

## **THE FINANCIAL MANAGEMENT OF CATASTROPHIC FLOOD RISKS IN EMERGING ECONOMY COUNTRIES\***

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### **Summary**

In the decade 1988-97, floods accounted for over half of the 390,000 recorded fatalities and a third of the damages from all natural catastrophes world-wide (Munich Re, 1998b). Most of the victims were in the developing world, which is typical of natural disasters more generally (Mitchell and Ericksen, 1997). Despite far greater capital stock in the developed world, most of the US\$ 233 billion global flood losses over the past decade have also occurred in the developing countries, especially in Asia which claims 65 per cent of flood damages (Munich Re, 1998a).

While the fatalities from flood disasters appear to be declining partly because of improved warning systems, economic damages are rising mainly because of increasing concentration of populations and vulnerable assets in high-risk zones (Loster, 1999).

Climate change may also be a factor influencing future flood losses. A warmer atmosphere absorbs more moisture leading to increased precipitation. Total precipitation has risen by about 10 per cent in the United States in the period 1910-1995, and the frequency of flooding has also become more severe in many parts of the country (MacDonald, 1998). A Dutch study of the Meuse River predicts that a 2 degree C global temperature increase accompanied by a 10 per cent increase in precipitation would more than double the average damage from flooding to property on the river. (see Tol, et al., 1999). Another factor that may cause increases in damage is the runoff from built property and concrete that may otherwise have been absorbed by the soil.

The purpose of this paper is to examine the potential of pre- and post-disaster instruments for financing disaster response and recovery and for creating incentives for flood loss mitigation in countries with emerging economies. We focus on developing or emerging-economy countries because of the distinct and serious problems they face in preparing for and responding to major floods and other disasters. Low incomes combined with very limited private insurance have placed the burden of aiding disaster victims in their recovery process primarily in the hands of the government. In addition, a large share of flood disaster losses in developing countries occurs in the public sector, namely to public buildings and infrastructure.

The governments of emerging-economy countries are ill prepared to assume the financial costs of flood loss mitigation, response and rehabilitation. After a disaster, governments often experience difficulties in raising funds to assist the recovery process because of political or other constraints on borrowing, taxes, diverting funds from other government or internationally financed projects.. This is particularly true following large-scale disasters where the damage is high relative to the country's gross domestic product (GDP) , as with Hurricane Mitch that devastated Honduras in 1998.

In the absence of private insurance, there are two principal types of mechanisms available to governments to fund the costs of recovery: *hedging instruments* and

*financing instruments.*<sup>1</sup> Hedging instruments are pre-disaster arrangements in which the government incurs a relatively small cost in return for the right to receive a much larger amount of money after a disaster occurs. Since the financial risk of the losses from future disasters is borne by another party, these hedging instruments are also referred to as *ex ante risk transfer mechanisms*. Insurance and capital market-based securities are examples of hedging instruments. The government obtains financial protection after a disaster by either paying a premium for insurance or interest on a capital market-based security.

Financing instruments are arrangements whereby the government either sets aside funds prior to a disaster or taps its own funding sources after the event occurs. An example of a pre-disaster measure is a public catastrophe fund where the government implicitly self-insures by setting aside money to finance some of the recovery needs following a disaster. Alternatively, the government can mobilize its own financing sources by such policy instruments as imposing taxes, borrowing domestically or internationally, or diverting from the public budget.

To make the discussion of these two types of instruments more concrete, in the next section we focus on the impact of the 1997 Polish flood. We then examine the advantages and limitations of hedging instruments and how they compare to more traditional financing instruments. Then we show how insurance and capital market-based securities can be designed to create incentives for the mitigation of damage to public infrastructure using the flood proofing of a water treatment plant on the River Oder in Poland as an illustrative example. We conclude that hedging instruments can be an attractive alternative to the financing instruments that have been traditionally used in emerging-economy countries to fund disaster recovery. Since very poor countries will have difficulties in paying the price of risk-transfer instruments, we suggest that international lending institutions consider innovations for subsidizing these payments

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<sup>1</sup> This distinction between hedging and financing instruments has been made by Doherty (1997).

The governments of emerging-economy countries are largely responsible for flood disaster response and rehabilitation, as well as mitigation of the losses. Yet, they often experience difficulties in providing funds for these purposes. These difficulties can have long-term effects on the economies of these countries and the welfare of the public.

We have compared the relative merits of pre-disaster hedging instruments, such as insurance and catastrophe bonds, with financing instruments such as post-disaster taxes and government borrowing. We have shown that this comparison is multifaceted. It depends on the costs and availability of these instruments, the risk aversion of those who will ultimately absorb the losses, and equity considerations. We were particularly interested in the impact these instruments have on the adoption of disaster loss prevention measures.

The comparative attractiveness of pre-disaster hedging instruments will also depend on the nature of the hazard and the circumstances of the country. We have examined the case of flooding in Poland, where there are a number of factors that may constrain the availability of financing alternatives. In particular, post-disaster borrowing will be limited by the budget austerity required for Poland's eventual entry into the European Union. Other financing options may also be politically difficult, such as imposing a disaster tax, or economically undesirable, such as transferring funds from other budgetary commitments.

Hedging instruments will be particularly important for financing disasters that comprise a large proportion of the country's GDP since after such events the government will have an extremely difficult time raising sufficient funds from its traditional sources. International lending organizations, such as the World Bank, will feel pressure following these events to provide loans to aid the recovery process, thus diverting funds from other development projects. If the country has insurance or has purchased cat bonds in advance of the disaster, this will channel funds from international capital markets to aiding the recovery effort.

For these reasons alone, hedging instruments such as insurance and catastrophe bonds may be desirable policy options for a country such as Poland to consider. An additional advantage is the incentives these instruments can create for preventing losses. Because of these incentives, it may be desirable for the national government to require regional authorities to hedge their risks especially if they would otherwise under invest in mitigation due to misperceptions of the flood risk and myopia. Both mandatory insurance and cat bonds can provide economic incentives for regional government authorities to invest in cost-effective mitigation measures.

Poor countries, such as Poland, will have great difficulties in paying the costs of ex ante transfers. Since the World Bank and other lending organizations are concerned about the losses on their investments in these countries by having funds diverted to disaster relief, innovative financing mechanisms to aid these countries might be considered. Helping poor countries to afford these pre-disaster protective measures may not only be desirable on equity grounds, but would avoid having investors depicted as capitalizing on the potential catastrophic losses facing poor countries from future natural disasters.

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