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III. GOVERNMENT RESPONSES TO NATURAL DISASTERS IN THE CARIBBEAN¹

A. Introduction

1. **Economic vulnerability in the Caribbean region is extremely high.** A major driver of the region's vulnerability has been its exposure to external shocks generated by natural disasters—over the last three decades, all of the six Eastern Caribbean Currency Union countries ranked in the top ten in the world in terms of natural disaster events per square mile (see Table III.1). Despite this demonstrated susceptibility to natural disasters, Caribbean risk mitigation activities have been limited and the region's risk-transfer markets are generally weak.^{2 3} As a result, natural disasters have a large negative impact on economic activity and poverty in the Caribbean. This chapter briefly sets out the major channels through which small, disaster-prone countries can respond to the challenges posed by natural disasters, with an emphasis on options for ameliorating disaster risk in the Caribbean.

B. Disaster Risk Mitigation

2. **At the government level, there are three main responses to the economic vulnerability induced by natural disasters, and obtaining needed post-reconstruction funds:**

- *Risk identification and risk reduction* focus on reducing the effects of a disaster should one occur. Proper risk identification occurs through hazard data collection and mapping, and vulnerability and risk assessments. Similarly, risk reduction activities can tackle revealed vulnerabilities through broad programs of disaster mitigation and preparedness, such as by strengthening and relocating structures, retrofitting existing structures, and implementing and enforcing land use codes and building standards.⁴ Such activities are

¹ Prepared by Paul Cashin and Pawel Dyczewski.

² A disaster is the realization of risk (the potential for significant loss), requiring the presence of a hazard, and the vulnerability of physical and human capital to that hazard. While the Caribbean region is the most disaster-prone in the world, there are significant differences in disaster (typically hurricane) exposure within the region (see Rasmussen, 2004). Traditionally, the Leeward Islands (St. Kitts and Nevis, Anguilla, Montserrat, and Antigua and Barbuda) are more exposed to hurricanes than the northern Windward Islands (St. Lucia, Dominica) and Barbados, which in turn are more exposed than the southern Windward Islands (Grenada, St. Vincent and the Grenadines) and Trinidad and Tobago.

³ Cashin (2004) finds that Caribbean output volatility is about twice that of the United States, while Auffret (2003) attributes much of this excessive Caribbean volatility to exogenous natural disaster shocks.

⁴ Economic diversification and restructuring economies away from disaster-prone activities, while being a traditional means of risk mitigation, is a much more difficult challenge in geographically-small island economies with economic agents subject to covariant disaster risk.

important as they can sharply (and permanently) reduce disaster risk exposure, and assist in lowering the cost of risk transfer mechanisms by reducing the underlying structural risk of physical assets. Organizations such as USAID, the European Union, the Caribbean Development Bank and the World Bank have funded a series of disaster mitigation initiatives in the region in recent decades.

- *Self-insurance*, which involves the attainment of economy-wide insurance through the intertemporal transfer of national resources. A typical example might involve the accretion of a precautionary saving fund (based on actuarial probabilities) to draw down upon in the event of a disaster.⁵ For many developing countries, the first response to a natural disaster involves the diversion of revenue sources from development expenditure to disaster relief and reconstruction, as has been the experience in Grenada in 2004 following Hurricane Ivan; other forms of self-insurance involve domestic borrowing and tapping external saving (through borrowing and remittance flows).⁶
- *Risk transfer*, which involves the transfer of resources across states of nature. Risk transfer mechanisms can, in principle, provide a valuable channel for the provision of capital for rapid rehabilitation and reconstruction of public and private assets. There are several types of risk transfer mechanisms: *external assistance*, through sovereign debt relief and official development assistance; *market insurance and reinsurance*, which can provide replacement coverage for public and private assets beyond the capacity of self-insurance; *insurance risk pooling*, whereby geographical or cross-industry pooling lowers the high cost of disaster risk insurance emanating from the correlation of disaster risks; capital-market based *risk transfer instruments*, such as catastrophe bonds, catastrophe options, or weather-related derivatives; *contingent lines of credit*, whereby large sums of credit are made available to insurers and banks in the event of a large disaster on the basis of the payment of an annual commitment fee; and *changes in the composition and structure of public borrowing*, which could promote risk-sharing between debtors and creditors.

3. Some developing countries have undertaken ex ante measures, such as the establishment of disaster funds, to draw upon in the event of a natural disaster.⁷ These

⁵ However, contingency funds maintained in liquid accounts offer a lower rate of return than that typically earned on alternative investment of such funds, and there may be political difficulties in maintaining annual commitments and protecting accumulated funds (Benson and Clay, 2003).

⁶ Reconstruction financed by borrowing does increase national public debt, but typically does not increase a country's ability to service its debt. In addition, the majority of the six Fund members of the ECCU have public debt stocks which are extremely high. Reliance on debt-financed disaster reconstruction is not an optimal policy for highly-indebted, disaster-prone countries.

⁷ In 1996 Mexico established the Fund for Natural Disasters (FONDEN), which is an annual budgetary allocation designed to meet post-disaster expenditures. The fund is designed to finance the repair of uninsured infrastructure, restore the productivity of affected low-income farmers, and for disaster relief activities

(continued...)

funds are based on the principle that as self-insurers, governments should garner sufficient funds to cope with disasters. As a useful rule of thumb, such calamity funds should concentrate on absorbing catastrophic risks that cannot be readily transferred—in particular, the disaster-related damage caused to farmers, the under- (non-) insured, and the poor. While budgets in Caribbean countries do make provision for disasters, it is typically not to provide resources for disaster funds, but for current expenditure on emergency relief and disaster response activities.

4. **As a self-insurance strategy, diversification of labor income through emigration and remittances are useful means to insure against covariant risk arising from natural disasters.** The Caribbean region displays the highest emigration rate in the world—about 12 percent of the labor force of the region migrated to OECD countries during the 1970-2000 period (Mishra, 2005). The Caribbean region is also the largest recipient of remittances (in proportion to its GDP) in the world. Remittances to the region were about 10 percent of regional GDP in 2002, an amount much larger than overseas development assistance and foreign direct investment flows. It has been pointed out in the literature that remittances play a critical role in insurance and reducing consumption vulnerability arising from shocks.⁸

C. Implications and Weaknesses of the Caribbean Natural Disaster Management Approach

5. **The catastrophe insurance industry faces higher risks and less developed means of risk assessment than other types of insurance, resulting in higher and more variable premiums.** Generally, insurance premiums transfer risk across time and space using well defined techniques for risk assessment. Insurance premiums are calculated based on three main factors: the probability distributions of adverse events, the structural vulnerability of the insured assets, and the value of such assets.⁹ Unfortunately, because catastrophic events are by definition rather rare and very severe, there is a limited actuarial base available for

(particularly in rural areas). However, FONDEN was insufficiently capitalized to accomplish its multiple obligations, and was recapitalized with the assistance of the World Bank in 2002. In addition, it is important to bear in mind that public commitment to extend disaster coverage to private assets reduces the incentive for economic agents to purchase risk transfer instruments.

⁸ Evidence from econometric analysis using panel data from 1980–2002 for 13 Caribbean countries indicates that while there is weak support for a contemporaneous insurance motive, the insurance effect does occur with a lag of two years. A 1 percent decrease in real GDP is associated with an increase in remittances of about 3 percent, following a two-year lag. There is also evidence that countries with higher remittances have lower volatility of real private consumption, a result that is consistent with the insurance motive (Mishra, 2005).

⁹ Typically, only certain public assets are insured in most Caribbean countries: key public buildings, as well as some hospitals and airports. Catastrophe insurance is more common in insuring hotels and private tourism infrastructure. While there is no compulsory insurance coverage in the eastern Caribbean, catastrophe cover (involving all natural hazards) is typically required in securing a mortgage.

calculating probability distributions and intensities of future catastrophic events. As a result, catastrophe insurance must compensate for this uncertainty factor with higher premiums. Hence, the premiums for catastrophe insurance are proportionally higher than the probability of the insured events. When catastrophic events happen with greater than anticipated frequency (such as hurricanes and earthquakes in the mid-1990s), insurance companies (particularly reinsurance companies) respond with increased premiums, especially for vulnerable regions. For instance, Caribbean countries faced 200 to 300 percent higher insurance premiums in 1992 after Hurricane Andrew in Florida and in 1994 after the Northridge earthquake in California.

6. National and regional disaster contingency funds are too small to meet financing needs following a disaster. High reliance on donor emergency assistance throughout the Caribbean region adversely affects the creation of any sizeable contingency funds. In the ECCU, the Eastern Caribbean Central Bank has created a fiscal reserve fund for all member countries in economic difficulties (including those caused by disasters), with contributions sourced from each country's share of central bank profits. However, the fund's small size is insufficient for major disaster relief. Another contingency fund for the region is the Disaster Mitigation Facility for the Caribbean (DMFC). In 2001, with support from the USAID Office of Foreign Disaster Assistance, the Caribbean Development Bank (CDB) established the DMFC, marking an important step toward the promotion and coordination of risk management within the region. Activities of the DMFC include support for strengthened building standards and enforcement mechanisms, and assistance to member countries with the development of national-level risk management policies and plans.

7. Traditional insurance markets in the Caribbean are characterized by relatively concentrated coverage, high prices and low risk transfer. According to a World Bank study (Pollner, 2001), the proportion of residential and commercial properties in the Caribbean covered by traditional insurance is significantly higher (at around 2.3 percent of GDP) than in other developing countries. Relative to population size, the Caribbean enjoys one of the highest densities of insurance companies—one company per 14,000 inhabitants versus one per 107,000 inhabitants for the United States. This translates into an overcrowded industry with an average insurance company writing barely over US\$1 million in premiums, less than 1 percent of a comparative United States insurance company. In such a market, most Caribbean insurance companies act as mere agencies of large reinsurance companies (transferring some 70 percent of premiums and risks to reinsurers in Europe and the United States), rather than genuine underwriters. The cost of reinsurance in the Caribbean is high, largely due to the small capitalization of local insurers, and the high exposure of the region to disasters. Further complicating this situation is the insurance industry's almost exclusive focus on medium to large dwellings and private businesses. Most low-income households, small businesses and public infrastructure in the region remain uninsured. It is estimated that

between 25 and 40 percent of the dwellings in the region are uninsured (and largely uninsurable)—the great majority of them belonging to the above groups.¹⁰

8. **While the regulatory framework for insurers in the Caribbean is generally adequate, the specifics of the Caribbean insurance market necessitate reforms aiding market consolidation.** National governments regulate insurance markets in the Caribbean, and most Caribbean countries have adopted European insurance regulations, including registration requirement and capital requirements. However, due to fragmentation of the Caribbean insurance market, the expense ratios of insurance companies are high by international standards. The resulting situation prevents adequate build up of capital, and makes local insurance companies more vulnerable. Furthermore, the tax systems of some Caribbean countries discourage insurers from setting up specific reserve provisions prior to catastrophic events. Another limitation of insurance market fragmentation is the unwillingness of local companies to insure special risk categories, such as power utilities or major hotels and tourist resorts. Regulations increasing minimum capital requirement and tighter solvency ratios could contribute to industry consolidation and wider insurance coverage in the region.

9. **Ex-post financing of damage following natural disasters by international financial institutions and bilateral donor assistance has provided the largest pool of funds for rehabilitation and reconstruction in disaster-affected Caribbean countries.** The World Bank has supported natural disaster reconstruction projects across the region, and in recent years has expanded its investments in disaster mitigation projects in members of the Organization of Eastern Caribbean States (OECS).¹¹ Similarly, since 1962, the IMF has provided assistance on nonconcessional terms to 26 member countries afflicted by 29 separate natural disasters (Table II.2) through its Emergency Assistance for Natural Disasters (ENDA) policy. Since January 2005, PRGF-eligible Fund members can access this facility at concessional rates (an interest rate of ½ of 1 percent per year), with the interest subsidies financed by grant contributions from bilateral donors.¹² A higher amount of resources can be accessed under other IMF facilities, such as the Stand-By and PRGF arrangements, but they

¹⁰ Auffret (2003) confirms that Caribbean catastrophe insurance premiums represented about 1.5 percent of GDP over the period 1970–99, while average (insured and uninsured) losses were only about 0.5 percent of GDP. Both would be equal under actuarially-fair pricing, and confirm that the price of catastrophe insurance in the Caribbean is ‘high.’

¹¹ Worldwide, the World Bank has funded post-disaster reconstruction projects in the 1980s and 1990s totaling over US\$14 billion, concentrating on repairs to transportation infrastructure, energy systems, and essential social services.

¹² As of April 30, 2005, four countries—Grenada, Malawi, Maldives and Sri Lanka—have outstanding purchases under the Fund’s ENDA policy. Both Grenada and Malawi have accessed ENDA at subsidized rates of interest.

are slower to disburse, subject to conditionality, and not geared toward the specific financing problems induced by natural disasters.

10. **While most Caribbean countries have looked to international financial institutions and bilateral donor agencies for assistance to recover from disasters, it is rather uncommon for such flows to fully offset the losses incurred.** This shortfall has largely arisen due to stagnation in the level of resources available from international donors.¹³ Overseas development assistance (ODA) flows from developed countries to developing countries have fallen in real terms since the early 1980s, with average ODA flows to ECCU countries having declined from 11 percent of ECCU GDP in the 1980s to less than 5 percent of ECCU GDP in the period 2000–03. Of this shrinking amount, an increasing proportion has been allocated to post-disaster reconstruction.

11. **External assistance from the international community has typically been made available without any conditions on undertaking disaster mitigation measures, thereby creating moral hazard problems.** As a result, development institutions (both multilateral and bilateral) have served, in effect, as reinsurers of last resort. In addition, given that international financial institutions (IFIs) and bilateral donors find it difficult to commit not to provide such assistance, moral hazard arises as there is then little incentive for disaster-affected countries to undertake disaster mitigation investments, or self-insure against future disasters. A useful option for IFIs would be to provide disaster-related lines of credit, with access contingent on the ex ante undertaking of disaster mitigating activities.

12. **In spite of the existence of risk-transfer mechanisms, very few developing country governments use them to reduce the resource gap (defined as the difference between funds available and needed for post-disaster reconstruction expenditure).** The size of the resource gap rises with the probability of adverse events—the gap for 1-in-20-year events (5 percent probability of occurrence) is typically smaller than that for 1-in-100-year events (1 percent probability of occurrence). Unfortunately, little reconstruction funding is provided by traditional insurance in Caribbean countries. In addition, sovereigns rarely purchase disaster insurance, and typically do not insure public assets, while catastrophe bonds and weather derivatives issued by developing country sovereigns are nonexistent. At present, the major channels for resource flows for post-disaster expenditure typically involve: external aid flows; reallocation of budget expenditures; increased domestic credit (chiefly through local commercial banks); redirection of existing loans from IFIs; and additional external commercial or IFI credit.

¹³ A study of Dominica in the year following the 1995 hurricane season (during which it was hit with two hurricanes and a tropical storm) revealed that grants and loans pledged constituted about 40 percent of storm damage. Similarly, pledges received following Hurricane Ivan's devastation of Grenada in 2004 amounted to about 20 percent of storm damage.

D. Scope for Improved Disaster Management

13. **Transferring catastrophic risks to the capital market has been effectively used in some countries as means of spreading risk, stabilizing the insurance market, and increasing insurance coverage.** Given the capital constraints of reinsurance companies (and the resulting fluctuations in catastrophe insurance rates), as well as domestic risk aversion of local insurers, there is scope for seeking additional risk bearing capacity in capital markets. Securitization of catastrophe risk into marketable financial securities is one such solution, and several instruments have been actively trading in developed markets (U.S., Europe and Japan) since the mid-1990s. A prime example of such a security is a *catastrophe bond*. Catastrophe bonds pay investors high yields, but are subject to default on all or part of principal and interest if a catastrophic event occurs during the life of the bond. The insured invests the principal in a risk free asset and is allowed to withdraw only when the specified catastrophic event occurs.¹⁴ Other examples of such securities include: *exchange traded catastrophe options* (the purchaser of such an option can demand payment if an insurance claims index exceeds a prespecified level), *catastrophe equity puts* (an option which allows the insurer to sell equity shares after a disaster), *catastrophe swaps* (whereby an insurance portfolio with potential payment liability is swapped for a security with cash-flow payment obligations), or *weather derivatives* (contracts which provide payments on the occurrence of specified weather events).¹⁵

14. **Capital market-based instruments are potentially relevant to the Caribbean, but have yet to be used.** They could address current market failures—mainly enabling public utilities and the government sector to obtain some form of insurance against catastrophic damages to public infrastructure. However, a major barrier to using these noninsurance hedges is their cost—in particular, the transactions cost of using these instruments (particularly for single transactions) makes catastrophe bonds (for example) significantly more expensive than traditional insurance as a means of transferring risk (Swiss Re, 1999). As such, catastrophe bonds and other securities are likely to find their greatest applicability in relation to large risk-transfer transactions that are beyond the capacity of insurance and reinsurance markets to bear. However, this is not the environment found in the Caribbean, where the demand for insurance has been more than adequately covered by insurers, who then reinsure the bulk of their risk. This state of affairs suggests that traditional insurance

¹⁴ In capturing the financial risk of catastrophic events and transferring them to capital markets, catastrophe bonds pay out if a defined event (such as a category four hurricane on the Saffir-Simpson scale) occurs. Catastrophe bonds have traditionally been issued by an insurance or reinsurance company, to assist in transferring underwriting risk. However, while of potential relevance to governments in developing countries, as yet no developing country (including those in the Caribbean) has used such bonds to transfer catastrophe risk.

¹⁵ Weather-indexed securities have not been as successful as originally envisaged, even in developed countries. A major stumbling block appears to be that of ‘basis risk’—indexes such as the Saffir-Simpson scale or quantity of rainfall are often poorly correlated with the extent of individual losses.

will continue to be the dominant option for Caribbean countries seeking to undertake additional ex ante transference of disaster risk.

15. **Catastrophe insurance pooling might address many problems in the Caribbean insurance market.** Instead of transferring insurance risk abroad or to capital markets, Caribbean governments would have the option of insurance pooling for the entire region. Insurance pooling can be much more efficient than individual country insurance. The primary reason is that insurance premiums depend not only on the probability of a given event but also on the uncertainty attached to that probability. Uncertainty of the catastrophic event for a single Caribbean country is much higher than the uncertainty for a group of countries. According to Pollner (2001), *“Pooling not only institutionalizes the coverage via insurance of catastrophic risks for both the private and public sectors, but also allows more standardization in the rating and pricing of such risks. Pooling also provides more leverage to cover risks with limited capital available. By retaining some part of the risk that is bearable, this also helps stabilize the availability of such insurance funding and its pricing. This is accomplished via more efficient accumulation of catastrophe reserves which can help buffer some of the global market risks related to natural disasters.”* Such pooling of insurance funds has been successfully implemented in several countries, including Turkey, the United States, Japan, and New Zealand (Box III.1).

Box III.1 Turkish Catastrophe Insurance Pool

The Turkish Catastrophe Insurance Pool (TCIP) is a recent example of risk pooling for developing countries. The TCIP is relevant to the Caribbean region as it combines risk pooling with the introduction of appropriate incentives for loss mitigation. Specifically, the TCIP is an earthquake risk insurance pooling program which is mandatory for owners of urban residential property in Turkey. The pool provides cover up to approximately US\$50,000 for each dwelling, for a premium that varies across the country depending upon seismicity of the area, and the type and quality of housing construction. The government exercises oversight to ensure that insurance pools are managed responsibly. Exposure of the insurance pool is managed by the TCIP’s own reserves, with higher layers of exposure covered by the global reinsurance market and the World Bank. The financial support provided by the World Bank (in the form of liquidity readily available to insured homeowners affected by future events), and the involvement of private insurers and reinsurers have contributed to the success of the TCIP since its creation in 2000—as measured by its high penetration ratios (about 17 percent of households, the highest among similar pooling programs of national catastrophe insurance for homeowners). The TCIP has also produced greater insurance capacity for Turkey and Turkish risk, and has promoted a broader and more efficient (re)insurance market for such risk.

16. **Proposals have been made in the recent past that the high cost of insurance in the Caribbean can be reduced through disaster mitigation initiatives and through regional pooling of insurance coverage (designed to diversify risk).** The recommendation to establish a regional catastrophe insurance pool came out of a CARICOM Working Party on Insurance in the late 1990s. However, this attempt to establish a regional insurance pool for OECS countries (under the auspices of the World Bank) failed to take root, as several

countries opted out of the discussions (in part due to the lack of grant funds to complete technical work assessing the actuarial viability of the project). In the wake of the disastrous 2004 hurricane season in the Caribbean, a second attempt is currently underway, again under World Bank stewardship, to establish a risk pooling mechanism for CARICOM countries. At the heart of this proposal is the notion that risk pooling across different risk zones in the Caribbean has advantages in that it would lower the minimum net capital requirement and allow for more efficient reinsurance arrangements. Extending such pooling to other small island economies in the world would further diversify the risk, thereby lowering premiums.

17. **Changing the composition and structure of public borrowing could also assist in the international transfer of the economic risk of a natural disaster.** Compared with advanced countries, developing countries find it difficult to issue long-term debt in their own currencies. Sovereign borrowers also lack equity-like instruments which ensure that investors share in the gains and losses of the sovereign's economic performance. However, the risk-sharing benefits of equity can be mimicked by the issuance of financial instruments with payment terms indexed to real variables that are either: (i) partly within the control of national authorities, such as national GDP, or (ii) to exogenously-determined variables such as real commodity prices or the occurrence of a natural disaster. Such real indexation would provide insurance-like benefits by reducing both the likelihood of debt crises and (by acting as an automatic fiscal stabilizer) the need for procyclical fiscal policies. There is a role for international financial institutions to play in encouraging the creation of markets for the issuance of such real-indexed bonds, through such activities as the coordination of contacts between debt managers and international investors, and boosting the independence of national statistical agencies (see Borenzstein and Mauro, 2002).

E. Issues of Relevance to Developing Countries

Consequences of post-disaster assistance

18. **The provision of post-disaster financial aid has been the traditional strategy for dealing with Caribbean natural disasters, with international donors becoming the de facto insurer of last resort.** However, Caribbean governments keen to implement ex-ante disaster prevention and mitigation measures are required to undertake current expenditures to reduce future risk, and as with any expenditures, these have opportunity costs. At present, post-disaster assistance is highly subsidized, yet by purchasing insurance and disaster-risk transfer mechanisms, poor disaster-affected countries will have to bear many of the costs presently borne by international donors. Unless international donors can credibly commit to not provide post-disaster assistance, there is little incentive for countries to undertake risk-transfer strategies or engage in risk-reduction and mitigation efforts. This is the 'Samaritan's dilemma', whereby households, farmers and businesses rationally believe that governments will be under political pressure to recognize uninsured losses; in turn, governments rationally believe that external donors will provide post hoc disaster assistance. In both cases, there is likely to be rational underinvestment in ex ante disaster mitigation activities.

Demand for risk-transfer mechanisms

19. **The demand for risk-transfer mechanisms will be determined by a country's willingness to accept the risk of lower future income due to disasters.** This willingness is a function of: (i) the probabilistic size of the risk; (ii) the cost of insurance; and (iii) the cost of other risk-transfer mechanisms (including subsidized post-disaster assistance). The degree of risk aversion in Caribbean countries will be a key determinant of the desirability of risk transfer mechanisms.¹⁶ Moreover, the greater the post-disaster access to external savings, the lower will be the demand for risk-transfer mechanisms.

What is government risk from natural hazards?

20. **How does one measure government risk from natural hazards?** In seeking to identify the risk that is being transferred, the responsibility of a developing-country government for losses from natural disasters is often poorly defined. Is government risk to be limited to the rehabilitation of public assets (risk-shifting of government-owned assets); or is public risk to be extended to losses by householders, farmers and businesses (resolution of market failures in the provision of risk-transfer options to nongovernment),¹⁷ or even extended further to work programs and public assistance to the poor? An important barrier to the adoption of risk-transfer mechanisms in developing countries is both the inability to calculate government risk from natural hazards and the tendency of developing-country governments to assume private sector risks (World Bank, 2002).

21. **However, for the transfer of catastrophe risks to operate, the risks being hedged against need to be precisely quantified.** Typically there is a three-stage process in quantifying the hedging of government risk: first, catastrophe modeling will enable a quantification of the expected annual loss; second, where the provision of government-sponsored insurance is involved, additional ambiguities involving moral hazard and adverse selection need to be taken into account; third, the poor may have claims on public resources in times of crisis, as disasters reduce income and destroy personal assets; and finally, the cost of any risk-transfer mechanism needs to be compared to existing sources of internal and

¹⁶ Catastrophe insurance is expensive, with premia several times larger than the actuarially-determined expected loss, chiefly due to a large risk premium arising from the variance of catastrophic losses (Froot, 1999). Over the past two decades, less than 1 percent of losses from catastrophes were insured in poor countries (Rasmussen, 2004).

¹⁷ Crop insurance is not typically available in the Caribbean, which makes poor farmers especially vulnerable to natural disasters. An exception exists for banana growers, whereby growers' cooperatives have banded together to provide crop insurance to farmers in Dominica, St. Lucia, Grenada and St. Vincent and the Grenadines affected by windstorm damage, through the Windward Islands Crop Insurance (WINCROP) scheme. About one-fifth of losses (including those arising from disasters) are covered. The size of the fund has been hampered by limited reserves, traditional adverse selection and moral hazard constraints, costly monitoring of small farmers, and large covariant risk in insuring crop yields.

external financing to cover disaster risk. To properly shift risk, the risk of loss itself needs to be defined. In developing countries, the risk of loss to government assets and activities of government may be so ambiguous that risk-shifting is not a viable option for the components of government risk.

F. Conclusion

22. **The Caribbean ranks as one of the most disaster prone regions in the world.** The macroeconomic impact of natural disasters often results in severely reduced welfare of these small island economies, with a disproportionate impact on the poorest segments of the populations and the mostly uninsured public infrastructure.

23. **Rather than ex ante preparedness for highly-likely disaster events, Caribbean governments have emphasized ex post responses.** Given limited coverage for natural disaster risks provided by local insurance markets, and the dearth of incentives for governments and households to undertake risk mitigation investments, Caribbean governments have typically emphasized ex post responses to natural disasters through the receipt of donor-based emergency external assistance and the diversion of expenditures within domestic budgets. However, while the frequency of natural disaster events and the value of assets at risk continue to rise, the capacity of donors to fund disaster assistance continues to remain constrained. The end result is a growing gap between the need for, and availability of, resources for disaster reconstruction and relief.

24. **Several tiers of nonmutually exclusive disaster risk management approaches are appropriate for Caribbean countries facing the world's highest risk of natural disaster.** Broadly, Caribbean countries should continue to finance post-disaster expenditures with their traditional financing instruments, supplemented by innovations in insurance and risk-transfer instruments. As always, the appropriate mix of financing options will need to place strong weight on the least-cost financing alternatives.

25. **The mix of financing options for post-disaster expenditure can usefully be arrayed as a graduated response to increasing layers (or levels) of natural disaster risk:**

- a. First, the undertaking of proper vulnerability assessments and fostering of actions designed to mitigate disaster risk and enhance post-disaster response is a key means to reduce immediate catastrophe risk. Indeed, the lack of knowledge by Caribbean governments of the risk of disaster events has hindered the ability of policymakers to plan for such disasters. Mitigation actions would include adopting and enforcing strong building codes, enhancing disaster management agencies, and ensuring effective supervision of national insurance companies.
- b. Second, lower level risk layers could be covered by the establishment of ex ante funding approaches, including the creation of taxpayer-funded national disaster contingency funds, emigration and remittance flows, and intertemporal consumption smoothing through the provision of traditional insurance for key public assets. While self-insurance

will not provide the full cost of disaster reconstruction, it is important that sufficient funds be available to government to meet the immediate (short-term disaster relief and rehabilitation) costs of disaster. Continuation of self-insurance by national governments would also be important, through the exercise of their taxing and borrowing powers to provide finance for disaster reconstruction and relief. However, Caribbean governments would also need to consider the sustainability of public debt stocks in any decision to incur additional domestic and external debt to finance post-disaster expenditures.

- c. Third, for higher risk layers, greater recourse could be made to risk transfer mechanisms such as regional insurance pools for catastrophe insurance of public and private assets. Where insurance markets are underdeveloped (as in the Caribbean), this may involve spreading risk through the establishment of a regional catastrophe insurance pool, potentially supported by reinsurance and catastrophe bonds, and require mandatory insurance policies and stringent risk mitigation initiatives.
- d. Fourth, for extremely high risk layers, provision could be made for access to contingent lines of credit.
- e. Fifth, funding of post-disaster expenditures would remain important. Such funding would include the continuing provision by IFIs and bilateral donors of concessional loans and grants designed to finance post-disaster mitigation and reconstruction costs, focusing on disaster relief and the rehabilitation of low-income households. Such funds should be made at least partly contingent on the undertaking of ex ante risk mitigation activities, so as not to encourage excessive moral hazard (Gurenko and Lester, 2004).

26. **While international capital market instruments (such as catastrophe bonds and weather derivatives) are promising risk transfer mechanisms, without subsidization from IFIs or donors they are beyond the reach of most developing countries.** A more practical approach would be to continue to tap local insurance markets until they are saturated. Indeed, proposals by the World Bank to establish the Caribbean Catastrophe Insurance Pool combine both approaches, involving government-supported regional insurance pools and publicly-issued catastrophe bonds.

27. **Importantly, the opportunity cost of greater use by developing countries of risk transfer mechanisms needs to be considered.** Indeed, it may be optimal from a developing country government perspective to engage in further borrowing, and seek debt forgiveness and donor flows as the main responses to natural disasters. That is, the public sector in most Caribbean countries does not typically insure its assets against catastrophic events, and this

behavior may well be optimal given the existence of donor support and prevailing conditions in regional insurance markets.¹⁸

28. Risk-transfer mechanisms can also play a vital role in promoting risk mitigation.

A key objective should be to transform the balance of catastrophe risk management in the Caribbean away from ex post, ad hoc responses and toward ex ante risk mitigation activities. As noted by the Fund,¹⁹ the willingness of donors to fund ex post disaster relief and reconstruction is finite. Financing gaps between limited donor resources and growing need for post-disaster funding will continue to rise, unless disaster-prone Caribbean countries undertake more ex ante disaster risk identification and mitigation activities, supplemented by greater recourse to risk transfer mechanisms.

¹⁸ From the perspective of Caribbean governments, the opportunity costs of risk transfer mechanisms include: creation of a catastrophic risk insurance program will limit discretion to provide disaster relief subsidies, and will undermine the ability of countries to access post-disaster external assistance; accumulating funds in national disaster funds will divert scarce national savings from other productive uses; and creation of a regional disaster insurance pool may result in the loss of reinsurance commissions to local insurers which have a relationship with international reinsurers.

¹⁹ See *Fund Assistance for Countries Facing Exogenous Shocks* (www.imf.org).

Table III.1. Worldwide Incidence of Natural Disasters, 1970–2002

	All Recorded Disasters					With Estimates of Persons Affected			With Estimates of Damage		
	Number of Events	Number of Events Divided by Land Area		Number of Events Divided by Population		Number of Events	Cumulative Affected in Percent of Population		Number of Events	Cumulative Damage in Percent of Annual GDP	
		Index	Rank	Index	Rank		Total	Rank		Total	Rank
All countries	6,480	100	76	100	76	4,511	62	76	2,036	21	76
Advanced economies	1,511	23	70	39	91	742	7	119	742	3	104
Caribbean	162	599	23	387	23	114	65	66	58	37	46
ECCU6	44	1,212	5	770	6	31	85	58	18	66	19
Antigua and Barbuda	7	1,198	3	883	4	6	248	7	2	22	34
Dominica	8	803	8	890	3	6	125	27	4	118	7
Grenada	4	886	7	348	12	2	1	127	3	23	32
St. Kitts and Nevis 1/	7	1,465	2	1,295	2	4	33	70	4	132	6
St. Lucia 2/	8	988	6	451	8	5	64	52	2	67	13
St. Vincent and the Grenadines	10	1,931	1	755	6	8	41	67	3	35	23
Other Caribbean	118	190	36	131	35	83	52	71	40	17	63
Bahamas	5	38	37	170	20	2	1	128	2	13	49
Barbados	6	1,051	4	193	19	5	3	117	3	7	67
Belize	10	33	41	457	7	7	131	25	7	51	16
Dominican Republic	23	36	39	29	69	14	62	53	4	17	40
Guyana	6	2	128	67	39	3	89	42	2	4	77
Haiti	36	98	23	47	50	30	83	46	4	9	62
Jamaica	23	160	17	82	33	15	74	49	13	50	17
Netherlands Antilles	2	188	14	90	31	1	20	78	1	1	122
Trinidad and Tobago	7	103	21	48	47	6	5	104	4	1	119
Other	4,807	49	84	75	79	3,655	74	67	1,236	23	73
GDP per capita of top-20 3/	...	...	4.2	...	5.5	...	...	1.4	...	...	1.9

Sources: EM-DAT for data on natural disasters, including estimates of the number of people affected and the value of damage; World Bank, World Development Indicators for data on land area; IMF, World Economic Outlook database for data on GDP and population.

Note: The sample contains 150 countries after omitting countries without at least one natural disaster associated with a cost estimate and/or missing information on GDP (24 advanced economies, 15 Caribbean countries, and 111 other developing countries). Simple unweighted averages are used for country groupings. Rankings are in descending order, with "1" indicating the most exposed to natural disaster.

1/ Using St. Kitts National Emergency Management Agency's damage estimate for 1998 Hurricane Georges would have implied a ranking of "2" in the last column.

2/ Excludes EM-DAT's damage estimate for 1988 Hurricane Gilbert. If included this would have implied a ranking of "1" in the last column.

3/ In thousands of U.S., dollars in 2002.

Table III.2. IMF Emergency Assistance for Natural Disasters, 1962–2005

Country	Year	Event	Purchases	
			In Mmillions of U.S. Dollars	In Percent of Quota
Egypt	1962	Crop failure	24.0	26.7
Yugoslavia	1963	Earthquake	30.0	25.0
India	1966	Drought	187.5	25.0
Nicaragua	1973	Earthquake	14.5	44.4
Chad	1974	Drought	3.4	21.5
Dominica	1979	Hurricane	1.3	50.0
Dominican Republic	1979	Hurricane	22.2	31.8
St. Lucia	1980	Hurricane	2.3	50.0
St. Vincent and the Grenadines	1980	Hurricane	0.5	25.0
Yemen, P.D.R.	1982	Floods	16.8	25.0
Yemen, Arab Republic	1983	Earthquake	10.7	50.3
Madagascar	1986	Cyclone	19.0	25.0
Mexico	1986	Earthquake	320.1	25.0
Solomon Islands	1986	Cyclone	1.5	25.0
Ecuador	1987	Earthquake	48.2	25.0
Bangladesh	1988	Floods	96.8	25.0
Jamaica	1989	Hurricane	48.1	25.0
Pakistan	1992	Floods	261.4	25.0
Bangladesh	1998	Floods	138.2	25.0
Dominican Republic	1998	Hurricane	55.9	25.0
Haiti	1998	Hurricane	21.0	25.0
Honduras	1998	Hurricane	65.6	50.0
St. Kitts and Nevis	1998	Hurricane	2.3	25.0
Turkey	1999	Earthquake	501.0	37.5
Malawi	2002	Food shortage	23.0	25.0
Grenada	2003	Hurricane	4.0	25.0
Grenada	2004	Hurricane	4.4	25.0
Maldives	2005	Tsunami	6.3	50.0
Sri Lanka	2005	Tsunami	158.4	25.0

Sources: International Monetary Fund.

Note: Caribbean countries are indicated in bold.