

Strategies and Financial Instruments
for Disaster Risk Management
in Latin America and the Caribbean

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Foreword

Natural hazards continue to have an impact on the development of Latin America and the Caribbean. Human and economic losses remain high and there is a continued need to design strategies that reduce risk and minimize sovereign losses as well as those experienced by the Inter-American Development Bank. The implementation of well-designed risk management strategies can reduce future damages. The appropriate use of financial tools can conduce to the attainment of the region's development objectives in spite of the occurrence of natural hazards.

Although disasters have a simultaneous impact on many different persons and institutions, it is often uneven. The various parties face varying pre-disaster risks and bear different post-disaster losses. In evaluating disaster risk management strategies, this paper draws together asymmetries in both pre-disaster planning and post-disaster recovery. The authors analyze various financial tools available to reduce or finance disaster risk. They also examine underlying incentives affecting the implementation and effectiveness of financial instruments.

This document is part of a set of papers produced by the Environment and the Infrastructure and Financial Markets Divisions of the Sustainable Development Department. These papers originally stem from a request of the Quebec Hemispheric Summit in 2001, which asked the IDB to analyze the applicability of various instruments for reducing disasters in Latin America and the Caribbean. However, they also serve as background for revising the Bank's Disaster Policy, whose aim is to safeguard lives and advance progressive social and economic development in Latin America and the Caribbean. The Bank's vision of sustainable growth for the region requires that careful attention be paid to the topic of disaster risk management.

The unique nature of disaster risk means that much work is needed to model and analyze best practices both on the national and local levels. We hope that this document will make a useful contribution to the field.

Janine Ferretti
Chief
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Executive Summary

This paper investigates potential avenues for reducing economic losses resulting from natural hazards, and discusses *ex ante* and *ex post* issues affecting disaster risk management. It also assesses how both types of measures can be jointly used to reduce the economic impact of disasters on sovereign governments and the IDB. The authors argue in favor of a balanced risk management strategy, which utilizes both *ex ante* and *ex post* measures to manage different risk layers. Effective reduction of disaster risk can be aided by a risk management policy that appropriately identifies at-risk parties, the level of risk, and the available responses. The bulk of the paper treats these topics in the context of the institutional and incentive issues that may affect their implementation.

Natural hazards are occurring with increasing frequency throughout Latin America and the Caribbean and have a great impact on the social, economic and institutional foundations of the afflicted countries. Estimated regional losses from disasters occurring between 1975 and 2002 approximated US\$92 billion, or an annual average of around US\$3.4 billion. IDB disaster-related loan activities since 1995 were roughly US\$475 million per year and amounted to only a fraction of the annual regional losses.

The IDB and the international community will continue to offer post-disaster aid to the extent possible. Yet, pure disaster response with increased IDB (and other external) assistance is not a viable long-term strategy for the region. The IDB is fundamentally a development organization, not a disaster relief entity. The emphasis must be on reducing losses and managing risk. This is a central task that both the IDB and client countries must embrace.

Essential to developing a risk management strategy is identifying the various layers of disaster risk, who bears each level of risk, and the possible risk transfer instruments available to each layer. National governments typically bear risk at the upper layers, or higher risk levels. These typically

represent low-probability disasters, which may cause large losses. Where the government and private sector each bear risk, governments look to public assets and citizen welfare, while the private sector largely manages its own assets. In cases where the IDB provides *ex post* funding with resources transferred from existing loans, or where disasters damage IDB-funded projects, the IDB's development mission is placed at risk. This paper focuses on opportunities and instruments for risk transfer, particularly at the higher layers of risk. The proposed risk management framework would utilize financial instruments to enable the government to transfer risk as potential losses begin to exceed its ability to cover them.

Lower layers of risk, resulting from disasters that have relatively low impacts, but which often take place repeatedly, can be proactively addressed using prevention and mitigation measures. Structural mitigation involves physical investments to reduce possible damages from disasters, while nonstructural measures refer to regulating human activities in disaster-prone areas. In either case, effective mitigation must be seen as an investment rather than a cost and should be incorporated into project designs. In addition, such measures are more effective if they fund first the actions with the highest rates of return. Good mitigation planning can serve to reduce risk, but even the best plans will still leave a residual exposure.

Currently, disaster loss financing is achieved through various *ex ante* measures (such as reserve funds, contingent credit and insurance schemes) and *ex post* measures (such as external borrowing and loan conversions). These instruments presently serve to address the lower layers of risk. Higher layers of disaster risk can be managed using securities provided by international capital markets. Two such security-based instruments are catastrophe bonds and weather derivatives, both of which have a potential for wider use.

There are also political and institutional issues involved in managing disaster risk. Several factors

contribute to how disaster funds are allocated: disaster preparation competes not only for political attention, but also for necessary funding. Experience from Latin America and the Caribbean shows that even if funds are available, justifying large mitigation investments may be difficult if a disaster has not occurred in recent memory. In addition, during times of budget shortfall, political pressure may be exerted to release funds earmarked for disaster management and preparation. Variation in government structures from centralized to decentralized control of resources affects greatly disaster risk management. The best results are obtained when a sizeable amount of disaster risk management is delegated to the local level, particularly for mitigation activities.

As disaster losses in Latin America and the Caribbean continue to rise, the IDB's direct and indirect exposure will also increase. In the past, the Bank has been fortunate to avoid substantial losses due to disasters. As such, it has a unique opportunity to implement proactive financial strategies to protect itself and its borrowers. To date, an overdependence on *ex post* strategies may have incurred unnecessary opportunity costs and affected the Bank's development mission in the region.

To this end, this paper proposes a balanced risk management strategy, both for the borrowing member countries and the IDB, which includes specific components to address different layers of risk. The foundation component is a combination of disaster prevention and mitigation measures that serve to reduce risk exposure. Subsequent loss financing layers can be covered with existing domestic resources. Higher layers may be covered using financial instruments, allowing governments and the private sector to interact directly with international capital and insurance markets.

The IDB is uniquely positioned to serve as a catalyst for a needed shift from a reactive to a proactive risk management approach in the region. It can do so by (i) contributing to the improvement of country risk management strategies and programs, (ii) strengthening its internal capacities and organization to facilitate risk management, and (iii) evaluating existing financing instruments and possibly introducing new IDB instruments. If successfully implemented, a balanced risk management approach will reduce the threat that disasters pose to the Bank's mission.

Introduction

The United Nations declared the 1990s as the International Decade for Natural Hazard Reduction. While initiatives such as these did much to heighten international awareness of the link between disasters and development, there is continued room for innovative strategies to reduce economic losses from disasters. In absolute amounts, the average annual loss inflicted by disasters in Latin American and the Caribbean is estimated at US\$3.4 billion for 1975-2002 (IDB, 2003a).¹ In contrast, IDB disaster-related loans in recent years have averaged slightly less than US\$500 million (IDB, 2003a).

Losses appear to be exhibiting an upward trend both in the region and the world (Chervariat, 2000). This is due to the interaction of several factors, including: (i) the location of geophysical phenomena in Latin America and the Caribbean; (ii) increased population growth and human activity in disaster-prone areas; (iii) a low use of mitigation and preventive measures; (iv) regional underdevelopment, which limits government resources available to meet disaster costs; and (v) environmental degradation and unsustainable land use policies. Even with concessionary loans and generous aid from the international community, post-disaster losses may disrupt economic growth and development programs. In many cases, disaster damage strikes the poor doubly hard: first, with the direct losses due to the disaster, and secondly, by potentially disrupting development and social programs.

Continued losses underscore the need for a long-term risk management approach to finance post-disaster losses. Moreover, evidence suggests that natural hazards can have a negative effect on poverty and economic performance at a level comparable to or greater than that of financial crises (Datt and Hoozeeven, 2003). To minimize future economic damages from disasters incurred by

both clients and the IDB, this paper proposes a three-pronged strategy:

- Identify who bears the disaster risk in the different risk layers.
- Develop a balanced risk management approach comprised of mitigation investment and *ex ante* and *ex post* funding mechanisms.
- Review and apply available individual financial risk management instruments.

Under prevalent risk management practices in Latin America and the Caribbean, the afflicted nations bear a large portion of the disaster risk themselves. This is due to a large use of *ex post* financing strategies that do not transfer risk. While recognizing the necessary and practical role of *ex post* financing arrangements, the IDB and its borrowing member countries should allocate increased resources to an *ex ante* strategy that combines mitigation investments and pre-established financial protection. A transition away from over-reliance on *ex post* financing will allow afflicted nations to reduce risk through mitigation and to transfer risk by using financial instruments. Financial instruments can play a useful role in disaster risk management. However, they alone do not constitute a risk management strategy.

A balanced risk management approach can reduce risk and disaster losses borne by IDB client governments. Identifying risk exposure and tolerance is essential for devising viable national strategies. Although the fiscal benefits of risk management are more clearly seen in the case of low-risk, high impact disasters, they can also be extended to high-risk, low loss events. Finally, while the discussion here centers on economic damages, human vulnerability to disasters and the continued loss of life must also be effectively addressed through prevention and mitigation techniques.

¹ Amounts in 2002 US dollars.

Current Losses and Opportunities for Action

This section reviews the economic impact of disasters and identifies risk layers and risk bearers. The chapters that follow discuss mitigation investments and provide an overview of common loss financing techniques as well as their benefits and limitations. The subsequent chapter describes potential applications for newer loss financing instruments. A discussion of the political and institutional issues related to risk management follows. Finally, IDB risk management options are reviewed and the paper closes with a summary of proposed Bank action steps.

programs (Pantoja, 2002). The adverse economic impact of disasters may also threaten the Bank's mission (IDB, 2003a).²

To address the impact of disasters, the IDB allocated nearly US\$4 billion to prevention/mitigation and disaster-related response loans between 1995 and 2002 (table 2).

Further IDB calculations (IDB, 2003a) indicate that the share spent on loans directed to emergency response and reconstruction outnumbers

Table 1: Total Losses Due to Natural Disasters (1975 – 2002, in nominal amounts)

	Total Loss (US\$ bn)	Total Loss per capita in 2001	Highest Annual Loss (US\$ bn)	Average Annual Loss (US\$ bn)
Caribbean	7.07	322	2.54 (1998)	0.47
Central America*	15.43	268	3.30 (1998)	0.77
Mexico	15.69	158	6.67 (1985)	0.92
South America	53.84	65	8.56 (1983)	1.92
Total	92.03			

* Includes Panama

Source: EM-DAT (2003), OFDA/CRED (2002), LaRed (2003) (as it appears in IDB, 2004).

THE ECONOMIC IMPACT OF DISASTERS

Left unchecked, the economic impact of disasters can generate large losses that disrupt long-run economic growth trajectories. Table 1 details the loss history of Latin America and the Caribbean from 1975 to 2002 as a consequence of natural hazards.

The damage from disaster losses can seriously affect the development process. Simulated economic growth trajectories for countries such as Honduras demonstrate that the effects of catastrophe exposure on a national economy can be large enough to impede future growth (Freeman, 2000). Disasters can also have adverse consequences for local development initiatives such as microfinance

prevention and mitigation by roughly three to two (59 versus 41 percent). While the amount spent on response and reconstruction provided vital aid to safeguard economic and social programs, it might have been reduced if additional mitigation spending and risk transfer instruments had been implemented.

² Natural disasters threaten both development prospects in LAC and the Bank's mission which (as set out in the Agreement Establishing the Bank) is to contribute to the acceleration of the process of economic and social development of the regional developing member countries. Natural disasters cause setbacks, at times very severe ones, and thus are at odds with the notion of acceleration of development (IDB, 2003a).

**Table 2: Apparent IDB Loan Portfolio Related to Natural Hazards
1995 - 2002 (US\$ million)**

Country	Earthquakes	Windstorms	Floods	Natural Disasters (general)	Loan Totals
The Bahamas		21 (1)			21 (1)
Barbados			17 (1)		17 (1)
Dominican Republic				5 (1)	110 (2)
Guyana		105 (1)			
Haiti				27 (1)	27 (1)
Jamaica			16 (1)		16 (1)
Suriname					
Trinidad and Tobago				28 (1)	28 (1)
Total Caribbean		126 (2)	33 (2)	60 (3)	219 (7)
Belize		41 (2)			41 (2)
Costa Rica					
El Salvador	193 (5)			148 (4)	341 (9)
Guatemala				260 (7)	260 (7)
Honduras		211 (7)		28 (2)	239 (9)
Mexico			365 (1)		365 (1)
Nicaragua		73 (2)		125 (5)	198 (7)
Panama				15 (1)	15 (1)
Total Central America, Mexico and Panama	193 (5)	325 (11)	365 (1)	576 (19)	1,459 (36)
Argentina			550 (2)		550 (2)
Bolivia			26 (1)	66 (3)	92 (9)
Brazil			280 (4)	330 (2)	610 (6)
Chile					
Colombia	20 (1)		250 (1)		270 (2)
Ecuador			159 (3)	50 (2)	209 (5)
Paraguay			35 (1)		35 (1)
Peru	20 (1)		270 (2)		290 (3)
Uruguay					
Venezuela			20 (1)		20 (1)
Total South America	40 (2)		1,590 (15)	446 (7)	2,076 (24)
Regional				57 (3)	57 (3)
Overall Total	233 (7)	451 (13)	1,988 (18)	1,139 (32)	3,811 (70)

* The figures are rough estimates compiled by the Office of Evaluation and Oversight using IDB annual reports. They take into consideration loan projects “materially” related to disaster expenditures and omit loan projects only “indirectly” related to disasters. For additional information, please refer to IDB, 2003a.

Source: IDB 2004. Number of loans in parenthesis.

THE FISCAL CASE FOR CLIENT AND IDB ACTION

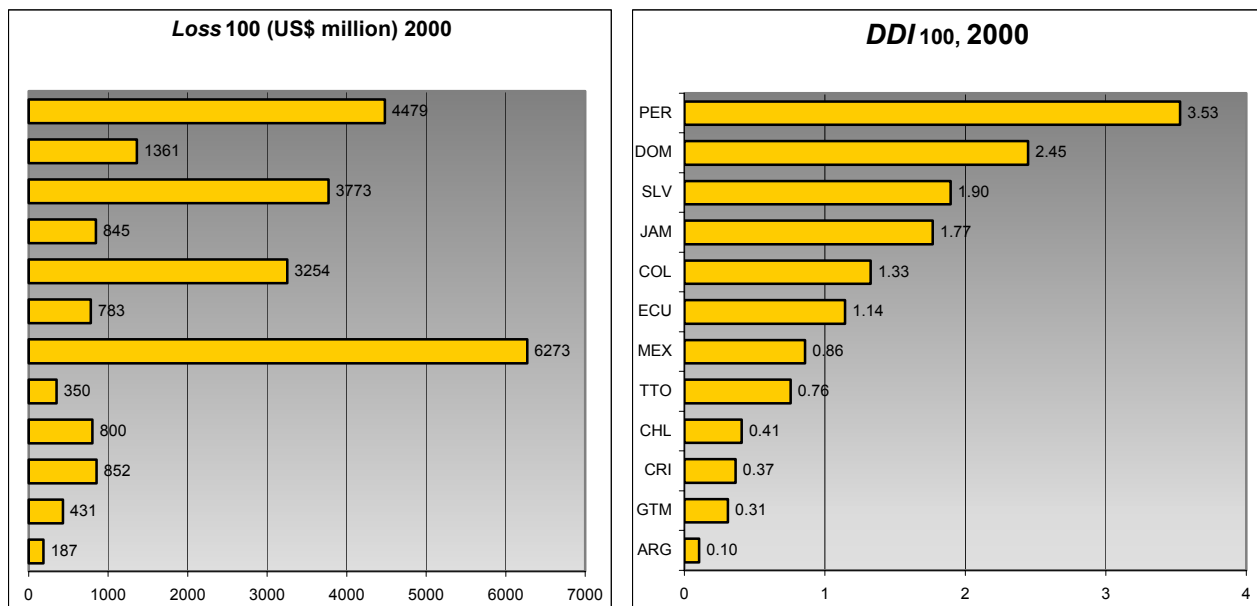
Table 1 shows that estimated losses for the region from 1975 to 2002 approximated US\$92 billion or around US\$3.4 billion annually. Table 2 shows

that IDB disaster-related loans between 1995 and 2002 (US\$3.8) amounted to only a fraction of annual regional losses (roughly US\$475 million). Although some nations may be able to meet their disaster losses with domestic resources and multi-lateral aid, that ability diminishes as the severity

of disasters increases. Cardona (2005) have estimated the potential resource gap for 12 countries in Latin America and the Caribbean. Figure 1 shows the probable maximum loss in the event of an extremely severe (once a century) disaster. Half of the countries are projected to have financial gaps (DDI greater than 1) as shown in Figure 2. These gaps would be even larger if expected aid from the IDB and World Bank would not materialize.

The IDB and the international community will continue to offer post-disaster aid to the extent possible. Yet, the IDB is fundamentally not a disaster relief organization and, as such, narrowing the residual gap with increased IDB (and other external) assistance is not a viable long-term strategy. The emphasis must be on reducing losses. This is a central task that both the IDB and client governments must embrace.

Figure 1: Probable Maximum Loss in 100 Years(L100) and Estimated Financial Gap (DDI100) (Cardona, 2005)



**Box 1
Economic Impact of Disasters Relative to Financial Crises**

Financial crises and natural disasters are typically exogenous events that represent covariate shocks across the country and households. Economic damages from natural hazards can jeopardize the health of national economies at a level comparable to or greater than that of financial crises. Datt and Hoogeeven (2003) found evidence to suggest that in 1997 and 1998 shocks related to El Niño held much larger implications for poverty than labor market shocks caused by the financial crisis.

In addition, unlike financial crises, natural disasters destroy human and physical capital. While physical capital can be rebuilt, opportunities for human capital investment may be less easily recovered. Following a disaster investment opportunities in human capital may be lost as families turn to coping strategies that sacrifice such investments. In order to maintain consumption and income, households may forego investments in nutrition, health care and education, which may transmit poverty to future generations and reduce future economic productivity (Skoufias, 2003).

OPPORTUNITIES FOR ACTION

The risk bearers in the event of a disaster may be the government, the private sector,³ or international entities such as the IDB. Identifying risk bearers allows the development of an appropriate risk management framework, which defines the roles and responsibilities of each actor. Figure 2 identifies risk layers, loss financing options, and available risk transfer instruments. Higher risk layers are commensurate with higher potential losses.

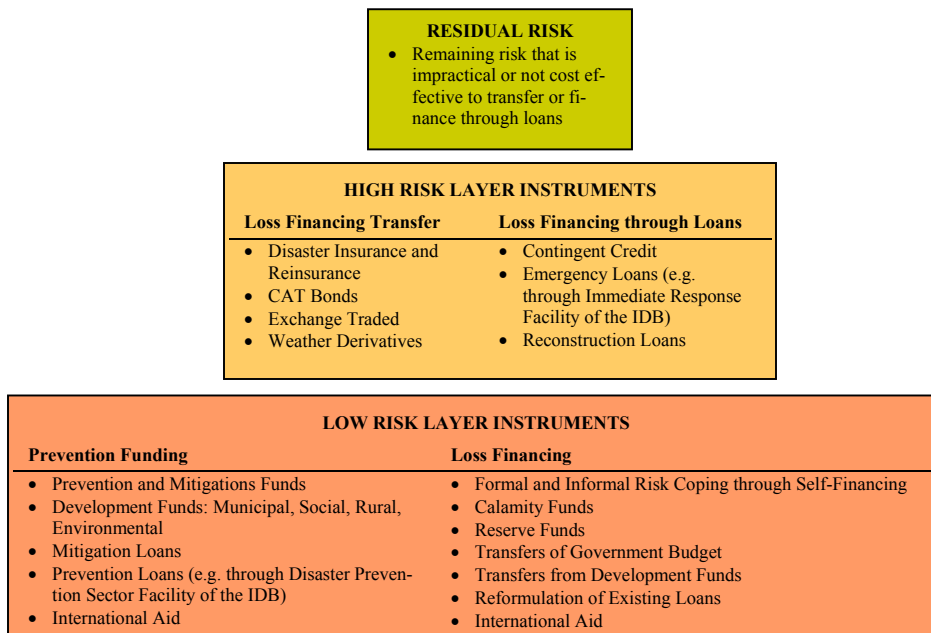
Disaster risk management strategies include risk reduction by increasing investment in mitigation and prevention. They also allow the use of a series of alternative instruments for loss financing. Figure 2 illustrates instruments that can be used at low and high layers of potential losses. In the case of a low risk layer, items on the left-hand side are measures to reduce risk and increase disaster preparedness. The right-hand side indicates mechanisms available to finance low layer losses. At this layer there is room for governments, the private sector, the IDB and the individual to reduce potential losses either by engaging in activities that

reduce risk or by using existing formal or informal risk coping mechanisms. These response measures can be effective, but do not transfer risk. In the case of greater losses, financing capacity at the lower layer may not be sufficient.

Insurance and other risk transfer mechanisms appear only as “high layer instruments” shown in the middle, left side of figure 2. In developed countries, transferring risks by means of insurance is common among lower layer instruments. However, insurance markets are poorly developed in Latin America. The right side of this layer shows several loan instruments, which are detailed further later in this paper. Finally, there is always a residual risk, depicted on top of the figure, the financing or transfer of which may be impractical or not cost effective.

Figure 3 demonstrates the theoretical relationship of a balanced approach to risk management. On the *ex ante* side, increased mitigation and preventive measures will reduce future damages up to a certain point. In most cases, there will be a residual risk (i.e., it is not cost effective to prevent or mitigate all the risk).

Figure 2: Financial Instruments for Risk Management and Opportunities for Risk Transfer

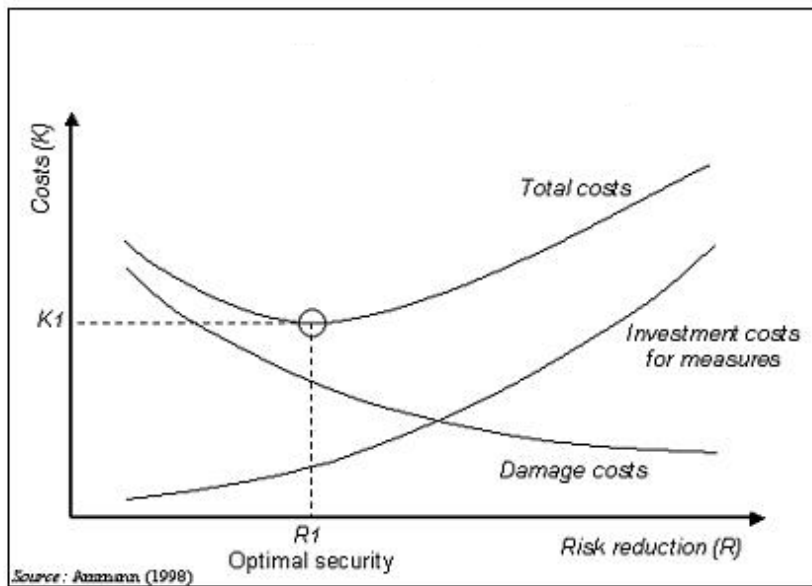


³ “Private sector” refers to domestic private sector activity that is vulnerable to disaster risk, exclusive of domestic private sector insurance providers.

On the *ex post* side, financing mechanisms can be used to cover the costs incurred by residual risk. Financing mechanisms also play an important role by allowing governments to transfer risk; however, it is important to stress that although the government may transfer risk, it does not transfer the responsibility of providing post-disaster aid. A balanced *ex ante* and *ex post* strategy can effectively optimize security and costs since it does not rely exclusively on *ex ante* or *ex post* financing, but draws on each.

The balanced approach, proposed in this paper, contrasts to the traditional strategies that emphasize *ex post* financing. *Ex post* mechanisms play an important role in the reconstruction process, particularly when they avoid recreating that vulnerability. *Ex post* financing mechanisms can effectively cover disaster losses, but they do not reduce the disruption to life and economic activity that disasters cause. Incorporating mitigation into reconstruction investments in order to reduce risk and potential losses is a way to address these issues.

Figure 3: The Optimal Level of Security at the Minimum of the Sum of Investments in Prevention Measures and Damage Costs (IDB 2004)



Mitigation Investments and Disaster Finance

The lower layer of risk can be addressed proactively using prevention and mitigation measures to reduce future disaster damage. Effective prevention and mitigation will also reduce the risk to human life. For example, in 1998, the IDB financed enhancements and strengthening of the Sabaneta Dam in the Dominican Republic, which reduced the risk of floods. The work was completed before Hurricane George caused 320mm of rainfall later that year. The dam, spillways and power plant were not significantly damaged and potential downstream disaster was avoided (Keipi and Tyson, 2002).

Effective prevention and mitigation can also reduce insurance premiums. Mitigation measures may take either structural or nonstructural forms. Both types require financing to implement and are optimally executed when the following conditions exist:

- Strong legal and organizational framework.
- Awareness of benefits and support for prevention by decisionmakers.
- Adequate funding.
- Sufficient information for risk identification and investment needs.
- Effective enforcement of existing laws and regulations.

Examples of structural mitigation are strengthening a dam (as described above), building a seawall as a defense against storm surges to minimize coastal flooding during a hurricane, and retrofitting buildings to withstand earthquakes. Carefully planned mitigation measures can save lives and prevent financial damage. From a practical perspective, while making mitigation investments in new structures may be relatively efficient, remodeling existing ones may be considerably more costly. Even if retrofitting existing structures were beneficial from a cost/benefit perspective, this

activity may be discouraged in certain cases. For example, if homeowners bear the cost of mitigation, but the government assumes the cost of replacement, there is a disincentive for homeowners to make mitigation investments.

Structural mitigation investments, while potentially effective, are subject to diminishing marginal returns.⁴ Experience from the World Bank indicates that more work is needed on the evaluation of the cost and benefits of mitigation investments. Gilbert and Kreimer (1999) note that:

“In the past, designers and managers of emergency reconstruction projects assumed that such operations that fixed broken economic infrastructure, for instance, had high internal economic rates of return (IERR). Thus it was not considered worth the (albeit not so great) effort of estimating IERR; nor did Bank Emergency Reconstruction Loan (ERL) guidelines require such an estimate. As a result, the Bank portfolio of reconstruction projects tells us very little about their economic impact. Actual estimates of internal rates of return are very rare. Especially now that mitigation is becoming more important, there is a greater need for an explicit and transparent estimate of all the costs and benefits of disaster management. Such estimates can help guide the allocation of resources to those disaster management efforts that achieve the highest IERRs.”

For countries with scarce financial resources, optimizing the allocation of mitigation investments takes a heightened importance. Achieving more value per dollar of mitigation expenditures is crucial to minimizing disaster losses.

The following factors can lead to a more effective use of structural mitigation:

⁴ For a brief review, refer to Freeman et al., 2003.

- Consider the incorporation of mitigation in the design of all projects in highly vulnerable areas and sectors.
- View mitigation measures as an investment, rather than a cost.
- Carry out cost-benefit analyses on mitigation alternatives.
- Invest in areas that yield high benefits for the investment.
- Seek additional protection through insurance with decreased premiums due to mitigation.
- Combine structural mitigation with nonstructural mitigation and prevention measures.

Nonstructural mitigation and prevention refer to directing or regulating human activity in disaster-prone areas. They may consist of training, awareness raising, land use planning regulations, building codes, etc. They can be particularly valuable means of avoiding risk in areas lacking the financial and technical resources to structurally reduce or financially transfer risk (Bollin et al., 2003). The IDB has provided funds to assess flood risk in Nicaragua and earthquake risk in Costa Rica through hazard mapping (IDB, 2000). Yet, while non-structural measures may be cheaper, they may be unpopular and challenged in the courts by property rights groups as has happened in the United States (Platt, 1999).

IDB resources are available for prevention and mitigation measures though regular development

loans and the Sector Facility for Disaster Prevention. The Facility provides funding (maximum US\$5 million per project) through a streamlined project approval process for a pre-established menu of activities that includes those listed below.

- Hazard monitoring and forecasting, geographical information systems for risk scenarios, vulnerability and risk assessments.
- Vulnerability reduction through structural engineering works, and nonstructural mitigation by means of the design and application of building codes, land use planning, etc.
- Improvement of disaster preparedness by strengthening early warning and communication systems, preparation of contingency plans, and organization of shelters.
- Studies and training on removing impediments for the development of insurance markets and other financial planning tools.
- Creation of national disaster risk management systems through institutional strengthening, training, preparation of sector specific risk reduction strategies, dialogue through seminars and workshops.

Well-planned prevention and mitigation measures can provide a foundation for risk reduction. Good planning can serve to reduce risk, but even the best mitigation and risk management will leave a residual exposure (Anderson, 2002). The next two sections discuss current and potential options for disaster loss financing.

Box 2

Shifting from an Ex Post to an Ex Ante Strategy to Reduce Drought Damages

In rural areas, farmers whose crops are at risk of drought are compensated (if at all) *ex post*. A recent study considers the impact on household income if *ex post* drought relief were instead distributed as *ex ante* payments. The authors cite previous work, which indicates that such payments would likely be invested and not used to finance consumption. Using various *ex ante* distribution scenarios and household data from Zimbabwe, the authors present evidence that *ex ante* payments will reduce poverty in non-drought years. There is still a decline in income in the drought year, but this can be alleviated with the increased capital built up during nondrought years as well as a social safety net managed by the state. In this case, they find a shift to *ex ante* payments increases household welfare and decreases poverty (Owens et al., 2003).

Current Arrangements for Disaster Loss Financing

The residual potential loss not covered by prevention and mitigation leaves higher risk layers to be addressed by *ex ante* and *ex post* protection through financial instruments. Both *ex ante* and *ex post* protection measures are components of a sound risk management strategy. This discussion does not imply that a proactive risk management strategy should be devoid of *ex post* mechanisms. Indeed, in some special cases *ex post* financing may be attractive. Following Arrow and Lind (1970), as the population increases the cost of risk borne by the government may approximate zero. Thus, it could be argued that nations that can distribute the disaster-loss burden across a large enough taxpayer base, may find *ex post* financing an effective strategy. Some nations (such as Colombia) may be able to generate a significant amount of tax revenue to meet disaster losses, but smaller nations (such as El Salvador) may not (Freeman et al., 2003). Not all nations may be able to spread disaster losses across the tax base. Larger countries may also have an advantage, since any disaster will be a fairly localized shock. By contrast, disasters are fairly covariate shocks for smaller nations Caribbean and Central American nations, in particular, may incur higher per capita losses (see table 1). The concern is with strategies that rely too much on *ex post* funding. *Ex ante* measures can be more cost effective especially when domestic loss financing instruments are underdeveloped, and affordable international funding may not be available.

EX ANTE MEASURES

Common examples of *ex-ante* instruments (detailed in figure 3) include reserve funds, contingent credit and insurance.⁵

⁵ Although contingent credit is usually an *ex ante* arrangement, the effects are similar to external borrowing.

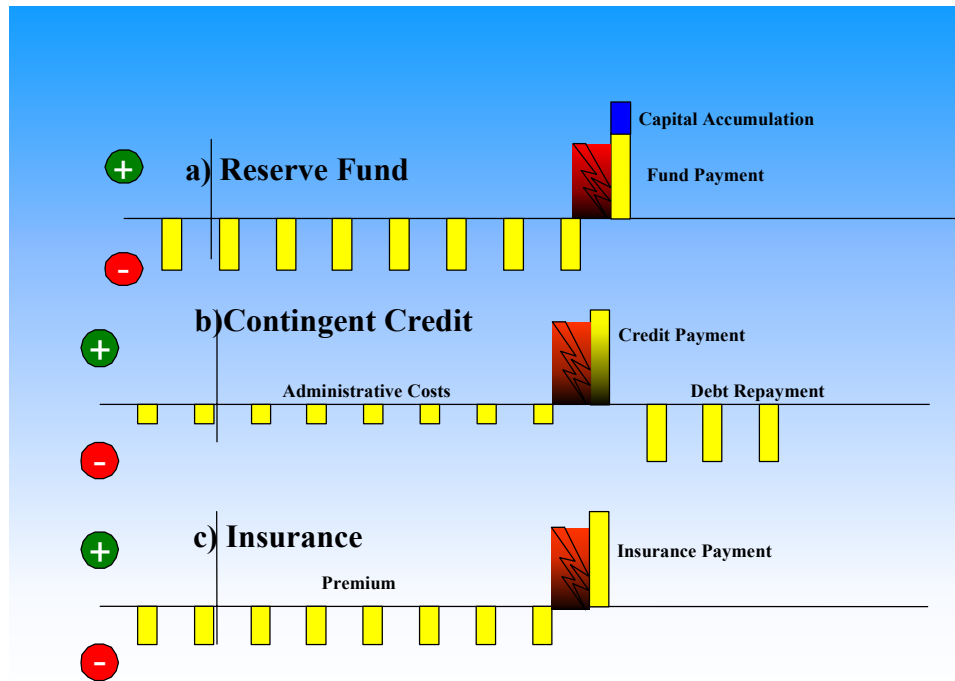
Reserve Funds

Reserve funds (e.g., FONDEN in Mexico) can be created to provide a source of post-disaster liquidity. These funds may finance both mitigation and cover post-disaster costs.

Provided that the original resource allocation and replenishment are sufficient, reserve funds eliminate the uncomfortable, common practice of re-portioning the national budget for loss financing. Additionally, releasing the funds can be done relatively quickly in comparison to receiving international resources, for example, through the approval of new loans. The risk is that funds held in anticipation of a disaster may be insufficient to cover high losses, or that the resources will have been used for other, nondisaster purposes, due to political pressures. However, in cases where the fund is available to be accessed for other purposes and is later replenished, the opportunity cost problem is reduced.

An additional concern with reserve funds is that they prepare for natural hazard damages, but do not transfer or diversify disaster risk. The country still bears the full cost of disaster response and reconstruction. While reserve funds offer a proactive approach to post-disaster loss financing, they can bear a significant opportunity cost. Finally, once a large-scale disaster occurs the fund is depleted and the process of resource accumulation would need to begin anew. The sustainability of such a saving process may be at risk due to changing government administrations and political priorities in the countries.

Figure 4: Flow of Funds for Reserve Funds, Contingent Credit and Insurance.
 Source: Pflug et al., 2002.



Contingent Credit

Contingent credit arrangements allow governments to draw down funds from private banks or international multilateral financial institution. While the funds are pre-cleared and disbursed quickly, the borrower must pay a fee over regular intervals to retain the right to access the funds. These administrative costs for maintenance may add up, and in some cases, the interest rates might be higher than those for more conventional loans. On the benefit side, contingent credit arrangements guarantee that liquidity and interest payments do not begin until the credit is accessed. This differs from catastrophe bonds (discussed later) where payments begin when the bond is issued (Pollner, 2001). On the other hand, it is a loan instrument and will increase indebtedness. For countries with low disaster risk, contingent credit arrangements may be a cost-effective tool. However, the advantage of contingent credit decreases and eventually reverses as the time horizon to the event narrows. Finally, contingent credit arrangements do not transfer risk. The country still bears responsibility for reconstruc-

tion, but the burden of payment is postponed until repayments begin.

Insurance

Currently, with the exception of life insurance, the penetration of this instrument is relatively low in the region. According to Swiss Re (2002), Latin America and the Caribbean accounted for only two percent of regional premium volume in 2001. This low level of penetration is related to several factors: the lack of competitiveness and competition, the absence of training and professionalism among insurance brokers, the financial weakness of local companies, and the fact that regulation and supervision of insurance does not adhere to international standards (Skipper, 1997; Keipi and Tyson, 2002). In addition to the issue of penetration, it is difficult to construct precise estimates of public and private sector insurance coverage. Creating estimates of public sector insurance coverage is challenging because, even when insurance of government assets is mandatory, incomplete information makes constructing aggregate insurance information difficult. However, in some isolated cases the private sector has used disaster

Box 3
Moving Past the Moral Hazard Problem

In the past, the international community has often assisted nations with post-disaster expenses. This relationship is a tricky one because the aid may be genuinely needed, but it creates an expectation of future contributions. In this respect, knowing that international institutions cannot credibly commit to withhold post-disaster aid, nations may count on it as a principal source of reconstruction funds (Auffret, 2003). Additional research supports this claim. Freeman, et al. (2002) note that often “[m]uch of the countries’ pre-disaster behavior is directed at maximizing post-disaster aid”. Such behavior underscores the value of reducing losses *ex ante*.

Viable insurance coverage (and other loss-funding strategies) used to meet residual, *ex post* losses may begin to change this behavior by reducing the amount of aid required from the international community. The IDB and client countries would each have to credibly commit to not covering all disaster losses: the IDB to clients and client governments to their citizens. Doing so can create an incentive structure that promotes insurance demand and reduces uncovered losses. This would require the provision of affordable insurance coverage (or similar alternatives). Reducing post-disaster resources must be matched by affordable alternatives that (as much as possible) are also accessible to the poor. In the absence of affordable and accessible alternatives, both governments and citizens (particularly the poor) would be vulnerable to large losses.

insurance. For example, Freeman, et al., (2003) cite evidence that some private firms were insured against damages from the 1999 Armenia earthquake in Colombia.

Insurance has several advantages. First, depending upon the premium amount, insurance can reduce the opportunity cost problem. Paying only a disaster insurance premium would allow clients to allocate money (not used for reserve funds, for example) to more proactive purposes, including mitigation. A second benefit of insurance is that it allows the policyholder to transfer and share risk. Individual policyholder’s liability decreases while there is no need for payouts from government coffers. Finally, insurance can provide the benefit of increasing risk distribution and lowering individual costs. As the number of parties sharing the risk increases, the cost to each individual party decreases.⁶

Despite the advantages, several problems must be overcome for insurance to work effectively. First, the effectiveness of insurance will depend on the covariate or idiosyncratic nature of the risk. As

covariate risk increases, the scope for insurance diminishes. Unlike reserve funds, which accumulate, insurance payments are lost if the event does not occur. Additionally, just as with other types of insurance, disaster insurance can suffer from the problems of adverse selection and moral hazard.

Adverse selection means that the parties most at risk are the ones likeliest to want insurance. A pool of high-risk parties generates high premiums, which further discourages low risk parties from purchasing insurance. This can have particularly deleterious effects when the at-risk parties would like to purchase insurance, but are unable to afford the premiums. The moral hazard problem applied to disaster insurance states that policyholders would be less inclined to engage in damage-preventing mitigation measures since their losses are insured (see Box 3).

Basis risk, which arises when “the measurement bias in the insurance contract differs significantly from the actual losses incurred as a result of the insured event,” must also be taken into account (Anderson, 2002). Insurance can also incur sizeable transaction costs since claims must be filed, processed, investigated, etc. High transaction costs may entail some delay in receiving payment,

⁶ This benefit is derived from the inverse relationship between the size of the risk collective and the size of the individual burden (Swiss Re, 2002).

which may be urgently needed in post-disaster situations.

The potential size of losses due to disasters also poses a problem for the insurance and reinsurance industries. In theory, since disaster damages are regionally covariate but spread out idiosyncratically over time, insurers and reinsurers should be able to manage losses using existing reserves. While insurers may be capable of accumulating sufficient reserves to meet natural hazard damages over time, accounting, tax, and takeover risk may combine to provide disincentives for their accumulation. These factors can give the impression that disasters are “uninsurable” even though disasters do not meet the traditional tests for uninsurable risks (which are adverse selection and moral hazard, excessive size of the insured risk, and a loss probability that cannot be actuarially calculated). Thus, what may actually be an insurable risk goes uncovered due to institutional disincentives (Jaffe and Russell, 1997).

In cases where countries are considering offering disaster insurance, it is essential that government policies complement rather than compete with private sector insurers (see Box 4). Complementary policies can leverage the government’s financial resources and ability to manage risk over time. The potential effects of competition could be quite harmful:

If the federal government were to offer reinsurance in competition with private reinsurers, the effect on the market equilibrium in both the spot and long-term reinsurance markets would be disas-

trous. In the spot reinsurance market, a competitive federal reinsurance product would crowd out private reinsurer firms, creating a deadweight loss to society as taxpayers absorbed risk that was better insured in the private financial markets. In the implicit long-term contracts market, the disruption would essentially destroy the market. (Lewis and Murdock, 1996)

Governments can also augment the effectiveness of private sector insurance by creating a legal and financial framework to allow (re)insurers to accumulate sufficient liquid capital, and removing potential disaster coverage disincentives (such as government bailouts of clearly insurable private sector losses). Governments could sell catastrophe call options to the insurance industry to cover large loss amounts, for example, between US\$25 and US\$50 billion (Lewis and Murdock, 1996).

While the functioning of indemnity-based insurance and reinsurance is generally well known, indexed contracts (parametric insurance) are another method of providing disaster insurance. They function in a manner that could make them accessible to a large proportion of the population:

The essential principle of area-based indexed contracts is that contracts are written against specific perils or events (e.g., area yield loss, drought, or flood) defined and recorded at a regional level (e.g., at a county or district level in the case of yields, or by the local weather station in the case of insured weather

Box 4
Domestic Framework for Insurance

The development of insurance markets requires updating pertinent legislation and the normative framework. Although most of the weaknesses that exist are on the demand side (such as the lack of enforcement of building codes and difficulties in establishing asset values, as well as the generally low capacity of clients to pay premiums), supply-side adjustments are also necessary. These include strengthening independent supervision systems to improve monitoring of the solvency of insurance companies, and eliminating conditions that favor anticompetitive practices. To meet this need, the supervisory entity should enjoy adequate oversight powers as well as the ability to exact appropriate penalties. Insurance companies should also be encouraged to adopt international standards in order to maintain solvency, increase efficiency, and promote transparency through the timely publication of detailed and precise financial statements. (Keipi and Tyson, 2002)

events). Insurance is sold in standard units (e.g., \$10 or \$100), with a standard contract (certificate) for each unit purchased, which is called a standard unit contract (SUC). The premium rate for a SUC is the same for all buyers who buy the same contract in a given region, and all buyers receive the same indemnity per SUC if the insured event occurs. Buyers are free to purchase as many units of the insurance as they wish. (Hazell, 2001)

Structuring the standard unit contracts in this way avoids adverse selection problems and often reduces transaction costs. Work by Skees, et al., (2002) suggests a positive role for parametric insurance in rural Mexico. The potential accessibility of these types of contracts to wide segments of the population suggests their ability to allow individuals to address lower risk layers. Of particular interest is the possibility that the coverage of parametric weather insurance can be extended to nonproducers as well as producers in rural economies. For example, households with livestock holdings are likely to be affected by the same weather patterns that influence crops. With parametric weather insurance, they could also purchase coverage.

Despite their potential usefulness, there are some disadvantages to using index contracts. First, although transaction costs are reduced, “index contracts essentially tradeoff basis risks for transaction costs, and the insurance will not be attractive if the basis risk becomes too high” (Hazell, 2001). Additionally, individuals could suffer a loss, but not be compensated if the triggering event, defined in the contract, has not occurred. Alternatively, they could be paid when they have not suffered a loss. In this respect, strongly correlating the index with individual losses is key. For instance,

Hurricanes typically hit the areas of a country very differently and have different impacts depending on landscape characteristics, for example. To serve as good insurer hedges, indices will need to

be developed for small geographic areas, ideally at the level of the farm owner. However, establishing such indices would pose considerable technical difficulties, especially in developing countries. (Auffret, 2003)

As Hazell points out, there are also factors that may reduce the attractiveness of administering these programs. Hurdles may include:

- Research costs of identifying key weather events and their correlation to agricultural production and income.
- Educating the rural population about the value of weather insurance.
- Provision of secure measurement stations.
- Appropriate legal and regulatory framework.
- Underwriting the insurance until sufficient business volume allows international reinsurers or banks to be willing to underwrite it themselves.
- Actuarial challenges due to repeated events such as the El Niño Southern Oscillation (ENSO).
- The covariate risk problem for the insurer.

At present, it appears that these types of securities cannot be relied upon as a *principal* means of disaster loss financing. Impediments to their market development exist. Disaster indicators, such as those being developed by the IDB, the United Nations Development Programme (UNDP), and the World Bank with Columbia University may provide additional information that may facilitate the implementation of these instruments (Cardona, 2005; UNDP, 2004; Pelling, 2004). Governments can provide the requisite legal and regulatory framework. As these efforts progress, area-based index contracts, provided they are correctly structured, can play an important role in insuring disasters.

EX POST MEASURES

Ex post measures include international aid, tax increases, domestic borrowing, external borrowing, loan conversion, and budget reallocation. Even nations with *ex ante* mechanisms in place may be forced by the sheer scale of damages to utilize these approaches. *Ex post* measures typically suffer from the opportunity cost problem (Freeman et al., 2003). Bearing this issue in mind we explore two strategies with high relevance to the borrower/IDB relationship: external borrowing and loan diversion.

External Borrowing

External borrowing leads to an increased debt burden. For our purposes we will analyze external borrowing and distinguish between those funds borrowed from the financial community and those borrowed from the IDB. When turning to the private credit market, borrowers may face higher interest rates and less generous loan terms. Borrowers may be further constrained by existing debt obligations, their sovereign bond rating and prevailing global economic conditions. On the other hand, credit drawn down from the IDB can be accessed on more favorable terms, but the borrower may be able to borrow only a limited amount. While the size may be limited, there are several flexible aspects to the IDB funds, which are detailed below.

The IDB has several facilities that can aid in post-disaster financing.⁷ One available instrument is the Immediate Response Facility (IRF). The IRF is a reimbursable loan whose only objective is to cover the immediate cost of restoring basic services to the population. Under the IRF, US\$20 million can be disbursed under Ordinary Capital, or US\$10 million from the Special Operations Fund per project. This fund can be mobilized within two to four weeks after a request is filed (IDB, 2000). The resources are available for immediate response, and can also be directed toward avoiding vulnerability of the investments to future disasters. The Bank has funded eight loans of this type since 1999. Additional money can also be made available for technical cooperation funds for

emergencies. This instrument is currently used to disburse up to US\$200,000 (nonreimbursable) to cover technical assistance expenditures following a disaster. It has been used widely: 10 countries benefited from these grants in 2004.

The provision of post-disaster finance at a reduced cost may be acting as a counter incentive to *ex ante* measures advocated by the IDB. A survey for the evaluation of IDB disaster policy found that, on balance, the IDB incentive structures encourage post-disaster activities more than pre-disaster ones (IDB, 2004). This is in large part driven by access to the IRF and the reallocation of resources to reconstruction efforts from existing development loans. Further work remains to be done to more precisely estimate the impact of potentially contradictory incentives.

Loan Diversion

An alternative to additional borrowing is the reformulation of the existing IDB loan portfolio to address post-disaster needs. In this case, the objectives of the original loan may be modified to incorporate post-disaster requirements. For example, El Salvador reallocated a US\$75 million IDB loan, which had been approved but not ratified shortly after the 2001 earthquake (Freeman et al., 2003). It may prove useful to have this flexibility in the wake of a disaster, yet there are two caveats with a long-term reliance on loan reformulation:

First, there is an institutional commitment only to maximizing the post-disaster loan diversion capacity to the exclusion of *ex ante* 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. (Freeman et al., 2003)

⁷ This section draws from Paez, 2002, Section 10.

Loan reformulation may be considered an involuntary risk transfer in which the original loan beneficiaries provide post-disaster assistance to the new recipients. Such a transfer raises questions of efficiency and aggregate benefits. If the original loan funds are not replaced, the involuntary nature of such transfers may retard the development goals of the original loan. Furthermore, loan transfers could conceivably occur even if there is no net welfare gain (or even a welfare loss) associated with the loan allocation. However, the pernicious effects of loan reformulation may be limited if the original loan is non-performing. In these cases, loan reformulation may allow funds to be used more productively. However, loan performance has been difficult to measure because logical framework and indicators which would facilitate monitoring, have often not been prepared for the reformulations.

A review of the IDB loan conversion process found areas for improvement:

The loan reallocation process is not transparent, it is hard to track and evalu-

ate, and eligibility criteria are unclear. Thus it is difficult to accurately assess the mission risk to the Bank, and the true developmental impacts on borrowing member countries. Loan documentation did not show the use of risk matrices (especially important for infrastructure projects), or define desirable outcomes in terms of vulnerability reduction, or quantify meaningful criteria along with the disbursement process that could encourage countries to undertake risk reduction. (IDB, 2004)

Adequate transparency of the reformulation should be assured and sufficient mechanisms for monitoring and auditing of the execution of resource transfers should be in place. The reformulation process should also account for the urgency and timeline of the situation. Once in place, reformulated loans should be monitored and audited to assure that the funds fully benefit the new objectives.

Alternative Loss Financing Options

Higher layers of risk can be managed using securities provided by international capital markets. The use of securities can be advantageous because they allow countries to diversify risk without waiting until domestic insurance markets are fully developed (Anderson, 2002). Securities also allow risk to be transferred inter-temporally. They may have low transaction costs, but require public (or symmetric) information to operate effectively. For optimal risk diversification, both securities and insurance should be used since neither is sufficient in isolation (Lewis and Murdock, 1996). Two such security-based instruments are catastrophe bonds and weather derivatives.

CATASTROPHE BONDS

Catastrophe bonds allow the issuer to transfer risk directly to the capital markets. The catastrophe (CAT) bond industry continues to grow with issuances now approximating US\$1 billion annually. CAT bonds have typically been promoted by insurance and reinsurance companies, although other types of financial sector firms have also issued them (Deutsche Bank, 2003). Despite the large percentage of insurance and reinsurance players in the CAT bond market, sovereign governments can also explore CAT bonds as a viable risk diversification option. The issuing government could thus interact directly with capital markets to hedge risk in the event that domestic the insurance market is not fully developed. Most catastrophes, including earthquakes and hurricanes, can be hedged against using CAT bonds.

The issuance of CAT bonds would, of course, need to be conducted in accordance with national financial, legal and accounting regulations.⁸ The at-risk entity is the issuer of the bond. The bond would typically be issued with a three- to five-year maturity. Credit rating agencies would rate the bond based upon the results of risk modeling

and analysis. Most bonds are rated BB+ or higher and nearly all are rated BB or better.⁹ The interest payment on CAT bonds is normally calculated using LIBOR (London Inter-Bank Offer Rate) plus a spread of 400 to 600 basis points, with the spread narrowing as the credit rating increases.

CAT bonds can either be parametric (tied to a loss index) or loss-based; however, over the past three years parametric bonds have become the dominant type of issue (Pettersen et al., 2004). The issuer typically acts through a Special Purpose Vehicle (SPV). The funds raised from the sale of the bonds are held in a collateral account. When the bond is to be redeemed (either because of maturation or loss), the account is liquidated and payments are made to the issuer for loss payments and the remainder to the investor (see figure 5) (Deutsche Bank, 2003a).

A neutral third party would evaluate the occurrence of the trigger event. For example, the trigger may be tied to indicators measured by the US-based Property Claims Services Office (PCS). CAT bonds can allow a great deal of flexibility in the payout structure. Rather than establishing one trigger, the activator can be graded so that catastrophes of different severities will be covered. The transparency of the trigger events is an advantage. In contrast to indemnity payments, these bond disbursement are quick since they are linked to an independently evaluated trigger.

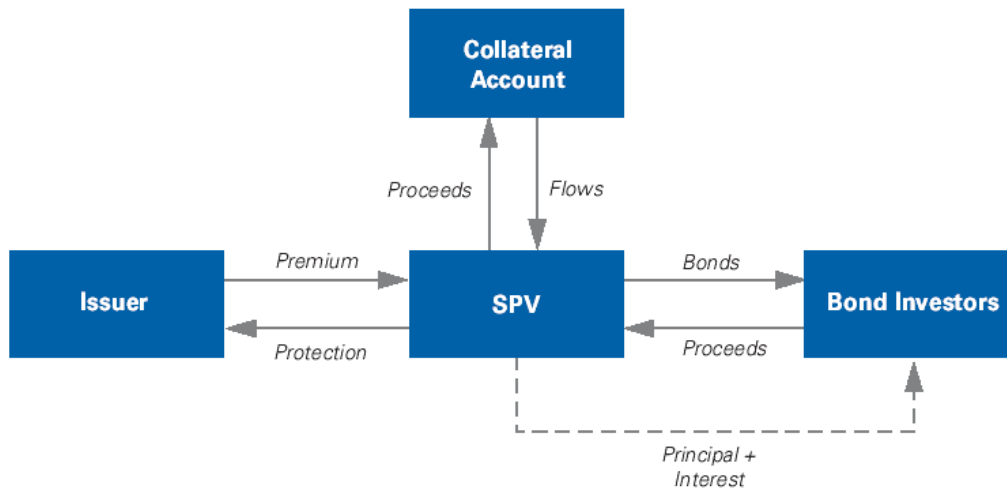
In addition to swift and transparent payment conditions, CAT bonds give the issuer several advantages especially when compared to traditional insurance. The bond issuer does not incur credit risk and obtains multi-year coverage at a fixed cost. CAT bonds can be marketed as favorable investment vehicles. Several studies cite the likelihood that these instruments are zero beta assets (no risk

⁸ For a review of finance and insurance regulations in Latin America and the Caribbean, see Demaestri and Guerrero, 2002.

⁹ Deutsche Bank 2003: 18; Chart "Rating Distribution of All Issued CAT Bonds" (originally from Lane Financial, LLC).

Figure 5: CAT Bond Structure

Typical CAT Securitization Structure



Source: Deutsche Bank

assets).¹⁰ Parametric CAT bonds also create positive risk management incentives for the issuer because payments are tied to a measurement indicator and not to a loss amount.

There are several factors that may reduce the effectiveness of CAT bonds. First, issuing CAT bonds with long maturities may mean missing out on favorable movements in catastrophe insurance and reinsurance rates. Basis risk is also a concern. If disaster risk models are inaccurate, then potential losses will be misstated. CAT bonds may not be priced favorably. For some nations, a rate of four to six points above LIBOR may make other financing mechanisms more attractive. Finally, the transaction costs associated with taking a low-value CAT bond to market may not be cost-effective (Deutsche Bank, 2003). Despite these concerns, catastrophe bonds can play an important role by bringing “more stability to a reinsurance market known for fluctuating rates and for developing sudden aversions for certain types of risk” (Auffret, 2003: 23).

¹⁰ A zero beta asset is one whose risk is uncorrelated to the market risk. For an analysis of catastrophe options as zero beta assets see Hoyt and McCullough, 1998.

CAT bonds could either be issued directly by the IDB or issued by the country with IDB support. Independent country issues may face higher costs that may limit the attractiveness of a sovereign CAT bond issuance. Sovereign issues in Latin America and the Caribbean would need to carry out the transaction through a SPV, which would raise transaction costs. Although a number of governments in the region have favorable credit ratings, they are lower than, for example, the IDB’s AAA rating. Independent sovereign issuances would pay a higher spread over LIBOR than they would if issuing with the IDB. Finally, there are some concerns about market size and economies of scale for sovereign issues. Some researchers suggest that US\$1 billion is the threshold for establishing a new disaster CAT bond in the region (Pettersen et al., 2004). Issues of this size could not be conducted for the smaller countries in the region.

If the IDB were to emit CAT bonds, direct IDB issues would simplify the issue structure by removing the need for a SPV and reduce transaction costs associated with the issuance. It would probably also result in additional investor interest. The Bank’s credit rating would help to lower the interest spread. The IDB could emit CAT bonds

following a “debt relief,” “pay on loss” or contingent liquidity model. Under the “debt relief” model, the IDB would lend the bond proceeds to the insured country at either the coupon rate or a subsidized rate. The proceeds could then be used for national development projects. In this fashion, the country would have immediate access to the funds.

The “pay on loss” model would put bond proceeds into a general IDB pool. The insured country then pays the IDB a spread above the IDB’s borrowing rate. In turn, the country receives a grant commensurate with the principal reduction on the CAT bond. Thus, disaster funds are readily available, but they must now be incorporated into IDB liquidity planning. Finally, contingent liquidity may allow the country to lock in loans at a favorable rate if the CAT event happens in a predetermined period. However, these loans add to the post-disaster debt burden. In practice, a strategy incorporating all three models for different situations may be optimal (Deutsche Bank, 2003a).

WEATHER DERIVATIVES

Weather derivatives are an extension of traditional derivatives such as swaps, futures or forwards. Derivatives are used to disaggregate risk in cases where risk is initially bundled. For example, using derivatives entities can guard against interest rate movement by swapping a fixed rate for a variable rate or vice versa. Trades are executed under the

oversight of the International Swaps Dealer Association (ISDA).

Weather derivatives are used by the private sector to hedge against climate risk. These risks can include variations in temperature, rainfall, snowfall, humidity, or even wind speed. Weather derivatives can be a good complement to CAT bonds or disaster insurance because they are typically used to cover high-probability, low-impact events such as seasonal weather variations. They are particularly useful for utility companies and other industries whose profits may be greatly affected by weather. Whereas typical financial derivatives allow companies to hedge against price fluctuations, weather derivatives allow for hedging volume fluctuations due to weather events. These instruments can be structured around different time periods such as weekly, monthly, or annually.

Weather derivatives typically require climate data over several decades to allow for risk to be effectively analyzed. Data integrity is an issue of great importance. In most European nations the weather data may be purchased from the national government (Weather Risk Advisory, 2001). Information must not only be present over a time series, but be checked for inconsistencies and potential errors in the measurement process. Compiling the data can be costly. While traditional players in the derivatives arena have not included sovereign governments, national governments may also be participating.

Political and Institutional Issues

Political and institutional issues include managing disaster funding, and administration and organization.

MANAGING DISASTER FUNDING

Currently, national governments often bear much of the economic risk related to disasters in Latin America and the Caribbean. Ideally, governments would look to risk related to public assets and citizens' welfare as a public good, while the private sector would largely manage the risk related to its own assets.

There are several factors that can lead politicians to adopt suboptimal disaster policies. These factors are sometimes called "disaster pathologies." They include, but are not limited to, underinvesting in prevention while overinvesting in response, and skepticism of policies based on sound insurance principles (Noll, 1996). In the context of natural hazards, it is common to assume that politicians may underinvest in risk reduction (Zeckhauser, 1996). Enacting an optimal level of disaster preparation and response would require the exploitation of windows of opportunity for policy reform. Such opportunities may arise after a catastrophe strikes or if the incumbent party fears losing office. Private agencies may also be able to play a role by offering nonpartisan policy analysis (Noll, 1996). Important work remains to be done on the political front so that mutually agreed upon disaster risk management strategies, including insurance, can be implemented efficiently. Financing is a critical problem, which must be addressed jointly by the IDB and borrower nations as the demands for disaster finance increases relative to the supply of available funds.

We now turn to three issues that may have an impact on disaster financing by the governments.

The first issue is continuity. Government budgets are typically tight and the authorities have little

room to maneuver. Disaster risk management competes with other uses for funds. Funds earmarked for disaster management and preparation may face popular pressure to be released in lean times to meet budget shortfalls. Once released, it is often difficult to replace them. Low-risk, high-impact disasters striking when disaster funds have been temporarily depleted will make the nation reliant upon the international community for aid. Disaster prevention is a continuous effort that cannot stop and start in conjunction with election cycles.

The second issue involves the matter of fiscal contributions by relevant levels of government. Constituents of a region or municipality may hold the view that the national government should foot the bill. Establishing sustainable long-run mechanisms for financing may require reevaluating traditional tax powers and governmental transfers. Wealthier municipalities may be able to issue municipal bonds to fund mitigation investments and risk diversification. Another possibility could be external loans, such as from the IDB, to municipalities with a sound financial base and support from the central government.

The third issue has to do with the temptation to use disasters for political gain. Powerful taxpayers in unaffected areas may not wish to subsidize disaster preparation in disaster-prone areas. Additionally, popular sentiment may put pressure on politicians to implement disaster-related spending on areas such as housing, which may result in fewer resources for other uses such as infrastructure repair.

Political incentives must be realigned to increase the returns to prevention and reduce the temptation to use a reactive, post-disaster environment for political gain. This includes not only funding, but also allowing designated agencies to respond to disasters instead of allowing another branch of government to circumvent them.

Administration and Organization

It is also important to clearly define the goals and terms used in disaster risk management to avoid inter-agency confusion in the public sector. There is a role for each relevant agency (such as Civil Defense, Environment, Planning and Sector Development Ministries) to play, but it is important that a chosen disaster risk management approach facilitate cooperation and not competition (see Box 5). This issue is of particular importance to nations transitioning from a response-based approach to disasters (usually coordinated by Civil Defense) to a more proactive approach that may be administered by a different government agency. The necessary coordination can take place within the national disaster risk management system in each country. Colombia has been a pioneer in this area (Cardona, 2001; Freeman et al., 2003).

Risk management must be implemented through existing administrative channels that may be characterized by appropriate levels of centralization and decentralization. Bollin et al. (2003) observe a general but slow trend toward decentralization in Latin America and the Caribbean. Some national governments have found it beneficial to accelerate this movement in areas related to disaster risk management. The difficulty of defining an appropriate institutional model and the importance of involving local actors has recently been noted:

Which institutional model to adopt is perhaps the most polemic topic in Latin America in relation to the management of risks... In general terms a consensus exists that the majority of risks are formed at the local level by an inappro-

priate interaction between human activity and the environment. This suggests the need for the elevated involvement of local actors in risk reduction. (Bollin et al., 2003)

Given the formation of risks at the local level, the involvement of local actors in risk reduction and loss financing activities is key. Establishing a sustainable political and financial model for risk management must account for the unique governmental structure and political environment in each nation. Table 3 presents examples of how funds have been utilized in cases of low, medium and high decentralization.

High local autonomy allows localities to leverage local knowledge and expertise to allocate resources. Disaster risk management efforts coordinated at a higher level should return decision-making power and resources to the local level, particularly for mitigation activities. In instances of high centralization, local autonomies may have little incentive for mitigation since damages and losses are funded and legally handled by the national entity. The process must also be sensitive to political pressures to guarantee that preapproved risk management channels are not used for political gain. Even though decentralization will empower local governments, decisions regarding certain public assets must be enacted at the national level. Moreover, many municipalities may lack the economic resources to implement mitigation measures without national assistance. With these supports, granting increased power and responsibility to local levels can provide greater incentives for active risk management.

Box 5 Disaster Risk Management in Ecuador

The importance of clearly defined disaster management channels cannot be overstated. Poorly designed institutions can weaken disaster management and response and create a vulnerability that is institutional, as opposed to technical or financial, in nature. Ineffective institutional management is characterized by the prevalence of *ad hoc* solutions, weak transparency and a delineation of powers. Disaster management in Ecuador has been weakened by these issues as well as by regional conflict, which disrupts the cohesiveness of its response capability. Multiple agencies jockey for political capital, authority and funding. Such fragmentation increases overhead costs and may compromise external aid. The result is an increase in Ecuador's disaster vulnerability that stimulates rent seeking at the project and national level. (Solberg et al., 2003)

Table 3: Local Risk Management in Different Levels of Decentralization

	Countries with a high level of local autonomy (Switzerland)	Countries with recent decentralization (Colombia and The Philippines)	Countries with high centralization (Guatemala)
Financial Aspects	Localities respond with their resources in accordance with the risks they face. The national government guarantees support only when local capacity is exceeded.	Localities respond with their resources, but with few exceptions, they are very limited. National support to the localities is limited. National and local disaster funds may exist, but, with some exceptions, these are principally used for emergencies	National funding prevails but tends to be insufficient and support principally emergencies. Only a few localities disburse their own limited resources, directed to emergencies.

Source: Bollin et al., 2003.

Finally, there should be a solid structural foundation in the form of a national system for disaster risk management with clearly defined public and private sector responsibilities, designed according to the specific situation of each country.

A strong relationship between the public and private sectors that clearly defines risk management roles and responsibilities is also necessary. A risk management approach that requires contributions from both the public and private sector but does not specify clear amounts or roles for each can lead to misunderstanding about the actions each

sector is required to take. Fairbanks and Lindsay (1997) observe the impact a similar miscommunication created for the perceived successes and failures of export industries in the Andean nations.

A development program that fails to demarcate roles for the government and private sector can undermine the development effort. Toward this end, the IDB could coordinate with commercial organizations such as local chambers of commerce to encourage dialogue to establishing public and private sector roles in disaster risk management.

IDB Risk Management Options

While the Bank's external role is to augment national risk management capabilities, it must also address internal financial and organizational issues in the context of disaster risk. The Bank's Operational Policy on Natural and Unexpected Disasters (OP-704) serves as the current foundation for disaster risk management (a policy on disaster risk management, currently in preparation, will supersede it). There are both external and internal organizational and financial actions the IDB can take in the near and long term to secure its financial position with respect to disaster losses.

INTERNAL RISK MANAGEMENT

Organization

A recent review of the Bank's disaster policy highlights the need to address its internal and external incentive structures for disaster risk management (IDB, 2004). According to the study, the incentive structure gives disaster risk management a low priority in the agenda of borrowers. The report indicated that existing loan and project evaluation criteria do not incorporate disaster risk management and do not provide sufficient incentives for IDB operations staff to bring disaster risk management into daily activities. Emphasizing disaster risk management internally and externally should be done in conjunction with, and arguably prior to, establishing mechanisms to manage the higher layers of disaster risk.

The study also stated that disaster risk management is often not a priority in the IDB/country dialogue (IDB, 2004). For example, a review of 24 Country Papers surveyed between 1995 and 2002 found that "despite the presence of important disaster-induced economic losses in recent years in most cases, Country Papers almost never mention disaster risk reduction and risk management in the context of the development strategy

discussion that (to a degree) is advanced in each of them". Two exceptions noted in the report are the country papers for Belize and the Dominican Republic, which were undertaken in 1999 and 2001, respectively.

Finance

Financially, the Bank and at-risk nations face a similar set of choices. However, a unique set of characteristics distinguishes the Bank from its borrowers and from commercial banks. Unlike borrower nations, the IDB has AAA credit rating, experience and a knowledge base that allow it preferential market access. Yet, the Bank differs from most commercial banks in that there is no secondary market for development loans. The Bank cannot sell nonperforming loans to a secondary market. As such, strategies to protect its portfolio take on increased importance.

In light of mitigation and prevention measures, the Bank must choose to manage residual risk using internal mechanisms, to use transfer mechanisms available in the insurance and capital markets, or to manage risk using some combination of these options. Managing the risk in-house could require a rigorous assessment of the effectiveness of existing disaster-related loan provisions.

The IDB may be viewed by borrowers as not only the lender of last resort, but the insurer of last resort as well. It would seem only prudent for the IDB to diversify risk as any other insurer or reinsurer would. Given the Bank's central position in disaster risk management in the region, it would seem imperative that it more fully explore the risk management options available in the reinsurance and capital markets. Possible avenues to be utilized are traditional reinsurance, CAT bonds and weather derivatives.

Box 6:
IDB's Risk Management Approach in the Dominican Republic

The IDB's risk management approach in the Dominican Republic (Program 1408/OC-DR) is notable because of its focus on disaster risk management and prevention. Although the effectiveness of the program was altered by subsequent legislative changes, the original focus consisted of three components.

(i) *Disaster Prevention and Local Risk Management*: target improving comprehension and management of risk across high-risk municipalities and provincial capitals. The objective is to assist municipalities in the legal and operational establishment and/or consolidation of environmental commissions in accordance with Dominican law.

(ii) *Risk Management Education*: collaborate with the Secretary of Education to include a disaster risk component aimed at reducing disaster vulnerability; emphasize disaster response techniques to prepare students and communities to respond to disasters.

(iii) *Political Risk Management Strategies*: establish a program for disseminating information on components of the current risk situation in the country to decision makers (e.g., economic impact of potential disasters, mitigation investments opportunities, institutional capacity) and monitoring actions executed under the National Risk Management Plan. Support the evaluation and design of a risk management financing strategy.

Source: Mora Castro, 2003.

Traditional reinsurance would allow the IDB to transfer higher layers of risk to reinsurers. Although IDB client loans have been repaid, it could work with reinsurers to cover losses in the event of an unpaid loan due to disaster damages. Alternatively, the IDB could act as an intermediary to facilitate the purchase of insurance coverage by clients. In the case of CAT bonds, for example, this would allow the Bank to sell risk directly to the capital markets on behalf of client countries.¹¹ The Bank could issue CAT bonds in three- to five-year maturities. The bonds could either be structured around a "pay on loss" model or a "debt relief" model, with the basic differences being whether the client country holds the principal and the amount of interest that would be paid. If no catastrophe strikes, the principal is returned

¹¹ According to the IDB's 2002 Annual Report, for the year ended December 31, 2002, all of the Bank's loans were fully performing except a US\$436 million loan issued under the Fund for Special Operations (FSO). The Bank already issues several billion dollars of global bonds. In 2002, the Bank marketed two global bond issues of US\$2 billion with maturities of three and ten years. The three-year issue was subsequently increased by US\$500 million (IDB Annual Report, 2002).

to investors when the bond matures. If a catastrophe strikes that meets predetermined conditions, the investor receives the principal less the loss amount (Deutsche Bank, 2003).

The Bank's high rating would likely eliminate the need to create Special Purpose Vehicles (SPVs) that would provide additional transparency to the bond issuance. IDB CAT bonds could also reduce the moral hazard problem since payouts are tied to indicators and not to incurred losses. The Bank also has experience with derivatives. It can offer expertise and technical assistance to clients interested in using weather derivatives to transfer risk. The Bank can also use weather derivatives itself to provide a cushion against unexpected loan diversions or defaults due to disasters that may increase mission risk and development risk in client countries.

EXTERNAL RISK MANAGEMENT

In the long term, the Bank can act to indirectly reduce the claims made upon it by borrower nations for post-disaster financing. Improving internal organization as well as collaborating with borrower nations to strengthen financing mechanisms

should have a long-term component whose aim would be to reduce post-disaster claims. Disaster losses in the future would then be financed by borrower nations as they interact with the insurance and capital markets directly. Possible avenues to explore include loans that allow nations to develop the weather measurement infrastructure necessary to hedge risk using weather derivatives and indexed contracts. The IDB could also partner with the countries of Latin America and the Caribbean to investigate the possibility of implementing an effective crop insurance program. Another possibility is partnering with a country to construct a risk management entity similar to the

World Bank/Turkish TCIP. In that case, it is important for the Bank to form a viable exit strategy where the financial responsibilities can be transferred to a sustainable government/private sector partnership in the future.

In sum, as disaster losses in Latin America and the Caribbean continue to rise, the Bank's direct and indirect exposure will also increase. In the past, the Bank has been fortunate to avoid substantial losses due to disasters. It has a unique opportunity to implement proactive financial strategies to protect itself as well as its borrowers in the future.

Conclusions and Steps for IDB Action

This paper has reviewed a number of *ex ante* and *ex post* loss financing strategies. While many of these strategies have operated in the past as a matter of necessity, an overdependence on *ex post* strategies may incur unnecessary opportunity cost and reduce the capability to transfer and cover risk. With this in mind, a balanced risk management strategy is proposed. It comprises of specific components addressing different layers of risk. Disaster prevention and mitigation measures are important since they serve to reduce risk exposure. Loss financing at a lower layer can be addressed with existing domestic resources. Higher layers can be covered using financial instruments, which allow governments to interact directly with international capital and insurance markets.

MITIGATION

Reducing potential losses from disasters should begin with investments in prevention and mitigation. Financing options should be used to cover the remaining risk. Many mitigation investments (such as large scale seawalls to protect against hurricane flooding) are public goods. The state will need to become the driving force behind these projects. However, the private sector bears responsibility for most of the structural mitigation investments (e.g., constructing housing and industrial facilities that are resistant to earthquakes). The government and private sector are also accountable for implementing nonstructural mitigation and prevention measures to reduce risk. Government and private sector mitigation behavior has important ramifications, which affect the cost of financing the higher layers of risk. The IDB's role here is to provide funding both for structural mitigation and nonstructural mitigation and prevention measures.

RISK FINANCING

The high layer of risk may be partitioned among several players. The domestic actors (the government and private sector) bear most of the risk in

this as well through self-financing or borrowing. Part of the risk may be transferred to domestic and international insurers. The IDB also bears risk to the degree that it serves as a lender or insurer of last resort. New tools such as CAT bonds and weather derivatives may complement traditional risk management approaches by covering the highest layers of risk. These instruments allow the government and domestic private sector to transfer risk. For example, governments that directly operate domestic utilities and private sector industrial farmers are prime candidates for the weather derivatives market. As such, weather derivatives may be a long-term option, but the IDB can play an auxiliary role by facilitating the development of high-quality weather information and measurement indexes and providing support for the issuance of CAT bonds.

INSTITUTIONAL ISSUES

The efficacy of risk management will be reduced without a supportive political and organizational foundation. The responsibility for establishing them lies with both the national governments and the private sector. Participation from local groups should also be encouraged.

Considering these factors, each government will form its own unique risk management strategy and risk layers based upon its resources and risk tolerance. Currently, many Latin American governments bear responsibility for almost all disaster risk and rely heavily upon international *ex post* assistance to finance losses. In the Caribbean, private sector participation is greater because of factors such as the tourism industry, which has a high level of international ownership.

The approach recommended in this paper is first to reduce risk through government as well as private sector actions. These include investments in disaster prevention and mitigation. They are also responsible for loss financing as the bearers of the lower layers of risk. At higher risk layers the gov-

ernment and private sector typically transfer part of the risk to third parties. Decisions about how to define and finance each layer need to be determined at the national level. As such, mitigation and loss financing measures must adapt to local conditions. The establishment of viable disaster risk management programs must be done with attention to local risks and the available resources to cover them.

Despite current limitations, governments can work in collaboration with outside parties to implement improved financial protection strategies. The IDB and other financial institutions can help in this process. There are several opportunities for IDB action. The Bank is uniquely positioned to become a catalyst for a shift from a reactive to a proactive risk management approach in the Latin America and the Caribbean. It can take the lead in encouraging action in three areas.

Optimize Country Risk Management Strategies

- The IDB's country strategy papers and programming exercises must emphasize disaster risk management as a component of a long-term development strategy especially in highly vulnerable countries. The studies the Bank is funding in the area of indicators will be of great importance in identifying the highly vulnerable countries (see Cardona, 2005).
- Disaster risk management should include both high-probability, low-impact disasters as well as low-probability, high-impact disasters. This is opposite to the reactionary stand that has often prevailed, emphasizing only the low-probability, high-impact disasters.
- Open a regional dialogue dedicated to promoting public and private sector partnership in disaster risk management. The Regional Disaster Policy Dialogue sponsored by the IDB has studied the roles of local government and private sector in financing and organizing national disaster risk management systems. The next step to discuss the progress of the countries in implementing principles of shared

responsibility between government and the private sector (see Freeman et al., 2003; Bollen et al., 2003; Rojas 2004).

- Continue providing technical support to member countries on risk reduction and mitigation activities. These include financing country financial vulnerability assessments, evaluation of risk tolerance, optimal strategies for managing each layer of risk *and* the development of disaster insurance markets. The support may be carried out through country specific or regional initiatives, such as the Regional Disaster Policy Dialogue and the new Regional Public Goods Program (IDB, 2004a). Shared knowledge on effective risk management would greatly diminish vulnerability to disasters.
- Offer incentives for risk management in client countries to encourage implementation of prevention and mitigation measures. Demand for reimbursable financing is highly sensitive to the financial condition and political economy of the countries. The Bank will need to apply innovative combinations of loan and grant resources in cooperation with bilateral donors (IDB, 2004).

Strengthen IDB Internal Guidance and Capacities to Implement Them in Risk Management

- Ensure that Bank projects are sufficiently resistant to disasters and they themselves do not add disaster risk. For this purpose, the analysis of projects financed by the Bank, especially in highly vulnerable countries, should be screened for disaster risk in order to: (i) minimize damage and physical loss to current Bank projects in potential zones of risk, and (ii) adopt measures to eliminate potentially negative impacts of IDB projects on the affected populations. The Bank should highlight opportunities for mainstreaming disaster risk management in the design and execution in sector loans such as housing, infrastructure, energy, water and sanitation, agriculture development programs.

- Provide additional guidance for risk management in the Bank project cycle. This could include checklists that help project teams incorporate risk considerations in the design and implementation of projects. There should be adequate procedures to monitor and evaluate investments to ensure better learning from programs in the context of the environmental and social impact evaluation process. The guidance could be used for all projects in highly vulnerable countries and for projects with potentially significant disaster risk in other countries. The IDB should explore ways to incorporate disaster risk analysis in the environmental impact assessment processes according to the model under development by the Caribbean Development Bank (CDB, 2005)
- The design of projects in rehabilitation and reconstruction operations should take sufficient precautions to avoid rebuilding vulnerability. There is concern for transparency in loan reformulation after a disaster. The IDB would need to help analyze the potential opportunity costs of loan reformulation for long-term development goals, taking into consideration the consequences for the original intended use of and objectives, and the proposed new destiny of funds, thereby creating conditions for more informed decision-making on the part of the approving authorities and relevant stakeholders. Adequate transparency should be ensured in the execution of resource transfers through monitoring and auditing.
- Provide training for Bank staff on lessons learned from disaster risk management within and outside the IDB, and on best practices in the use of appropriate tools to implement successful strategies.

Evaluate Existing Financing Arrangements and Possibly Introduce New IDB Instruments

- Critically assess the vulnerability of the IDB portfolio to disaster risk in highly vulnerable countries. Develop near-term and long-term financial strategies to protect the Bank's portfolio.
- Analyze how important the moral hazard is in countries due to disincentives to investments in risk reduction when significant amounts of post-disaster relief and reconstruction money from external sources are present or perceived to be present.
- Analyze the mission risk (of not attaining the desired developmental impact) faced by the Bank due to frequent reconstruction financing through loan reformulations and fresh loans which increase indebtedness.
- Consider further development of the instruments of the Bank. Continue research into the IDB issuance of new financial mechanisms (such as CAT bonds) under the leadership of the Bank's Finance Department.

To conclude, mitigation and prevention funding must constitute the foundation of a risk management strategy, both for borrowers and for the Bank. Self-financing of losses may allow the countries to address the lowest layers of damage from calamities. Domestic and international financing arrangements can be used to address remaining risk. As the IDB works with borrowers to develop risk management strategies it should also consider risk management activities to protect the health of its portfolio against disaster loss. If successfully implemented, a balanced risk management approach will reduce the threat disasters pose to the IDB's mission as well as to the economic and social development of Latin America and the Caribbean.

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