Financial Protection of the State against Natural Disasters

Francis Ghesquiere, Lead Disaster Risk Management Specialist, World Bank

Olivier Mahul, Program Coordinator, Insurance for the Poor & Disaster Risk Financing, World Bank[1]

Revised version: May 15, 2010

Summary

This paper has been prepared for policy makers interested in establishing or strengthening financial strategies to increase the financial response capacity of government of developing countries in the aftermath of natural disasters while protecting their long term fiscal balance. It analyses various aspects of emergency financing, including the type of instruments available, their relative costs and disbursement speed, and how these can be combined to provide cost-effective financing for the different phases that follow a disaster. The paper shows in a didactic manner why governments are usually better served by retaining most of their natural disaster risk through risk retention while using risk transfer mechanisms to manage the excess volatility on their budget or access immediate liquidity in the aftermath of a disaster. Finally, it discusses innovative approaches to disaster risk financing and provides examples of strategies implemented by developing countries in recent years.

Introduction

There has been increasing interest in recent years on the use of financial instruments to help developing countries cope with their financial needs resulting from natural disasters. Indeed, various new instruments have become available that allow government to more easily access the international markets either to transfer their risk in order to better manage the volatility created on their budget by natural disasters and access immediate liquidity post-disaster. Yet, a key lesson from the experience of the last decade shows that there is no magic bullet. Governments interested in strengthening their response capacity will generally have to combine a number of financial instruments and policies that complement each other.

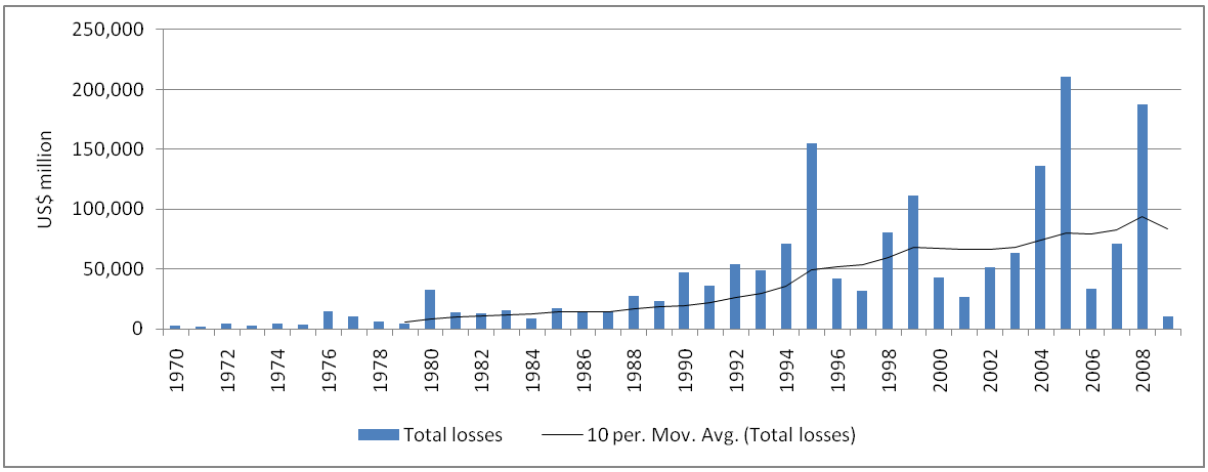
This paper presents a simple framework to help policy makers devise financial protection strategies against natural disasters. It starts with a short analysis of the impact of disaster on government budget and fiscal balance. It presents various instruments available to governments interested in improving their response capacity in the aftermath of a disaster while protecting their long term fiscal balance. It then provides a brief analysis of various dimensions to be considered in the establishment of a cost-effective financial protection strategy and provides a general framework to guide the establishment of such strategy.

[1] Contact author: omahul@worldbank.org.

Why Should Developing Countries Develop Risk Financing Strategies?

Disaster losses are increasing all over the world. Figure 1 presents estimates of damage from natural disasters. This upward trend is principally due to increase in population and assets exposed to adverse natural events, a trend likely to worsen with growing urbanization, environment degradation and an expected increase in the number and intensity of hydrometerological events resulting from climate change.

Figure 1. Direct losses from natural disasters, worldwide

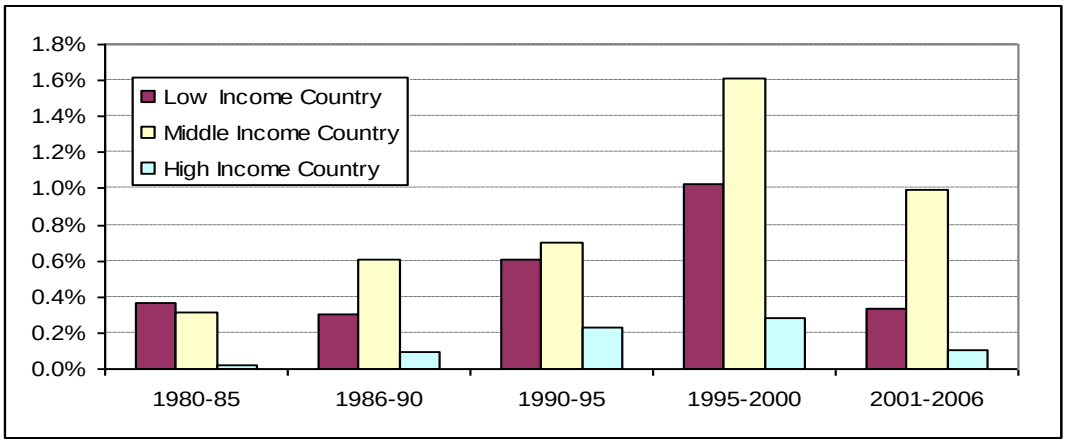


The estimated direct losses (in value of 2009) from natural disasters (CRED definition) excludes: epidemics, insect infestations, slides and wildfire.
Source: CRED EM-DAT database.

Developing countries are particularly vulnerable to adverse natural events. Advanced economies are generally able to dedicate increasing resources to reducing vulnerability, including enforcement of building standards and retrofitting of lifeline infrastructure. This is rarely the case in developing countries, many of which are going through rapid urbanization without the means to implement effective risk mitigation strategies. Emerging economies are particularly impacted, as they generally experience rapid growth in their asset base (growth in infrastructure and economic activities) before systems can be put in place to adopt appropriate building standards.

Disasters have a particularly disruptive effect on the fiscal balance of developing countries. It is well known that poorer countries bear the brunt of disaster loss when it comes to the number of victims. For earthquake alone, the ratio is estimated to be one in ten. What is less known is that developing countries also bear the brunt of disaster impact in terms on economic and budget impact. Figure 2 shows the estimated average annual direct losses as percentage of GDP for low-, milld and high-income countries. Middle income countries are particularly affected by natural disasters (in terms of GDP) due to their increasing asset base at risk.

Figure 2. Average annual direct Losses from natural disasters compared to GDP



Source: Cummins and Mahul (2009).

While disasters can lead to major loss of life and asset, they rarely impact the economy (and budget) of advanced economies. Indeed, the $83 billion budget appropriation voted by Congress after Hurricane Katrina, hardly registered in the scale of the United States budget. Most developing countries government, particularly from smaller and less advanced economies, can hardly afford such luxury. In absolute terms, the costliest disasters mainly occur in developed countries (or at least in large economies) where the concentration of assets, and thus potential losses, is the highest. However, in such economies, the damage as a proportion of GDP is limited to a few percentage points (see Table 1).

Table 1. Major disasters in the last 40 years

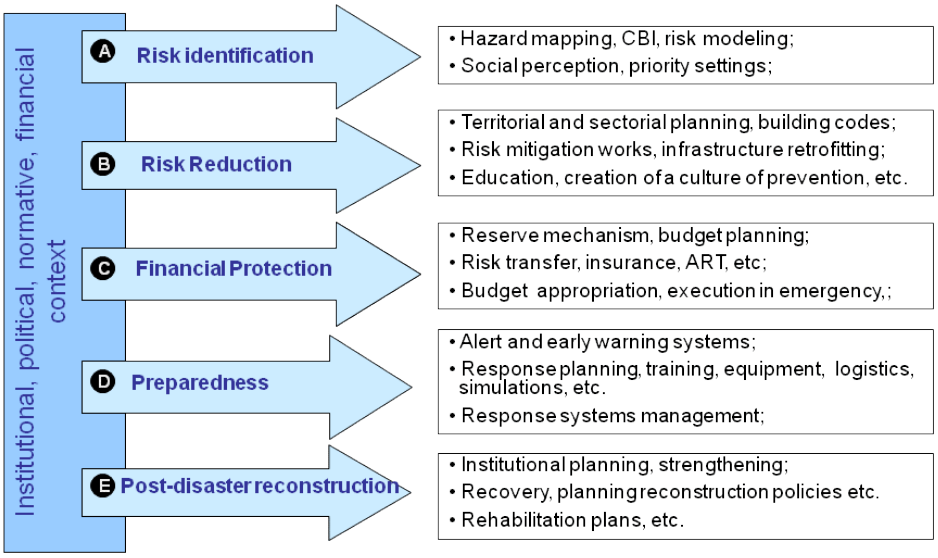
Year	Natural Disaster	Country	Region	Estimated Direct Loss (US$ million)	Direct Loss (% of GDP)
Large Economies					
2005	Hurricane (Katrina)	USA	North America	125,000	1.1%
1995	Earthquake	Japan	East Asia	100,000	3.2%
1998	Flood	China	East Asia	30,000	0.7%
1992	Hurricane (Andrew)	USA	North America	26,500	0.4%
Small Island Economies					
1988	Hurricane (Gilbert)	St. Lucia	Caribbean	1,000	365%
1991	Cyclone (Val and Wasa)	Samoa	Oceania	278	248%
2004	Hurricane (Ivan)	Grenada	Caribbean	889	203%
1990	Cyclone (Ofa)	Samoa	Oceania	200	178%
1985	Cyclone (Eric and Nigel)	Vanuatu	Oceania	173	143%
2010	Earthquake	Haiti	Caribbean	8,000	114%
2009	Tsunami	Samoa	Oceania	120	22%

Source: Authors, from CRED EM-DAT database.

Financial Protection and Disaster Risk Management

It is first important to underscore that financial protection is only one component of a comprehensive disaster risk management strategy. It will help governments mobilize resources in the immediate aftermath of a disaster, while buffering the impact on its long term fiscal balance. A comprehensive risk management strategy will include many other dimensions, including programs to better identify risk, reduce the impact of adverse events and strengthen emergency services (see Figure 3). While this paper touches upon some of these areas, it mainly concentrates on the mechanism that can be put in place to address the potential financial impact of risks that have not been eliminated or transferred through other means.

Figure 3. Comprehensive disaster risk management strategy



Source: Authors.

It is often argued that financial protection strategies treat the symptoms but not the cause of disasters. Good strategies can help government cope with the financial impact of disasters; but do little to shelter populations and assets from the destruction of cyclone and earthquake. With risks increasing every day, financial protection strategies are unlikely to be sustainable if they are not combined with aggressive risk reduction programs. However, well designed disaster risk financing strategies can create financial incentives for governments and/or households to further mitigate their risks. Risk mitigation investments reduce the risk of loss and thus allow for lower insurance deductible and/or lower insurance premium. For example, the Turkish Catastrophe Insurance Pool differentiates premium rates according to the type of construction of the insured dwelling.

The Different Dimensions of a Financial Protection Framework

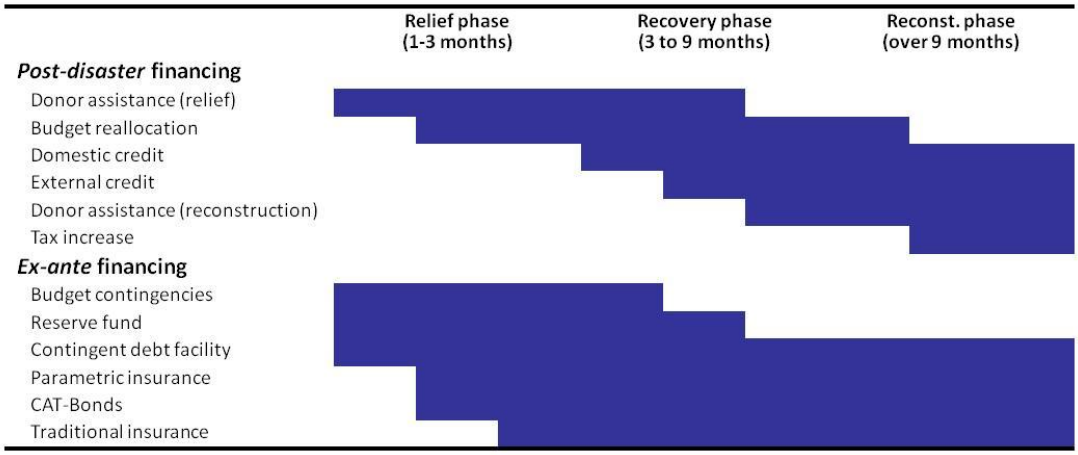
This section reviews the sources of financing generally used by government to finance immediate response and recovery post-disasters. It provides a brief analysis of the main characteristics of these sources of financing, including the relative cost of each instrument and the speed at which funds can be mobilized. It also briefly discusses the administrative and legal aspects of any efficient financial protection strategy, a dimension that is too often ignored, yet essential to an effective response in case of disasters.

Sources of Financing Post-Disaster

Governments generally have access to various sources of financing following a disaster. These sources can be categorized as ex-post and ex-ante financing instruments. Ex-post instruments are sources that do not require advance planning. This includes budget reallocation, domestic credit, external credit, tax increase, and donor assistance. Ex-ante risk financing instruments require pro-active ex-ante planning and include reserves or calamity funds, budget contingencies, contingent debt facility and risk transfer mechanisms. Risk transfer instruments are instruments through which risk is ceded to a third party such as traditional insurance and reinsurance, parametric insurance (where insurance payouts are triggered by pre-defined parameters such as the wind-speed of a hurricane) and Alternative Risk Transfer (ART) instruments such as catastrophe (CAT) bonds.

Figure 4 lists the most common instruments used by governments to mobilize funding after a disaster. It also provides an assessment of the time necessary to mobilize funds though these instruments. The main advantage of ex-ante instruments is that they allow for quick disbursement while ex-post instruments can take some time to mobilize. Of course, the quick disbursing characteristic of ex-ante instrument has a cost. This is discussed in the next section.

Figure 4. Sources of post-disaster financing



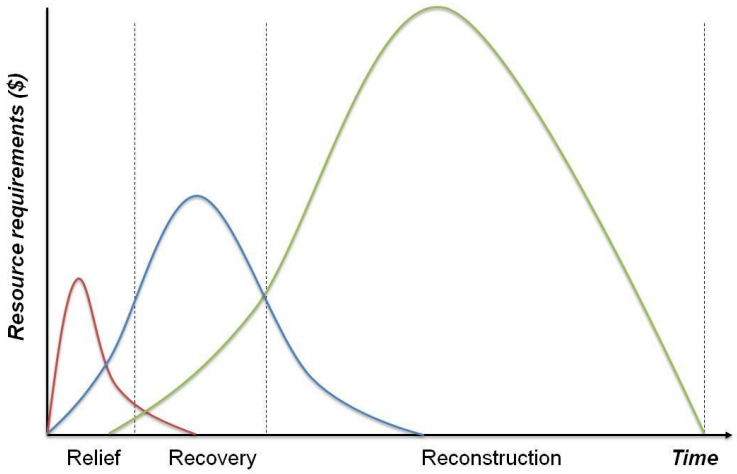
Source: Authors.

The Time Dimension

It is important to realize that a government facing a natural calamity will not require funding for its entire recovery program right at the time of the disasters. While resources are necessary to support

relief operations, the bulk of the funds required will only be needed several months later when the actual reconstruction program starts. Indeed, the planning of reconstruction operations, design of infrastructure to be rebuilt and tender of major works generally takes time. The design of an efficient financial protection strategy must consider this time dimension to ensure that funding requirements are matched with the capacity to disburse funds when required. See Figure 5.

Figure 5. Post disaster funding needs



Source: Authors.

The Cost of Financing Instruments

Life would be easy for financial planners if financial instruments could be used without regard to cost. The truth of the matter is that the cost of financial instruments varies greatly. Table 2 provides an estimate of the cost multiplier of the source of financing describe previously. This cost is contrasted with the speed at which funds can be mobilized from each source of financing.

Donor financing are generally the cheaper source of financing, although there is sometimes an opportunity cost due to the reallocation of donor assistance from ongoing programs. Many donors have well established humanitarian programs and can be quick to respond, particularly to support relief operations. Unfortunately, donor financing is plagued with limitations. It is often driven by media coverage. For example, the catastrophic floods in Guyana in 2005 occurred just a few weeks after the major earthquake in Pakistan in October 2005, and had very limited media coverage resulting in limited international assistance. Mobilizing such funds and making the necessary arrangements to program and disburse them is a complex process which can take months to complete. In addition, these funds are earmarked to support pre-identified expenditures. With limited resources, donors are rarely able to support larger reconstruction programs. Indeed, if only to safeguard their sovereignty, developing country governments are well advised not to rely solely on the generosity of their donor partners.

Table 2. The cost of financial instruments

Instruments	Cost (multiplier)	Disbursement (months)	Amount of funds available
Donor support (relief)	0-1	1-6	Uncertain
Donor support (recovery & reconstruction)	0-2	4-9	Uncertain
Budget contingencies	1-2	0-9	Small
Reserves	1-2	0-1	Small
Budget reallocations	1-2	0-1	Small
Contingent debt facility (e.g., CAT DDO)	1-2	0-1	Medium
Domestic credit (bond issue)	1-2	3-9	Medium
External credit (e.g. emergency loans, bond issue)	1-2	3-6	Large
Parametric insurance	2 & up	1-2	Large
ART (e.g., cat bonds, weather derivatives)	2 & up	1-2	Large
Traditional insurance	2 & up	2-6	Large

Note: The cost multiplier represented the estimated cost of resources as a multiple of the average expected loss it finances. Donor Grants are free but may be reallocated from other ongoing projects. Reserves are generally held in short term assets, their cost is the difference between the opportunity cost and return on short term investments. Budget reallocation are funds reallocated from other programs; unless they affect the credit rating of a government, emergency loans is reflected in the interest rate applied; see discussion below on the cost of risk transfer instruments.

Source: Authors.

Own reserves, budget contingencies, budget reallocations and emergency loan are the most common sources of post-disasters financing. Unfortunately, all have their limitations. Budget contingencies usually represent about 2 percent of the government expenditures (see Vietnam, Indonesia or Colombia) and are not earmarked for natural disasters only. Vietnam for example has experienced several cases where a major cyclone hits the country in November, when the contingency budget has already been fully exhausted. Governments, particularly from small states, are generally unable to accumulate sufficient reserves to respond to major events. Beyond the financial cost of short term liquidity sitting in an account, competing demand and political consideration make it virtually impossible for governments to build reserves beyond a certain level. Systematic use of budget reallocations endangers development programs that have often required years of preparation. Emergency loans may take a long time to negotiate and do not allow for immediate resource mobilization. Yet, as seen in Table 2, they remain by far the cheapest mean to finance disaster.

To better support developing countries government affected by natural disasters, multilateral agencies such as the World Bank and the Inter-American Development Bank recently created new instruments that provide middle-income countries with contingent credit that can be immediately accessed in case of an emergency. These allow for immediate access to liquidity in case of disasters, combining the benefits of low interest rates provided by multilateral credit with rapid and flexible access to resources **(**see Box 1).

Box 1. Reducing the Moral Hazard of Assistance Post Disaster

The Development Policy Loan (DPL) with Catastrophe Risk Deferred Drawdown Option, DPL with CAT DDO, is a development policy loan that offers IBRD-eligible countries immediate liquidity up to USD$500 million or 0.25 percent of GDP (whichever is less) if they suffer a natural disaster (OP/BP 8.60). The instrument was designed to provide affected countries with bridge financing while other sources of funding are being mobilized. Eligible borrowers must have an adequate macroeconomic framework in place at inception of the program, and a disaster risk management program that is monitored by the World Bank.

The DPL with CAT DDO has the same lending base rate as regular IBRD loans, making it an extremely competitive risk financing instrument. The front-end-fee, payable upon effectiveness, is 0.5% and there is no commitment fee. The draw down period is for three years, renewable up to four times (with a renewal fee of 0.25%). Repayment terms may be determined either upon commitment, or upon drawdown within prevailing maturity policy limits. Repayment schedule would commence from date of drawdown.

It is interesting to note that the CAT DDO was created first and foremost to encourage investment in risk reduction. Indeed, to have access to this contingent credit, countries must show that they have engaged in a comprehensive disaster management strategy. As such, it is the first financial instrument offered by the donor community that aims at addressing the problem of moral hazard in donor funding for disaster recovery.

The first DPL with CAT DDO was approved in September 2008 by the World Bank's Board of Executive Directors. The US$65 million contingent loan to aims the Government of Costa Rica aims to enhance its capacity to "implement a Disaster Risk Management Program for natural disasters." This program is described in the loan document and agreed upon before signing. Following the 6.2 magnitude earthquake that hit Costa Rica on January 8, 2009, the Government of Costa drew down approximately US$15 million. DPLs with CAT DDO have since been negotiated with Colombia and Guatemala and are currently under preparation in various other countries.

Finally, Governments have recently taken a closer look at instruments available in the financial markets such as traditional insurance, parametric insurance and ART mechanism (CAT-Bonds in particular).

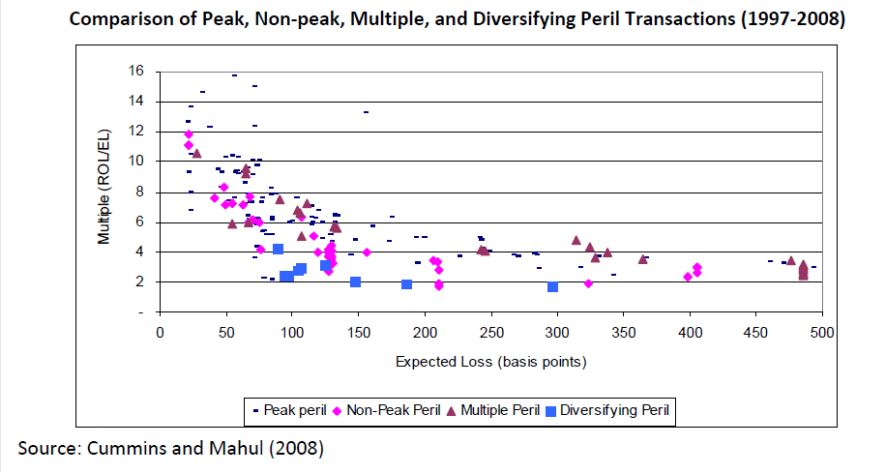
Traditional insurance is already in use in many countries to insure public and private assets. When properly designed, traditional insurance can provide tailored coverage for specific assets and perils. By promoting insurance penetration in the private sector, governments in many part of the word have been able to reduce the impact of disaster on their budget and increase the resilience of their economy. Some, like Mexico, have recently ventured in the use of Cat Bonds to cover specific needs.

Nevertheless, the use of insurance and ART remains a relatively expensive proposition for governments (see Box 2) and their use has remained limited to specific cases discussed later in this paper.

Box 2. The Catastrophe Load and the Cost of Transferring Risk

The role of insurance is to serve as a recipient of risks and to diversify them by pooling losses among many policyholders. The statistical foundation of insurance is the Law of Large Numbers. Intuitively, the observed average loss (per policy) gets closer to the statistical expected loss (per policy) as the size of the insured population increases. In other words, an insurer can almost predict the average loss (per policy) and thus charge the policyholder accordingly. This result is valid when a large number of small independent risks are at stake, such as in the case of automobile insurance.

Unfortunately, the risks of natural disasters such as earthquakes and hurricanes are not easily diversifiable because many policyholders are affected at the same time. Moreover, the premium collected every year is generally small compared to a potential payout. As a result, insurers have to maintain risk capital provisions far beyond their expected annual loss to ensure that they will be able to disburse large indemnity payouts after a catastrophic event. These provisions generate substantial costs to the insurer and are passed to the policyholder (a catastrophe load is added the expected annual loss). The higher the capital reserves and/or the opportunity cost of capital, the higher the premium. For low frequency risks, say 1 in 100 years, the market will often charge over four times the actuarial cost (the expected annual loss). For more frequent risks (say 1 in 7 years), the multiple is still close to twice the expected loss. (Source: Lane and Mahul 2009)



Source: Cummins and Mahul (2008)

Other dimensions can be added in this discussion. For example the amount of funds available varies among the financial instruments (see Table 2). Post-disaster assistance is uncertain and depends on the generosity of the international community. Governments can set aside reserves but their amount is limited by political considerations and by other pressing needs. Contingent credit can provide the governments with additional financial capacity in the aftermath of a disaster, but their amount is

constrained by the borrowing capacity of the country. This is the case of many small island states that already have high debt level and very limited borrowing capacity.

One should also consider the fungibility of the funds. While reserves or budget contingencies can be used for many purposes (as long as they comply with the budget laws), post-disaster donor assistance is usually provided in kind (e.g., food or material for relief) and post-disaster reconstruction assistance is usually earmarked to specific projects. For example, it is estimated that only 2 percent of the immediate post-disaster assistance to Haiti following the devastating earthquake in January 2010 was in form of cash for the government. In these circumstances, it is sometimes difficult for an affected government to ensure that the continuity of its public services or service its debt obligation, circumstances that may exacerbate already difficult post disaster situations.

The Administrative/Legal Dimension

The administrative and legal dimension of risk financing is often overlooked. Yet, it is essential to an effective and timely response. Indeed, there is no point in mobilizing resources after a disaster if no mechanisms exist to execute these resources in an emergency. In Indonesia for example, should a government entity like the Disaster Risk Management (DRM) Agency purchase disaster insurance, any insurance payout would be treated as non-tax revenue and thus would be transferred to the Treasury department first, creating delays in the transfer of the funds to the DRM Agency. The budget regulation should thus be changed to allow the DRM agency to receive directly any insurance payout, with an appropriate reporting system to the Treasury on the utilization of the funds. In too many cases, efforts to make resources available quickly are rendered fruitless by the multiple steps required to appropriate and execute these resources. Worse, in the spur of an emergency, control on the use of resources are often waived, leading to significant leakage when public finance are already scarce. This paper argues that the administrative and legal dimension of risk financing should be at the core of any risk financing strategy. Box 3 presents some of the key dimensions that need to be considered.

Box 3. Legal and administrative aspects in sovereign disaster risk financing

Legal Aspects

- Legal framework for emergencies – Who does declare an emergency? Under what circumstances? Who is in charge?
- Appropriation and execution – Who does appropriate the budget? How is it done? How are the funds transferred? What control and safeguard exist to ensure that funds are used efficiently and effectively?
- What norms, standards and safeguard exist to guide the interventions?

Administrative Aspects

- Execution - Who and how are interventions coordinated? How will line ministries be involved? How is progress reported?
- Fiduciary controls – Who is responsible? What are the procurements to be applied? How are waivers, if any, being processed? How will the use of fund be tracked? When are audit conducted?
- Being pro-active – Can specific emergencies be predicted and contracts be tendered in advance (this is often the case of re-opening roads, re-establishing power distribution)? Can we ask suppliers to hold minimum amount of supplies that will be purchased at a set price?

Source: Authors.

An exercise rarely done by governments but extremely useful is to conduct a disaster simulation with the various parties involved in post disaster financing and assistance, including the budget office. Such simulation invariably helps identify bottleneck and weaknesses in existing budget processes, emergency procurement, contract monitoring, and payment systems, among other aspects. It also helps sensitize public officials, particularly in finance ministries, that are rarely confronted with disaster emergencies, and help improve preparedness at all level of the government structure.

Bringing it All Together

How does it all come together and how can we combine the various instruments described above in an efficient and effective financial protection strategy for the governments? The obvious choice is to ensure that cheaper sources are used first, with the more expansive instruments used only in particular circumstances.

Funding gap analysis

The design of a financial protection strategy generally requires the development of a country disaster risk profile. Such a profile can be derived from probabilistic risk model (see Box 4) and/or by looking at historical disaster losses. It also requires a good understanding of a government (explicit and implicit) contingent liability in case of a disaster. Indeed, government intervention post disasters vary greatly from one country to the next. Often, tradition and practices must be taken into account beyond what is stipulated in a country's legislation. In Vietnam for example, the law stipulates that rural households can receive up to US$250 for the destruction of their house by a natural disaster. This amount is generally insufficient and the government of Vietnam usually increases this cap after a disaster. Likewise, in Colombia, the government is not supposed by law to provide financial assistance for the reconstruction of private dwellings, but does it in practice. Uncertainty on the contingent liability the state can create additional variability in the fiscal budget. The disaster risk profile of a country can then be contrasted with the resources available. As discussed in previous sections, the time dimension is must also be considered. Relief operations will require resources that can be mobilized immediately after a disaster, while recovery and reconstruction needs will generally require major resources in the medium term to the longer term (one year or more), respectively. Contrasting potential resource requirement with resource availability will help the identification and quantification of potential ***funding gaps*** *during the* relief, recovery and reconstruction phase.

Box 4. Probabilistic catastrophe risk modeling

A typical probabilistic catastrophe risk model is made of the following modules:

Hazard module: It defines the frequency and severity of a given peril (e.g. earthquake) at a specific location within the region of interest. This is done by analyzing historical frequencies and reviewing scientific studies performed on the severity and frequencies in the region of interest. This module then generates thousands of stochastic events based on historical data and experts' opinions.

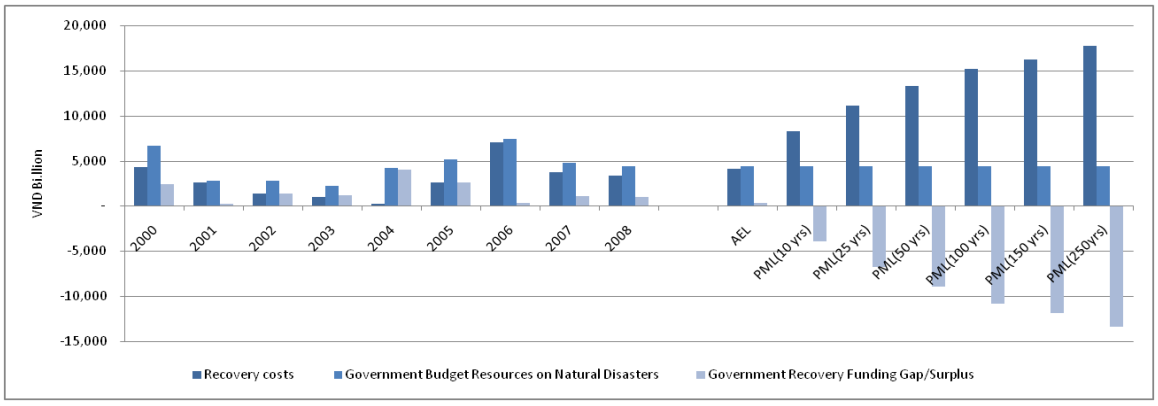
Exposure module. The geo-referenced database of assets at risk, the exposure module assigns for each of the assets a list of attributes (including exact location, contraction type, number of stories, etc.). This information is used to determine its vulnerability, captured though vulnerability functions.

Loss Module: It combines the hazard module and the exposure module to calculate different risk metrics, such as the *annual expected loss*, which is an expression of the long-term (for example, 1,000 years) average annual loss, and the probable maximum loss for a given return period, which represents the expected loss severity based on likely occurrence, such as the 1-in-50-year loss or the 1-in-100-year loss.

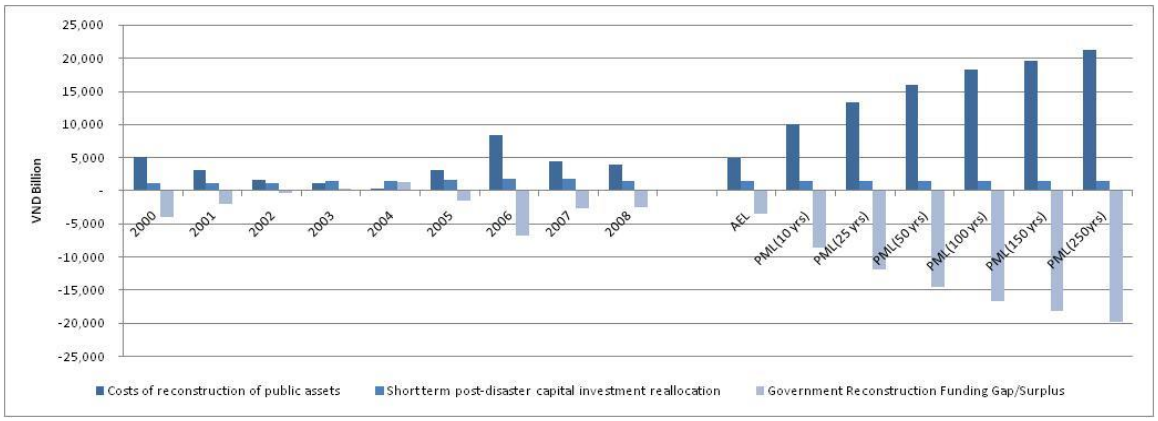
As an illustration, Figure 6 shows the funding gap analysis recently conducted in Vietnam. It shows that while no recovery funding gap was observed over the last 9 nine years, a major disaster (with a return period of 10 years or more) may create a substantial recovery gap. It also shows that reconstruction funding gaps have been recurrent over the last 10 years.

Figure 6. Vietnam: Funding gap analysis

a. Recovery Funding Gap



b. Reconstruction Funding Gap

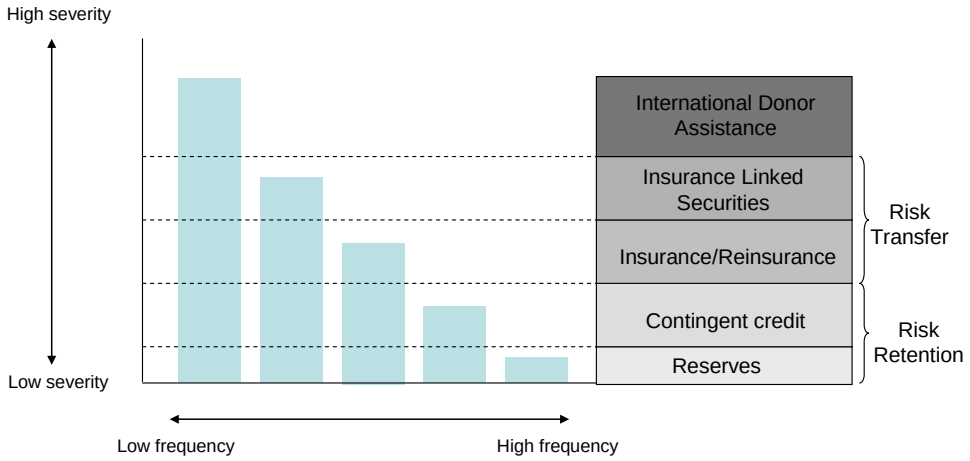


Source: World Bank (2010).

Combining financial instruments

Figure 7 illustrates how catastrophe risk layering can be used to design a risk financing strategy. Budget contingencies together with reserves are the cheapest source of financing and will generally be used to cover the recurrent losses. Other sources of financing will enter into play such as contingent credit, emergency loans and possibly insurance. Governments should be advised to first secure financing for the recurrent losses and then expand this financing for major events. A "bottom-up" approach, where the government starts securing funds for recurrent disaster events and then less frequent but more severe events. . Catastrophe risk modeling techniques can help the governments assess the economic and fiscal impact of natural disasters and design cost-effective risk financing strategies. However, the level of financial resilience of a state, which drives the optimal financial strategies against natural disasters, is a decision to be taken by the government based on economic and social considerations.

Figure 7. Catastrophe risk layering



Source: Authors.

It is important to remember that the resource requirements will evolve with time after a disaster. Two problems of a very different nature need to be addressed. The first one is the need for immediate liquidity to ensure that relief and recovery are not delayed. The second one is the need to be able to mobilize much more important resources for reconstruction.

Emergency risk financing: Covering immediate liquidity needs

Risk transfer remains an expensive proposition for those governments that have otherwise access to sovereign financing. Nevertheless, the speed at which they can sometime provide liquidity without requiring access to credit make them attractive to some governments. This is particularly the case for small states that do not generally have sufficient capacity to build reserves and are restricted in their access to credit due to already high debt ratios. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) provides an example where small Caribbean islands acted together create regional reserve mechanism to secure access to immediate liquidity in case of a major disaster (see Box 5).

Box 5. The Caribbean Catastrophe Risk Insurance Facility

The World Bank recently assisted CARICOM in establishing the Caribbean Catastrophe Risk Insurance Facility (CCRIF), a joint reserve facility, which offers liquidity coverage, akin to business interruption insurance, to sixteen Caribbean Countries exposed to earthquake and hurricanes.

The CCRIF was capitalized with support from participating countries and donor partners. It combines the benefits of pooled reserves with the capacity of the international financial markets. To do so, it retains the first loss through its own reserves while transferring the excess risk to the international capital markets.

The Facility became operational on June 1, 2007 and can count on its own reserves exceeding US$90 million and reinsurance of US$110 million. This thus provides the Facility with US$200 million of risk capital at very competitive rates. The reinsurance strategy of the CCRIF is designed to sustain a series of major natural disasters events (with a probability of occurrence lower than 0.1 percent), achieving a higher level of resilience than international standards.

Drawing on the lessons of the CCRIF, the Pacific island states are exploring the creation of the Pacific Disaster Reserve Fund, a joint reserve mechanism against natural disasters for the Pacific island countries.

New risk transfer instruments have also proven attractive to governments that wish to circumvent slow budget appropriation processes. The CAT Bond recently issued by Mexico provides an example of creative use of risk transfer instruments (see Box 6). The issuance of a cat bond by the government of Mexico is the result of a multi-year effort to design a comprehensive disaster risk financing. The government of Mexico, through the reserve fund for public assets FONDEN, first created a reserve fund built up with an annual budget allocation. The reserves of the fund were considered insufficient to cover a major disaster and, therefore, the FONDEN decided to purchase parametric reinsurance. Finally, the FONDEN wanted to increase its resilience to major disasters and decided to complement its reserves and reinsurance with a cat bond.

Box 6. Catastrophe bonds

CAT bonds are part of a broader class of assets known as *event-linked bonds*, which trigger payments on the occurrence of a specified event. Most event-linked bonds issued to date have been linked to catastrophes such as hurricanes and earthquakes, although bonds also have been issued that respond to mortality events.

Capital raised by issuing the bond is invested in safe securities such Treasury bonds, which are held by a special-purpose vehicle (SPV). The bond issuer holds a call option on the principal in the SPV with triggers spelled out in a bond contract. Those can be expressed in terms of the issuer's losses from a predefined catastrophic event, by hazard event characteristics, or by hazard event location. If the defined catastrophic event occurs, the bond issuer can withdraw funds from the SPV to pay claims, and part or all of interest and principal payments are forgiven. If the defined catastrophic event does not occur, the investors receive their principal plus interest equal to the risk-free rate, for example, London Inter-Bank Offered Rate (LIBOR), plus a spread above LIBOR. The typical maturity of CAT bonds is 1–5 years, with an average maturity of 3 years.

The cat bond market has been growing steadily since its creation in the mid 1990s until 2008. As a consequence of the 2008 financial crisis, the market stopped issuing cat bonds in the third and fourth quarters of 2008, leading to a new issuance in the non-life bond sector of US$2.7 billion in 2008, a 65 percent drop from 2007 new issuance (US$7 billion). The cat bond market recovered in 2009, with a new issuance of US$3 billion.

In October 2009, Mexico issued a US$290 million series of notes, which was well received and oversubscribed in the market, through the World Bank MultiCat platform. The notes provide coverage over three years for three perils – earthquakes (three areas around Mexico City), Pacific hurricanes (two

areas) and Atlantic hurricanes (area around Cancun). The Government of Mexico recognizes that $290 million would hardly cover 10 percent of the needs arising from the type of event likely to trigger a payout. Nevertheless, this amount, in addition to reserves held in FONDEN, is likely to be sufficient to cover the resources needed during the first three to six month after a disaster and until additional post-disaster funds can be mobilized.

Financing recovery and reconstruction

As discussed earlier, the resources required for recovery and reconstruction are rarely required in the immediate aftermath of a disaster. Reconstruction planning takes time, engineers need to design new infrastructure, projects have to be tendered and contractors have to mobilize. It is not rare that actual reconstruction operations start six months or more after a disaster. Large infrastructure rehabilitation may sometime take years with a large share of reconstruction contracts due at completion.

This generally gives time for governments to reallocate their planned capital expenditures in their future budget and access additional credit on the domestic or international markets. At the same time, programs that made sense before a disaster are sometimes rendered irrelevant by the disaster itself. Resources from less urgent projects can often be redirected to the affected area. With sufficient time, Ministries of Finance can also prepare bond issuance and negotiate emergency loans with multilateral and other financial institutions. Finally, government will sometimes establish special taxes to support reconstruction. This was the case for example in Colombia where the government established a special tax to support FOREC a fiduciary entity established to finance the reconstruction of the coffee region after it was devastated by an earthquake in 1998.

Recent experience using traditional property insurance

If insurance is sometimes expensive compared to other risk financing instruments, one may ask why some governments insist on insuring their public assets or promote private sector insurance. It should be noted that in many cases, in both developed and developing countries, public programs are self-insured, and, governments are in fact transferring only limited amounts to the private markets. Box 7 explains how substantial savings can be obtained when such program are properly structured.

Box 7. Insuring Public Assets in Costa Rica

A clear benefit of insurance is that it allows for risk to be structured and allocated efficiently. As such, numerous governments require from manager of public assets that they buy insurance for the assets under their purview. In Costa Rica, the World Bank has been working with the national insurance company (INS) to design a dedicated vehicle to insure public assets at lower cost than currently available. The proposed vehicle allows for the Government of Costa Rica to retain most of the risk while transferring only excess losses to the international financial markets. By retaining the lower risk layers through a simple guarantee or through a contingent line of credit, the Costa Rican Government takes a calculated and limited risk while ceding the part of the exposure that it is not willing to assume. Preliminary analyses show that the proposed vehicle would improve coverage with a net savings of at least $5 million every year.

A similar program for the insurance coverage of key public assets is under preparation in Indonesia and in Colombia.

The promotion of insurance in the private sector (which goes beyond the scope of this paper) should be considered as a risk reduction strategy rather than a risk financing strategy. Indeed, various programs developed over the last decade have helped government reduce their exposure to disasters by deepening the use of private insurance in key sector of their economies, thus reducing the government's contingent liability due to natural disasters. Box 8 shows how the establishment of the Turkish Catastrophe Insurance Pool (TCIP) helped the Government of Turkey better manage its contingent liability by promoting domestic property catastrophe insurance markets. By making possible for homeowners to purchase insurance, the Government of Turkey has increased the number of citizens that would be compensated by the private sector in case of an earthquake. By making earthquake insurance compulsory for urban middle- and high-income households, the Government of Turkey has also seriously reduced the possibility for wealthier homeowners to request financial assistance after a disaster, as well as the inherent problem of adverse selection where only the homeowners living in high risk areas purchase insurance.

The provision of property catastrophe insurance requires both technical capacity (in product design, rating and loss adjustment) and financial capacity (as catastrophe risks is highly capital intensive), as well as a strong regulatory framework. Therefore, these market-based solutions can be considered only when the domestic non-life insurance market is relatively well developed. The development of catastrophe insurance markets will thus require dedicated efforts from developing countries government to promote the use of insurance but also to ensure appropriate regulation and controls.

Box 8. The Turkish Catastrophe Insurance Program

The Turkish Catastrophe Insurance Pool, TCIP, was established in the aftermath of the Marmara earthquake in 2000, with assistance from The World Bank. Traditionally Turkey's private insurance market was unable to provide adequate capacity for catastrophe property insurance against earthquake risk, with the government of Turkey faced a major financial exposure in post-disaster reconstruction of private property.

The government of Turkey's objectives for TCIP were to:

- Ensure that all property tax paying dwellings have earthquake insurance cover;
- Reduce government fiscal exposure to recurrent earthquake;
- Transfer catastrophe risk to the international reinsurance market;
- Encourage physical risk mitigation through insurance.

TCIP was established in 2000 as a public sector insurance company, managed on sound technical and commercial insurance principles. The company's initial capital was supplemented by a World Bank Contingent loan. TCIP purchases commercial reinsurance and the government of Turkey acts as a catastrophe reinsurer of last resort for claims arising out of an earthquake with a return period of greater than 300 years.

The TCIP Policy was designed as a stand-alone property earthquake policy with a maximum sum insured per policy of US$ 65,000 and an average premium of US$ 46 and a 2% deductible. Premium rates are based on the construction type (2 types) and property location (5 earthquake risk zones were identified) and vary from less that 0.05% for a concrete reinforced house in a low risk zone to 0.60% for a house located in the highest risk zone.

The policy is distributed by about 30 existing Turkish insurance companies, which receive a commission. The government invested heavily in insurance awareness campaigns and made earthquake insurance compulsory for home-owners on registered land in urban centers. Cover is voluntary for homeowners in rural areas.

The program is reinsured by international reinsurers. Since inception in 2000, TCIP has achieved an average penetration rate of about 20% of domestic dwellings (about 3 million dwellings). Romania is about to studying a similar pool for earthquakes and floods.

Conclusions

A sovereign risk financing strategy aims at strengthening the capacity of the government to respond after a natural disaster while protecting its fiscal balance. A number of instruments can be combined to build such strategy, based on the cost and benefit of each financial instrument, such as the cost (insurance premiums, opportunity cost of capital, etc.) and the delay before resources become available. An effective financial strategy against natural disasters should combine these instruments, taking into consideration the country risk profile, the cost of available instruments and the likely disbursement profile after a disaster.

This paper argues that a conservative fiscal policy remains the most efficient way to manage financial risk resulting from natural disasters. Own resources and post-disaster debt instruments are usually the cheapest source of financing for governments. Contingent lines of credit available through various multilateral development banks provide a flexible mechanism to manage risk at relatively low cost.

Risk transfer instruments have become increasingly available and can provide efficient mechanisms to access immediate financing after a disaster. They can be used as budget instrument to help buffer resource needs until other sources of fund can be mobilized. As such, these instruments are generally used to help manage the variability of loss. They can also be used to increase the financial discipline in the risk management of public assets.

A variety of program launched in recent years have helped build efficient risk management vehicles where the government retains the first losses and transfer only the excess risk. Such programs may become more important in the future by providing partial solutions to the increased variability of losses resulting from climate change.

Finally, a financial protection would not be complete without a suitable legal and administrative framework that ensures that resources can be used effectively and efficiently in the aftermath of a disaster.

References

Cummins, J.D. and O. Mahul (2009). *Catastrophe Risk Financing in Developing Countries: Principles for Public Intervention*. The World Bank, Washington, D.C.

Ghesquiere, F., and O. Mahul (2007). Sovereign Natural Disaster Insurance for Developing Countries: A Paradigm Shift in Catastrophe Risk Financing. World Bank Policy Research Working Paper #4345.

Lane, M., and O. Mahul (2009). Catastrophe Risk Pricing: An Empirical Analysis. World Bank Policy Research Working Paper #4765.

World Bank (2010). Weather the Storm: Options for Disaster Risk Financing for Vietnam, World Bank report. The World Bank, Washington, D.C.