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Mechanisms for financing the costs of disasters

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Contents

Mechanisms for financing the costs of disasters

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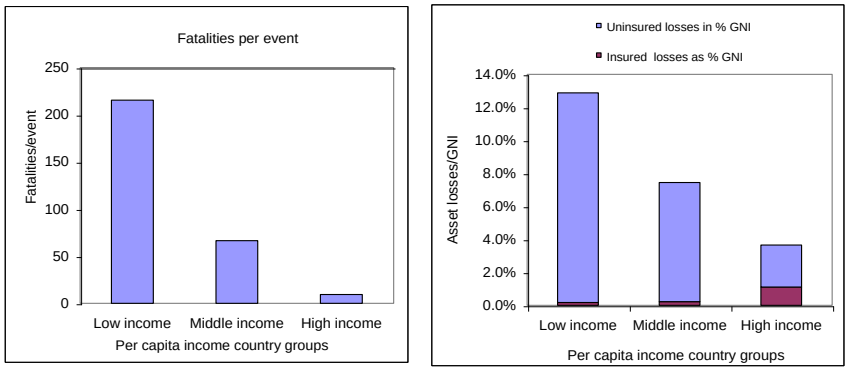
Abstract

This paper provides an overview of disaster risk financing mechanisms, both traditional instruments that share the costs of disastrous events after they happen and ex ante instruments, some innovative, that contractually transfer risks before the events occur. The focus is on developing countries and the most vulnerable within those countries. As recent novel instruments, we describe index-based insurance for farmers and herders, national insurance programs, sovereign instruments for governments and regional risk insurance pools. We present evidence on their benefits, costs and risks, and, finally, address the question: What financial-protection actions could be taken in the next ten years that might reduce the negative impact of disasters occurring up to 2040?

1. Introduction

The rising costs of natural hazards - weather variability, climate extremes and geophysical events – disproportionately affect the poor and vulnerable in developing countries (Munich Re 2010; CRED 2010). During the quarter century (1980-2004) over 95% of natural disaster deaths occurred in low- and middle-income countries, and per-capita direct economic losses totaled over 12 percent for low-income countries compared to under four percent for high income countries (Figure 1) (Munich Re 2005). Deaths and losses to assets and livelihoods are destined to increase as marginalized populations settle in areas exposed to earthquakes, floods, droughts and other extremes, and as climate change increases weather variability (IPCC 2012).

Figure 1: Differential burden of natural disasters: (i) fatalities per event and (ii) insured and uninsured losses according to country income groups[2] (based on Munich Re 2005).



Even within countries, natural hazards can cause disproportionate losses to poor households, which account for only a minor share of formal GDP. In Mongolia, as an example, herders experienced an extreme climatic event (dzud) in 2009 resulting in the death of around a quarter of the country's livestock or 4.4 percent of GDP. As dramatic as this was to the country's herders, who account for about a third of (mostly subsistence) employment, real GDP increased by 6.1 percent in 2010. (Benson 2011)

Not only are the poor often the most severely affected, but disasters can be a major contributor to poverty. A World Bank study based on 9000 household interviews in 15 developing countries found that natural disasters were considered to be the second most important reason (after

[2]Country income groups are according to World Bank classification using GNI per capita. Low income: less than 760 US$/year, middle: 760-9360 US$/year, high larger than 9360 US$/year in 2005.

health problems and death) of why people become poor (World Bank 2009). Unlike their wealthy counterparts, poor households typically have little savings, remaining assets or insurance to recover from disaster events, and their governments may also be unable to provide assistance. Many poor households are thus dependent on ad hoc and limited international relief and aid.

Poverty can be further reinforced by risk-averting livelihood choices. At-risk farmers may cultivate lower-yielding crops because they are more hazard-tolerant, thereby reducing the risk of crop failure at the expense of earnings (World Bank, 2007). According to some experts, farmers may sacrifice 12 to 15 percent of average income to reduce risk (Hazell and Hess, 2010), and according to some estimates average farm incomes could be 10-20 percent higher in the absence of risk (Sakurai and Reardon, 1997).

Given the impacts of natural disasters on highly exposed developing counties, as well as on intermediary institutions that serve the poor, the need for risk management as an alternative to a purely post-disaster response is well acknowledged. Risk management includes investments in high-return risk reduction projects and regulations, and also in instruments that provide post-disaster capital for the recovery process. Financial instruments not only provide needed ex-post resources, but can also contribute importantly to ex ante social protection and incentives for risk reduction and adaptation to climate change (Newsham *et al* 2011; Heltberg *et al*. 2009a, b). At the same time, insurance and other ex ante financing instruments can lead to less precaution and investments in risk reduction, what is referred to as moral hazard.

This paper provides an overview of traditional mechanisms for financing the costs of disasters, and also instruments, some innovative, that contractually transfer risks before the events occur. The focus is on developing countries and the most vulnerable within those countries. After describing traditional mechanisms in the next section, we turn our attention to index-based insurance for farmers and herders, national insurance programs, and sovereign instruments for governments and regional risk insurance pools. We present evidence on the benefits, costs and risks of these instruments in section four, and, finally, we address the question: What financial-protection actions could be taken in the next ten years that might reduce the negative impact of disasters occurring up to 2040?

2. Overview of financial mechanisms for managing disaster risk

Table 1 gives an overview of traditional and innovative financial mechanisms available for managing disaster risk on the part of households, farms and small and medium enterprises (SMEs) operating at the micro scale, microfinance institutions and donor organizations operating at the intermediary scale, and governments as macro-scale operators. As we see from this table, mechanisms to finance recovery range from government and humanitarian aid, savings and credit, informal risk sharing, to insurance and alternative risk-transfer instruments. Many of these instruments have a long history, and others, such as index-based insurance, catastrophe bonds and regional insurance pools, are recent and sometimes novel developments.

At the outset it is important to recognize that financial instruments are not neutral with regard to who takes responsibility for disaster relief and reconstruction and thus "pays the cost" of disasters. Market-based instruments, like micro-insurance and micro-credit, can shift responsibility from social institutions to the poor, while non-market mechanisms, such as reserve funds, share responsibility usually across taxpayers. It is important to keep this distinction in mind -– individual responsibility versus solidarity – throughout this overview.

Table 1: Examples of traditional and innovative financial mechanisms for managing risks at different scales

	Micro-scale **Households/SMEs/Farms**	***Intermediary-scale*** **Financial institutions/donor organizations**	***Macro-scale*** **Governments**
Traditional risk financing mechanisms			
Solidarity	Government assistance; humanitarian aid	Government guarantees/bail outs	Bi-lateral and multi-lateral assistance; EU solidarity fund
Savings and credit	Savings; micro-savings; micro-credit; fungible assets; food	Emergency liquidity funds	Reserve funds; post-disaster credit;

	Micro-scale **Households/SMEs/Farms**	***Intermediary-scale*** **Financial institutions/donor organizations**	***Macro-scale*** **Governments**
	storage, money lenders		
Informal risk sharing	Kinship and other mutual arrangements; remittances		Diversions from other budgeted programs
Traditional Insurance	Property insurance; crop insurance, national hazard insurance	Re-insurance	Property insurance for state assets
Innovative risk financing mechanisms			
Novel Insurance – related instruments	index-based crop and livestock insurance; weather hedges	Indexed insurance including catastrophe bonds	Sovereign risk financing (e.g., catastrophe bonds); contingent credit; regional catastrophe insurance pools

Source: Adapted from Linnerooth-Bayer, *et al*. 2010.

3. Traditional risk financing mechanisms

3.1 Solidarity

With few exceptions, in-need disaster victims depend on their governments to provide relief and reconstruction, and often private insurers rely on backups through government guarantees or bail outs. Governments are not only committed to providing post-disaster relief to vulnerable households and businesses, but they typically have a large portfolio of public assets exposed to risks from natural hazards. In low-income countries governments, themselves, can face severe post-disaster fiscal constraints in meeting their post-disaster expenditures. To procure needed post-event capital, governments rely on diversions from other budgeted expenditures, tax hikes, borrowing and donor contributions. They may also pro-actively plan for extreme events and put into place a reserve fund or risk transfer mechanisms such as sovereign insurance.

While disaster-affected households in low-income countries may receive public assistance, this support is often ad hoc, inadequately targeted and slow to disburse, falling far short of its potential role in protecting the poor (Benson *et al*. 2012). As an example, after Cyclone Nargis in Myanmar in 2008, internationally funded assistance was slow to arrive, and poor households had to borrow in order to cope with the damages, for example, replacing their pots and pans (DFID 2011).Voluntary donations from the international community of individuals, NGOs and governments average only about 10 percent of direct economic losses in developing countries (Mechler 2004), although some high-visibility events receive significant amounts of aid. After the 2004 Asian tsunami pledged donor assistance was reportedly greater than direct economic damages (World Bank 2005). Pledges, however, often do not translate into actual transfers (Walker *et al*. 2005).

3.2 Savings and credit

Savings, which in low-income communities can take the form of stockpiles of food, grains, seeds and fungible assets, can serve to smooth consumption during crises. In disaster-prone slum areas in El Salvador, for example, research shows that households spend an average of nine percent of their yearly income on risk management, including strategies for financing emergency relief and recovery. One slum dweller reported that he deliberately fastened

corrugated iron to his roof in a temporary fashion so he could sell the iron in a post-disaster emergency (Wamsler 2007).

Globally micro-savings deposits have increased significantly, amounting to one to two billion USD (CGAP 2005). Savings are increasingly channeled through micro-finance institutions (MFIs) and banks, which, however, can be directly impacted by catastrophes resulting in insufficient liquidity to handle a run on their accounts as occurred during the 1998 floods in Bangladesh (Kull 2006). Savings can also be organized through less formal means, like community-based organizations (CBOs), which not only pool financial resources but often set up community grain and seed banks. Despite strides in enabling formal savings, the poor spend their limited income primarily on consumption and livelihood investments, and many still lack access to safe, formal deposit services (Hochrainer *et al* 2009; CGAP 2005). Moreover, a sizeable amount of the saving from low income households is in commitment savings products which might not be accessible in the aftermath of a disaster (Morduch and Armendariz 2010).

Governments also save for a rainy day. Many countries (particularly in Latin America) have in place a reserve or catastrophe fund (Charvériat 2000), which provides resources immediately after a disaster with low transaction costs, but with high opportunity costs of holding liquid capital. A major problem with a catastrophe fund is the political risk that it is diverted for other purposes in years with no disasters, which has been a risk to Mexico's reserve fund (Cardenas *et al*. 2007).

Lacking savings, households and businesses typically borrow to meet their needs in the aftermath of a disaster, and the provision of small loans to the poor through micro-finance institutions has become mainstream. The 18-60% interest rate charged on formal micro-credit, although high compared to some rates charged in wealthy countries, is generally far below the 120-300% often charged by local moneylenders (Grameen Foundation, 2008). Such "loan sharking" is most common after disasters when demand is high. A CNN documentary exposed practices in India where in some cases farmers have been forced to sell their wives to pay back loans after repeated droughts (Sidner, 2009).

Post-disaster micro-credit is not without its own risks as increased post-disaster demand can challenge the liquidity of micro-credit organizations and tempt relaxed loan conditions or even debt pardoning. To deal with this problem, development organizations and private investors in Latin America have created a novel intermediary institution, the Emergency Liquidity Facility

(ELF), which acts as a lender of last resort by providing needed and immediate post-disaster liquidity to MFIs (ELF, 2012).

Governments also borrow in order to finance their post-disaster liabilities, but generally after they have exploited all available sources from their budget. In developing countries funds are often diverted from projects funded by loans from the World Bank and other lending agencies. Whereas this response may be the least costly one for the government, it can be disruptive both economically and politically. Most countries require that budget reallocations have parliamentary approval, which can delay appropriation of funding.

Bonds and other debt instruments, which transfer the burden to future periods and even future generations, are the most common sovereign post-disaster financing mechanism in wealthy countries. Highly indebted developing countries, particularly those without natural resources, can have difficulties issuing bonds since the disaster may seriously impinge on their ability to service the debt. In the absence of commercial lending or natural resources, developing country governments rely heavily on the World Bank and other international financial institutions (IFIs) for post-disaster credit. Since the early 1980s, the World Bank alone has initiated over $40 billion in loans for reconstruction purposes (World Bank, 2006), which has created concern about the escalating demands on post-disaster credit. Recipient countries, in turn, are concerned that international donations and loans for post-disaster reconstruction will continue to take an increasing portion of declining official development assistance (Mechler, 2004).

Finally, to cover the post-disaster liquidity deficit, governments rely on international donor assistance. As mentioned earlier, highly publicized disasters typically receive generous pledges of international aid; yet, pledges frequently fall far short of actual disbursements. After the 2010 earthquake in Haiti, as one typical example, a total of $4.46 billion was pledged over 2010 and 2011, but six months after the disaster only two percent of funds had been delivered, and as of January 2011 fourteen countries had still not dispersed any of the pledged money (Miller, 2011).

The absence of immediate liquidity in the aftermath of a disaster often retards recovery and can force the government to conduct an emergency budget reallocation, which can be detrimental to the long-term fiscal stabilization programs and investment programs (Cummins and Mahul, 2009; Mahul, 2011). According to Benson and co-authors (2012), relief and recovery efforts in developing countries remain frequently underfunded, poorly timed and

poorly targeted. The planning exacerbates the socio-economic consequences of disasters, and the poor, with least capacity to cope with or recover from disaster shocks, can fare the worst.

3.3 Informal risk sharing

Lacking savings, credit and government support, at-risk individuals in developing countries rely on financial arrangements that involve reciprocal exchange, kinship ties and community self help. Especially women often engage in complex, yet innovative, ways to access post-disaster capital by joining informal risk-hedging schemes, becoming clients of multiple micro-finance institutions, or maintaining reciprocal social relationships. Beyond sharing financial resources, whether through self-organized pools, exchanges or loans, households use informal networks to protect livelihood processes (Cox and Fafchamps, 2006). Combined analysis of multiple surveys indicates that about 40% of households in low- and lower-middle income countries are involved in private transfers in a given year, either as recipients, donors, or both (Davies, 2007).

The most common form of assistance is remittances, or the money sent home by migrants. Developing country diaspora people may be better educated than their relatives back home and have higher levels of income. Remittances are expected to reach $467 billion in 2012, a sum more than three times the size of official development assistance (World Bank, 2012). The earthquake in Pakistan in 2005 demonstrated how important remittancescan be for disaster relief. Mohapatra *et al* (2009) cite examples, including evidence from Ethiopia, showing that households receiving international remittances are less likely to sell productive assets as a response to disasters. There is also a fledgling insurance market for migrants, covering disruptions in flows of remittances (e.g., to loss of jobs or death of the migrant) and shocks faced by migrants' families in their country of origins (e.g., illness) (Powers *et al*, 2011).

While remittances are simple in concept, survey results show that the associated costs of an average transfer can vary widely, between 2.5% and 40% (Inter-American Development Bank 2007). Payments are usually sent through banks or professional money transfer organizations, but often these channels break down after disasters, and remittances are carried by hand (Savage and Harvey, 2007). Some non-profit organizations disburse pre-paid cell phones to the affected population after a disaster, allowing easier communication with foreign relatives.

3.5 Insurance mechanisms

Insurance, in contrast to savings, pools risks across communities and regions and in so doing "smooths" consumption allowing households to survive shocks to their livelihoods and assets. Insurance can have added benefits, such as enabling productive investments and thus helping high-risk agents escape disaster-induced poverty traps. Insurance also has advantages to donors since providing partial support for these instruments can ultimately reduce their post-disaster liabilities (Linnerooth-Bayer *et al*. 2005). Finally, and importantly, insurance instruments can be directly linked to reducing risks and losses, and in this way reducing moral hazard. An example from Mauritius (Box 1) serves to illustrate.

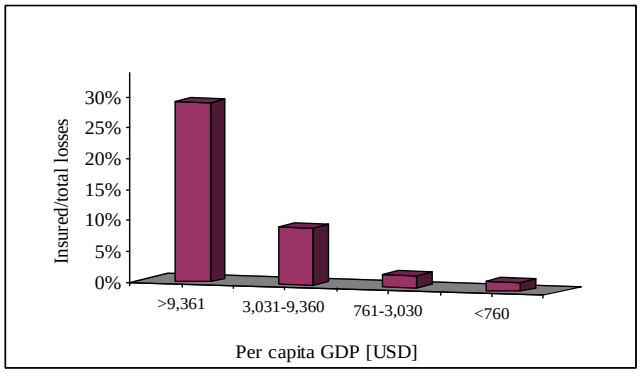
Box 1: The Mauritius crop insurance program

A para-governmental agency, the Mauritius Sugar Insurance Fund (MSIF), provides protection to the island's sugar farmers against losses from cyclones, fire, excessive rain and yellow spot disease. This public-private program has developed a sophisticated method for rewarding growers with good claims experience. For each crop season, farmers are placed on a 100-point scale, which determines the level of premium to be paid and the indemnity level they will receive in the event of a claim. As farmers improve or worsen their claims record, they are moved on the scale. (Roberts 2005)

Source: Adapted from Linnerooth-Bayer, *et al*. 2010.

The Mauritius program targets middle-income farmers. As shown in Figure 2 catastrophe insurance density drops from around a third in wealthy countries to less than a tenth in higher-middle income countries, and it is almost negligible (1-2%) in lower-middle and low-income countries.

Figure 2: Catastrophe insurance density during the period 1985-1999 according to country income groups (per capita GDP in 2000)



Data source: Munich Re (2005)

In the wealthy countries of the US, parts of Europe and Australia the average person pays over $500 annually in premium for non-life disaster cover compared, for instance, to Africa and parts of Asia with less than $5 in per capita premium. The averages, however, hide large differences in these regions, and also within countries. In Africa, for instance, there is virtually no coverage at all in a number of countries compared with a per capita premium in South Africa of 160 USD (Munich Re 2003; Swiss Re 2007).

3.7 Assessment of traditional loss financing instruments

Reliance on savings, credit, informal loss-sharing (such as remittances) and solidarity can work reasonably well for low-loss events (Cohen and Sebstad 2003), but these arrangements are often unreliable and inadequate for covariate and catastrophic shocks that place a significant financial strain on whole communities, regions and governments. Faced with large losses, households may be forced to sell productive assets at very low prices; post-disaster inflation may greatly reduce the value of savings; money lenders may exploit their clients; entire families, even if geographically diverse, may be affected; and donor assistance rarely covers more than a small percentage of losses. The resulting liquidity deficit can greatly aggravate poverty by forcing families to give up assets essential for their livelihoods, withdraw children from school and even migrate to other (sometimes riskier) locations, although it seems unlikely that micro-insurance, particularly with low average claims, could stem disaster-related migration (Clarke and Grenham 2011).

If the effects of climate change on the livelihoods of workers in developing countries become particularly severe so that they cannot adapt and sustain themselves and their families, then no

amount of short-term insurance protection will enable them to remain where they are. Whether people in this situation will migrate within or across borders will depend on many factors, such as immigration policies in potential host countries and the ability of affected people to afford the high cost of international or intercontinental migration.

Partly because of the lack of coping mechanisms for extreme events, poverty can be further reinforced by deliberate pre-disaster risk-averting livelihood choices. Benson and co-authors cite several studies that show the livelihood losses of taking risk-averse production strategies (Benson *et al*. 2012). Marginal farmers in the Philippines, as one example, cultivate traditional, lower-yielding rice varieties because they are relatively more hazard tolerant, thereby reducing the risk of devastating crop failure at the expense of potential earnings (World Bank 2007a). In drought-prone areas of India and Burkina Faso farmers may sacrifice 12 to 15 percent of average income to reduce risk (Hazell and Hess 2010). More generally, estimates show that average farm incomes could be 10-20 percent higher in the absence of risk (Sakurai and Reardon, 1997).3This does not mean, of course, that farmers should enter into costly insurance contracts for which premiums can greatly exceed expected losses, but it is worth examining whether the above coping mechanisms are more or less costly than insurance options, and can make a case for donor support.

[3] Cited in WFP and IFAD, 2010.

4. Innovative risk financing mechanisms

Recognizing that international donor assistance and other traditional risk financing options have failed to meet the needs of developing countries in ensuring sufficient post-disaster funds and providing the safety nets necessary for development, the donor community – international financial institutions, non-governmental organizations, and donor governments – is examining non-conventional risk-pooling and risk-transfer programs. Risk transfer instruments cede risk to a third party, and innovations include index-based, parametric micro-insurance (where insurance payouts are triggered by pre-defined parameters such as the wind-speed of a hurricane), sovereign catastrophe (cat) bonds (where interest is contingent on a pre-defined event) and regional risk pools (that aggregate risk across small highly exposed countries in order to reduce their costs of risk transfer). In what follows, we review these innovations with regard to how they can serve poor communities and governments.

4.1 Index-based micro-insurance programs

The intent of micro-insurance is to circumvent the high costs of traditional insurance in order to service low-income markets by offering limited cover and greatly reducing transaction costs (Mechler *et al*. 2006). Micro-insurance can be indemnity based, where products are written against actual losses, or parametric (index-based), where products are written against physical or economic triggers – against events that cause loss, not against the loss itself. A new generation of insurance products is now being offered, usually in pilot programs, based on parametric mechanisms. A report by the International Fund for Agricultural Development and World Food Programme cite 36 weather index insurance programs, including 28 addressing individual farmer/herder, slum dweller, village or cooperative risk (Hazell *et al*. 2010).

4.1.1 Insuring farmers and herders

Over 40 per cent of farmers in the developing world face weather-related threats to their livelihood (World Bank, 2005), which will predictably increase with climate change. Only a small percentage now benefit directly from micro-insurance programs. In an indexed program, farmers collect an insurance payment if a precipitation index reaches a certain measure or “trigger” within specified times of the growing season. As an early example, an index-based drought insurance program in Andhra Pradesh known as BASIX provides post-drought cash payouts to middle-income farmers who insure their cash crops (Hess and Syroka 2005; Mechler *et al*. 2006). This program supplements an indemnity-based government supported

crop insurance program. While transaction costs are greatly reduced with index-based products, and moral hazard is partly avoided, a major drawback is basis risk, which is the risk a farmer faces that the index is not correlated with individual farmer losses. Basis risk is a characteristic of all index-based systems.

In Mongolia, where domestic animals provide sustenance, income and wealth to protect nearly half the residents, a harsh winter (dzud) can have devastating effects even for experienced herders. In 2006, an index-based livestock insurance program (IBLI) was introduced on a pilot basis in three Mongolian provinces. The index is not based on weather, but rather on the overall mortality rate of adult animals in a given county determined by a (long-standing) yearly census. The insurance system is made affordable to herders and viable to insurers by a layered system of responsibility and payment, including herders (who retain small losses), the private insurance industry (risk-based premium payments) and taxpayers (the “social product”) and – as a fourth layer - a contingent credit provided by the World Bank (Mahul and Skees 2006). The contingent credit, while it will eventually be paid by herders or taxpayers, is likely far less than the premium charged on re-insurance.

4.1.2 Bundled microinsurance

A recent example in Malawi shows that insurance can also have benefits even in the absence of a disaster. Because of drought risk, groundnut farmers in this country have historically experienced extreme difficulty in receiving loans that enable them to purchase more productive seed and other agricultural inputs (Hess and Syroka 2005). A pilot program initiated in 2005 provided the safety net necessary for farmers to plant higher-risk seeds that increased their productivity (in this case) five-fold. Typical for micro-insurance pilots, the Malawi program was made affordable by international assistance. Although at the outset farmers were enthused about the program, the pilot was not operational in 2011/2012 due to a number of problems, not least the absence of ties to existing government safety net programs and institutions.

4.1.3 Forecast index insurance

Index insurance not only reduces moral hazard (since claims are independent of losses) but can be directly linked to disaster risk reduction by establishing the payout threshold on the basis of the forecast of the event, for instance, the forecast of a flood predicted by relying on upstream water levels. This was the idea behind a novel insurance program recently operating in Peru, where claims are based on forecasts of an ENSO event that are, in turn, derived from an index of sea temperature (Skees and Collier 2010). Since insurance payouts are made before the event (and irrespective of eventual losses), clients can take preventive measures to

reduce losses from ENSO-related flooding, such as purchasing machinery that accelerates cleaning of canals or improving main roads to reach markets. Productivity can also be increased with timely weather forecasts. In the Malawi project discussed above, researchers showed that farmers could limit losses and increase revenues by adjusting their planting practices to seasonal forecasts The main message is that micro-insurance schemes that use skillful seasonal forecasts can reduce losses and increase productivity (Suarez and Linnerooth-Bayer 2010).

4.1.4 Participatory micro-insurance as part of a risk reduction package

The HARITA project described in Box 2 aims to promote climate change resiliency, food security and productive livelihoods by addressing the needs of smallholder producers through an unusual mix of risk reduction, drought insurance, and increased market access (primarily through credit-led investments).

Box 2: The Horn of Africa Risk Transfer for Adaptation (HARITA) project

The HARITA project is an ongoing initiative involving, among other partners, Oxfam America (OA), Swiss Re, The Rockefeller Foundation, and the Relief Society of Tigray (REST). Starting at the concept stage in late November 2007, the HARITA partners designed an agricultural risk management package for farmers in Ethiopia's northernmost state of Tigray.

The initiative builds on an existing, donor-supported, government run program, namely Ethiopia's Productive Safety Net Program (PSNP) that provides transfers to chronically food-insecure subsistence farmers. Farmers in the first pilot village of Adi Ha were central participants in the design of a rainfall index insurance package. The community itself identified farmers' vulnerabilities to specific hazards and their capacity to adapt, and elected community members to join the pilot design team. This process of engagement resulted in what many view as an attractive insurance package as well as substantially increased ability to educate farmers about the product.

The farmers could opt either to pay an unsubsidized premium, or, alternatively, they could participate in an insurance-for-work plan, whereby cash-constrained farmers can pay the premium through labor that directly contributes to reducing their own vulnerability to future extreme events.

The project has scaled from 200 households enrolled in one village in 2009 to over 13,000 households enrolled in 43 villages in 2011. The project formally transitioned to R4 Rural Resilience Initiative in January 2012. R4 refers to the four risk management strategies that the initiative integrates- improved resource management (risk reduction), microcredit (prudent risk taking), insurance (risk transfer) and savings (risk reserves). R4 is set to expand the HARITA model within Ethiopia, in Senegal and two other countries in the next five years.

Ethiopia suffered a severe drought in 2012. For 1,810 farmers in seven villages hit hardest by the drought, each will now get a share of the total $17,392 in payouts. (Kebede 2012)

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

The participatory Harita insurance model has effectively reached very vulnerable households. In both years, approximately 40 percent of those covered by the program were female-headed households (considered the most vulnerable in an already very vulnerable community) and 65 percent were officially registered as chronically food-insecure (Kebede 2012).

4.2 Public sector risk transfer

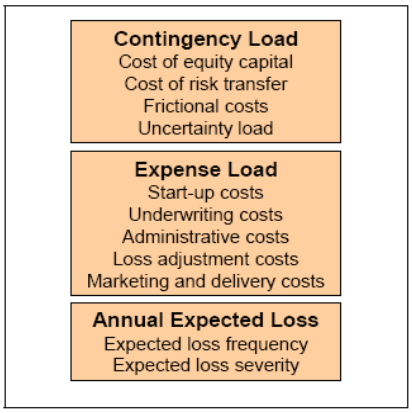
Governments typically have a large portfolio of public assets that may face risks from hazards, and in addition, most governments are committed to providing post-disaster relief to the private sector. If governments lack the necessary infusion of post-disaster capital to rebuild critical infrastructure, restore homes and provide humanitarian assistance, indirect costs can greatly surpass the direct losses of a disaster. Many Ethiopian households, lacking government assistance, sold productive assets to survive the 1984-85 drought-induced famine. These households continued during the 1990s to experience considerably less annual per capita growth than those which had not experienced the drought (Wiseman and Hess 2007). As Pakistan's millions of flood victims without sufficient food and water for months following the 2009 disaster bear witness, these costs can have dire human and economic dimensions. Such delays can also trigger secondary economic and social effects, such as deterioration in trade, budget imbalances and an increase in poverty (Barnett *et al*. 2008). Honduras, as one example, experienced difficulty in repairing public infrastructure and assisting private sector recovery from the devastation of Hurricane Mitch in 1998. Five years later, the GDP of Honduras was 6% below pre-disaster projections (although other factors, such as the financial crisis during that time, may also have played a role) (Mechler 2004).

Large developed countries with diversified assets have little rationale for insuring public infrastructure risks since they can rely on taxpayers for post-disaster liquidity (Arrow and Lind 1970). This is not the case for small, low-income and highly exposed countries that have highly correlated infrastructure risks and cannot rely on their natural resources or on over-stretched tax bases (Linnerooth-Bayer *et al*. 2005; Hochrainer and Pflug 2009). Governments wishing to insure their assets and guarantee sufficient capital for response and relief activities turn to global insurers because of their capacity to absorb risks of even large countries. Risk transfer can thus be a key component of a risk management strategy, including government insurance of its own property, of its broader contingent liability and, also, public support of private risk transfer products.

Governments can also act as insurers of last resort for private or public/private insurers, and in this capacity may purchase reinsurance in order to transfer some of their risks outside of the country. The reinsurance market's capacity has grown significantly—from less than $40 billion in 1994 to about $70 billion in 2002, and up to $168 billion in 2011 (Guy Carpenter 2011). The September 2001 attacks on New York City greatly impacted world reinsurance capacity and prices, including those for natural disaster risks.

Sovereign insurance is costly. As is the case with all insurance, governments pay more for catastrophe insurance than their expected losses, and sometimes significantly more. Figure 3 illustrates many reasons for the high cost (Cummins and Mahul 2009). Premiums are inflated above the annual expected loss not only by the cost of holding sufficient capital to pay claims in the event of large or multiple disasters, but also by the cost of assuming uncertain contracts and frictional costs (contingency load). There is also an expense load, which reflects the costs of doing business.

Figure 3: Costs contributing to catastrophe insurance premiums (Cummins and Mahul, 2009).



Although governments in the past have seldom purchased insurance cover for public assets, this is changing. Responding to lessons learnt from Hurricane Mitch, the Honduran government insured its quasi-private public infrastructure, including airports, telecommunications and energy facilities (but not roads and other transport and water infrastructure). Barbados and the Czech Republic are among the few developing and transition countries now insuring public infrastructure (Linnerooth-Bayer and Mechler 2007).

4.3 National insurance programs

Even in industrialized countries, private insurers have been reluctant to offer region- or nation-wide policies covering droughts, floods and other hazards because of the systemic nature of

the risks, as well as problems of moral hazard and adverse selection (Kunreuther 1998). Adverse selection occurs when those facing higher risks purchase insurance, and those less at risk do not. Furthermore, even well capitalized and diversified insurers can face a risk of insolvency for repeated high-loss events, whichdemonstrates the importance of public or private arrangements that protect clients against insurer insolvency (US Government Accounting Office 2005).

To circumvent problems associated with insuring systemic risk in low- and middle-income countries, the first national (and non-parametric) public-private partnership in the developing world was created. The Turkish Catastrophe Insurance Pool (TCIP) provides cover for earthquake risk in urban areas throughout the country (see Box 3). The purposes of this pool are to reduce the government's fiscal exposure (large post-disaster liabilities) by gradually building up capital in an insurance pool funded by affordable private contributions.

Box 3: Turkish Catastrophe Insurance Pool

The Turkish Catastrophe Insurance Pool (TCIP) launched in 2000 is the first of its kind to tackle the problem of insurance affordability in a middle-income developing country (Gurenko, 2004). In response to high seismic risk, earthquake insurance policies are obligatory for all property owners in Istanbul and other high-risk urban centers. Property owners pay a premium based in part on their risk (but not their risk-reduction measures, such as retrofitting their apartment buildings) to a privately administered public fund. The system does not apply to most of Turkey's very poor households by exempting property owners in rural areas. To reduce premiums and thus make the system affordable to urban dwellers, the World Bank absorbs a pre-specified part of the risk by providing a contingent loan facility with highly favorable conditions and contingent on the occurrence of a major disaster. In other words, if the fund cannot meet claims after a major earthquake, or if the earthquake is particularly catastrophic, the World Bank provides low-cost capital to the pool (Ghesquiere *et al*. 2006).

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

By making policies mandatory and risk based, and by providing for commercial and donor backup capital, TCIP designers attempted to avoid the problems of insufficient penetration and moral hazard experienced by the US flood and French all-hazards systems, respectively. The ambitions of the designers, however, have not been fully realized. Enforcement of compulsory policies has been weak, and penetration at about 20% is far from universal. Even full

penetration would not include the large number of illegal dwellings in Istanbul. Nor are premiums fully risk based, and some critics argue that the system should have been more closely linked with public spending for retrofitting high-risk apartments (Smyth *et al*., 2004). Despite these serious issues, the TCIP is a first demonstration of a nation-wide disaster insurance system in a middle-income developing country.

4.3.1 Catastrophe bonds

An alternative to commercial reinsurance is a catastrophe bond, an instrument whereby the investor receives an above-market return when a pre-specified catastrophe (measured in terms of an index, for example, earthquake intensity) does not occur in a specified time but sacrifices interest or part of the principal following by the event. By hedging catastrophe risk for a payment, catastrophe bonds serve the same purpose as reinsurance. Yet the risks are not absorbed by international insurers but directly by financial markets via investors, who receive a contingent interest rate calculated on the basis of the estimated risk. Catastrophe bonds can be attractive to investors who wish to add non-correlated investments to their portfolio. Disaster risk can thus be transferred to international financial markets that have many times the capacity of the reinsurance market.

The first developing country government to issue a catastrophe bond was Mexico, in order to provide security to its catastrophe reserve fund (Box 4) (Cardenas *et al*. 2007). Despite technical support from the World Bank, the costs of the Mexican cat bond amounted to about 2% of the cover amount, which substantially exceeds the usually around 1% cost for traditional reinsurance. With more experience, better data collection and improved local expertise (the Mexican's relied heavily on outside consultants), the transaction costs might be substantially lowered.

Box 4: The Mexican catastrophe bond

In 2006, the Mexican government chose to insure its catastrophe reserve fund, FONDEN, against major earthquakes with a mix of reinsurance and a catastrophe bond. The resulting contract was linked to a parametric trigger in terms of magnitude and depth of seismicity for the three-year period 2007-09. The catastrophe bond provided cover of US$160 million for a premium/interest totaling $26 million. The major reinsurance company, Swiss Re, guaranteed the bond. An insurance claim payment is triggered if:

- an earthquake with specified magnitude and depth is recorded with its epicenter located in

one of the specified zones; and if

- there is official declaration of a disaster by a federal agency.

Three regions in Mexico considered at highest risk were thus financially protected. Mexico has received substantial technical assistance from the World Bank and Inter American Development Bank over the years, but, as a middle-income developing country and member of the OECD, Mexico financed the transaction out of its own means. (Cardenas *et al*. 2007)

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

Other similar instruments include catastrophe futures or options contracts, also designed to provide insurers and reinsurers with an alternative or supplement to traditional reinsurance. They allow parties to hedge catastrophe risk exposure through access to the capital markets. Governments can also engage in risk swaps with another government facing non-correlated risks, an instrument that is used extensively by insurance companies (Cardenas 2008).

Worldwide losses from extreme disasters are only a small percentage of the world capital market, which highlights the scope and potential of trans-border risk transfer, especially for governments of small countries unable to form a viable insurance pool within their borders (because disasters can affect a large part of their country).

4.3.2 Contingent credit: ensuring access to loans in times of crisis

Because of increasing scarcity of post-disaster credit, governments can pay a fee for the option of a guaranteed loan at a pre-determined rate, contingent on a disaster or some other defined event occurring.

Box 5: Contingency credit for Colombia and Mongolia

Colombia was the first country to secure contingent capital from the World Bank to provide immediate and less expensive capital to the government when it is most needed. Natural disaster risks in this country are high - on average Colombians face more than one severe flood every year and a strong earthquake every two years. Past disasters, including the 1999 Armenia earthquake, have caused losses up to US$3 billion. At the same time, fiscal operations are heavily constrained by high external debt and debt service payments, which severely limit the ability of the central government to respond to disasters. To ensure sufficient post-disaster capital, the government of Colombia and the World Bank designed a project to reduce the country's fiscal vulnerability by strengthening disaster risk management. This was financed through a World Bank loan including a contingent credit arrangement for US$150

million in order to provide the government with immediate post-disaster liquidity. (Cummins and Mahul 2009)

A similar instrument designed since 2005 for the government of Mongolia, which is acting as a reinsurer of last resort for the nation's Index-Based Livestock Insurance program, protects the government against large livestock losses due to exceptionally bad weather. A US$5 million contingent credit line has been made available by the World Bank (Cummins and Mahul, 2009).

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

Although contingent credit can potentially provide a government with lower cost capital relative to either insurance or the accumulation of reserves, the major disadvantage is that it can also exacerbate a country's debt burden. The desirability of this product, which is an instrument for risk retention, depends on the country's post-disaster financial profile, and more specifically on its post disaster fiscal situation (Cummins and Mahul 2009).

4.3.3 Insuring donors that support governments

Like governments, donor organizations can also be strapped for cash especially after large-scale droughts and multiple disasters (particularly in the crucial time window between the observed natural hazard and its manifestations of avoidable losses - such as long-term health impacts to children due to malnutrition that can be addressed by timely food distribution). In such cases donors might consider insurance for rapid deployment of assistance, or alternatively they may help arrange insurance for vulnerable governments. This was the reasoning behind an innovative idea by the World Food Programme (WFP) to set up an insurance program to relieve its limited capacity to provide timely cash to the Ethiopian government in the case of extreme droughts (Box 6).

The potential for combining index-based approaches and safety net tools is, according to Wiseman and Hess (2007), substantial. Well-established safety net programs, such as Ethiopia's Productive Safety Net Program, can be scaled-up relatively quickly. In addition to ensuring that resources reach beneficiaries before negative coping strategies are employed, there are also spin-off benefits. Most importantly, the predictability of the system and related monitoring/evaluation systems can support more comprehensive contingency planning.

Box 6: The Ethiopian index-based insurance project

To supplement and partly replace Ethiopia's traditional food-aid response to famine, the World Food Programme (WFP) supported the government-sponsored Productive Safety Net Programme (PSNP) by insuring it against extreme droughts. The contract was designed to provide a maximum payout of about US$7 million for an annual premium of US$930,000 financed through a USAID grant. The PSNP provides immediate cash payments in the event of food emergencies. In the case of very severe droughts, however, this donor/government system is sufficient to save lives, but not to save livelihoods. The WFP thus designed an index-based insurance system to provide extra capital in the case of extreme drought, the amount being based on contractually specified catastrophic shortfalls in precipitation, measured in terms of the Ethiopia Drought Index (EDI). Rainfall data is taken from 26 weather stations representing the various agricultural areas of Ethiopia. In 2006, WFP successfully obtained an insurance contract based on the EDI through AXA Re, a Paris-based reinsurer (Wiseman and Hess, 2007). A limitation of the WFP Ethiopian system proved to be its integration with other programs targeting those chronically short of food, and especially nomadic herders. The insurance contract did not trigger in 2006 and was not renewed in 2007.

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

4.4 Insurance pools among small states

Developing country governments, particularly those of small states, pay international prices for insurance, which are subject to fluctuations often caused elsewhere. Barbados, one of few countries insuring public infrastructure, experienced a ten-fold increase in insurance premiums in 1992 after Hurricane Andrew - despite Barbados not lying in a major hurricane path (Cummins and Mahul, 2009). Larger countries can generally absorb the impact of adverse natural events since an affected region can be subsidized by revenues from unaffected regions. This type of geographic distribution of risk is not possible in small island states.

To circumvent the small-country problem, the Caribbean Catastrophe Risk Insurance Facility (CCRIF) was established to provide participating governments with immediate liquidity in the event of a major hurricane or earthquake at a significantly lower cost than if they were to purchase insurance separately in the financial markets (Box 7). Governments contribute resources to the pool relative to the exposure of their country, and the fund is reinsured in the

capital markets. Early cash claim payments received after an event help overcome the typical post-disaster liquidity crunch.

With reinsurance and pro-rated contracts, CCRIF appears well protected against insolvency. A major concern about the long-term acceptance and viability of the pool, however, is basis risk. This was illustrated when Hurricane Dean imposed damages on Jamaica in 2007, which were not sufficient to trigger compensation from the pool. This created considerable controversy about the value of the insurance contract, and CCRIF became an issue in the ensuing elections. The following year Haiti experienced three hurricanes collectively causing considerable damage; however, most of the damage was due to flooding and not wind and thus a payout was not triggered. In contrast, the ability of CCRIF to make funds available at a critical hour was demonstrated after the 2010 Haiti earthquake: CCRIF funds represented the first payment received by the Haitian government out of all the pledges made internationally and regionally, and accounted for 50% of funds received by the government within the first 10 weeks of the disaster. There is as yet, however, no documentation on how these funds have been administered given the multifaceted weaknesses of the post-disaster government. The Haiti example underscores the importance of good governance and reliable institutions to administer any sovereign risk financing program, whether it is insurance, credit or donor assistance.

Box 7: Caribbean Catastrophe Risk Insurance Facility

The Caribbean Catastrophe Risk Insurance Facility (CCRIF) became operational in June 2007 with the participation of 16 Caribbean countries. These governments contributed resources ranging from US$200 thousand to US$4 million, depending on the exposure of their respective countries to earthquakes and hurricanes. This better-diversified portfolio has resulted in a substantial reduction in premium costs (about 45 – 50%) for the participating countries. The CCRIF fund covers up to 20% of estimated loss, and claims are paid based on an index for hurricanes (wind speed) and earthquakes (ground tremors). Initial funding by donor organizations supported start-up costs and helped to capitalize the pool. The facility can transfer the risks it cannot retain to the international financial markets through reinsurance, catastrophe bonds, or other financial instruments. The accumulation of reserves over time should lessen the facility's dependence on outside risk transfer. Should total insured losses exceed claims-paying capacity, payouts are pro-rated, based on the total amount of expected claims compared to remaining available funds. In addition, donors are adding to the reserves.

The governments of Bermuda, Canada, France, the United Kingdom, as well as the Caribbean Development Bank and the World Bank recently pledged a total of US $47 million to the CCRIF reserve fund.

The CCRIF acts much like mutual insurance. It is established as an independent legal entity, managed by a specialized firm, under the supervision of a Board of Directors composed of donor representatives. (Ghesquiere *et al*. 2006; World Bank 2007b)

Source: Adapted from Linnerooth-Bayer, *et al*. 2010

5. Novel financing instruments: benefits, costs and risks

Experience is too short to fully assess the current and prospective role of innovative financial instruments in genuinely reducing the financial burdens of disaster shocks on the most vulnerable communities and their governments; yet, some insights on the benefits, costs, risks and future prospects can be gleaned from recent experience.

5.1 Benefits

By providing low-income households, farmers and businesses with the right to post-disaster liquidity, thus securing their livelihoods, micro-insurance instruments can lessen the burdens from disasters and expedite the recovery process. For many, an insurance contract is a more dignified and secure means of coping with disasters than dependency on the ad hoc generosity of donors. Since insured households and farms are more creditworthy, insurance can also promote investments in productive assets and higher-risk/higher-yield activities. As we have emphasized throughout this review, innovative insurance instruments can also provide incentives to reduce risk and losses, but only if they do not themselves encourage negligent behavior (parametric contracts avoid this moral hazard). This discussion has highlighted how micro-insurance can support disaster risk reduction (DRR)as summarized below:

- Loan packages bundled to micro-insurance can enable (i) productive investments that reduce long-term vulnerability (for example, by providing the security necessary to buy high-yield seeds) and (ii) investments in risk reduction.
- Index insurance can be linked to the forecast of an event (such as the indexed business interruption insurance product tied to the seasonal rainfall forecasts in Peru), which can provide timely funds for pre-disaster risk reduction activities.
- Participatory risk management initiatives can explicitly link risk transfer with risk reduction (as does the Ethiopia pilot that offers cash-constrained farmers the possibility to pay premiums with DRR-oriented labour).

Sovereign disaster risk financing and insurance instruments can also have large payoffs to governments. Due to limited tax bases, high indebtedness and low uptake of insurance, many highly exposed developing countries cannot fully recover by simply relying on limited external donor aid. By providing ex post liquidity that enables governments to provide relief to the most vulnerable and to invest in reconstruction and recovery – and quickly get back on their feet -

insurance reduces long-term losses and the significant development set backs from disasters. Just like investments in prevention, insurance can therefore save lives and livelihoods. With internationally backed risk-transfer programs, developing country governments will rely less on debt financing and international donations, and assured funds for repairing critical infrastructure will attract foreign investment.

5.2 Costs and risks

Despite the significant benefits of these instruments, and their potential for promoting risk reduction and climate adaptation, the benefits should be evaluated in view of the costs. In contrast to other types of insurance (e.g., for health or funeral expenses) insurers offering cover for co-variant risks face large, stochastic losses and thus must hold expensive capital reserves, diversify or purchase reinsurance, all of which "load" or add to its cost. Moreover, providing insurance at a small scale involves high transaction costs for reaching clients, estimating risks and handling claims. Transaction costs are also proving high for alternative sovereign insurance instruments such as the catastrophe bond in Mexico (Cardenas *et al*. 2007). Because of these costs, and the return anticipated by insurers for entering high-risk markets, the premium on micro-insurance products and sovereign insurance instruments can greatly exceed expected losses. Because there can be added value in assessing and responding to risks before disasters, it may pay donors to switch from post-disaster relief to subsidizing these products.

As current programs demonstrate, insurance premiums are made affordable by targeting higher income clients, limiting coverage, providing outside support and forming partnerships. The TCIP and BASIX systems target middle-income property owners and farmers, respectively. In Malawi, the insurance covered only the cost of the seed; in the case of the Caribbean pool, insurance amounts to only about 20% of estimated losses to public infrastructure. Voluntary support from NGOs and international assistance also contributes to the affordability of insurance. Arguably, the AfatVimo program and the Oxfam America and Swiss Re initiatives in Africa would not be possible without the significant support they receive from NGOs and donors. The reinsurance and catastrophe bonds that transferred risks from Mexico and Ethiopia to the international capital markets were made possible by outside technical support from IFIs and other types of start-up assistance. The World Bank frequently pays the costs of starting up systems, and has also helped capitalize the insurance pools in Turkey and Mongolia.

5.2.1 Moral hazard, adverse selection and basis risk

Moral hazard and adverse selection have contributed to the reluctance of private insurers to enter many catastrophe markets, most notably flood coverage, and motivated governments to form public-private insurance systems. Risks of adverse selection and moral hazard facing conventional insurance systems are more-or-less absent in the case of index-based programs. Yet, basis risk may be one of the most difficult challenges facing these programs. As discussed earlier, basis risk is the potential for a mismatch between parametric insurance claims settlement and the actual losses of the insured. This risk plagues most indexed insurance programs and particularly the weather pilots discussed in earlier sections. If weather stations are not located very densely, rainfall measurements may not be closely correlated with an individual farmer's experience. One potential innovation for reducing basis risk is the use of satellite data for measuring rainfall specific to insured fields.

5.2.2 Institutional stability, public confidence and trust

Without competent regulatory bodies that assure conditions for both insurers and clients, the market cannot provide sustainable insurance contracts. Among other reasons, there will be no protection for clients if insurers renege on claims, and well capitalized firms will be undercut by those with insufficient capital. Responses to a survey in Malawi showed widespread mistrust in the implementing institutions and insurance mechanisms, notably in the administrating NGO, the private insurer and the weather station data (Suarez *et al*. 2007). Even more worrying is the apparent lack of understanding of the insurance contract. Many farmers in Malawi did not fully understand the index-based system. In India, there are concerns that farmers' enthusiasm for the BASIX system is based on generous payouts in recent years.

Both trust and financial literacy can be improved through educational awareness. Simulation games have been developed to improve understanding of insurance products (Patt *et al*. 2005, Patt *et al*. 2010) A field experiment in India found that communicating the need for personal financial management and the utility of formal hedging of agricultural production risks increased demand for an insurance product by 5.3 percentage points (Gaurav *et al*, 2010).

5.2.3 Modelling and pricing uncertainties

Data quality and availability are crucial factors determining the feasibility and viability of micro and sovereign insurance schemes. Simulations can partly supplement the need for extensive, and often unobtainable, historical data. Catastrophe models generate probabilistic losses by simulating stochastic events based on the geophysical characteristics of the hazard and combining the hazard data with analyses of exposure and vulnerability of assets. Advances in

modelling have increased the feasibility of risk-transfer programs in developing countries by making it possible to better estimate and price low-probability extreme event risks, even if there are limited historical data available. Still, the models need data for calibration, and in event of "fat tailed" distributions, reliance on historical data is questionable.

5.2.4 Climate change

Finally, climate change will likely impose additional stress and risks on weather insurance. The Intergovernmental Panel on Climate Change (IPCC) has predicted that climate change will increase weather variability as well as the intensity and frequency of climate-related extremes, and there is some evidence of a current "climate signal" with the IPCC (2012) reporting observations of long-term and widespread changes in wind patterns and aspects of extreme weather including precipitation and heat waves.

There is growing acknowledgement on the part of insurers that the impact of climate change on future weather losses may be profound. The chairman of Lloyd's of London deemed climate change to be its number-one issue, and Europe's largest insurer, Allianz, stated that "climate change stands to increase insured losses from extreme events in an average year by 37 percent within just a decade while losses in a bad year could top US$400 billion" (quoted in Mills 2007).

6. Prospects

The important message is that whole countries, regions and communities - despite solidarity, informal mechanisms for sharing risks, savings and other inter-temporal risk strategies – can face a risk of insolvency and impoverishment after disasters, which at the same time discourages pre-disaster lending for investments in their future. A way out of this development cul-de-sac is to invest in risk management, including risk reduction as well as financial mechanisms, formal and informal, for responding to disaster impacts. Since isk transfer mechanisms are not the cheapest option for risk management, they should be applied only to those risks that cannot be cost effectively reduced. An important consideration, when comparing across financial mechanisms, is that risk transfer can generate additional benefits by strengthening long-term resilience. Moreover, donor supported risk transfer can provide a mechanism for leveraging public assistance resources.

As promising, and also costly, as traditional and new financial instruments may be for contributing to disaster risk management, micro and sovereign risk transfer programs today only reach a very small population of low-income farmers, herders, households, intermediaries and governments. From the standpoint of commercial viability, there has been little analysis of the current or likely future sustainability of market-based disaster risk transfer products, beyond analysis of individual projects. A few insurers, however, are taking an interest in this market segment. For Swiss Re, micro-insurance is expected to become a new growth market segment. Insurers targeting the poor, even if profits are small or non-existent, help support long-term growth by creating a strong brand name, building a large client base and developing an insurance buying culture (Swiss Re 2012). The target market for Swiss Re includes those who can afford premiums that are commercially sustainable. This includes the estimated 2.6 billion people living above the international poverty line of USD1.25/day and up to USD 4/day. Few insurers, however, are optimistic about the prospects of catastrophe micro-insurance for the very poor (below USD 1.25/day) unless it is supported by the government, NGOs or international donors.

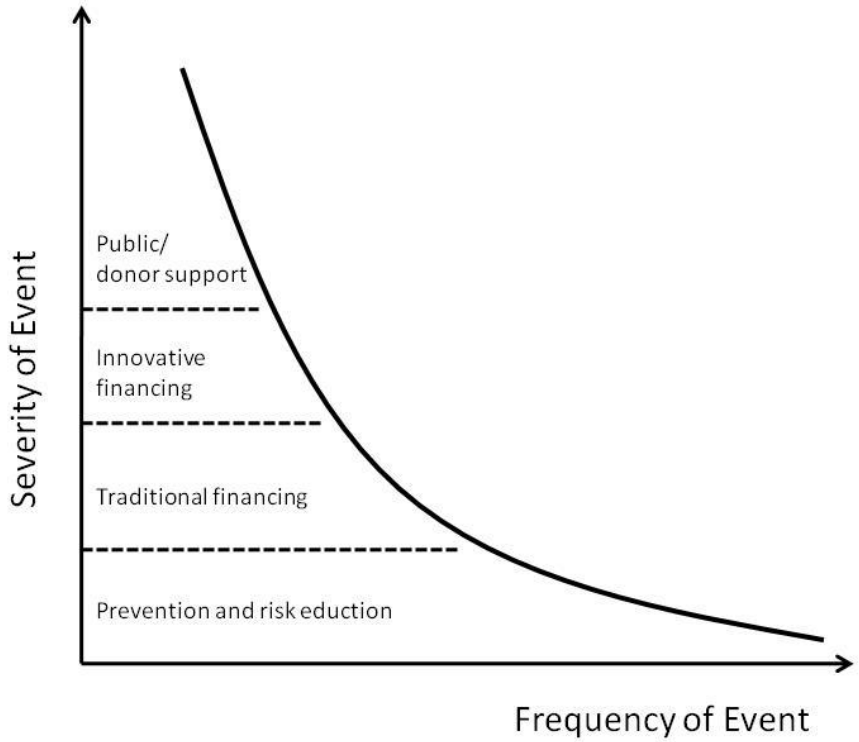
It is clear thus that donor support will be necessary if these instruments are accessible to the very poor. From the standpoint of donor organizations, there are compelling reasons to follow the examples of financial institutions like the World Bank and the World Food Programme and invest in risk-transfer programs. By sharing responsibility with individuals and the state, donors leverage their limited budgets and substitute a calculable annual commitment to a financial risk

transfer system for the unpredictable granting of post-disaster aid. Viewed as an alternative to post-disaster assistance, support of insurance programs has the added advantage of requiring detailed assessments of risk and thus directing early attention, not only to insurance, but to prevention. Donor-assisted risk-transfer programs are thus attractive to developing countries and the donor community because they can potentially reduce the long-term need for assistance.

Notwithstanding these motivations for providing donor support for innovative financing markets, there are those who caution that support, especially in the form of subsidies, will lessen incentives for reducing vulnerability. In addition, donor institutions seldom make long-term commitments, thus jeopardizing the sustainability of insurance programs dependent on their support. Yet, another view holds that if the alternative to donor-supported risk transfer is continuing to aid victims after disasters strike, donor-supported insurance systems are a legitimate route for addressing poverty, especially if they keep market distortions as low as feasible. The case is stronger given the responsibility of industrialized countries for the damage inflicted by greenhouse gas emissions on vulnerable and low-emitting countries.

Given the pros and cons of assisting the development of innovative financial instruments, donor support should be carefully targeted. Many experts are suggesting a layered approach as shown in Figure 4 based on the principle that varying risk management strategies are appropriate at different levels of risk, in part on grounds of cost-efficiency (Hochrainer-Stigler and Pflug, 2012; Benson *et al*. 2012; Cummins and Mahul, 2009). There is some evidence that the most cost effective risk reduction investments target high probability and low-consequence events, and traditional financing may also be most effective for this low risk level, above which risk financing programs may be effective. Donors could provide backup capital above and beyond commercial reinsurance to support micro-insurance, sovereign risk instruments and regional pools by supporting the often uninsurable high-level risks. Assistance at this level can reduce the price of high layers of risk (the low-probability, very high impact events) but maintain the “pure risk price” on lower levels. The lowest levels of risk can generally be cost-effectively reduced and/or financed through traditional means.

Figure 4: A risk-layering approach



Source: Benson *et al*. 2012

In addition to providing back up capital donors can:

- provide improved information (e.g., assistance in conducting risk assessments), market institutions (e.g., insurance regulations) and market infrastructure (e.g., weather stations);
- pool insurance programs that have uncorrelated or negatively correlated risks (e.g., the spatially differential effects of El Niño events in Africa); and
- broker reinsurance deals, (e.g., the case of the Caribbean pool).

While much remains to be learned and done in the field of risk transfer, interviews with informed and experienced stakeholders (Linnerooth-Bayer *et al*. 2011) reveal that the key bottlenecks to growth do not involve only capital availability, technical expertise, demand for services or political will, but also the know-how to identify supply chains and assess, quantify and especially aggregate risk. Best options are likely to emerge when risk transfer instruments are bundled with other (preferably existing) processes, such as commodity markets or safety net programs.

7. Actions to reduce the negative impact of disasters occurring up to 2040

Cost-benefit studies performed on disaster risk reduction in the developing world show the potential for high returns (Hochrainer-Stigler *et al*. 2011; MMC 2005; Mechler, 2005) and highlight the importance of an integrated risk management strategy that focuses on the intersection of risk financing activities with adaptation and development. What this means in practice may best be illustrated by the HARITA micro-insurance scheme, which enables farmers to purchase the product with labour devoted to reducing the community's drought risk. If micro-insurance can improve farmers' creditworthiness, as was the intent of the Malawi project, it can pave the way for participating farmers to increase productivity, and, in turn, make them and their families more resilient to drought. More ambitious schemes could combine outside support with government action, such as investing in early warning programs or community flood walls.

Support for organizations, including IFIs, donors and NGOs, working in this field, could have high payouts in advancing risk financing and risk management in developing countries. Alternatively, or in addition, regional risk management facilities, including regional risk pools, might serve this function. As a recent example, Japan has agreed to contribute about USD 4.6 million for a regional program, including a pool similar to CCRIF, to be set up with the World Bank to help Pacific island countries deal with the risk of natural disasters (PINA, 2012). Support of this type could be conditional on countries engaging in far-reaching risk reduction programs, also partially funded by the regional entity.

In more detail, donor-supported regional facilities could promote disaster risk financing (both traditional and novel) and reduction at different scales as outlined below:

- *Regional scale*: As the CCRIF has demonstrated, regional facilities can serve to pool uncorrelated sovereign risks that reduce each participating country's vulnerability at lower costs than going it alone. Keeping in mind the challenges, especially basis risk, sovereign risk pools could be either parametric or indemnity based. Donors could provide support for technical assistance and also help capitalize the funds in the early operating years. The full potential of donor-supported regional pools could be realized by requiring risk reducing activities in the region to qualify for participation in the pool.

- *National scale*: Regional facilities can also lend support to national governments in setting up public-private insurance programs and indexed or indemnity micro-insurance, and perhaps assisting in brokering reinsurance and sovereign risk transfer instruments (if this is not covered by the regional pool). This support can take many forms, including
    - developing risk management solutions, including catastrophe loss modeling and cost-benefit analysis of risk reduction measures;
    - exploring the potential of risk financing options to promote disaster risk reduction;
    - providing technical assistance to design and implement the required policy and institutional infrastructure to enable risk financing instruments;
- *Micro scale:* Regional facilities could also help create and scale up micro-insurance. CCRIF is pioneering several micro-insurance projects (with German donor support) on the island states by providing technical risk analyses and other types of assistance. Many micro-insurers operate without sufficient capital back up, and a regional facility could provide low cost capital for the high layers of risk, also making the premiums more affordable.

As we have emphasized in this discussion, risk transfer instruments can be costly and inaccessible, in which case more traditional mechanisms, including informal risk sharing, remittances, savings and credit, should be part of the disaster financing portfolio for the poor. Regional facilities could also support these mechanisms by strengthening financial processes that facilitate informal transactions. For many of the poor, governments and donor support will and should continue to provide safety nets, and regional facilities could strengthen public finance processes so that in the event of disaster money goes where it is most needed. In particular, if risk transfer is too expensive or basis risk is too high for financial instruments, investments in public finance mechanisms to support risk retention and post-disaster within-country targeting of resources can have high social returns.

Proposals for regional risk management facilities as part of a climate change adaptation strategy have recently been put forward by the Munich Climate Insurance Initiative (MCII 2008) as well as the Alliance for Small Island States (AOSIS 2008). Both initiatives emphasize the importance of forging creative ways of linking disaster financing with loss reduction for the most vulnerable. Consistent with the layered approach discussed above, the MCII proposal envisages a prevention pillar for low-level risks and a two-tiered insurance pillar for middle- and high-layer risks. The first tier would act as a solidarity fund and cover losses to the most vulnerable countries falling victim to infrequent and severe weather-related events. For medium-level risks, the second tier would support local, national and regional insurance

programs. (Linnerooth-Bayer *et al*. 2009). The important message is that donor support can operate at the regional and global scales, and it may be most effective if targeted differently for different layers of risk.

The urgency and importance of disaster risk management, as opposed to the traditional reactive approach to disaster assistance, for the billions of disaster-exposed persons living below or close to the poverty line cannot be over emphasized. Innovative forms of risk financing, although replete with challenges, may have benefits in terms of saving lives and restoring livelihoods in the aftermath of disasters, providing safety nets that enable productive investment and development and, finally, linking with disaster risk reduction and climate change adaptation. There are no magic bullets, however, for making these benefits accessible and affordable to those most in need, and in many instances, more traditional means of financing will be preferable. Still, innovation is welcome, and many persons, NGOs, donor institutions and private enterprises are pioneering projects at the micro, national and regional scales. These projects and experiences deserve careful scrutiny in the hopes they can serve as scalable models for increasing cost-effective disaster resilience in the developing world. This will require considerable resources from development and financial organizations, but with the potential of saving large sums in the future on post-disaster assistance.

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