Being Prepared

Natural disasters are becoming more frequent, more destructive, and deadlier, and poor countries are being hit the hardest.

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AS THE incidence and intensity of natural disasters have increased, the resulting economic losses have soared. During the past 10 years for which comprehensive data are available (1992–2001), losses stemming from natural disasters have averaged about $65 billion a year—more than a sevenfold real increase since the 1960s (see pages 40–41)—and they are expected to increase another fivefold over the next 50 years. A comprehensive study by Munich Re, a reinsurance company that specializes in disaster business, estimates that the global direct costs of natural disasters will top $300 billion annually by 2050, about 750 percent, in real terms, of current levels. Munich Re estimates that average losses will range from a few tenths of a percent of GDP to a few percent of GDP and that some countries, especially small island states, could face losses exceeding 10 percent of GDP.

Many scientists believe that global warming is responsible for the increasing frequency and severity of extreme weather events like floods, hurricanes, windstorms, and droughts. While few places will be spared, Asia and Latin America will probably feel the effects of climate change the most. The Intergovernmental Panel on Climate Change (IPPC) forecasts a 90 to 99 percent chance that, over the next 50 years, floods and droughts will become more common in Latin America, rising sea levels will threaten the survival of some island states, and tropical cyclones will become more intense.

The growing urbanization of the world's population has compounded the problem: even a minor event can cause significant damage in a heavily populated area. The proportion of people in developing countries who live in cities has doubled since 1960. More than 40 percent now live in urban areas, and this figure is expected to surpass 55 percent by 2030. Nearly half of these cities are subject to extreme weather events because of the same features that made them attractive to settlers—such as natural flood plains, alluvial soil, and river or sea access. Fourteen of the world's 19 megacities—cities with 10 million or more inhabitants—are in coastal zones, and over 70 of the world's 100 largest cities can expect a strong earthquake at least once every 50 years (see table).

Ninety-four percent of the world's major disasters in 1990–98 were in developing countries, according to the World Bank's *World Development Report 2000/2001*. However, these countries have made fewer efforts than developed countries to adapt their physical environments to mitigate the impact of natural disasters or to insure themselves against disaster risk, partly because of the disincentive known as the "Samaritan's dilemma." The dilemma arises whenever those at risk (whether private sector parties or governments of vulnerable countries) expect to receive support if disaster strikes (from their national government or foreign donors) and therefore underinvest in protective measures—physical and financial—to reduce the costs they will incur when it does strike. And, given the humanitarian imperative, it is hard for those in a

position to help to make a credible commitment to scale back postdisaster assistance even if those suffering did not take appropriate protective measures.

The vulnerability of the poor

Twenty-four of the 49 poorest countries face a high level of disaster risk; at least 6 of them have been hit by 2–8 major disasters in each of the past 15 years. The chart on page 44 shows that the frequency of disaster in the 77 poor countries eligible for support under the IMF's Poverty Reduction and Growth Facility (PRGF) is both high (with an average of nearly three disasters each in 2002) and apparently rising. Small island states are also especially at risk because of their small economies, dependence on agriculture and tourism, and narrow resource base. Some may eventually disappear.

Although economic losses stemming from natural disasters are smaller, in absolute terms, in developing than in developed countries, because of lower levels of infrastructure and capital stock, they are far higher relative to GDP. Between 1985 and 1999, the world's wealthiest countries sustained 57.3 percent of the direct losses caused by disasters, representing 2.5 percent of their combined GDP; the world's poorest countries accounted for only 24.4 percent of losses, but their losses represented 13.4 percent of their combined GDP. Loss of life, moreover, is far greater in developing countries. More than 97 percent of all deaths from natural disasters in 1990–98 were in developing countries.

Within developing countries, the poor are more likely to suffer than the rich. First, they often live in areas especially vulnerable to destructive events such as floods, hurricanes, and landslides (not least because high-risk housing is more affordable). Second, disasters can severely depress the food production of the rural poor. Third, even small reductions in income can have a dramatic impact on the poor: their savings are unlikely to be adequate in the event of large-scale or multiple catastrophes, and they may be forced to sell real assets such as agricultural land and livestock. Fourth, damage to water supply and transport infrastructures hurt the poor more than they hurt the rich. Finally, the poor are less likely to have access to risk-sharing mechanisms like insurance.

Disasters can substantially increase measured poverty. It has been estimated that El Niño increased headcount poverty in affected areas in Ecuador by more than 10 percentage points, and about 50 percent of the increase in headcount poverty in the Philippines during the 1998 crisis has been attributed to El Niño.

Macroeconomic impact

The destruction of physical assets, including capital stock, infrastructure, natural resources, and, not least, labor, has both a short- and a long-term impact on macroeconomic performance in some countries, while natural disasters have caused only minor economic disruptions in others. In 25 country-specific studies, the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) found that the worse socioeconomic conditions were at the time a disaster struck, the stronger its impact.

In the wake of a natural disaster, a country's tax base shrinks while its spending needs rise. Because disasters are small relative to their economies, developed countries have the flexibility to meet the cost of disaster relief by some mix of temporary tax increases—Germany temporarily raised taxes, for instance, after the 2002 floods—and borrowing. It is far more difficult for developing countries to raise taxes. Unless they receive external grants, they must either increase borrowing or resort to monetization.

Along with the deterioration of their fiscal position, affected countries may suffer a weakening of their trade balance, as declining production of export goods and postdisaster reconstruction boost demand for imports and divert tradables to the home market. These developments, combined with the flight of panicky foreign investors, put downward pressure on the exchange rate, resulting in inflationary pressures. Disasters depress not only the immediate macroeconomic outlook but also the balance sheet positions of key economic sectors. Public sector debt ratios are likely to worsen and domestic saving to decline, forcing both the private and the public sectors to increase their borrowing abroad.

Preparedness

To some extent, countries can prepare themselves for natural disaster by adapting their physical environment and their economies and by purchasing insurance. (Measures aimed at reducing the risk of natural disasters, like lowering carbon dioxide emissions, are not addressed here.)

Megacities at risk

Cities with 10 million or more inhabitants, 2000 and 2015

2000 (millions of people)		2015 (millions of people)	
Tokyo*	26.4	Tokyo*	26.4
Mexico City	18.1	Bombay*	26.1
Bombay*	18.1	Lagos*	23.2
São Paulo	17.8	Dhaka*	21.1
Shanghai	17.0	São Paulo	20.4
New York*	16.6	Karachi*	19.2
Lagos*	13.4	Mexico City	19.2
Los Angeles*	13.1	Shanghai*	19.1
Calcutta*	12.9	New York*	17.4
Buenos Aires*	12.6	Jakarta*	17.3
Dhaka*	12.3	Calcutta*	17.3
Karachi*	11.8	Delhi	16.8
Delhi	11.7	Metro Manila*	14.8
Jakarta*	11.0	Los Angeles*	14.1
Osaka*	11.0	Buenos Aires*	14.1
Metro Manila*	10.9	Cairo*	13.8
Beijing	10.8	Istanbul*	12.5
Rio de Janeiro*	10.6	Beijing	12.3
Cairo*	10.6	Rio de Janeiro*	11.9
		Osaka*	11.0
		Tianjin*	10.7
		Hyderabad	10.5
		Bangkok*	10.1

Source: UN Population Division, March 2000.
* Cities located in coastal areas.

Adaptation. Possible measures include land-use planning to avoid construction on seismic fault lines, in vulnerable coastal regions, and on river shorelines; adoption of standards aimed at ensuring that buildings are resistant to shocks like earthquakes and hurricanes; mitigation of environmental degradation like soil erosion that can increase the impact of disasters; and engineering interventions, such as the creation of dams for flood control, dikes to reroute flood waters, and seawalls to break storm surges. In its 2001 *World Disaster Report*, the Red Cross argued that investments of $40 billion in disaster preparedness, prevention, and mitigation would have reduced global economic losses in the 1990s by $280 billion.

Governments can also promote farming practices that enable farmers to weather climatic variations—using drought-resistant crop varieties, for instance—and help farmers increase their ability to adapt to long-term change. To ensure adequate water supply, governments may need to anticipate increased seasonal variation and greater frequency of both storms and dry periods.

Developed countries have done much more than developing countries to protect themselves against natural disasters. The United States, in particular, significantly increased expenditures on preparedness, mitigation, and recovery during the disaster-prone 1990s—$1.9 billion in fiscal 1999 alone, according to the National Emergency Management Association. In contrast, many developing countries lack the financial resources, technical knowledge, and political will to mitigate physical vulnerability. Moreover, in many countries—especially the small island countries—physical adaptation is inordinately expensive. And mitigation measures can eliminate only some of the risk, much of which stems from the movement of people to disaster-prone areas.

Insurance. Even the best prepared will not be able to avoid all natural disaster–inflicted damage. While disaster insurance is fairly extensive in the United States—more than 50 percent of direct losses from catastrophes is insured—it is much less commonplace in other developed countries. In Austria, the Czech Republic, and Germany, for instance, only about 10–20 percent of the losses from the floods in 2002 were insured. And, in countries with per capita incomes below $10,000, insurance coverage is less than 10 percent; in those with per capita incomes under $760, it is about 1 percent. Asia, which suffered half of all the damage caused by natural catastrophes and two-thirds of all the casualties from catastrophic events in 1997, accounted for only 8 percent of global purchases of catastrophic insurance, whereas Japan, the United Kingdom, and the United States—less than 2 percent of the total market—accounted for 55 percent of the total.

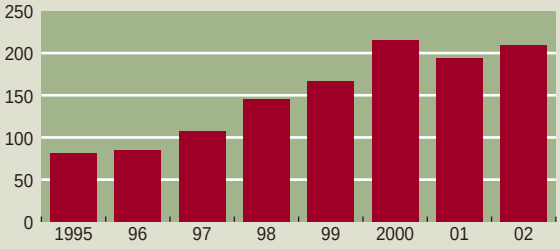
The insurance sector is still rudimentary in many developing countries. Disaster insurance is largely confined to wealthy individuals and large enterprises, such as utilities and hotels, that are strongly affected by the weather. Such insurance schemes as have existed—usually offered by the public sector—have often failed because of high administrative costs, inefficient loss calculation, and inadequate premium charges. In many countries, governments have stifled the development of innovative insurance products by operating highly subsidized public insurance programs.

There are important failures in the market for disaster insurance. Adverse selection—the purchaser of insurance knowing more about the underlying risk than the seller—may be less of a problem than in other insurance markets, in that the likelihood of disaster is, in principle, knowable with some accuracy, as is the value of the property at stake. In the San Francisco area, for instance, insurers are able to differentiate risk by zip code. Risk predictions are less accurate in many developing countries; however, this is due not to inherent technical constraints but to the thinness of existing markets. This is not to say that assessing risk is easy—indeed, climate change is adding to the difficulty of assessing the probability of extreme weather events, and ill-defined property rights make assessment even more complicated in developing countries. Nevertheless, two other problems appear more fundamental: the difficulty of risk spreading (given the size of the loss relative to that of the affected economies) and the Samaritan's dilemma.

New financial instruments tailored to extreme natural events have been developed but have had little impact as yet (see box). And, although governments could ease market failures in the provision of disaster insurance, they are generally not positioned to act as insurers of last resort. However, by strictly enforcing building and zoning regulations, they can monitor firms' and households' preparedness in a cost-effective way. Perhaps more important, governments can address their Samaritan's dilemma by making the purchase of insurance compulsory or providing a premium subsidy. France provides for catastrophe insurance using the existing fire insurance program backed by government guarantees. Other developed countries have established public-private collaborative schemes to insure catastrophic events through risk pooling, coupled with group reinsurance arrangements and last resort credit backup. Turkey's recently established

Hardest hit

The number of natural disasters in PRGF-eligible countries is high and rising.



Source: Center for Research on the Epidemiology of Disasters database and IMF staff calculations.

insurance program for homeowners' losses from earthquakes is based on this model. While such measures can be an efficiency-enhancing response to market failure, they have a serious drawback—they may perpetuate inadequate adaptation. It is widely believed, for instance, that government support for subsidized insurance (and relief when disaster strikes) has encouraged inefficient migration in the United States to disaster-prone coastal areas on the eastern seaboard.

Fiscal implications

Countries at risk must also prepare themselves fiscally for natural disasters. The risk of natural disaster creates a contingent liability of a particularly difficult kind, given the implicit guarantees given to—or at least perceived by—the private sector. Because of the lack of demand for, or unavailability of, insurance in many developing and emerging market countries, governments assume substantial risk for reconstruction after a disaster. (For example, the World Bank estimates that approximately 50 percent of its postdisaster funding goes to restore damaged housing.) More generally, the protection of those affected by disaster is widely seen as a basic duty of government.

Countries must identify and acknowledge such contingent liabilities. This requires assessing the probabilities and costs of the various natural disasters that might befall them. Clearly, there is considerable uncertainty as to, for example, the maximum loss that might be suffered. There is, however, considerable historical information to build on. Combining this with evidence on current trends, a rough estimate should be feasible. A recent study by the World Bank, Swiss Re, and the International Institute for Applied Systems Analysis illustrates how natural catastrophe loss calculations can be integrated into the World Bank's macroeconomic planning model for countries.

Some provisioning against the risk of disaster may also be appropriate. While governments typically set up contingency funds to deal with unanticipated spending needs, natural disasters are not systematically factored into the calculations. A number of countries have been exploring the use of reserve funds for postdisaster financing. Mexico's FONDEN, for example, is an annual budgetary allocation for natural disaster expenditures. While it is evidently impossible to set aside enough to meet the costs of all conceivable disasters—and this would, in any event, not be the best use of scarce development funds—the importance of covering the immediate costs makes it prudent to adopt a fiscal stance that provides some degree of self-insurance.

Disaster risk makes it appropriate for a government to adopt a tighter long-term fiscal stance (with possible exceptions for investment in measures of adaptation). In general, one would expect the amount set aside to be higher (relative to the expected loss) the larger the potential loss relative to national income, the greater the likelihood of disaster, the more expensive the insurance, and the more risk-averse the government. Governments, especially in developing countries, can also offset failures in local insurance markets—for example, by issuing guarantees to insurers and reinsurers (guarantees that might then be hedged in world reinsurance and capital markets). There may also be scope for simply requiring certain parties to buy at least a minimum amount of insurance coverage. Not least, governments might do more to insure their own property.

The international financial institutions can support these efforts by tackling market failures and helping to finance relief and adaptation efforts. Prompt foreign assistance can reduce both the long-term macroeconomic damage caused by natural disasters—although some physical losses may be permanent (for example, irreversible soil erosion caused by severe flooding)—and the costs of recovery. The quicker output recovers, the less the public sector will need to borrow or monetize, and the sooner clean water is restored, the lower the morbidity impact. ■

Risk management

New financial instruments for hedging against weather and natural disaster risks are available in international capital markets.

- **Catastrophe bonds** are subject to default if a defined catastrophe occurs during the life of the bond but are attractive to investors because of their correspondingly high yields.
- **Contingent surplus notes** are essentially "put" rights that allow the notes' owners to issue debt to prespecified buyers in the event of a catastrophic event.
- **Exchange-traded catastrophe options** allow their purchasers to demand payment under an option contract if the index of property claims service options traded on the Chicago Board of Trade surpasses a prespecified level. Indexes cover different areas of the United States and reflect insurance industry aggregate reported claims.
- **Catastrophe equity puts** are a type of option that permits the insurer to sell equity shares on demand after a major disaster.
- **Catastrophe swaps** are derivatives that use capital market players as counterparties. An insurance portfolio with potential payment liability is swapped for a security and its associated cash flow payment obligations.
- **Weather derivatives** are contracts that provide payouts in the event of a specified number of days with temperatures or rainfall above or below a specified trigger point.

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For a more detailed treatment of this issue, see the authors' paper "Dealing with Increased Risk of Natural Disasters: Challenges and Options" (forthcoming; Washington: International Monetary Fund, 2003).