by these countries to finance substantial reconstruction after major natural disasters. In each country, meetings were held with relevant government and nongovernment agencies to understand their role in post-disaster reconstruction and the sources of funding they use to support their activities. All of the countries rely on funding from international financial institutions to support their post-disaster reconstruction.

An important lesson for multilateral financial institutions and three broad policy lessons for the countries emerged from the country visits. The former has to do with the complex process of providing post-disaster funds and how it is reflected in the activities of the countries. The three lessons applicable to the countries are the failure to account for natural disaster risk in the national planning process, the inadvertent assumption of risk by many governments, and the inefficient purchase of insurance in each country. This section explores these themes in more detail.

Country Policy and Funding from the International Aid Community

A surprising development from the study concerns the way in which financing strategies of the countries are driven by expectations of post-disaster aid from the international finance community. In each country (with the possible exception of Colombia), government officials expect that the multilateral finance community will provide post-disaster financing for reconstruction. Much of the countries' pre-disaster behavior is directed at maximizing post-disaster aid.

A good example of this policy is the recent activity in Bolivia, which has passed new legislation to revamp its national disaster system. Two changes in this legislation are directly related to guarantying access to international aid after a disaster. The first is the establishment of a national disaster fund with the primary purpose, according to both the housing and sustainable development ministries, being to ensure that Bolivia has sufficient funds to meet its co-pay obligations that arise with disaster aid. In this way, the country can maximize the amount of available post-disaster assistance. The second change is the movement of the natural disaster agency from being under the direction

of civil defense, which is considered a component of the military. After the earthquakes in 1998, the Bolivian government was denied some assistance from a number of European governments because the institution directing reconstruction was a military entity. Reconstruction responsibility was reassigned to the sustainable development ministry. In this way, it is hoped that additional post-disaster aid will be forthcoming.

In each country, officials recognized that the primary source of reconstruction funding from international financial institutions is the diversion of existing loans. This has significant advantage for the countries, since the administrative burden of diverting loans is considerably less than the effort required for new credits. The immediacy of the loans requires that compromises be made that would not be acceptable if the emergency was not already on the country.

Two policy implications result from this limited focus of country officials on international financial institutions for post-disaster financing. First, there is an institutional commitment only to maximizing the post-disaster loan diversion capacity to the exclusion of other ex ante policy initiatives, like insurance. Second, the willingness of the international financial institutions to permit loan conversions significantly reduces their ability to impose loss reduction measures as a condition of lending. In the moment of crisis, it is difficult to impose additional conditions on already approved loans. As a result, the usual bank conditions on reconstruction loans are not required for diverted loans. It is not surprising that countries attempt to maximize their access to these types of credits.

There is a need for the international finance community to better understand the expectation created around their willingness to divert existing loans to finance disaster reconstruction. While the policy of many governments is being directed to access unfunded loans in times of disaster, the international institutions have not clearly established the conditions for loan conversions. As a result, the opportunity to advance policy objectives, like prevention and mitigation, is lost in the loan diversion process.

Disaster Risk and National Planning

Despite the considerable research regarding the long-term impacts of disasters on sustainable development, none of the visited countries formally incorporates natural disaster risk in its national planning process. While all the countries budget for disaster relief through civil defense, and have some planning activity related to risk mitigation, none accounts for probabilistic losses from natural phenomena as an ongoing component of the budgeting process. Without accounting for potential contingent losses, the countries lack the necessary information to consider and evaluate alternatives to reduce or finance probabilistic losses. As a result, policies directed at reducing risk through a culture of prevention lack the attention they require, as Mitchell (1999) notes.

Safety (a prime consideration in hazards management) does not necessarily equal sustainability, and contingencies (of which hazards and disasters are good examples) may require different responses than enduring problems. The truth is that large and complex cities require expansive management initiatives that can simultaneously address incommensurable goals. Mega-cities must be prepared to cope with unexpected or unfamiliar events as well as long-term problems; acute natural hazards as well as chronic crises of environmental degradation. To assume that sustainable urban development can be achieved without attention to problems of contingency—of which natural hazards are a pre-eminent example—is to court frustration and failure.

The need to plan for contingencies is as true for countries as it is for mega-cities. Despite this apparent need, understanding and planning for the contingent nature of natural disaster risk is not a policy objective of any of the countries visited.

The failure to understand the risk from natural hazard events has wide ranging implications. The most obvious is that lack of understanding of contingent exposure to natural hazards limits the ability of a country to evaluate the desirability of financial planning tools to cope with risk. These tools, of which insurance is the best known, require that risk be reasonably quantified as a precondition to use. While it is possible to make policy decisions without probabilistic estimates, the failure to quantify risk when it is possible constrains the decision-making process. The management of financial losses always involves tradeoffs with respect to anticipated future consequences. Lacking any predictive knowledge of potential future outcomes reduces the ability to evaluate alternative options to finance risk. The governments of the four countries studied herein are currently incapable of evaluating such policy options.

The lack of probabilistic estimates for natural hazards has other serious implications. Since the cost of reconstruction is not planned for in advance, the primary incentive to promote mitigation and risk prevention is lost. Mitigation and risk prevention require funding. Their purpose is to reduce future damages from expected events by making efficient current expenditures to reduce risk. If the future damages are not considered as a component of the current planning process, it is nearly impossible to sustain budgetary resources to reduce those potential damages.

This concern addresses the financial issue of the sustainability of national systems, which depends on the participation of those responsible for national budgeting and planning in the national system. A prerequisite for the involvement of a national planning office must be the recognition of risk from natural phenomena. The planning obligation must be to understand how the risk will be handled prospectively. The absence of comprehensive understanding of risk explains why efforts to advance risk mitigation and prevention receive little national attention. It also helps explain the frustration in maintaining sustainable national systems.

The only agency found in the four selected countries that considers the probabilistic losses from natural hazard events in its budgeting process was the agency responsible for national highways in Colombia. The agency is responsible for highway maintenance and reconstruction after a disaster. For each segment of the highway, it has prepared a probabilistic estimate of future losses from natural hazard events. These estimates, created with the help of the University of the Andes, are used to set the agency's annual maintenance and reconstruction budget. For years in which the natural hazard events are less than estimated, budgeted funds are used to reduce vulnerability through increased maintenance. For this agency, the link between mitigation and risk reduction is clearly defined. The agency understands its contingent exposure to loss and can therefore plan its resources to manage that risk.

The tools to develop probabilistic estimates of future losses are available in all the studied countries. Why these tools are not being used to quantify risk and develop planning options is unknown.

Assumption of Risk by Governments

In the post-disaster period, decisions were made about reconstruction based on damage studies. Little attention was focused on whether the assets damaged were the

responsibility of the government. Rather, the decision process focused on damages, potential government resources for reconstruction, and how best to spend those resources in the event of an emergency. In both Colombia and Bolivia, after the most recent earthquake disasters, the governments rebuilt homes destroyed or damaged by the earthquake. The governments in both countries claimed that rebuilding housing had not been a government obligation in past disasters. An expectation has been created that the government is responsible for housing reconstruction.

In Bolivia, the government has met that expectation by rebuilding housing after recent floods and fires. Colombia spent US$800 million to rebuild in Armenia and Pereira after the 1999 earthquakes. An earthquake that impacted Bogota would incur considerably higher damages. The policy issue is not whether the government should be obligated to rebuild after a disaster, but whether obligations of this magnitude should be informally incurred as a result of the post-disaster financing process now employed. Countries under severe fiscal constraints should incur substantial future contingent obligations only as part of a long-term planning process, not in response to unplanned disaster borrowing.

Efficiency of Existing Insurance Purchases

The final general observation relates to existing practice with respect to government purchase of insurance. In every country examined for this study, a requirement existed for government agencies to purchase insurance to protect their buildings and their contents. In each instance, the level of insurance, the premium paid, and the company from whom the insurance was purchased was left to the discretion of the appropriate minister or agency (whether at the national, provincial, or municipal level). In none of the countries did anyone know the aggregate amount of insurance purchased, the premiums paid, or the level of protection provided. What is clear is that the existing process of acquiring insurance is inefficient.

The use of consolidated insurance purchased by the public sector in these countries would likely substantially increase the amount of insurance protection available at no additional budgetary cost. By matching the purchase of insurance with the risk to government as a whole, as opposed to the risk to a particular building or agency, the insurance purchase could be integrated into a comprehensive risk management process. How the government handles risk in the aggregate is much different than how a single agency manages risk. The diversification of risk at the government level, particularly for idiosyncratic risk, would probably indicate that the purchase of insurance should be done for the highest, but least expensive levels of risk. The government itself can generally absorb the lower levels of risk more efficiently using its own resources. A study examining the management of disaster risk in Mexico finds a similar situation. Mexico required that all its government agencies purchase insurance. In reviewing the purchases of the different agencies, the conclusion was reached that consolidating the purchase of public sector insurance combined with the employment of international brokers should increase the efficiency of the risk transfer for public sector risks (Kreimer, Arnold, and Freeman, 1999).

Measuring the Resource Gap

The resource gap is a measurement of the inability of a country to finance its reconstruction obligations after a disaster. The calculation of the resource gap requires three computations. First, the risk of the country to natural hazard events must be calculated. Risk is a function of the hazard (or probability of phenomena of different magnitudes

impacting a country) and the vulnerability (or susceptibility of the exposed population and assets to loss). The second calculation is the financial responsibility of the government to finance country losses. Primary losses from natural hazard events may be the responsibility of various parties in addition to the government—industry, businesses, homeowners, and individuals—but the concern here is with government responsibility. Third, the capacity of the government to meet its financial obligations must be calculated. To the extent that the government lacks the resources to fund its obligations, it has a natural disaster resource gap. The required resources may come from international aid, government revenues (taxes), reserves, insurance proceeds, borrowing, or diversion of resources from other programs. All of these alternatives have an associated cost and limitations on availability.

Hazard

Hazard is the probability of occurrence of natural events that can cause significant economic damage. For example, floods, hurricanes, and earthquakes are responsible for 90 percent of the economic costs from natural hazards worldwide. Countries tend to be impacted by the same types of natural hazard events. Earthquakes usually occur in well-defined seismic zones; windstorms usually travel along identified hurricane paths; and floods usually occur in river and coastal areas. The concern about hazards relates to the intensity and timing of their occurrence. Different countries are impacted by different phenomena. It is not uncommon for some countries to be exposed to more than one natural hazard.

Bolivia is primarily exposed to small, recurring floods and landslides scattered across the country. Bolivia, along with Colombia and El Salvador, is particularly concerned about floods and drought due to the El Niño phenomenon. Seismic hazard is also an issue, primarily in Bolivia's central region, but also potentially in La Paz. The two most recent events in Bolivia are the February 2002 floods in La Paz and the May 1999 earthquakes near Tarija that measured 6.3 on the Richter scale. Bolivia is relatively fortunate that it is mainly exposed to low hazards in limited geographic regions in the country.

The geographic diversification of the disaster risk in Bolivia is mirrored in Colombia. In contrast to Bolivia, however, natural hazard events in Colombia can be very severe. In 1906, for example, an earthquake of magnitude 8.9 Mw hit off the Pacific Coast of Colombia and was felt in the entire country and surroundings. Colombia is affected primarily by earthquakes and tsunamis. It also is exposed to floods and volcanoes with consequent mud floods. The most important recent event in Colombia was the 1999 earthquake in Quindio, known as the "Eje Cafetero" disaster because the shocks affected a key coffee producing area.

In contrast to the geographically constrained events that affect Bolivia and Colombia, the Dominican Republic and El Salvador are susceptible to being affected in their entirety by individual catastrophic events. The Dominican Republic has hurricane and earthquake hazards. Hurricanes occur frequently; earthquakes occur rarely but with larger associated potential losses. The last large earthquake in the Dominican Republic occurred in 1946 with a magnitude of 8.1 on the Richter scale. The most important recent event was Hurricane Georges in 1998, which ranked 3 out of 5 on the Saffir Simpson hurricane scale. Hurricane David in 1979 ranked a full 5.

The most important hazard events in El Salvador are earthquakes and volcanic eruptions, with resulting landslides likely and tsunamis possible. Earthquakes have struck

San Salvador 13 times over the past 400 years, almost destroying the city in 1854, 1873, 1917, and 1986. The largest recent events in El Salvador were the earthquakes of January and February 2001, with Richter magnitudes of 7.6 and 6.6, respectively. Figure 2.1 shows the seismic hazard for all of Central America.

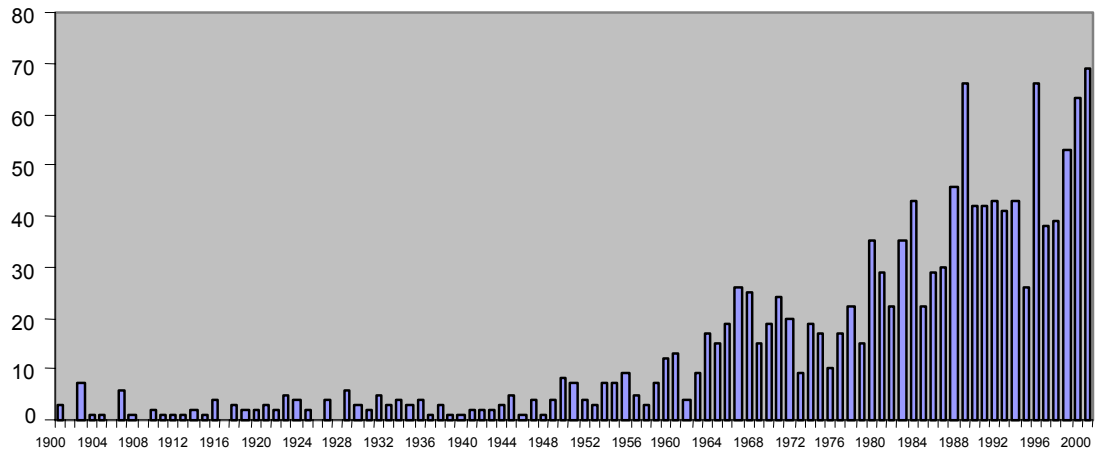
Vulnerability

Figure 2.1. Seismic Hazard in Central America

Source: Freeman and others (2000).

The entire Latin American and Caribbean region is experiencing increased vulnerability to natural hazard events (see figure 2.2). Worse yet, the impacts of natural hazard events are estimated to increase dramatically over the next 50 years. By some estimates, the global cost of natural disasters is anticipated to top US$300 billion annually by the year 2050 (Munich Reinsurance Company, 2001). The primary factor influencing

Figure 2.2. Increasing Number of Events Qualifying as Natural Disasters in Latin America and the Caribbean, 1900-2000.



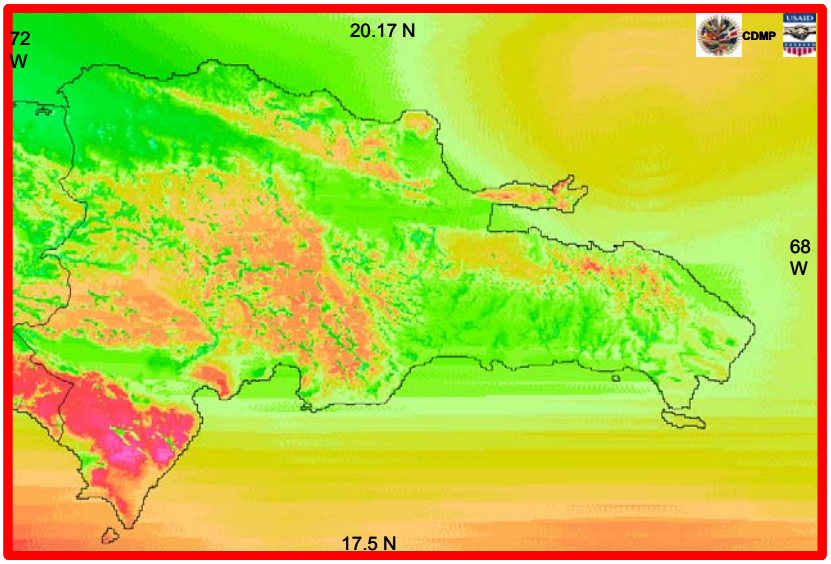
Source: Charvériat (2000).

the estimated increase in damages is the increasing concentration of wealth and population in hazard-prone regions of the world, primarily urban areas. In Latin America and the Caribbean, more than 75 percent of the population is projected to live in urban areas by 2030 (UNFPA, 1999). Mega-cities are highly vulnerable to natural hazard events. Nearly half of the world's largest cities are situated along major earthquake zones or tropical cyclone tracks (Bendimerad and others, 1999).

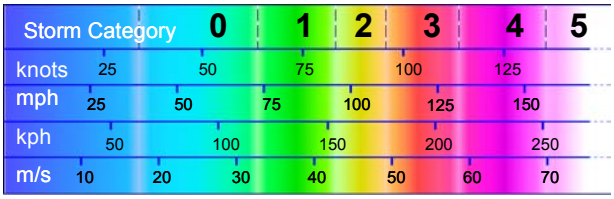
The social and economic effects from natural phenomena are a consequence of the social fragility of low-income countries. A disaster occurs when vulnerable people are impacted by a hazard event and suffer severe damage and/or disruption of their livelihood system in such a way that recovery is unlikely without external aid (Blaike and others, 1994). Vulnerability is a function of a group's socioeconomic condition; thus, the poor are more vulnerable than the rich.

The Dominican Republic is one of the countries in Latin America where vulnerability to natural phenomena has increased most over the past four decades. According to a methodology developed at the University of Colorado, vulnerability in the Dominican Republic has increased more than 30 times in that period. This measure of vulnerability represents both increasing physical vulnerability of structures and the accumulation of assets over the period. The same analysis estimates that if Hurricane David (1979) were to hit again, it would cause not US$150 million in damages, but US$4 billion in damages (Pielke and others, 2001). Figure 2.3 shows the hurricane hazard in the Dominican Republic, including wind speeds associated with a 50-year event, and the possible damage such an event could cause to the capital, Santo Domingo.

Figure 2.3. Hurricane Hazard in the Dominican Republic



Wind Speeds



Damage (percentage of total value of structures)

Source of damage	Wind speed 35 m/s	45 m/s	55 m/s
Wind	1	3	8
Water	3	6	10

Source: OAS, 1999a. Caribbean Disaster Mitigation Project, implemented by the OAS Unit of Sustainable Development and Environment for the USAID Office of Foreign Disaster Assistance and the Caribbean Regional Program.

The vulnerability of housing is of particular concern in the four case study countries. Although sources estimate that the vulnerability of structures in San Salvador has decreased since the 1986 earthquake, the four countries still have high levels of informal construction, a small fraction of which is estimated to adhere to disaster-resistant building codes. Even in the country with the most developed disaster system, Colombia, building codes formally did not exist until 1984. In regions where property rights are ill defined, risk of disputes has been a deterrent to investing in disaster-resistant structures.

In Bolivia, vulnerability of crops and crop revenues is also an important issue for small farmers who are subject to relatively frequent floods and landslides. The largest impact on the productive sectors in Bolivia comes from the potential effects of El Niño-related floods and droughts on agricultural exports. Table 2.1 shows assumptions of projected losses used in the modeling exercise for the four case countries. It is expected that in Bolivia, there would be direct losses to capital stock of at least US$200 million approximately every 20 years; more specifically, there is a 1-in-20 chance every year to have a catastrophic event equaling or exceeding US$200 million in losses. Likewise, there is a 1-in-50 chance, or 0.02 percent probability, every year of at least US$600 million in direct losses. Including indirect losses in production, tourism, or other services could double the magnitude of these figures.

Table 2.1. Projected Economic Loss Caused and Government Financing Needs in Response to a Disaster in the Case Study Countries

Country	20-year event	50-year event	100-year event
Projected loss			
Bolivia	200	600	1,000
Colombia	2,000	5,000	8,000
Dominican Republic	1,250	3,000	6,000
El Salvador	900	3,000	4,500
Financing needs			
Bolivia	100	300	500
Colombia	1,000	2,500	4,000
Dominican Republic	625	1,500	3,000
El Salvador	450	1,500	2,250

Note: Figures are in millions of U.S. dollars. The projected losses are assumptions made on the basis of available past information for the four case countries. Government liability and financing needs that correspond to half of the losses are assumed on the basis of the information available for El Salvador.

In the Dominican Republic, the vulnerability of the tourism sector is critical. Although most hotels and resorts are insured against hurricanes, the indirect impacts of a hurricane on the flow of tourists were identified as a serious concern. Tourism receipts currently exceed US$2 billion a year, contributing to more than 12 percent of gross domestic product (GDP).

El Salvador is most concerned about the potential impact of earthquakes on housing and the transportation sector. The quality of construction in San Salvador is estimated to have improved since the 1986 earthquake, but the construction in the rest of the country is said to be highly vulnerable to earthquakes. As for the transport sector, the Pan American highway crosses the length of the country, San Salvador's airport is one

of the largest in the region, and a new port is under construction that is planned to be the largest port on the Pacific Coast for the region. If any of these were affected, the entire region would feel the impacts of disrupted transport.
For purposes of calculating the resource gap, certain assumptions were made about the vulnerability of each case study country. (Note that these figures are ballpark estimates.) Combining the hazard and vulnerability estimates produces the estimates of disaster loss in the four countries given in table 2.1.

Risks Governments Assume

Once probabilistic estimates of loss are determined, it is essential to know the responsibility of the government for those losses. Two broad categories of government responsibility can be generally defined: risk arising from national government ownership of assets, and risk government assumes for others. In the first category is the probability of loss to government buildings, including schools and hospitals, and infrastructure, like roads, bridges, and airports. The second category focuses attention on risk that the government assumes for others. This generally includes the risk to homeowners, agriculture, local and provincial governments, and the poor. There are different policy implications in how the national government copes with risk from its ownership of assets and the role it plays in coping with risk that is created from decisions made by others. The policy issues associated with the latter risk are influenced by moral hazard: the likelihood that behavior is changed as a result of the government's assumption of risk.

Infrastructure

In all countries, the government is responsible for the reconstruction of real property that it owns after a natural disaster. The rebuilding of roads, bridges, hospitals, schools, airports, and office buildings must be borne by the national government. Three main issues distinguish the level of this risk between different countries: the extent to which the damaged assets are insured; the level of privatization of formerly government-owned assets; and the ownership of assets by municipal and provincial governments.

In all four countries surveyed, there is a mandatory requirement to purchase insurance for government-owned office buildings. In none of the countries was it possible to determine the level of insurance actually purchased, the premiums paid, or the expected reimbursement in times of disaster. As a general rule, the governments did not expect that insurance proceeds would provide significant financial resources after a disaster. In fact, no one agency in any of the countries knew what assets were actually insured. The insurance purchase decision was left to each ministry.

There are anecdotal references to insurance proceeds making a difference for the reconstruction of specific buildings. In El Salvador, the reconstruction of the main ministry offices is supported by insurance proceeds. There is discussion of extending the purchase of insurance for key infrastructure, primarily bridges and roads. The view is that significant benefit would have occurred if hospitals and schools were insured, but they were not. Similarly, a proposal to insure all roads and bridges has been made for Colombia, but was rejected as too costly. All national government office buildings in Bogota are insured, but the level of coverage for each building is left to the discretion of the relevant ministries. Bolivia requires all government office buildings be insured, but whether this requirement is complied with is unknown. In the Dominican Republic, it is also understood that all government buildings should be insured, but it is unlikely that it actually happens.

In most of the developing world, the government owns 95 percent of public infrastructure. One byproduct of privatization is the potential shifting of risk of post-disaster reconstruction from the government to private entities. In El Salvador, the privatization of major utilities made a large difference in reconstruction after the recent earthquakes. The privatized companies in electricity transmission and generation were responsible for their own reconstruction after the disaster. An additional component of the privatization process in El Salvador was that funds received from the privatization of government assets had been held in a reserve account of US$500 million. This account was tapped in the immediate post-disaster period to fund recovery efforts in the country. In the Dominican Republic, the main port is now privatized, and any potential losses should not be borne by the government.

In Bolivia and Colombia, the nature of privatization is more complicated. In these countries, privatization takes the form of granting concessions to private parties to operate assets still owned by the government. It is not clear who bears the cost of risk to those assets, but it seems that the risk remains with the government.

In all of the countries visited, there is a significant effort at decentralization. Responsibility for government functions is being shifted from the national government to regional and municipal governments. With the shifting of responsibility is also a movement of financial resources to those government entities. As a general rule, the national governments believe that the local government units should bear responsibility for the reconstruction of their assets after a disaster. In practice, the national government continues to assume some responsibility for local repairs and reconstruction. This was less the case in Colombia than the other countries. Bolivia is now trying to formalize responsibility at the local level for both maintenance and repair of key locally owned infrastructure, with a reduction in payments to the local government if it fails to meet its responsibilities. This process accompanies a detailed arrangement on revenue sharing between the central government and the units of local government. In neither El Salvador nor the Dominican Republic were the lines of national and local responsibility clearly drawn. It should be noted that all four countries have proposed or revised laws on natural disaster planning and risk management that may formalize the obligations between different units of government on post-disaster reconstruction.

As a general rule, the national government in all these countries bears the risk of reconstruction of government-owned assets. There have been efforts to reduce the risk borne by the national government through insurance, privatization, and devolution to local government units. While anecdotal evidence exists as to the success in particular cases of risk absorbed by these processes, no systematic understanding of the risk reduction consequences of these activities was determined. A major shortcoming in each country was the failure to quantify the natural disaster risk on a probabilistic basis. Without an appreciation of the risk at a national planning level, the effectiveness of tools to reduce that risk is not evaluated.

Agriculture

The responsibility of government for agricultural losses from natural disasters is perceived as being important for policymakers. Fluctuations in income, whether from catastrophic loss or other causes, create significant welfare issues for farmers and have important spillover effects for other rural households and businesses. As noted in Varangis, Skees, and Barnett (2002), "destroyed crops and livestock reduce employment opportunities, with serious implications for the landless rural poor in developing countries." Addressing farm risk through government intervention has a

long and complicated history. Across many developing countries, including those in Latin America, new initiatives are constantly being explored. In Mexico, the first use of government purchase of weather derivatives to absorb some risk to small farmers has been completed. Recently, the World Bank and the IDB announced a new program to help stabilize the incomes of coffee growers in Central America.

Of interest to this analysis is the drain on government resources to support the agricultural sector post-disaster. In this regard, there were different approaches in all the countries studied. In the Dominican Republic, government support of agriculture is done through a government sponsored agriculture bank that provides needed credit to farmers. After disasters, the government generally forgives those credits. There have been proposals for crop insurance that requires some government subsidy, but the proposals have not been seriously considered.

In El Salvador, the issue of loss of agricultural production from earthquakes is less critical than the collapse in coffee prices. In 2000, the coffee crop went unpicked because of poor prices for coffee. The 2001 earthquakes did nothing to improve the price of coffee, and it is likely that the crop for that year, even if it were not damaged, would have remained unpicked.

Bolivia does not have a government-supported agricultural bank. The export farmers in Bolivia are large, well capitalized enterprises. Other than the political pressure from the government to ask the private banks to reconfigure farmer credits after a disaster, the government does not seem to have a direct role assisting farmers. Bolivia is now discussing potential crop insurance programs.

Colombia is similar to Bolivia and El Salvador. A main export crop is coffee, which is experiencing severe pricing issues regardless of disaster. There is no formal program to help farmers after a disaster. Crop insurance exists in Colombia, particularly for bananas.

In all these countries, the main government concern is the spillover effect of lost employment for the poor after a disaster. This topic is discussed in the section on how the government copes with the needs of the poor.

Housing

The most interesting outcome of this study was how governments dealt with the loss of housing after a disaster. In none of the four countries is there a legally mandated obligation to rebuild destroyed housing after a disaster. Yet, in each of the four countries after their most recent disasters, the government undertook significant responsibility for housing reconstruction. In all four of the countries, the cost of housing reconstruction was among the most significant financial obligations for the government in its reconstruction efforts.

The vexing issue is the level of government obligation to reconstruct private housing in the event of future disasters. In Bolivia, Colombia and El Salvador, future disasters could cause substantially greater housing losses than the last disasters. In all three countries, major urban areas were not struck in the last incidents. If they were, housing losses would have been staggering. The assumption of responsibility for housing reconstruction in each case occurred after the disaster took place. Furthermore, the role the government would play in reconstruction was newly developed in the wake of the

disaster. The international community approved funding for the government housing reconstruction effort, and housing was rebuilt with borrowed funds.

The concern is the potential contingent liability of the government in future disasters for housing reconstruction as well as the moral hazard if the population perceives that a disaster is an opportunity to obtain new housing at government cost. This moral hazard has already manifested itself in two examples. In the Dominican Republic, there is concern that improvement of permanent housing by the poor is not undertaken because the government will only replace destroyed homes. As a result, mitigation efforts that may preserve a home after a disaster are not employed. It is better to have a new government home than to remain with a disaster-resistant existing house. In Bolivia, homeowners exposed to forest fires were burning their houses in order to receive a government rebuilt home.

The situation in these countries is reminiscent of the situation in Turkey prior to its devastating earthquakes in 1999. Turkey had a constitutional obligation to rebuild destroyed housing caused by natural causes. It was widely perceived that this obligation by the government created a disincentive for homeowners to properly protect their properties from potential loss. After the earthquake, the government changed the constitution, created a mandatory insurance program for homeowners, limited the government liability for reconstruction above the insured amount of each home, and created a funding mechanism to meet its future obligations. In effect, the government defined, limited, and funded its future obligation for housing reconstruction.

In all four countries, it is important that the responsibility for housing reconstruction be defined. In each country, expectations are now being created about the role of the government in rebuilding housing. These expectations are likely to become significant liabilities in the face of large disasters. Since the obligations are not legally defined, government officials did not seem concerned about the potential losses. In truth, the risk to the governments for housing damage may be the most significant risk they bear from natural hazard events. As such, it should be defined, limited, and funded.

Local and Provincial Governments

The interrelationship between the national government and local and provincial governments plays an important role in the risk assumed by the national government. In each country, there is a major effort to allocate some portion of reconstruction to other units of government. The requirement of the purchase of insurance also extends to them, but their compliance with these provisions is even less well known than it is for national government departments. At best, the role of the national government relative to damages to municipal or provincial assets is not well understood. How the national government will respond is a function of the size of the disaster, the political strength of the local government, and party allegiances. In theory, the losses at the local level are the responsibility of local governments in each country. This contrasts with the United States, where the national government is obligated by law to fund 75 percent of the losses in declared national emergencies of the state and local governments. In practice, the decision seems to be made on a case-by-case basis. In any event, there is little monitoring of the local risk at the national level.

The Poor

How each country handles the obligation of the government to provide income support and assistance to the poor in the wake of a natural disaster is a function of its existing

safety net arrangements. In the post-disaster period, there is an urgency to immediately respond to the needs of everyone. This response activity is handled by each country's civil defense agencies. The evaluation of that response capacity, which is undergoing significant changes in some of these countries, is beyond the scope of this analysis. The concern here is with the income support needed in the longer term after an event.

After a disaster, one major concern is the rebuilding of income-producing activity in the private sector. Depending on the size and nature of the disaster, it may take several months or years to restore economic activity to its pre-disaster levels. For the poor, it is mandatory that alternative sources of income be made available to them during this interim period. The most common means to provide that income is to engage them in paid work to support reconstruction; these are deemed public workfare programs.

In all four countries, efforts are made to provide work for the poor in the reconstruction process. The most complicated problems are those that arise in situations like El Salvador, where broader economic issues are blended with natural disasters. The destruction of coffee plantations by earthquakes makes little difference in markets where the coffee is not picked anyway. In this case, the obligation of the government to provide income support is broader than waiting for production to return.

Government Liability

Absent the availability of better data on the magnitude of government responsibilities, it has been decided, based on the experience in El Salvador after the 2001 earthquakes and the Dominican Republic after Hurricane Georges, to assume that governments are responsible for funding approximately half of direct losses.[6] Estimated government liabilities facing disaster risk are shown in table 2.1. These estimates primarily represent government liabilities for infrastructure reconstruction, but also include contributions to the reconstruction of private housing and the provision of programs for the poor.

Table 2.2. Expected Average Annual Loss Relative to Economic Indicators in the Case Study Countries (Percent unless otherwise noted)

Country	Pure premium (million US$)	Premium/ GDP	Premium/ government expenditures	Premium/IDB annual lending	Premium /ODA
Bolivia	10	0.12	0.4	11	2
Colombia	85	0.08	0.6	16	--[7]
Dominican Republic	54	0.34	1.8	54	23
El Salvador	48	0.40	2.2	34	19

Note: The expected average annual loss is a proxy for the pure premium. The pure premium figures are based on table 2.1 and assumed annual distribution of government liabilities covering 20 to 100 year events. The economic indicators reflect statistical data available for the case countries.

Table 2.2 presents the calculation of the pure premium for potential insurance on assumed government liabilities covering 20- to 100-year events. The pure premiums

[6] ECLAC estimates that the 2001 earthquakes in El Salvador were unique in that the public sector bore a relatively small fraction of the losses (34 percent of the total US$750 million). The Central Bank of the Dominican Republic estimated that the country was responsible for US$625 million of the US$1,250 million in direct losses suffered during Hurricane Georges.

[7] Colombia receives much less Official Development Assistance (ODA) than the other case study countries: US$41 million in 1998 relative to US$590 million received by Bolivia, US$240 million by the Dominican Republic and US$252 million received by El Salvador. Note that IDB loans do not count towards ODA.

represent the annualized expected loss due to all events that occur less frequently than once every 20 years, but at least as frequently as once every 100 years. The table reads, for example, that Bolivia has an annualized expected loss of US$10 million. This means that to cover its losses, Bolivia will need to put aside on average US$10 million a year.

As expected, although the pure premium in absolute terms is largest in Colombia, its impact relative to economic indicators is most significant in the Dominican Republic and El Salvador. In particular, the cost of disasters relative to government expenditures is three times as high in the Dominican Republic and almost four times as high in El Salvador as in Colombia.

For example, this premium is large relative to annual IDB lending in each country. In the case of the Dominican Republic and El Salvador, the premium is significant compared with annual receipts of Official Development Assistance (ODA).

Resource Gaps in Case Study Countries

Some governments cope relatively well with the disaster risks they assume; others experience serious difficulties in their ability to raise funds for reconstruction. Many countries in this latter category, like Honduras and Nicaragua, are still recovering from events that occurred several years ago because of their struggle to raise and disburse sufficient funds for reconstruction projects.

A resource gap is a shortfall in funds available for reconstruction that a government should expect to face following a natural disaster event. Being able to quickly access sufficient funds for reconstruction after a disaster is critical to a country's ability to recover with minimal long-term consequences. Countries with severe unmet resource gaps can fall significantly short of their development goals. Studies conducted by the International Institute for Applied Systems Analysis demonstrate that in Honduras and Nicaragua, resource gaps could stagnate future growth projections (Freeman and others, 2001).

A resource gap is calculated by comparing a government's need for reconstruction funds (given the risks of natural disasters) and its anticipated access to internal and external funds. Resource gaps are expressed as probabilities because the need for funds is defined as a function of the country's probabilistic disaster losses. The supply of funds is determined by such factors as international aid, the size and flexibility of national budgets, the depth of the domestic credit market, expected insurance payments, and the government's ability to reallocate existing loans and place new loans in the international markets. If an event with a given probability of occurrence creates a demand for reconstruction funds that exceeds the supply, a resource gap and its probability of occurrence is identified. The resource gap is based only on the potential availability of funds, and it does not take into account the cost of raising those funds. In other words, it is based entirely on the constraints a government may face in raising financial resources after a disaster.

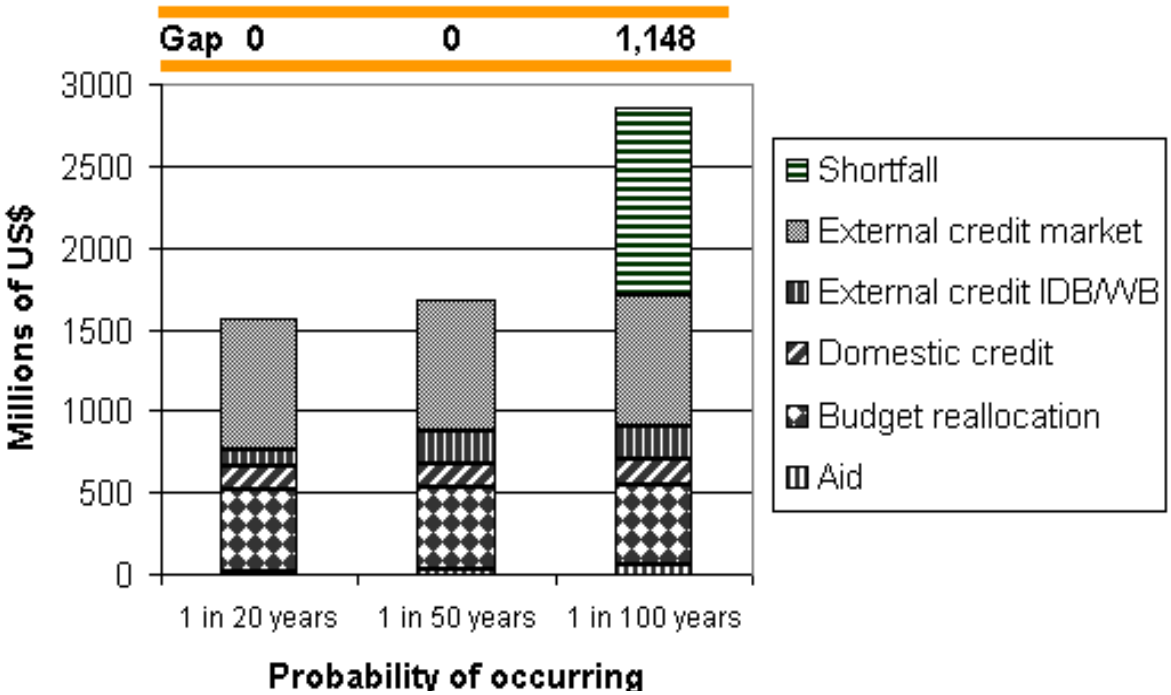
In analyzing potential resource gaps, interesting variations emerged among the four countries. According to this analysis, Bolivia can anticipate no resource gap over the range of 20, 50, and 100-year events. Bolivia is the poorest country in South America, but the level of hazard and therefore of risk is so low that it should have sufficient resources to respond, particularly thanks to its access to subsidized loans from the multilateral financial institutions. Colombia has a high level of natural disaster risk, but per

capita incomes are high and the risk is geographically diverse, so the government could expand its tax revenues in response to a catastrophic event. Depending on assumptions governing how much Colombia can raise, it could potentially have a resource gap associated with 1-in-100 year events. Alternatively, El Salvador and the Dominican Republic can anticipate resource gaps given their disaster risk. Both countries have a high vulnerability to large-scale natural events and limited financial resources. For each country, there is at least a 1-in-100 chance that they will suffer an event that outstrips their ability to raise post-disaster reconstruction funds.

Resource gap projections depend on a set of assumptions about the magnitude of risk in each country and the availability of funds from different sources. The following exercise demonstrates the importance of further research in measuring disaster risk in the four case study countries, the capacity of the Dominican Republic and El Salvador to take on additional external debt, the access of the Bolivian government to additional domestic credit, and the magnitude of potential tax increases in Colombia after a major catastrophe.

Figure 2.4 illustrates the resource gap calculated for the Dominican Republic. The vertical axis represents the maximum amount of funds available to the Dominican Republic's national government for reconstruction and any shortfall in funding. The resource gap is calculated at three separate points: after a 1-in-20 year event (like Hurricane Georges), after a 1-in-50 year event (like Hurricane David), and after a 1-in-100 year event (such as a Richter 7 earthquake affecting the northern coast). The 20- and 50-year events do not generate a resource gap, but the 100-year event does. The probabilities associated with the different events are associated with probabilities of different resource gaps, translating to a greater than 98 percent chance of no catastrophes or only small events that do not generate a resource gap, and a 1 percent chance of events creating a gap of more than US$1,148 million.

Figure 2.4. Resource Gap in the Dominican Republic



Note: Values represent the estimated financing available for reconstructing and the potential gap, as indicated under the assumptions of table 2.3.

The magnitude of the resource gaps is based on the discrepancy between the demand for funds and the potential supply of funds after an event. In the case of a 20-year event in the Dominican Republic, direct damages are estimated at US$1.25 billion and government liabilities at half that amount. A 20-year event does not create a resource gap for the government because a potential supply of more than US$1.5 billion in funds offsets the demand for US$625 million. These funds come from several sources: international aid, insurance payments, budget reallocations, new taxes, increases in domestic credit, and additional external commercial or IDB/World Bank credit. It is important to note that although the funds may be available, they are not free. A 20-year event would shift US$500 million in resources away from current projects and increase debt levels by US$83 million.

As the magnitude of the event increases, the amount of aid the country can expect to receive will increase, and there may be more willingness to reallocate from other internal and external sources. However, based on experience in the Dominican Republic, it is unlikely that these additional funds will be sufficient to cover the additional costs. For less frequent but much larger magnitude events, a resource gap appears.

Table 2.3 gives the details of estimates of the resource gap in the Dominican Republic. The first two rows represent the demand for funds from the catastrophe exposure estimate and the government's liability. The following rows represent estimates on the extent of (or constraints on) internal and external sources of ex post funding. This section describes the rationale and assumptions underlying the estimates of available ex post funding.

Table 2.3. Calculation of the Resource Gap for the Dominican Republic

Item	20-year	50-year	100-year
Direct Damages	1250	3,000	6,000
Government responsibility	625	1,500	3,000
Aid	11	26	52
Insurance payments	31	75	150
Budget reallocation	500	500	500
New taxes	0	0	0
Domestic credit	150	150	150
External credit IDB/WB	100	200	200
External credit market	800	800	800
Shortfall	None	None	1,148
Shortfall without IDB/WB	None	None	1,348
Additional debt	83	899	1,150

Note: Figures are in millions of U.S. dollars. The estimates for funding sources are assumptions based on historical data from previous disasters events. The results are used in this study to show how tradeoffs in policies could be understood, not to demonstrate the actual tradeoffs for the country.

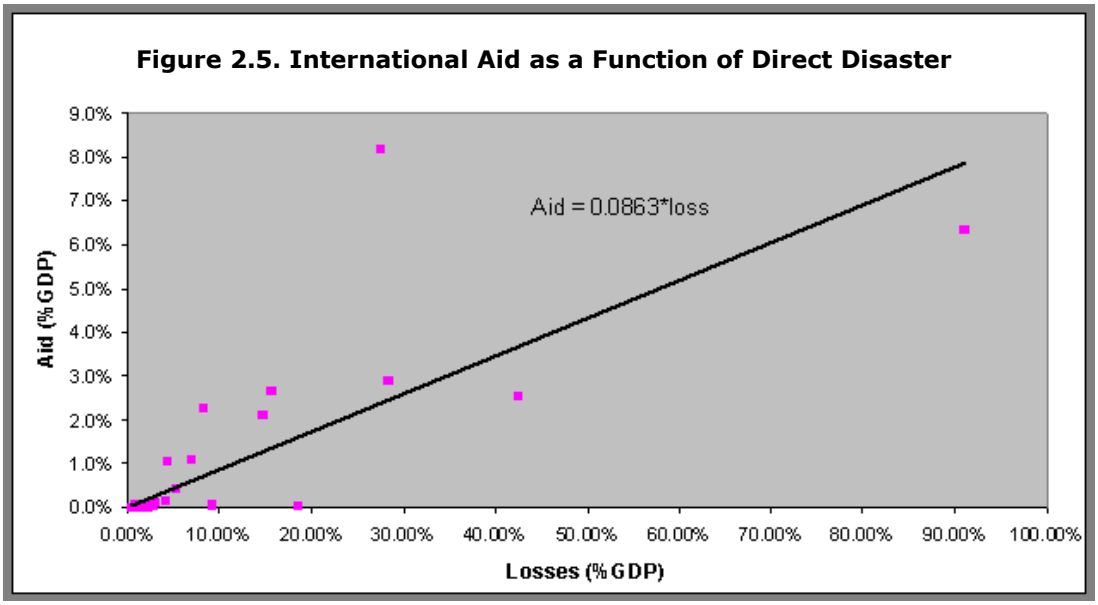
International Aid

Aid inflows from abroad after a disaster include private and public donations from private institutions, government agencies, and intergovernmental agencies in the form of

relief, technical assistance, grants, commodities, and money (Albala-Betrand, 1993). The amount of aid appears to depend on the nature and extent of the event, which influences the will of the donors to grant assistance. There is considerable uncertainty as regards the amount of aid available after a disaster.

There is little research on estimating how much aid a country can expect to receive after a natural disaster. Given the importance of aid in the recovery process, this lack of research is surprising. To estimate expected aid inflows, data were collected on historical events since 1960 resulting in economic losses of more than US$50 million and the

Figure 2.5. International Aid as a Function of Direct Disaster



Note: The regression sample is disasters since 1960 resulting in economic losses of more than US$50 million and the corresponding amounts of aid received for 16 countries in Latin America.

corresponding amounts of aid received. Sixteen Latin American countries were included in the database.[8] Figure 2.5 shows the results of a regression analysis to ascertain any statistical relationship between economic losses and aid inflows, as measured as a percentage of GDP.

The regression indicates that on average 8.6 percent of direct disaster losses can be expected to be covered by international assistance, with the exception of one outlier, with a range of events from as little as 6 percent, to one event that received as much as 25 percent.[9]

It is important to note that most aid received after a natural catastrophe is aid in kind, that is, food, blankets, shelters, and the use of trucks and helicopters for emergency response. It is estimated that on average only 5-10 percent of all international donations received come in the form of cash. In El Salvador, for example, after the recent earthquakes, the country received US$500 million in donations from abroad, US$25

[8] Loss data come from: Central American Natural Disasters Preparedness Center (CEPREDENAC); Munich Re; and the OAS. Assistance data were obtained through the OAS. For events during the 1960s and 1970s, the data source is Albala-Betrand (1993). For the Dominican Republic in 1998: IMF, IDB, European Union, International Bank for Reconstruction and Development, United Nations, and the U.S. Agency for International Development. For El Salvador in 2001: IMF and World Bank staff assessment for bonds; ECLAC-Mexico for loans and donations.

[9] The coefficient of correlation for this regression was at 0.55 after eliminating outliers.

million of which was in cash. Colombia and Bolivia reported similar experiences. Therefore, the analysis assumes that only 10 percent of the total aid received comes in the form of cash that contributes to relieving the government's need for reconstruction funds. For the purpose of calculating the resource gap for the case study countries, the estimated aid received in cash is given in table 2.4.

Insurance Payments

Generally speaking, insurance plays a minor role in providing reconstruction funding in the countries after a disaster. Only 3 percent of the losses from disasters in Latin America are covered by insurance, and this coverage is generally for large industrial customers (Swiss Reinsurance Company, 1997). There is, however, some anecdotal evidence on catastrophic insurance coverage. In Colombia, reinsurers paid US$200 million in claims after the recent earthquakes in Armenia. The hotel and industrial sectors in the Dominican Republic received US$500 million in reinsurance payments after Hurricane Georges. After the 2001 earthquakes, local insurance companies in El Salvador received US$350 million in reinsurance payouts. However, most of these payments went to the private sector.

Few government assets appear to be insured in the case study countries. In those cases where there is a legal requirement for public insurance, there is incomplete information concerning the extent to which each government ministry's assets are actually insured. For this analysis, it is somewhat arbitrarily assumed that five percent of each country's infrastructure is insured. These assumptions lead to the estimated insurance payments shown in table 2.4.

Table 2.4. Estimates of Aid Received in Cash and Insurance Payments

Country	20-year event	50-year event	100-year event
Aid in cash			
Bolivia	2	5	9
Colombia	17	43	69
Dominican Republic	11	26	52
El Salvador	8	26	39
Insurance			
Bolivia	5	15	25
Colombia	50	125	200
Dominican Republic	31	75	150
El Salvador	23	75	113

Note: Figures are in millions of US dollars. The aid estimates are based in historical data while it is assumed that five percent of each country's infrastructure is insured.

Budget Reallocation

The amount a government can divert from current budgets is constrained by the inflexibility of operational overhead, salaries, debt service, and pro-poor expenditures. During the country visits, personnel in the budget and planning offices estimated that a maximum of 5-10 percent of current expenditures could be redirected in the case of a natural disaster.

Budget reallocation is facilitated by loan reallocation from the multilateral financial institutions. This reallocation is currently one of the primary sources of short-term liquidity for Bolivia, Colombia, the Dominican Republic, and El Salvador. For example, immediately following the 2001 earthquakes, in one day El Salvador approved US$600 million in financing from pending loans and then later obtained additional credits to replenish the diverted funds.

One approach to estimating potential budget diversions is to identify discretionary and nondiscretionary items in the national budget. This accounting-based methodology can provide a rough indication of the upper limit of the fiscal resources that can be rerouted to reconstruction spending. Table 2.5 can be used to establish upper limits on budget reallocation by assuming that a large percentage of capital expenditures can be used for reconstruction (assume 50 percent), along with a smaller percentage of wages and

Table 2.5. National Budgets by Category, 1999 (Percent unless otherwise noted)

Category	Bolivia	Colombia	Dominican Republic	El Salvador
Total expenditure (million US$)	**1,869**	**15,476**	**3,368**	**2,256**
Total expenditure	**100.0**	**100.0**	**100.0**	**100.0**
Current expenditure	**84.8**	**83.1**	**77.4**	**85.8**
Of which pro-poor expenditure	37.3	40.2	28.2	33.3
Education	20.5	12.9	9.5	8.6
Health	0.0	25.7	9.5	12.9
Pensions	16.8	1.6	9.2	11.8
Wages and salaries	22.2	11.0	35.9	38.2
Debt service	25.3	32.0	13.2	14.3
Capital expenditure	**15.2**	**16.9**	**22.6**	**14.2**
10% from wages and salaries and 50% of capital expenditures	**9.8**	**9.5**	**14.9**	**10.9**
10% from wages and salaries and 50% of capital expenditures (million US$)	**183**	**1,476**	**502**	**246**

Source: Country interviews by the authors.

salaries (assume 10 percent). These estimates yield a reallocation of 10-15 percent of total expenditures. Corresponding figures have been used for the four countries in this study. In reality, the ability to access these funds will increase with the magnitude of the event and sense of social solidarity felt after the event.

The cost of reallocating or diverting funds from other government budget items should be measured in terms of the foregone returns/benefits of budgeted projects and services. For the purposes of this analysis, it is assumed that government investments in infrastructure bring an annual return of 16 percent (World Bank, 1994). There may, in addition, be high political costs of diversion due to disruptions in government planning and negotiations between the ministries over where to obtain the funds; such political costs are not taken into account in this model.

In reallocating budgetary funds, it is important to keep the sources of those funds in mind. Loan reallocation is currently one of the primary sources of short-term liquidity for Bolivia, Colombia, the Dominican Republic, and El Salvador.

Increasing Budget Revenues

Imposing additional taxes is always problematic, even more so after a major catastrophe when the economy may be in a recession or low-growth situation. Although a new tax has costs in foregone returns for the citizens of the country, the costs to the government are administrative and political. Taxes on financial transactions have severe impacts on the financial sector in terms of repression and moving savings overseas. El Salvador and Colombia have experience in increasing the tax burden after a natural disaster, but this is not the case in Bolivia and the Dominican Republic. In El Salvador after the 2001 earthquakes, the government increased its revenues by reducing the number and extent of previous tax exemptions and improving tax collection. Reconstruction after the 1999 earthquakes in Colombia's coffee-growing area was primarily financed by the creation of a new tax a few months prior (the *dos por mil*) that initially taxed 0.2 percent of all financial transactions and now taxes 0.3 percent. This tax, which was not originally intended for disaster relief and reconstruction, generated US$900 million annually in revenues.

This analysis assumes that Bolivia and the Dominican Republic are unable to raise additional tax revenues after an event, whereas El Salvador and Colombia would be able to increases revenues by 5, 10, and 15 percent after 20-, 50-, and 100-year events, respectively.

Expanding Domestic Credit

Borrowing domestically also has associated costs and constraints. Domestic borrowing, if at all possible, may compress domestic consumption, particularly in shallow credit markets. This may result in a rise in the interest rate and a crowding out of domestic investment.

Domestic credit can be obtained from commercial banks or, in all the case study countries except Colombia, from the central bank. However, in El Salvador and the Dominican Republic, central bank borrowing is constitutionally legal only in the case of natural disasters. The sale of government bonds to the central bank is potentially inflationary if money growth is not in proportion to real GDP growth. Using the foreign exchange reserves of the central bank carries the risk of provoking a balance-of-payments crisis due to the lack of needed reserves for imports. The risks and costs of these options make them problematic; the World Bank and International Monetary Fund (IMF) have strongly recommended against their use.[10]

A country's ability to increase domestic credit is constrained by both the government's ability to repay and the depth of the domestic capital markets. In Bolivia, domestic credit is scarce. Yet due to the low growth and inflation rates associated with the current recession, the government has in recent years borrowed close to US$200 million

[10] In an assessment of financing options following the 2001 El Salvador earthquakes, the World Bank/IMF team stated: "Under any monetary system, a country needs to maintain a strong underlying fiscal position and a sound credit policy, with an adequate cushion of net international reserves, to preserve macroeconomic stability. Expanding the money supply or reducing the central bank's net international reserves is never optional sources of financing for reconstruction costs."

from the central bank. Sources disagree over whether the central bank will be a viable alternative for funding reconstruction in the future.

In Colombia, domestic credit is also considered extremely scarce and capital markets shallow (IDB, 2000a). In 1998, Colombia experienced a severe commodity price shock as world market prices for oil and coffee fell. External financing became very expensive, and the Colombian government turned to the domestic market resulting in the already high real interest rates rising to 20 percent, depressing economic activity (World Bank, 2002). No extra domestic credit is assumed for Colombia.

In the Dominican Republic, investor confidence in domestic government bonds is low because bond interest payments in the past were delayed. To tap domestic sources after a disaster, the central bank can legally force commercial banks to loan funds to the government. After Hurricane Georges, the government obtained US$150 million in this way. Sources estimate that another such credit could be obtained in the future.

As domestic debt tends to be short-term, high interest rates will be charged on all government debt and the cost of repayment will go up. Domestic interest rates are already high in the case study countries. In El Salvador, it is estimated that there is no additional domestic market as investors invest directly in external markets.

Based on these assumptions, estimates of additional domestic credit available (or constraints on this credit) after a catastrophic event would be US$100 million in Bolivia, US$150 million in the Dominican Republic, and none in Colombia or El Salvador.

Accessing Additional External Credit

Accessing additional external credit increases future debt service obligations and reduces a country's ability to take on additional debt. Constraints for external credit come from the demand side as well as the supply side. Demand is restricted by external debt sustainability. The Highly Indebted Poor Countries Initiative (HIPC) assesses on a regular basis the debt sustainability for developing countries. The main indicator used in the HIPC is the ratio of the net present value of debt to exports. A ratio of less than 150 percent is generally regarded as a sustainable value for this indicator. Another important indicator is the debt service/exports ratio for which a value above 20 percent signals a problematic debt situation. For the case study countries, indicators for 2001 are given in table 2.6.

Table 2.6. Estimates of Additional Domestic Credit Available (Percent)

Country	Debt service/ exports	Net present value of debt/exports
Bolivia	13	133
Colombia	48	222
Dominican Republic	10	74
El Salvador	8	98

Sources: IMF/WB (2001a, 2001b); IDB (2002a, 2002b).

According to the HIPC metric, in 2001 Bolivia, the Dominican Republic, and El Salvador had sustainable levels of debt, whereas Colombia's debt had reached unsustainable levels. Table 2.6 also shows that Bolivia, after qualifying for significant debt relief in 2001, is now under the ceiling of 150 percent (IMF and World Bank, 2001b). For the Domini-

can Republic, external indebtedness is less severe and also projected to stay roughly constant. This is also the case for El Salvador, despite additional financing needs after the earthquakes of 2001. This analysis assumes that extra borrowing is allowed only to the extent that these two indicators remain below critical levels. The more binding indicator is generally the net present value of debt to exports. For Colombia, no extra borrowing is assumed to be feasible due to the critical debt situation.

On the supply side, multilateral financial institutions offer loans at more generous terms than borrowing at market conditions. Whereas the supply of international loans is potentially unconstrained for the purposes of reconstruction financing, the availability of loans from multilateral financial institutions is limited by the willingness of the donor community to grant subsidized credit. Eligibility for highly concessional loans, that is, loans offered at better than market rates, is determined by per capita income. The World Bank offers highly concessional loans to the poorest low-income countries with a per capita income of less than US$885 in 2000. Countries with higher incomes have to borrow on significantly less favorable terms.

All case study countries are classified as lower-middle-income countries (World Bank, 2001a). However, Bolivia has the lowest per capita income (US$980 in 2001), and the World Bank defines it as a blend country, that is, it is eligible for concessional conditions: 0.75 percent interest rate, 35-year maturity, and a 10-year grace period.

For El Salvador, the conditions outlined in the IMF and World Bank (2001a) assessment of the 2001 earthquakes were used: 7.5 percent interest rate, 20-year maturity, and 5-year grace period. These conditions were also assumed to hold for Colombia and the Dominican Republic.

Capital market conditions for issuing bonds are contingent on sovereign ratings from agencies such as Moody's. The lower the rating, the higher the risk premium and total interest on bonds will be. According to this rating, domestic Colombian bonds and El Salvadoran domestic and international bonds are still in the investment grade category, whereas the others fall below this rating. The ratings imply a risk premium or spread on top of the risk-free benchmark interest rate of 30-year U.S. treasury bonds, which, as of March 11, 2002, was at 5.7 percent. Bolivia, as part of the HIPC agreements, has renounced its ability to take out additional debt at commercial rates.

The final estimates of additional external credit available to the case study countries indicates that all of them have credit available through the IDB and the World Bank of up to US$200 million, while only the Dominican Republic and El Salvador have additional market credit of up to US$800 million.

Summary of the Resource Gap for the Four Case Study Countries

It is useful to compare the estimates on the upper limits and constraints on the sources of financing to the demand for financing derived from the earlier disaster risk estimates and analysis of the government's liabilities. This generates estimates of the potential resource gap for each of the four case study countries. Note that the resource gap does not take into account the costs of the financing sources, but rather the upper bounds or constraints on the availability of these sources. The estimates of the resource gap for the four case study countries are presented in table 2.7. Caution should be exercised, however, in the interpretation of the results since they are based, in the absence of exact information, on many assumptions.

Table 2.7. Calculated Resources Gap for the Four Case Study Countries

Item	20-year event				50-year event				100-year event			
	Bolivia	Colombia	Dom. Rep	El Salvador	Bolivia	Colombia	Dom. Rep	El Salvador	Bolivia	Colombia	Dom. Rep	El Salvador
Direct Damage	200	2,000	1,250	900	600	5,000	3,000	3,000	1,000	8,000	6,000	4,500
Government responsibility	100	1,000	625	450	300	2,500	1,500	1,500	500	4,000	3,000	2,250
Aid	2	17	11	8	5	43	26	26	9	69	52	39
Insurance payments	5	50	31	23	15	125	75	75	25	200	150	113
Budget reallocation	250	1,500	500	250	250	1,500	500	250	250	1,500	500	250
New taxes	0	500	0	90	0	1,000	0	180	0	1,500	0	270
Domestic credit	100	0	150	0	100	0	150	0	100	0	150	0
External credit IDB/WB	100	100		100	200	200	200	200	200	200	200	200
External credit market	0	0		800	0	0	800	800	0	0	800	800
Resource gap	None	None	None	None	None	None	None	None	None	531	1,148	579
Resource gap w/o IDB/WB	None	None	None	None	None	None	None	169	116	731	1,348	779
Additional debt	0	0	83	80	30	0	899	969	216	200	1,150	1,000

Note: Figures are in millions of US dollars. The numbers are based on data in tables 2.1 – 2.6 and suppositions explained in the text. They are used in this study to show how tradeoffs in policies could be understood, not to demonstrate the actual tradeoffs for each country.

It appears that low hazard and access to World Bank and IMF loans protects Bolivia from shortfalls in reconstruction financing. It is important, however, to note that without access to World Bank and IMF loans, there is an estimated 1-in-100 chance annually of a shortfall of over US$100 million due to natural disaster risk.

In the case of Colombia, there is an estimated resource gap associated with 100-year events. This shortfall is not as dramatic as calculated for El Salvador and the Dominican Republic because of a certain demonstrated ability of Colombia to raise taxes. Under these assumptions, Colombia could raise more than US$2 billion after a major disaster, instead of the estimated 15 percent increase of US$1.5 billion, the resource gap for Colombia would disappear.

In the case of El Salvador, however, the resource gap shown for 100-year events is less likely to be filled. The magnitude of this gap depends primarily on the assumption about additional credit the country could access in external markets. The current assumption sets external credit limits at an additional US$1 billion. Only if El Salvador could raise more than an additional US$579 million could it, too, avoid a resource gap at least 99 percent of the time. If El Salvador has less access to credit markets than estimated, it would not only face a resource gap for 100-year events, but also for 50-year events. If El Salvador could not tap into US$169 million in World Bank and IMF loans after a 50-year event, it would have a higher annual probability of experiencing a resource gap (table 2.7).

Financing Reconstruction

This section reviews the specific policies used by each of the four countries to finance post-disaster reconstruction. Two comments about this review deserve mention. First, all of these countries are in the process of dramatically changing their national strategies to cope with natural disasters. In the Dominican Republic, the national assembly has been considering new legislation. The country is redirecting its civil defense operations. El Salvador has recently passed new legislation and is in the process of reorganizing its internal government structure for coping with disasters (2003). Bolivia has also just passed new legislation, and is in the process of designing regulations to implement the new proposed structure. During the time of the country visit, the new legislation had not yet been officially published. Finally, Colombia has modified its long-standing legislation and is also now reorganizing its administrative structure. While all these changes are important for each country, and considerable data were collected on the new realignments of responsibility, the purpose of this study is to examine how reconstruction is financed. Often, that decision is outside the expertise of the newly reorganized or recently created agencies in each country.

Second, the technical details about existing financing strategies formed the basis for much of the work done in calculating the resource gap for each country. The discussion of the variables used to determine the resource gap included much of the information gleaned from the country visit. Those assumptions will not be repeated here. Rather, this section highlights some of the important findings from the country visits.

Current Government Strategies for Financing Reconstruction

Reliance on Loan Diversions

All of the studied countries depend heavily on loan diversions for post-disaster financing. Most recently, El Salvador reoriented US$300 million in existing loans, including a

US$75 million IDB loan that had been approved but not ratified. It was ratified in the hours following the first 2001 earthquake and was immediately used. In addition to redirecting loans from international financial institutions, deferral of commercial credits also played a role. The Dominican Republic received a one-year moratorium on its debt service payments from the Paris Club after Hurricane Georges.

Role of the Central Bank

The central bank plays a critical role in some of the selected countries in providing immediate liquidity. Bolivia and the Dominican Republic rely on short-term loans from their central banks to fund immediate post-disaster assistance. Neither Colombia nor El Salvador is permitted to borrow from the central bank.

Budget Reallocation

Bolivia, Colombia, and El Salvador have all experienced significant difficulties in reallocating current budgets to finance reconstruction projects. Sources in El Salvador commented on how fortunate they were that the 2001 earthquakes occurred at the beginning of the fiscal year, when there was still some flexibility in the national budget. Some flexibility also exists within individual ministries. INVIAS, the Colombian agency responsible for road construction and maintenance, reallocates its annual budget between maintenance and post-disaster reconstruction every year.

The Dominican Republic has a highly flexible budget. Pursuant to Section 1402 of the Constitution, the Dominican Republic allocates 25 percent of all discretionary budget funds allotted to the president. This generally amounts to 12.5 percent of total government expenditures each year. These funds are kept in an accumulating fund for emergencies. In practice, this provides a discretionary fund for the office of the president that is often used to meet immediate needs after a disaster. Outside this special fund, there is little discretionary spending in the national budget.

Increasing Taxes

Bolivia, the Dominican Republic, and El Salvador are limited in their ability to raise revenues through tax increases. Typical sources of additional revenues are reductions in tax exemptions (as seen in El Salvador after the recent earthquakes) and mandatory employee contributions (as seen in the Dominican Republic after Hurricane Georges).

The use of increased tax revenue to fund reconstruction has historically been used in Colombia. Colombians have relatively higher per capita incomes, and the disaster risk in Colombia is geographically diversified across the entire country, so there is little risk that major production centers would all be affected simultaneously. Combined with a strong feeling of social solidarity, Colombians have effectively found tax revenue sources to fund post-disaster reconstruction. It was the feeling of the finance ministry that it would be able to access additional taxes in the event of future emergencies.

International Aid

International aid is important for all the countries in the immediate post-disaster period. Generally, this aid is directed at relief efforts, not reconstruction. Most of the relief aid is gifts in kind: food, machinery, volunteer services, clothing, and the like. The cash portion of the aid is less than 10 percent of the face value of contributed aid. El Salvador had specific figures related to the cash and noncash portions of the aid. In

discussions with the other countries, they confirmed the cash portion of their aid. Overall, international aid makes up a small fraction of the funds needed for reconstruction work.

External Debt

El Salvador and the Dominican Republic both use external commercial debt to provide additional needed financial resources. For both countries, the majority of reconstruction in recent years has been financed by issuing bonds in external commercial markets. The Dominican Republic recently borrowed US$500 million in the commercial market. El Salvador has one of the lowest debt ratios in Latin America, and its sovereign bonds have been investment grade since 1997. Its government took on US$700 million in new loans to finance reconstruction after the 2001 earthquakes. Bolivia is limited from accessing new commercial external debt by its arrangements with the international financial community as a component of its debt relief package. Colombia has relatively high levels of current debt.

Insurance Proceeds and Reserve Funds

There is current experience with both insurance and reserve funds as a source of financing in all of the countries. They all require some level of insurance on government-owned property. Both the Dominican Republic and El Salvador have seen substantial increases in the use of insurance for disaster risk. Last year in both countries, premium revenue from property and liability insurance increased by more than 10 percent. Bolivia has seen a dramatic increase in premium revenue, but this is primarily associated with a new mandatory automobile program. In all the countries, the major industrial enterprises are insured against natural hazard risk.

There is some experience in the region with reserve funds. Colombia has a reserve fund at the national level designed explicitly for coping with natural disasters. The fund was established in 1984 after the Popayán earthquake, and its annual funding has been subject to political will. At the end of the 1980s and the beginning of the 1990s, it was an average of US$5 million a year, but at the time of the 1999 earthquake it was exhausted. Municipal governments across Colombia also keep reserve funds. There unfortunately is limited information sharing about which cities have reserve funds and how much is contained in each one. One source estimates that the reserve funds held in Bogotá and Medellín are each larger than the one the national system maintains centrally.

El Salvador has an account consisting of the proceeds received by the government from the privatization of telecommunication assets. The rules governing disbursement from this fund are vaguely defined, but are primarily intended for road maintenance. After the recent earthquakes, US$100 million of an initial fund of US$500 million was used for reconstruction.

Bolivia has passed legislation to set up a natural disaster reserve fund. The goal of the fund is to guarantee that Bolivia has sufficient resources to meet the contribution needed to access borrowing from the international financial institutions. The initial US$10 million is being provided from unused funds held at the housing ministry. This ministry played a critical role in designing the fund. It is hoped that annual funding will amount to US$8 million.

Inherent Tradeoffs in Ex Ante Risk Management Strategies

An alternative set of tools can be used to manage disaster risk: ex ante risk management tools. As noted by their name, these tools are operative before an event occurs. They are directed at either reducing the risk (mitigation and risk prevention) or guaranteeing resources for funding losses if a hazardous event happens (insurance). Tools addressed at providing financial resources after an event are generally termed risk-financing instruments.

By their very nature, ex ante risk management tools are complicated. The benefit of these tools lies in an understanding of probability; they are valuable for planning against an unknown future. These instruments require monies to be spent today to reduce the consequences of an unknown, but probably certain, future event. If the future event does not occur, the value of the money spent to protect against the event looks lost. Even worse, the perceived benefit of spending the funds on another project whose benefit is immediately apparent is also lost. To use ex ante risk management tools, a policymaker must bridge the psychological gap of weighing the cost of current expenditure against future unknown but predictable consequences. This is often a hard gap to cross.

At the country level, the tradeoff is usually framed as a being between growth (a result of more money being spent now) and stability (a guarantee of funds to pay for future losses). The tradeoff between stability and growth can be seen in the growth trajectories in figures 2.6 and 2.7, which show various computer runs of alternative simulated GDP growth paths based on projected levels of growth for El Salvador. The growth trajectories account for the likelihood of natural hazard losses. Figure 2.6 represents a simulation of growth trajectories over a 10-year period generated by sampling from El Salvador's disaster risk distribution with frequencies proportional to the probability of given disaster events occurring. Figure 2.7 is the same simulation with one change: the government decides to purchase insurance against disaster losses.

The purchase of insurance slightly lowers the average growth rate trajectory from 2.53 to 2.38 percent, and the median trajectory from 2.66 to 2.40 percent, because the funds spent on insurance cannot be spent on other growth encouraging activities. Insurance reduces the number and magnitude of worst-case scenarios by guaranteeing funds to rebuild. Without insurance, economic growth rates range from a maximum of 2.99 to a low of 1.11 percent; with insurance, the highest possible 10-year return is 2.55, but returns are guaranteed to never drop below 1.85 percent. In essence, maximum growth is reduced by 0.44 percentage points, but minimum growth is guaranteed to be at least 0.75 percentage points higher. This illustrates the tradeoff inherent in an insurance purchase: a reduction in funds spent on current growth permits a government to protect itself against extreme future losses. This is a common, well-known feature of insurance. Applying the model to the other case study countries generates similar results.

Figure 2.6. Projected Annual Economic Growth for El Salvador without Insurance

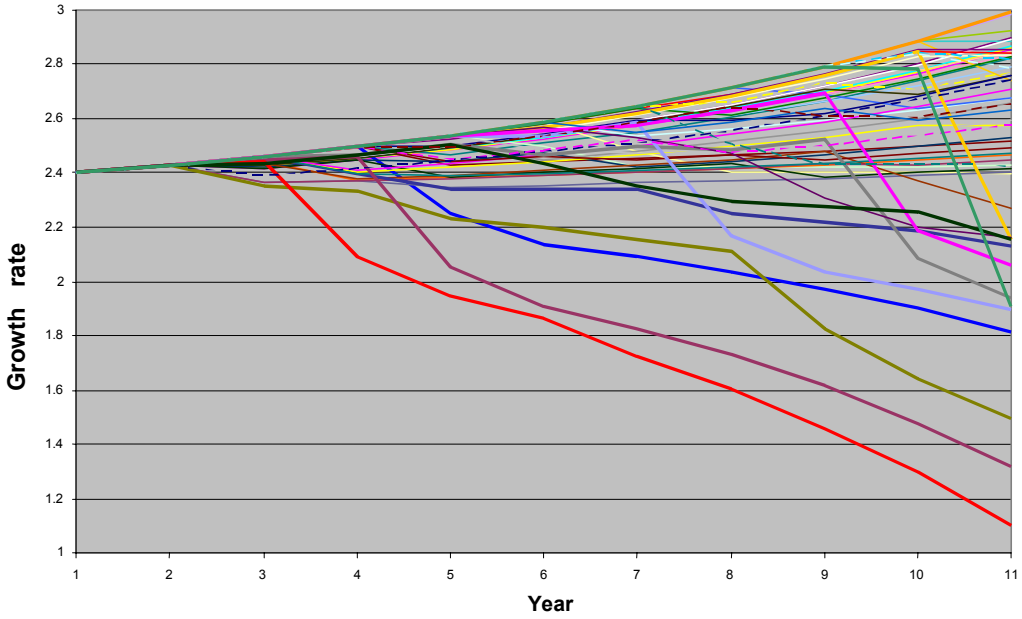
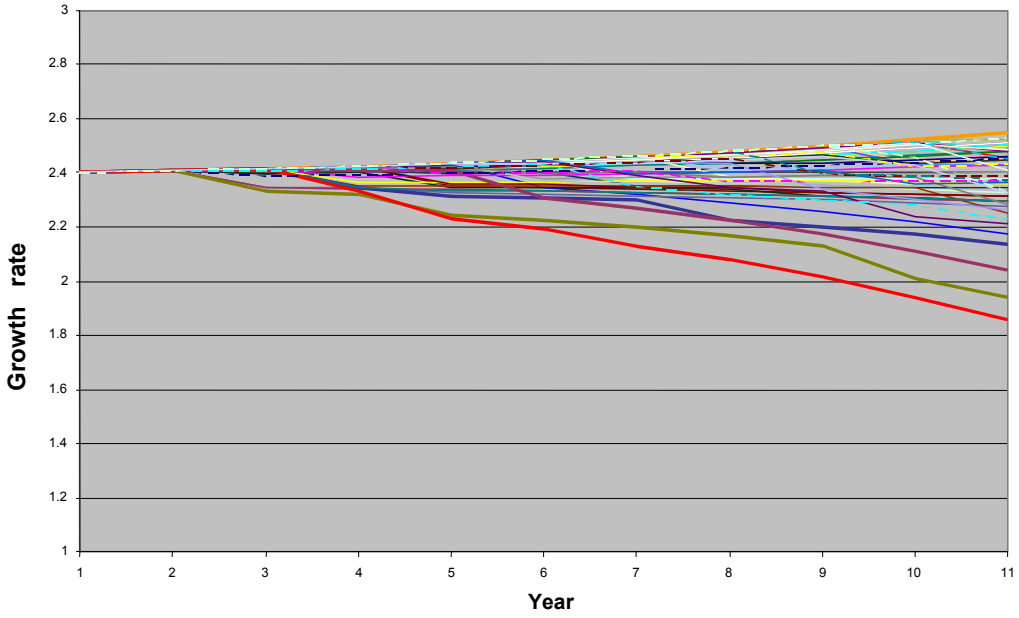


Figure 2.7. Projected Annual Economic Growth for El Salvador with Insurance



Costs and Benefits of Different Ex Ante Tools

A range of ex ante tools can provide security against resource gaps. All the tools involve an opportunity cost of resources foregone in the current period for the benefit of guaranteed future resources. The exact costs and benefits are specific to each tool. Table 2.8 compares the costs and benefits of three tools: reserve funds, insurance, and contingent credit.

Table 2.8. Costs and Benefits of Ex Ante Financing Tools

Cost, benefit	*Reserve fund*	*Insurance*	Contingent credit
Cost before event	Contribution x number of years before event	Premium x number of years before event	Holding fee x number of years before event
Benefit after event	Only reserved funds and interest available	All funds available for covered losses	All needed funds available
Cost after event	None	None	Additional debt service and reduced ability to take out future debt

Reserve funds involve setting aside funds in highly liquid accounts held either domestically or abroad. In theory, the annual contribution to that fund should be equal to the annual expected loss based on the risk the fund is designed to cover. The cost of these funds is primarily the opportunity cost of not investing the funds elsewhere. Highly liquid accounts offer only a 5-6 percent rate of return compared with the 16 percent rate of return frequently attributed to investment in development projects.

Annual insurance premiums are also based on annual expected losses for the risk in question, but they include additional administrative, capital, and uncertainty costs. In the case of disaster risk in a developing country, insurance premiums can be twice the cost of the annual expected loss. In contrast to reserve funds, however, insurance arrangements guarantee the entirety of the covered risk regardless of how long the policy has been in place. With reserve funds, it can take many years to build up sufficient reserves.

Contingent credit agreements are similar to insurance policies in that they also guarantee access to sufficient funds immediately post-event. These credit arrangements, however, do not transfer the risk but simply postpone and spread it. The cost of a contingent credit arrangement is very low before an event: a holding fee may cost only 0.5 percent of the amount guaranteed, but the amount disbursed will need to be repaid with interest in the years following the event.

Mitigation is a fourth ex ante instrument but is not presented in Table 2.8. In its most recent World Disaster Report, the Red Cross indicates that investments of US$40 billion in disaster preparedness, prevention, and mitigation would have reduced global economic losses in the 1990s by US$280 billion (IFRC, 2001). It is very difficult, however, to calculate the benefits of mitigation on a countrywide basis. Currently, the benefits of mitigation are generally demonstrated on a project-by-project basis.

In evaluating other ex ante tools, in addition to the immediate cost and benefits of each tool, it is useful to consider the extent to which each tool provides incentives for

investment in mitigation. Insurance could provide these incentives directly through reduced premiums.

The pros and cons of the different ex ante instruments can be highlighted with a numerical example. In the case of El Salvador, say that after evaluating the growth/stability tradeoff, the government decides it is willing to deal in an ex post manner with all events that require less than US$1.5 billion of government funds, that is, with all events that on average are expected to return more frequently than once every 50 years. In addition, say that the government is indifferent to all events that occur on average less frequently than once every 100 years, that is, to all the very rare events that would cost it more than US$2.2 billion in reconstruction. The government decides to use an ex ante tool to cover the US$700 million in funds that it would need to avoid a resource gap over that range of events.

Table 2.9 gives the pros and cons of the different ex ante tools in covering that risk for El Salvador.[11] The tables shows that reserve funds cost the least but also provide the least guaranteed benefit: a reserve fund alone will only provide as much benefit as an insurance or contingent credit arrangement if it is able to accumulate for 22 years before the first large event occurs.[12] In comparing a contingent credit agreement with insurance, table 2.9 shows that the relative cost depends on when the event occurs and how future payments are discounted relative to current ones. If the event does not occur at all, or occurs in the distant future, contingent credit will be considerably more cost-efficient. If the event occurs in the near future, the 20 years of loan repayments will cost significantly more than insurance payments that are calculated by averaging costs over a much longer time horizon.

Table 2.9. Example of Costs and Benefits of Ex Ante Tools for El Salvador

Cost, benefit	Reserve fund	Insurance	Contingent credit
Cost before event	US$19 million x number of years before event	US$38 million x number of years before event	US$3.5 million x number of years before event
Benefit after event	US$19 million x number of years before event + 5 percent interest compounded over that period	US$700 million available immediately	US$700 million available immediately
Cost after event	None	None	US$56 million a year for 20 years after the event in debt service payments

Note: The numbers are based on the assumptions explained in the text.

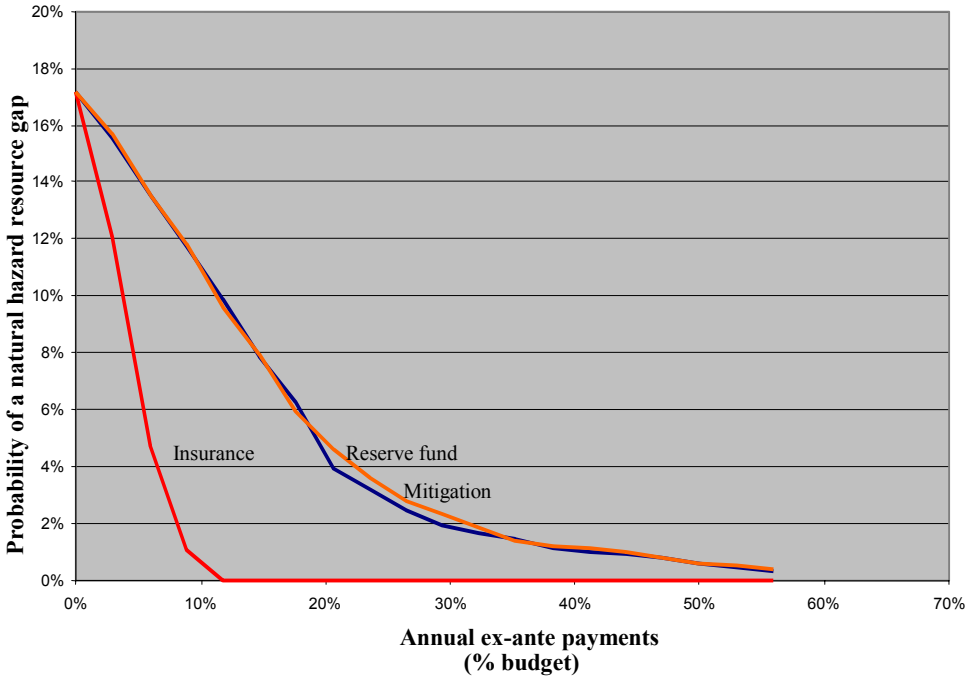
To compare and contrast the ex ante instruments, a two-stage decision model was developed. Among others, the modeling presents the tradeoff between the probability of having a resource gap and the cost of the tools to avoid those gaps. It generates cost-efficient strategies for reducing the probability of a resource gap.

[11] The government faces expected liabilities of US$48 million annually from its exposure to 20 to 100-year disaster events. Of that figure, the expected loss for all 50 to 100-year events is approximately US$19 million. The debt service payments for the contingent credit agreement are based on 5 percent interest and a five-year grace period.

[12] Accumulated funds in year n are $19 * \Sigma (1 + (1+i) + (1+i)^2 + \ldots + (1+i)^n)$.

Figure 2.8 represents the cost of reducing the probability of a resource gap for each tool, based on data from the Dominican Republic. The figure shows that insurance most drastically reduces the probability of a resource gap: investing 12 percent of the annual budget fully eliminates any such danger. A reserve fund also reduces the probability of a resource gap, but only in the long run. It takes time to build up sufficient funds in a reserve account to guarantee that the resource gap for a 100-year risk is eliminated. Investments in mitigation could be considered similar from a financing point of view. However, it is not really comparable, because mitigation measures reduce the damages and thus the losses. The amount of up-front investment in reserve funds required to guarantee covering the potential losses in the short run is inordinately high: 10 percent of the budget invested in insurance provides the same loss reduction as 50 percent of the budget invested in reserve funds.

Figure 2.8. Cost of Reduced Probability of a Resource Gap for the Dominican Republic



The results from the modeling example presented above for the Dominican Republic also hold true for El Salvador. Since both Colombia and Bolivia have small or no resource gaps, there is no need to examine modeling for them looking solely at the resource gap.

Another important observation from tables 2.8 and 2.9 is the impact of contingent credit on reducing the amount of future credit available. As noted in table 2.7, the reduction of the resource gap required a significant increase in debt levels in Bolivia, the Dominican Republic, and El Salvador. It may be that it is prudent policy for countries to also reduce their dependence on borrowing as the primary tool to generate needed post-disaster financing resources. Insurance and sufficiently large reserve funds reduce the dependency of countries on ex post borrowing to finance reconstruction and preserve their buffer of potential future credits for other eventualities.

Ex Ante Financing Instruments in Practice

Reserve Funds

There are many differences among the ex ante options and, in particular, issues that arise with their implementation.

A number of countries have been exploring the use of reserve funds as a means to provide post-disaster funding. The best-known fund is FONDEN in Mexico. This fund is an annual budgetary allocation for natural disaster expenditures. It does not accumulate from year to year (Kreimer and others, 1999). There is a new fiscal stabilization fund in Peru, but no record exists as to its effectiveness (World Bank, 2001c). There is no reserve fund currently in use that is set aside solely for natural disasters. As demonstrated in the modeling, reserve funds alone do not appear as the most cost effective way of reducing the resource gap. The problem is that the time frame involved in accumulating a sufficient fund is so long that the fund will not effectively protect against large events that occur in the first years of accumulation.

In the case study countries, the topic of reserve funds was often mentioned. In many countries, the budgetary process does not allow the accumulation of reserve funds between periods. Bolivia is exploring a new model for establishing a reserve fund. It plans on making annual expenditures to a fund held outside the country and monitored by an international financial institution. The issue with disaster reserve funds is similar to the problems surrounding reserve funds established for pensions or other purposes. It may be that a disaster reserve fund lacks a natural political constituency to protect it as it accumulates.

Contingent Credit

Contingent credit agreements offer, for a small annual fee, the option to borrow a given amount immediately at a previously determined interest rate. To measure the benefits of contingent credit arrangements, would require estimating the cost of having to wait several months after a disaster to reorient funds from existing projects and acquire new loans, versus having the funds on hand in a matter of days.

Relative to the other ex ante options, these credit arrangements require a smaller fee paid up front, but they increase the debt burden after an event. Low interest ex post borrowing would be more attractive than contingent credit agreements if it were quickly available after an event. If expedient ex post event loans and rates were guaranteed to a country through some other mechanism, there would be no value in paying the fee for a formal contingency credit agreement. On the other hand, if available loans or associated rates were subject to deteriorating terms after an event, or to a lengthy process of negotiation and processing, then the holding fee may be worthwhile. The case study countries did not experience any deterioration of their terms of credit after recent disasters.

Insurance

The modeling results here show insurance as a cost-effective option for reducing the probability of a resource gap and protecting countries from worsening their debt position after disaster events. Insurance also could provide current-period incentives for investment in physical mitigation through risk-adjusted premiums. The best example of the use of private insurance as a viable means of reducing societal risk comes from the

mutual insurance companies, founded in early nineteenth century New England, that covered factories (Bainbridge, 1952). These mutual companies offered factories protection against potentially large losses from fire in return for a small premium. In order to reduce risk, the mutuals required inspection of a factory both prior to issuing a policy and after one was in force. Customers who were regarded as poor risks had their policies canceled; factories that instituted loss prevention measures received premium reductions.

As the mutual companies gained experience with fire risks, they set up research departments to determine what factors caused fires and how to reduce losses by concentrating on those factors. For example, the Boston Manufacturers' Mutual Company worked with lantern manufacturers to encourage them to develop safer designs, and required policyholders to purchase lanterns only from companies whose products met their specifications. Manufacturers' Mutual hired researchers to find ways to reduce the risk of fire, for example, by developing nonflammable lubricating oils. It then shared these findings with key trade associations, and distributed educational pamphlets on preventing fires to textile mill owners.

In many cases, mutual companies would only offer insurance to companies that adopted specific loss prevention methods. For example, Spinners Mutual only insured factories that installed automatic sprinkler systems. Manufacturers' Mutual in Providence, Rhode Island, developed specifications for fire hoses and advised mills to buy only from companies whose hoses met those specifications. By researching and requiring loss prevention techniques and inspecting facilities before issuing or renewing a policy, nineteenth century insurers were able to reduce losses dramatically and provide coverage against risks for which there had previously been no protection.

In these ways, insurance companies provide incentives for mitigation. Insuring national infrastructure would provide the contractual obligation to maintain the structures and disincentives for placing new structures in high-risk areas. Bringing the cost of disaster risk into the current period also provides political impetus to allocate monies from the current budget funds for mitigation and prevention works.

The benefits of insurance naturally raise issues regarding the status of insurance in Latin America. Since the beginning of the decade, Latin America has gone through a significant transformation in its insurance markets. As Swiss Reinsurance Company (2000) notes, "growth was three times as high as in the industrialized countries." Economic reforms at the beginning of the 1990s created new business opportunities across the board for both domestic and foreign insurance companies. From 1990 to 1998, premium incomes in the nonlife sector increased on average by 4.6 percent annually in real terms in the region's six largest countries (Swiss Reinsurance Company, 2000). In 2000, nonlife insurance premiums increased in the region by another 4.6 percent to US$27.1 billion. Increasing premium rates, especially for natural hazards, contributed to this growth. Both the Dominican Republic and El Salvador showed double-digit growth in their premiums. Colombia increased premiums by 4.7 percent in 2000 (Swiss Reinsurance Company, 2001). The premium volume for Bolivia was too low to be separately captured in worldwide surveys, but according to the insurance department, a dramatic increase in premiums occurred in 2000 due to a new mandatory automobile insurance program.

While this growth is impressive in the region, it is based on a small, beginning insurance market. By all measures, the insurance penetration in Latin America is small. Even among emerging markets, the countries in this study all ranked among those with the

lowest penetration. On average, less than US$50 per capita is spent on insurance and insurance purchases constitute less than 1 percent of GDP. Latin America constitutes less than 3 percent of the worldwide market for nonlife insurance premiums (Swiss Re-insurance Company, 2001).

Why is insurance not more prevalent? Insurance requires a complex series of laws, regulations, and administrative agencies. The requirements to operate an effective regulatory and supervisory scheme are complex. In addition to the regulatory issues, there are issues related to the fundamental structure of the market for insurance. For example, many countries may be too small to provide adequate risk diversification to properly support a national insurance scheme. Proposals to create regional insurance markets hope to increase risk diversification and potential market size, thereby making the market more attractive for the insurance industry and lowering the cost of insurance. A larger potential market subject to a uniform regulatory scheme may encourage the international insurance industry to help develop viable markets. Regional proposals, like the World Bank initiative for a Central American insurance market, are based on overcoming impediments to the supply of insurance.

Additional limitations to insurance relate to broader market cycles. The availability of insurance for natural hazard risk in developing countries is dependant on a series of factors that impact the world insurance market. The events of September 11, 2001 have influenced the availability and cost of all insurance for catastrophes, natural or manmade, worldwide.

Professional risk bearers, like insurance companies, are fully capable of modifying their products to adapt to local needs. However, there will be little willingness on their part to do so if no demand exists for the modified products. Some countries make insurance in certain sectors mandatory. For example, Turkey adopted this strategy by requiring homeowners to insure themselves. Another approach to stimulate the insurance market is to demonstrate the benefits of insurance by taking out policies at the government level, for example by insuring government-owned buildings and infrastructure. To some extent, this has been the approach taken by the four studied countries.

Despite the limitations of markets in developing countries, the modeling would indicate that policies directed at increasing the efficiency of insurance markets in the developing world could yield large dividends.

Other Risk Transfer Instruments

A new strategy for dealing with risk shifting of disaster loss has developed since 1996: catastrophe hedges. These instruments bring the same benefits as insurance, but they are set up in a way that brings risk directly to the capital market, bypassing the traditional path of insurance. Since the cost of catastrophe insurance is dominated by capacity limitations, and the capital markets lack a capacity constraint, pricing theoretically should be competitive for these products in the long term (Doherty, 1997; Pollner, 2000).

Considerable interest has developed regarding the use of derivatives as replacements or complements to catastrophe insurance. The strategy in developing these derivatives is to create a financial instrument that is negatively correlated (has a negative covariance value) with both the risk of a portfolio of stocks or bonds and the risk of loss from a catastrophic event. By creating a derivative with a return negatively correlated with a portfolio of stocks, the ownership of the derivative is attractive to a stock portfolio

owner. The correlation matrix between catastrophe risk and other financial assets may be as low as –0.13 (Hodgson, 1997). In addition, these derivatives can act like insurance. Their payment is based on some measure of realized catastrophe risk. As a result, these hedges should be of interest to both portfolio investors and the owners of catastrophe risk.

The new capital market hedges for catastrophe risk are varied in how they attempt to hedge risk. In essence, the hedges vary on two primary variables: whether they are issued as equity or debt, and whether they pay based on indemnifying losses or on the occurrence of a specified physical event.

The proceeds from an equity hedge need not be repaid. The owner of the hedge would book the proceeds from the hedge as an asset. A debt hedge would require that the proceeds received by the owner of the hedge must be repaid. The proceeds from the hedge would be booked as a liability, to be repaid over some predetermined future period. A contingent surplus would be a debt hedge.

Insurance is an indemnity instrument, which is designed to reimburse incurred damages. For example, fire insurance will reimburse homeowners for fire damages subject to the deductible and limits of the policy. If a homeowner has a fire, but no damage is caused, the homeowner is not entitled to any reimbursement because there is no damage to be indemnified.

An event hedge pays if a specified physical event occurs, regardless of whether damages are suffered. For example, weather derivatives based on the number of cold days in winter pay the owner of the derivative solely based on the number of cold days, regardless of the damages incurred by the owner of the derivative. Table 2.10 delineates these hedges.

Table 2.10. Overview of Noninsurance Catastrophe Hedge Instruments

Basis for loss payments	Type of instrument	
	Equity	**Debt**
Indemnity	Catastrophe bonds	Contingent surplus notes
Event	Exchange traded	Catastrophe equity puts
	Catastrophe options	
	Weather derivatives	Catastrophe swaps

The new capital market instruments on the market fall into six broad categories:

- *Catastrophe bonds*. These are "Acts of God" bonds that pay investors high yields, but are subject to default if a defined catastrophe occurs during the life of the bond. The investor appeal comes from a high yield with a low probability of default. Funds obtained from the sale of these bonds are normally invested in risk-free instruments, and the interest earned reduces the net cost of the bond to the issuer.
- *Contingent surplus notes*. These notes are essentially "put" rights that allow the owner of the note to issue debt to prespecified buyers in the event of a catastrophic event. The owner of the note pays a fee to the potential debt buyers for their commitment to buy the debt.
- *Exchange-traded catastrophe options*. The property claims service options that trade on the Chicago Board of Trade provide for the purchaser of the option to demand

payment under an option contract if the claims index surpasses a prespecified level. The indexes used cover different areas of the United States and reflect aggregate reported claims by the insurance industry.

- *Catastrophe equity puts*. Equity puts are another form of an option that permits the insurer to sell equity shares on demand after a major disaster. The insurer pays a fee for the put option. These instruments are similar to contingent surplus notes.
- *Weather derivatives*. Weather derivatives are contracts that provide payouts in the event a specified number of days occurring with temperatures or rainfall above or below a specified trigger point.
- *Catastrophe swaps*. These derivatives use capital market players as counterparties. An insurance portfolio with potential payment liability is swapped for a security and its associated cash flow payment obligations. An insurer takes on the obligation to pay an investor periodic payments on a specified portfolio of securities that the investor was originally liable to pay, while the investor assumes the liability of the insurer to make payments in the event of a catastrophe.

The range of instruments is both diverse and growing (Pollner, 2000). Since 1996, nearly US$4 billion in catastrophe hedges have been placed in the capital markets. The most significant limitation to using noninsurance hedges, however, is their cost. Securities markets are notoriously complex, and the tools they develop are often expensive for single transactions (Chichilnisky and Heal, 1997). Their high transaction costs currently make "Acts of God" bonds much more expensive than insurance. By some estimates, they are twice as expensive (Swiss Reinsurance Company, 1999). For this reason, their application may be limited to large transactions that may exceed the capacity of the insurance market to provide protection. It is estimated that insurance is still more than 95 percent of the market for catastrophe risk shifting (Swiss Reinsurance Company, 1997).

Mitigation

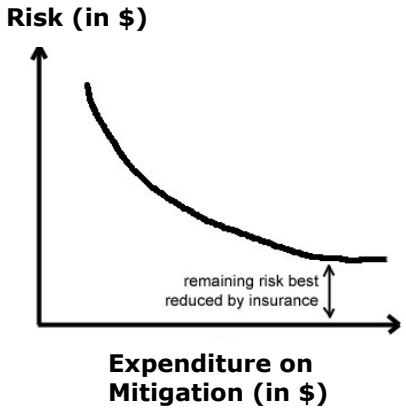
Initial investments in physical mitigation can significantly and cost-effectively reduce vulnerability of a construction project to natural phenomena. After basic precautions are taken, however, considerably larger expenditures may be required to achieve additional reductions in risk. As shown in figure 2.9, at some point it may be more cost effective to transfer the remaining risk or find alternative ways to finance it than to attempt to mitigate it away. For example, constructing a new structure to code is relatively cheap, whereas constructing the perfect structure to resist all shocks is inordinately expensive. It is therefore difficult to estimate on a national level the aggregate benefits of physical mitigation without knowing where that mitigation will be applied.

For the purpose of this modeling, it is assumed that the first dollars invested in physical mitigation have a large impact, reducing losses by four to five or more times the amount invested in mitigation. After these initial investments have been made, additional investments have a decreasing marginal benefit. As a result, investment in physical mitigation is beneficial only up to a point. The value of this point depends entirely on the curve chosen to describe decreasing returns to mitigation. Afterward there is a residual risk that mitigation does not efficiently cover.

The analysis also shows that physical mitigation takes a longer time to close the resource gap than does insurance. On the other hand, there are some significant benefits to mitigation not captured in the modeling. If mitigation is integrated as a component of a project, the marginal cost for each project may be small. The cumulative effect of including mitigation as a piece of each new project may be considerably less expensive

than investing in physical mitigation on a countrywide basis for existing structures. And various risk prevention measures, like land-use planning and building codes, may be inexpensive to implement and may substantially reduce long-term risk.

Figure 2.9. Decreasing Marginal Returns to Investment in Physical Mitigation



Policy Recommendations

In making policy recommendations based on this research, a warning needs to be emphasized. The models contained herein are not intended to dictate policy decisions. Rather, the models are tools in a methodology for exploring alternative policy options, describing the working assumptions and data used in arriving at the results highlighted, but not the level of detail required to make effective final policy recommendations. Considerably more attention to the structure of the models and the required data will be needed to frame policy decisions.

Another critical factor in the modeling is that it is based on the assumption that the high levels of post-disaster support currently provided to the case study countries will continue at existing levels. Both the international aid and international finance communities have expressed considerable concern about their ability to sustain their current level of funding. The models assume that funding will be available in the same proportional amount relative to disasters as has been the case to date. If this assumption were wrong, it would dramatically impact the results of this analysis, particularly for the most vulnerable countries.

The analysis of the cases suggests that small countries with historically high incidence of natural disasters may face the possibility of significant shortfalls in their ability to finance post-disaster reconstruction. This is the situation in the Dominican Republic and El Salvador, cases analyzed in this study. For large countries with more modest or diversified disaster risk, the study suggests a greater ability to absorb losses from disasters. This has been the case for Bolivia, which also has had sufficient resources to respond, thanks to traditional access to low interest loans from multilateral institutions. On the other hand, in the similarly geographically diverse but more populous and relatively high per capita income country of Colombia, the government has been able to expand tax revenues to cover disaster losses. But for any country, changes in their vulnerability (increasing urbanization in disaster prone areas, for example) or economic situation should compel a reexamination of past financial solutions to finance potential future disaster losses.

Keeping the above precautions in mind, a number of policy recommendations can be made:

- Governments should analyze the risk of natural hazard events. The modeling techniques for measuring risk exist and most countries have the necessary data to evaluate hazard exposure and vulnerability. What is lacking is the time and resources to integrate the known information, thus limiting the ability of the government to plan for disasters, instead of only responding to them of course, modeling is expensive and obtaining detail is very time consuming. At a minimum, working estimates of potential losses should be developed. The modeling should be done at the national, regional, and municipal levels for all essential infrastructure and buildings. Schools, hospitals, bridges, and roads are all examples of assets for which models can be developed.
- Governments should guarantee the institutional capacity to avoid rebuilding exposure after a disaster occurs. Land-use planning, building codes, and proper reconstruction standards should be developed before disaster occurs. Reconstruction after a disaster should provide the opportunity to implement the proper risk reduction policies.
- Each government needs to create a clear inventory of risks for which it is responsible. If the government is responsible for housing reconstruction, this should be made clear and the obligation budgeted. If the government does not assume responsibility for some private sector risk, it should examine strategies to assist the private sector to assume that risk on its own behalf.
- Multilateral financial institutions and their client countries should look at the options imbedded in existing loans to convert to reconstruction financing at the time of a disaster. The terms of the conversion should be openly discussed in advance, and not be left to a decision process made in the immediate post-disaster period. In this way, issues of loss prevention and mitigation can receive the policy hearing often missing in the crisis atmosphere of the immediate post-disaster period.
- Governments should evaluate their current strategies to purchase insurance against natural disaster risk. Insurance purchases should be part of an integrated risk management strategy. The governments need to understand the different ways public entities may purchase insurance, and explore the means to make such purchases more efficient. Considerable savings or substantial increases in insurance protection could be accomplished in each country if it systematically reviewed its insurance purchasing activities.

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