Quantify Contingent Liabilities Associated With Natural Disasters

Towards effective post-disaster public financial management

Background

Quantifying the contingent liabilities associated with natural disasters is a critical first step to understand and reduce their fiscal impact. Natural disasters can create major explicit or implicit contingent liabilities for the government. Explicit contingent liabilities may include losses incurred on government assets and emergency response and recovery. Despite sometimes clear regulation defining the limits of government responsibility, political and social pressures often lead the government to accept additional liabilities after a major disaster for example for low-income housing. These implicit contingent liabilities are often the most difficult to assess and can pose major fiscal risk to the government budget.

This note discusses how fiscal risk assessments and fiscal disaster risk profiles help quantify potential losses from disasters. It is the first of a series of six notes that, together, review the process of establishing an institutional mechanism to finance post-disaster recovery and reconstruction.

General Principles

A fiscal risk assessment of natural disasters is a fundamental process in the development of any financial protection strategy against natural disasters. A comprehensive fiscal risk assessment builds on both historical loss data and simulated loss information from probabilistic catastrophe risk models.

Robust data is essential for a substantive fiscal risk assessment. Using both historical and simulated data captures the potential losses the government faces across varying levels of disaster severity and frequency. Historical loss data reflect disaster losses arising from recurrent events, while losses caused by infrequent high-impact events inherently have sparse records, hence must be simulated using probabilistic catastrophe risk models.

The resulting fiscal disaster risk profile of a country includes disaster loss estimates and potential post-disaster funding gaps of the government, given its contingent liabilities. Governments can use outputs of the fiscal disaster risk profile to make budgetary decisions tailored to the unique needs of the country. Ultimately, more informed financial decision-making can help protect the government budget from the potentially significant and highly variable burden of natural disasters.

Considerations for Implementation

Generally, the Ministry of Finance is responsible for establishing the fiscal disaster risk profile, as the outputs feed into the financial decision-making processes. However, outputs of the fiscal disaster risk profile have applications across all areas of disaster risk management, from contingency planning to construction standards and structural resilience.

In order to develop a fiscal disaster risk profile, specific input information on hazards, exposures, and vulnerability is required for probabilistic financial analysis. A hazard module defines the frequency and severity of potential events based on a consolidated database of historical events. This hazard database is optimally developed by the government entity tasked with disaster risk reduction and prevention activities. For example, in Mexico, the hazard database is integrated within the National Risk Atlas and is maintained and managed by the National Center for Disaster Prevention (CENAPRED).

A geo-referenced inventory of public assets at risk and their attributes (e.g., exact location, construction type, number of stories) constitutes the exposure database. The inventory could also include private assets such as houses and small and medium enterprises. Input data to construct the inventory can be collected from various sources such as government agencies, universities, research centers, international organizations, and statistics institutions. As the exposure database identifies what assets need to be protected, the unit within the Ministry
The accuracy and granularity of exposure data directly affects the resolution of probabilistic catastrophe risk models. To better understand the collected information, governments may choose to standardize and house the information on an open-source web-based platform and make it accessible to all stakeholders.

While fiscal risk assessments can be complex, requiring extensive data analysis and modeling, there are a range of tools available to countries to assess, model, and visualize their risk. Beside catastrophe risk models offered by commercial firms, international initiatives have increasingly promoted open-source catastrophe risk models. For instance, the Comprehensive Approach to Probabilistic Risk Assessment (CAPRA) is a Geographic Information System-based platform that can combine multi-hazard information with exposure and vulnerability data. It allows the user to quantify and geographically visualize their financial exposure. Provided by the World Bank, CAPRA is available to governments, the private sector, academia, technical experts, and citizens to engage all stakeholders.

These technological innovations help policy makers quantify expected damages from specific hazards, integrate cost-benefit analyses for mitigation measures, and calculate potential losses for a modeled territory. Public-private partnerships such as the Global Earthquake Model and the Global Flood Model, as well as national models developed by local universities for the governments, also offer opportunities to access common methodologies for multi-hazard models.

International Experience

Governments are increasingly aware of contingent liabilities and their potential adverse impacts on their fiscal balance. For this reason, the Government of Colombia (GoC) conducted a comprehensive review of its contingent liabilities for the first time in 2010. Using state-of-the-art catastrophe risk modeling techniques, an earthquake catastrophe risk model was developed for Colombia, which allows the decision maker to assess the cost of reconstruction for public and private assets (including low-income housing).

In Mexico, the government’s fiscal and budgetary decisions including the annual budget allocation for FONDEN, Mexico’s Natural Disaster Fund, are based on R-FONDEN, a probabilistic catastrophe risk model tool. It was developed by the National University of Mexico for the Government of Mexico (GoM).

R-FONDEN includes a geo-referenced inventory of main public assets, their structural characteristics, and replacement values. The R-FONDEN model estimates potential material and human losses for four major perils (earthquake, flood, tropical cyclone, storm surge); infrastructure in key sectors (education, health, roads and bridges, hydraulic infrastructure, low-income housing); for any geographic area; at both the national and subnational levels.

The technical analysis of R-FONDEN’s innovative system has also informed the design and placement of the GoM’s risk transfer instruments, including the US$315 million cat bond MultiCat Mexico 2012 as well as an indemnity-based excess-of-loss insurance program of US$425 million. Beyond risk financing, R-FONDEN has been integrated as a layer within the National Risk Atlas of the GoM. Its technical analysis provides support for risk reduction measures such as early warning systems and the design of evacuation routes, location of shelters, gathering centers, and aid supplies.

Figure 1. R-FONDEN exposure data screenshot

Source: R-FONDEN (2012)

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