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COPING WITH LOSSES:
OPTIONS FOR DISASTER RISK FINANCING IN BRAZIL

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ABBREVIATIONS AND ACRONYMS

AAL	Average Annual Loss
AVADAN	Damage Assessment Form
CEDEC	Civil Defense State Coordinating Office
CEPED	University Study and Research Center on Disasters
CNSP	National Council of Private Insurance
COMDEC	Coordination Office of the Municipal Civil Defense
CONAB	National Supply Company
CONDEC	National Council on Civil Defense
CORDEC	Civil Defense Regional Coordinating Office
CEMADEN	Center for Monitoring and Early Warning of Natural Disasters
DAC	Damage Assessment Committee
DaLA	Damage and Loss Assessment
DPL	Development Policy Loan
DRM	Disaster Risk Management
DRFI	Disaster Risk Financing and Insurance
DRR	Disaster Risk Reduction
ECLAC	Economic Commission for Latin America and the Caribbean
FESR	Crop Insurance Stabilization Fund
FONDEN	Mexico's Natural Disaster Fund
FUNCAP	Special Fund for Public Calamities
GDP	Gross Domestic Product
GIS	Geographic Information System
GoB	Federal Government of Brazil
LEC	Loss Exceedance Curve
LOA	Annual Budgetary Law
MAPA	Ministry of Agriculture, Livestock and Food Supply
MI	Ministry of National Integration
MPCI	Multi-peril Crop Insurance
MPOG	Ministry of Planning
NOPRED	Preliminary Disaster Notification Form
PML	Probable Maximum Loss
PPA	Multi-Year Plan
PRED	Disaster Response Program
PROAGRO	Rural Activity Guarantee Program
PRONAMP	National Rural Support Program for Small Producers
PRRC	Program of Preparedness for Emergencies and Disasters (PPED)
PRVD	Disaster Prevention Program
PSR	Government Premium Subsidies Program for Agricultural Insurance
RAP	Carry-Over (Restos a Pagar)
SEDEC	National Secretariat of Civil Defense
S2ID	Disaster Information System
SINDEC	National Civil Defense System
SOF	Secretariat of the Federal Budget
SUSEP	Superintendence of Private Insurance

EXECUTIVE SUMMARY

This study presents options for disaster risk financing in Brazil, drawing from international experience. The study presents a series of complementary options for disaster risk financing, based on a preliminary fiscal risk analysis and a preliminary review of the current budget management of natural disasters in Brazil. It benefits from the international experience of the World Bank, which has provided assistance to several countries on the design and implementation of sovereign disaster risk financing strategies (e.g. Mexico, Colombia, Peru, Indonesia, Vietnam, Philippines, Pakistan and the Caribbean island states). This experience is tailored to the extensive risk profile and institutional, social and economic characteristics of Brazil, as well as to the availability of relevant data.

Brazil is exposed to several adverse natural events, the most recurrent being of a hydro-meteorological nature, namely drought, severe rainfall and landslides. The high population density in urban areas is the main determinant of vulnerability to natural hazards in the country, largely driven by the poor land use and planning that characterizes Brazilian cities. Since 2008, extreme weather events have caused several major disasters in Brazil, leading State and Federal Governments to prioritize the strengthening of Disaster Risk Management (DRM) practices in their agendas. While the number of recorded disasters has grown significantly, both the human and economic losses associated with these occurrences have also increased over the past five years.

However, since the country is exposed to recurrent small-scale events[1], whose negative financial impacts tend to be localized in specific cities or regions, the impacts of these events have been overlooked for decades. While the cumulative effects generate major economic and fiscal losses, little is known about the extent to which these disasters affect the economies and welfare of the people.

To address this lack of information, the World Bank team, in partnership with State Governments, carried out a series of case studies which estimated that disaster-related costs of four major events[2] alone totaled approximately R$ 15.3 billion – R$ 9.4 billion in damages (direct costs) and R$ 5.9 billion in losses (indirect costs[3]).

The case studies also suggested that fiscal impacts were significant and that the GoB (Federal Government of Brazil) plays a major role in supporting disaster response in the affected communities, since government liability associated to such events can be substantial at the local level.

Within this context, the purpose of this study is to initiate a debate on the fiscal impacts of natural disasters in Brazil and to propose the next steps towards developing a broader Disaster Risk Financing and Insurance (DRFI) strategy that strengthens the financial resilience of Federal and State Governments. The main components of the study are:

- **A preliminary financial risk assessment of natural disasters at the national level, including assessment of private and public costs;**
- **A review of the current budgetary process used for financing responses to natural disasters in Brazil, both at the Federal and State levels, which includes the development of series of fiscal data on disaster public budgetary resources and expenditures during the past 10 years;**
- **A retrospective funding gap analysis that takes into account budgetary resources before and after reallocations, under different cost scenarios;**
- **A disaster insurance market overview focusing on the role of private agricultural insurance as a risk transfers mechanism and on the use of temporary cash transfers by the GoB to deal with disaster effects among vulnerable populations in both urban and rural areas;**
- **A discussion on the next steps that government bodies such as the Ministries of Planning, Finance and National Integration could take to develop a broader DRFI strategy in Brazil.**

1 Following the GAR2013 report, an extensive risk profile is characterized by small-scale, localized, but frequent events. These events can also be spread over a large area, affecting local communities but not disrupting the country as a whole. In contrast, countries with intensive profile risk are those that might experience a severe catastrophe of national relevance, but less frequently.
2 The 2011 floods and landslides in Rio de Janeiro, the 2010 floods in Pernambuco and Alagoas and the 2008 floods in Santa Catarina.
3 Total costs in this case were estimated using information available at the time of the study and, for this reason, the final results may represent a slight underestimation of the real-life economic impact.

FISCAL RISK ASSESSMENT

The use of fiscal risk assessment tools can support policy makers to design a disaster risk financing and insurance strategy better suited to the country's hazard profile. By using partial historical data on disaster losses, it was possible to carry out a preliminary fiscal risk assessment of Brazil. The total Average Annual Losses (AAL) is US$3.9 billion (R$8.9 billion) and, assuming that the government´s liability amounts to 30% to 40%[4] of total costs, **the public AAL is between US$1.2 billion (R$2.7 billion) and US$1.7 billion (R$3.9 billion).**

An event with a 10 year return period could be enough to generate public losses as high as US$3.7 billion (R$8.7 billion) and an event with a 15 year return period could result in total losses as high as US$ 12.8 billion (R$29.4 billion), with public costs amounting to as much as US$5.1 billion (R$11.7 billion).

BUDGETARY PROCESS REVIEW

The current financial management of natural disasters in Brazil is not guided by an integrated national disaster risk financing and insurance strategy. **The GoB primarily relies instead on ex-post disaster risk financing mechanisms.** Budgetary reallocation after the occurrence of natural disasters has been the most common budgetary practice, since annual budgeting is usually insufficient to meet disaster response requirements.

Multi-year reserves are not used at the national level, and some states have already established their own disaster funds. In parallel to the ongoing discussions in the National Congress regarding the regulation of the established (but not operational) National Calamity Fund (FUNCAP), the development of a national disaster risk financing and insurance strategy might help optimize the GoB's financial management of disasters.

FUNDING GAP ANALYSIS

Recovery and reconstruction gaps exacerbate the negative impacts of disasters on socioeconomic outcomes and for this reason we estimate post-disaster needs funding gaps in Brazil from 2006 to 2010. **In this period, the financing gaps in a given year was an av-**

4 According to the case studies discussed below, public costs correspond to about 50% of total costs. However, given the omission of some elements of the private sector due to the lack of available data, a 30-40% share of public costs is assumed in the fiscal risk assessment.

erage of R$1.4 billion, or 30% of the estimated average disaster-related government liability.

These numbers are based on a series of assumptions, but they corroborate anecdotal evidence from the field, suggesting that improving both disaster risk financing arrangements and damage and loss assessment systems are needed for resilient and timely reconstruction.

DISASTER INSURANCE MARKET OVERVIEW

One of the main features of the Brazilian disaster insurance markets is the high level of public sector support for risk management in the agricultural sectors. In 2003, the GoB established a program of subsidies for private agricultural insurance and penetration rates have since then increased significantly. In addition, in the occurrence of a disaster, temporary cash transfers are made to farmers not covered by private insurance, with a focus on smaller producing units.

However, despite being relatively well established, the financial management of these initiatives has been challenging and available relevant information about Brazil's hazard profile is not being used to promote adequate budgetary planning and pricing. Incorporated in a broader DRFI strategy, such programs could be more cost-effective.

DISCUSSING A NATIONAL DRFI STRATEGY

The main goal of a DRFI strategy is to increase financial response capacity while reducing the fiscal burden generated by the government´s liabilities associated to natural disasters. The World Bank has developed a DRFI framework that takes account of different layers of risk that a country might be exposed to, and considers the most appropriate financial instruments for financing responses to disasters.

Given Brazil's hazard profile, the low risk layer (i.e. those associated to small-scale, but more frequent events) could be prioritized, and for this a risk retention strategy based on reserve funds, budgetary allocations and contingent funds is most appropriate. However, it is important to work up the details of such a risk retention strategy in order to avoid financing gaps and ensure the cost effective and timely use of disaster response funds, while promoting the right incentives for prevention and adequate conditions for resilient reconstruction. In order to improve the current disaster risk financing approach, government bodies such as the Ministries of Planning, Finance and National Integration may consider the following:

- **The Ministry of Planning may be central in the operationalization of FUNCAP** by completing the standard operating procedures and by formalizing the funding flow arrangements between FUNCAP and local institutions, such as the calamity funds at state level.

- **The Ministry of Finance may coordinate an assessment of the GoB subsidy programs for natural hazard insurance, particularly for agriculture (PSR)**. Updating these schemes after defining the optimal relationship between insurers, banks, beneficiaries and the Government may translate into expanded coverage at reduced costs.

- **Regarding temporary cash transfers, both in the agriculture and housing sectors, better understanding the contingent liability (AAL and PML)** for GoB cash transfer systems to support vulnerable populations such as the PROAGRO, Garantia Safra, Bolsa-Estiagem, and the cash transfers for temporary housing programs, may serve as the basis for increasing cost-effectiveness. The possibility of consolidating these payments into a stand-alone risk pool managed through risk retention or risk transfer schemes may also be considered.

- **Planning and finance institutions may consider carrying out an improved fiscal risk assessment**, potentially focused at the State level and in this way use the risk metrics produced to inform how transfers to local governments should be managed. **Developing catastrophic risk models** may also be the key to complementing the fiscal risk analysis based exclusively on historical losses.

- **The Ministry of National Integration adopting an objective damage and loss assessment methodology** may provide the basis for (i) a clear guideline for allocating disaster response funds and (ii) the data collection efforts needed to keep track of the historical material losses - inputs that are required for the appropriate design and updating of an evolving national DRFI strategy.

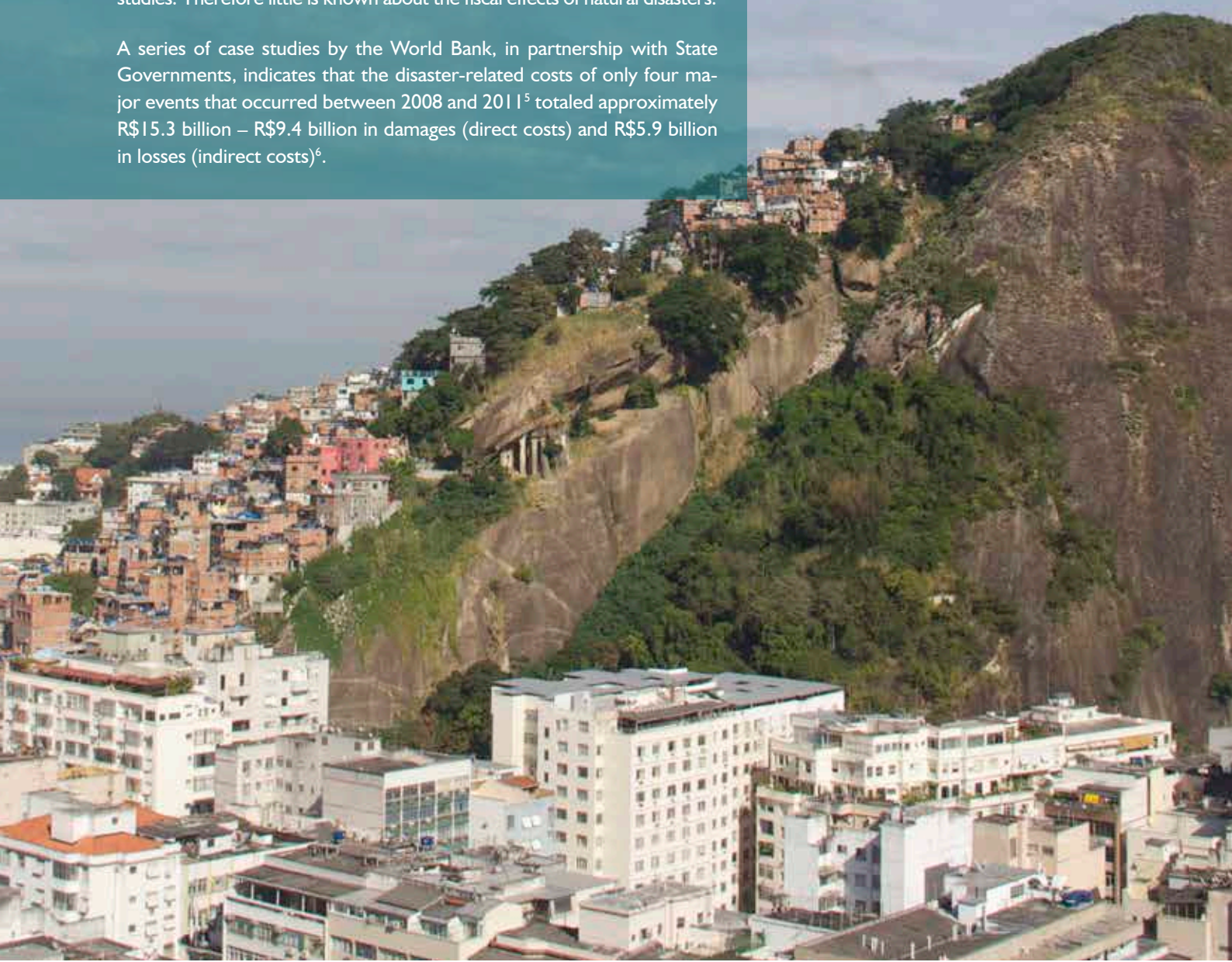
CHAPTER 1. INTRODUCTION

Brazil is exposed to several adverse natural events, the most recurrent being of a hydro-meteorological nature, namely drought, severe rainfall, and landslides. The high population density in urban areas is the main determinant of vulnerability to natural hazards in the country, largely driven by the poor land use and planning that characterizes Brazilian cities.

Since 2008, extreme weather events have caused several major disruptions in Brazil, leading to both State and Federal Governments to prioritize the strengthening of Disaster Risk Management (DRM) practices in their agendas. While the number of recorded disasters has grown significantly, the associated human and economic losses have also increased over the past five years.

Despite Brazil´s exposure and vulnerability to adverse natural events and recurring disasters, the impacts have not been subject of systematic, in depth, studies. Therefore little is known about the fiscal effects of natural disasters.

A series of case studies by the World Bank, in partnership with State Governments, indicates that the disaster-related costs of only four major events that occurred between 2008 and 2011[5] totaled approximately R$15.3 billion – R$9.4 billion in damages (direct costs) and R$5.9 billion in losses (indirect costs)[6].



The total cost of the 2011 Rio de Janeiro landslides (R$4.78 billion), for example, was equivalent to 36.20% of the regional GDP (Gross Domestic Product). The 2008 floods in Santa Catarina occurred in an area with a high concentration of assets. In Pernambuco and Alagoas, the floods mainly affected vulnerable and low-income populations, further complicating the recovery process. In the specific case of Alagoas, the impacts were estimated at 8% of that state's GDP, illustrating the disruptive impact of disasters on state and local economies.

The analysis also suggests that fiscal impacts were considerable. Public damages and losses due to flooding in Santa Catarina were estimated at approximately R$2 billion, roughly 20% of the state's tax revenue in 2009. Similar figures were also recorded in the states of Alagoas and Pernambuco, where public damages and losses corresponded to 14% and 16% of each state's net revenues in 2010 respectively. Finally, the state of Rio de Janeiro had to contend with public damages and losses of R$3.1 billion, equivalent to 8% of current revenues and 10% of the state's tax revenue in 2011.

However, data on fiscal impacts are still very limited and often recorded by government institutions that do not always interact with each other. As a result, neither Federal nor State governments have a comprehensive understanding of how disasters affect government budgets and jeopardize fiscal balances.

The GoB instead relies primarily on ex-post disaster risk financing mechanisms. Budgetary reallocations after natural disasters occur have been the most common budgetary practice given that annual budgeting is usually insufficient to meet disaster response needs. Multi-year reserves are not used at the national level, and some states have established their own disaster funds. Budgetary execution procedures are still cumbersome, especially in the case of local governments. As a result, the GoB has recurrent financing gaps for recovery and reconstruction.

The current financial instruments could be further optimized to better meet financing needs in the aftermath of natural disasters. Developing a national disaster risk financing and insurance strategy would strengthen the GoB's fiscal resilience as well as that of local governments, closing funding gaps that amplify the effects of natural disasters on economic activity and welfare, while simultaneously promoting prevention and resilient reconstruction.

OBJECTIVES OF THE STUDY

In the light of the above, the purpose of this study is to stimulate dialogue on the fiscal impacts of natural disasters in Brazil and to propose some options for the development of a broader disaster risk financing and insurance strategy to strengthen the financial resilience of governments at the Federal and local levels. The main components of the study are:

- A preliminary financial risk assessment of natural disasters at the national level, including both private and public costs;
- A review of the current budgetary process for financing response to natural disasters in Brazil, at both Federal and State levels. This includes the development of series of fiscal data on disaster public budgetary resources and expenditures over the last 10 years;
- A retrospective funding gap analysis that takes into account budgetary resources before and after reallocations, under different cost scenarios;
- A disaster insurance market overview, focusing on the role of private agricultural insurance as a risk transfers mechanism and on the use of temporary cash transfers by the GoB to handle disaster effects on vulnerable populations, in both urban and rural areas;
- A discussion on the next steps that government bodies such as the Ministries of Planning, Finance and National Integration could take to develop a broader DRFI strategy in Brazil.

This report consists of five chapters including this Introduction. Chapter 2 provides a brief presentation of Brazil's hazard profile and a preliminary fiscal risk assessment. Chapter 3 presents an overview of existing post-disaster funding mechanisms at the Federal and State levels and suggests a recovery and reconstruction financing gap analysis. A private disaster insurance markets review is presented in Chapter 4. Finally, Chapter 5 reviews the main issues that Brazil should tackle to enhance its disaster risk financing and insurance strategy and suggests the next steps to be taken to stimulate this debate.

5 The 2011 floods and landslides in Rio de Janeiro, the 2010 floods in Pernambuco and Alagoas and the 2008 floods in Santa Catarina.
6 Total costs in this case were estimated using information available at the time of the study and, for this reason, the final results may represent a slight underestimation of the real-life economic impact.

CHAPTER 2. FINANCIAL DISASTER RISK ASSESSMENT IN BRAZIL

Recently released data show that Brazil is exposed to recurrent and small-scale disasters, localized in cities or regions, deemed with extensive risks. Such a "hidden risks" risk profile is one of the main reasons for the impacts of these frequent events to have been overlooked for decades. Little has been known to date about the extent to which disasters affect the economy and welfare. The World Bank assessed four recent extreme adverse natural events in Brazil and estimates US$6.6 billion (R$15.3 billion) in damage and losses, most of it concentrated on the housing sector and on the poorest and most vulnerable populations. The use of fiscal risk assessment tools can support policy makers and planners to design financial plans better suited to a country's hazard profile. Using partial historical data on disaster losses it was possible to carry out a preliminary fiscal risk assessment of Brazil which suggests that the country may expect annual losses in excess of US$3.9 billion. The total Average Annual Loss (AAL) is US$3.9 billion (R$8.9 billion) and, under the assumption that the government liability corresponds to 30% to 40% of total costs, the public AAL is between US$1.2 billion (R$2.8 billion) and US$1.7 billion (R$3.9 billion). An event with a 5 year period of return could be enough to generate public losses as high as US$ 1.9 billion (R$4.5 billion).

2.1 EXPOSURE TO NATURAL HAZARDS IN BRAZIL

High magnitude earthquakes, tsunamis and hurricanes are not part of Brazilian history. Floods, landslides and droughts are routine. Despite the known fact that small-scale and highly frequent disasters can have a negative impact on many Brazilian cities, it was only in 2011, when the Federal Government launched the Brazilian Natural Disaster Atlas (MI, 2012), that the country's hazard profile could be subjected to an in-depth analysis.

Based on this publication, figure 2.1 points to an upward trend in the number of officially recorded disasters. This could be a result of a higher frequency of adverse natural events and/or of an improvement in recording systems.

From the total official number of recorded disasters, more than half are due to droughts, a type of disaster that affects mainly the Northeastern and the Southern regions of the country. This hazard is associated to only 10% of the people killed, but responds to 50% of the affected population. Damage and losses caused by droughts are particularly hard to assess, but several studies have found evidence of major impacts on agricultural and related sectors, as well as on health and education outcomes. The latter are important channels through which natural adverse events jeopardize the long-term development of affected communities.

Flash floods are also frequent in Brazil, especially in the Southern, Southeastern and Northeastern regions. The fatalities associated with floods correspond to 43% of the total number of people killed by disasters, but the number of people made homeless by floods is also alarming. Since 1991, more than 1.3 million people have had to leave their homes in the aftermath of disasters in Brazil.

Also associated with heavy rain, the number of officially recorded landslides has increased more than 20 times since the 1990s. This kind of event is usually associated with costly damage to private properties and public infrastructure, which can be worse if a disaster hit areas with a high concentration of high value assets.

In short, droughts, floods, and landslides are the most frequent adverse natural events in Brazil and, while the occurrence of catastrophic events is not of significant importance to the country's hazard profile (unless there is a string of such events in short period of time), the exposure to major risks jeopardizes local development and imposes a heavy burden on the poorest and more vulnerable populations, even though this burden might seem immaterial in the countrys overall economy.

Figure 2.1 Total Number of Recorded Disasters in Brazil by Year

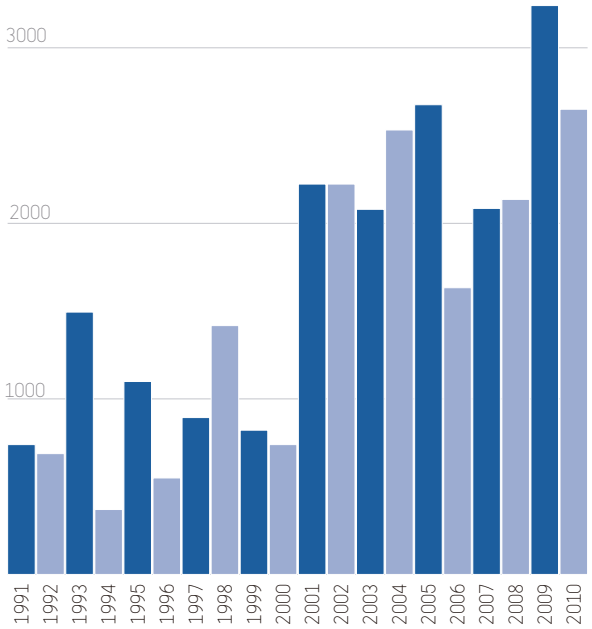
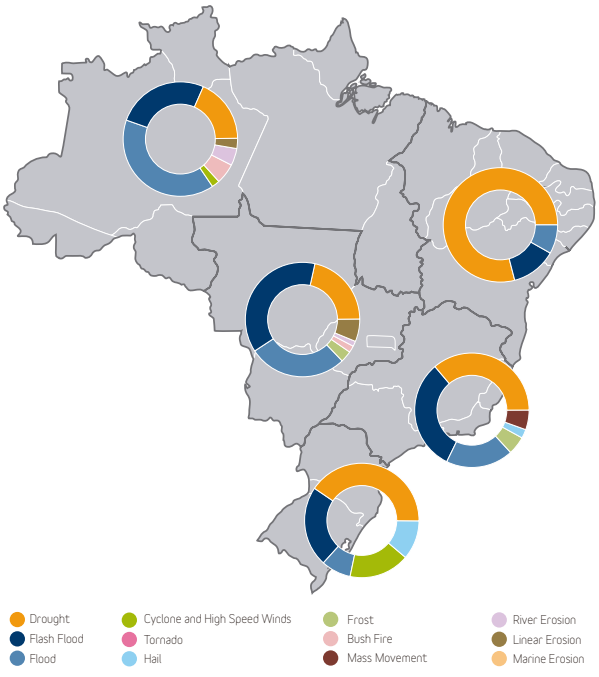


Figure 2.2 Spatial Distribution of Natural Disasters in Brazil by Region

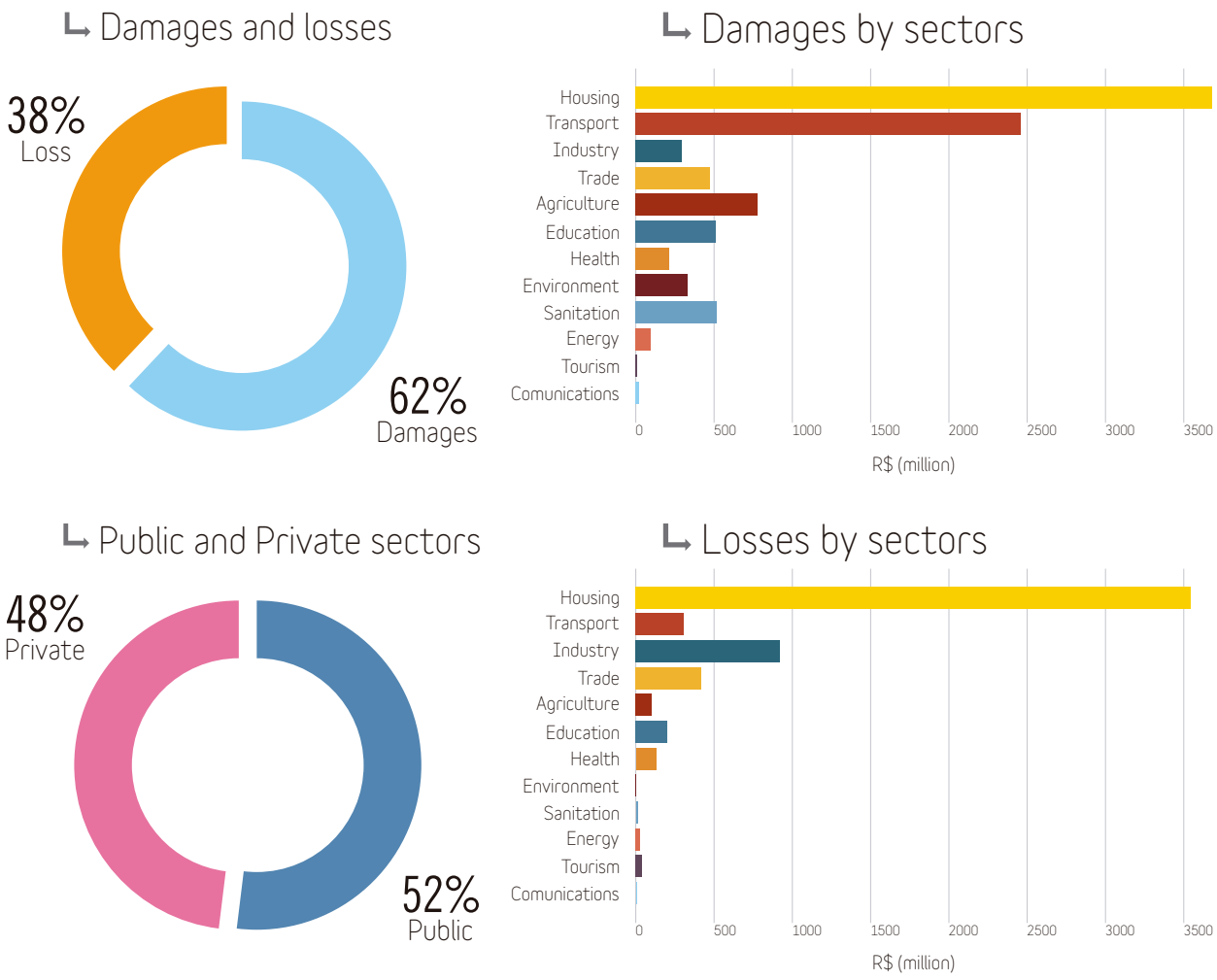


Source: Atlas Brasileiro de Desastres Naturais, CEPED - UFSC, 2012

2.2 LOOKING FOR THE UNACCOUNTED RISKS: DAMAGE AND LOSSES FROM FOUR RECENT MAJOR DISASTERS

A common problem to countries with such an extensive risk profile[7] is that it can lead governments to ignore Disaster Risk Management (DRM) practices in their national agendas. As a result, assessment systems and data management are not incorporated in disaster response policies. This lack of basic infrastructure for developing private risk markets and appropriate planning tools to support sovereign risk financing strategies severely undermines the financial resilience of public and private agents, causing reconstruction delays and increasing the negative effects of disasters on economic development.

Figure 2.3. Damage and Loss Assessment of Four Major Recent Events



Source: World Bank Estimates

7 Following the GAR2013 report, an extensive risk profile refers to that that is characterized by less severe, but frequent events. These events can also be spread over a large area, affecting local communities but not disrupting the country as a whole. In contrast, countries with an intensive profile risk are those that might experience severe, but less frequent catastrophes of national relevance.

In Brazil, although the primary data sources on which the Brazilian Natural Disasters Atlas was compiled include information on material damage and losses[8], the damage assessment systems used before 2011 put substantial difficulties for disaster data management. A comprehensive historical damage and losses dataset associated to major risks is not therefore currently available. The absence of a workable dataset constitutes a challenge for all kinds of decision makers: public policy makers, entrepreneurs, families, etc.

Within this context, the World Bank, in partnership with the Ministry of National Integration (MI), ECLAC (Economic Commission for Latin America and the Caribbean), and the Brazilian State Finance and Planning Secretariats, assessed damages and losses from four major disasters that beset Brazil since 2008. The case studies aim to assess damage and losses from a sector perspective, in accordance with ECLAC's Damage and Loss Assessment (DaLA) methodology, identifying the main channels of impact and outlining an agenda on which an effective and efficient disaster risk management (DRM) strategy can be built.

In January 2011, the state of Rio de Janeiro experienced heavy rainfall, eventually culminating in a series of flash floods and landslides. Resulting in around 1000 causalities in 7 municipalities, the event was quickly deemed the worst disaster in Brazilian history. A few months earlier, in June 2010, the states of Alagoas and Pernambuco suffered severe flash flooding during the worst rainy season of the past 20 years. In late 2008, floods and landslides killed 110 people in the state of Santa Catarina, and damaged the Port of Itajaí and the nearby Bolivia-Brazil gas pipeline.

The abovementioned events are not an exhaustive list of the disasters of the past four years. Nonetheless, they are representative of the economic and human losses caused by natural hazards in Brazil. They were also chosen for complete Damage and Loss Assessment (DaLA) studies[8] given the relative availability of information related to these events. According to the DaLA studies conducted in all four of the affected states, disaster-related costs totaled approximately R$15.3 billion – R$9.4 billion in damages (direct costs) and R$ 5.9 billion in losses (indirect costs)[9].

Interestingly, total costs were evenly distributed between the public and private sectors (Figure 2.3). Property of damage and losses were assigned on a case-by-case basis, depending on the sector and state under assessment; private sector losses and damages were harder to estimate, due to the lack of data. Overall, however, the studies suggest that in Brazil the public sector tends to absorb a large share of private sector costs during disaster relief and the reconstruction process.

Beyond the government's explicit liabilities (such as infrastructure repair), post-disaster relief must also address liabilities beyond the concerns of the DaLA methodology. For example, the government has a moral responsibility in post-disaster scenarios to support home reconstruction for poor families. Studies also show that the public sector will frequently offer subsidized credit to local businesses, industry and agriculture as a means of restoring a degree of normality to traumatized communities. The task of effectively limiting the private indirect economic impacts of disaster, in other words, rests

Table 2.1. Disasters and economic losses: four major disasters in Brazil

Year	Event	Number of Victims	Total Cost (R$ bi)	Total Losses (% State GDP)
2008	Floods and Landslides in Santa Catarina	110	5.32	2.67%
2010	Floods in Pernambuco	20	3.37	4.30%
2010	Floods in Alagoas	36	1.85	8.72%
2011	Floods and Landslides in Rio de Janeiro (Região Serrana)	1,000 (approx.*)	4.78	1.35%

* Given that there remain missing persons in the Região Serrana, these individuals cannot be counted as victims.

8 In the Insurance sector, damages are often called "physical damage", i.e. the value of lost physical assets, while "losses" most closely corresponds to financial losses due to the natural event, such as the interruption of businesses and the need to secure emergency funds. Following ECLAC's Damage and Loss Assessment methodology, the interpretation is the same. The term "damage" refers to direct costs such as the loss of assets that have been partially or totally destroyed. The term "loss" refers to indirect losses caused by disasters. Examples of indirect losses are the income lost due to equipment that that has been destroyed and requires replacing, reduced agricultural output resulting from flooded land, and so on.
9 Total costs in this case were estimated using information available at the time of the study and, for this reason, the final results may represent a slight underestimation of real-life economic impact.

largely with government.

According to the studies below, the 2008 Santa Catarina floods and landslides generated the highest estimated costs (R$ 5.32 billion[10]), while the assessment conducted for the Rio de Janeiro event in 2011 potentially underestimated its total impact by omitting a handful of relevant sectors due to a shortage of data. The authors of this report suspect that if this information had been included, Rio de Janeiro may have been – in terms of human and economic losses –the most costly and damaging disaster.

On one hand, the area affected in Rio de Janeiro was geographically smaller than those of the other events and the costs of re-building the region's physical infrastructure was significantly higher. Nevertheless, the total cost of the disaster (R$ 4.78 billion) exerted only a small impact on the overall state GDP – although its impact on the Região Serrana was severe, equivalent to 36.20% of the regional GDP (when one considers that the Rio disaster affected 7 of the Serrana's 11 municipalities, however, this is perhaps unsurprising).

On the other hand, the floods in Santa Catarina occurred in an area with a high concentration of valuable assets (ex. the Port of Itajaí and a variety of federal and state highways). In Pernambuco and Alagoas, the total costs from flash floods were lower than those estimated in Santa Catarina, but the impacts mainly affected vulnerable and low-income populations, further complicating the recovery process. In the case of Alagoas specifically, the impacts were estimated at 8.7% of the state's GDP, illustrating the disruptive impact of disasters such as this on state and local economies. Table 2.2 presents a comparison of the four events in which total losses vis-à-vis state GDP serve to illustrate the economic impact of each disaster.

Table 2.2 shows that the government liability generated by these events is too high compared to the budgetary allocations to the Civil Defense related programs at those states. This supports the claim that local governments lack the capacity to respond on their own and that intervention by the Federal Government was of paramount importance.

Table 2.2. Recent damage and loss assessment for selected Brazilian states

Year	Event	Government Liability (R$ bi)	State Civil Defense Initial Budgetary Allocation* (R$ bi)
2008	Floods and Landslides in Santa Catarina	2.3	0.03
2010	Floods in Pernambuco	2	0.23
2010	Floods in Alagoas	0.605	0.05
2011	Floods and Landslides in Rio de Janeiro (Região Serrana)	3.2	0.76

*Santa Catarina: 2008 and 2009; Alagoas and Pernambuco: 2010 and 2011; Rio de Janeiro: 2011 e 2012.

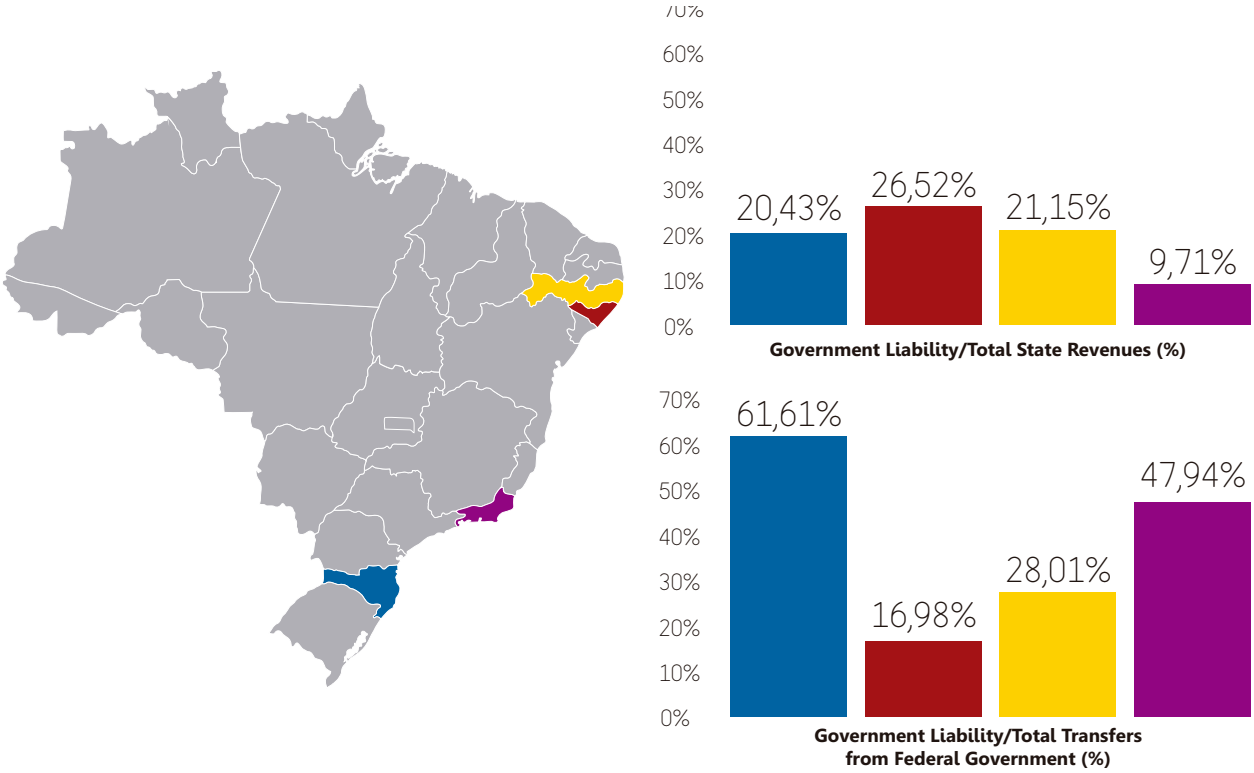
While one could argue that in the aftermath of a disaster the state governments could reallocate budgetary resources and are not limited to the resources provisioned in their annual budgets, figure 2.4 shows that the government liability corresponding to each of these events was equivalent to a relevant share of the states' financial revenues and that the realignment of resources towards disaster response would imply major disruptions in their regular systems.

As for the impacts by sector, housing – during all four events – was by far the most affected. Beyond those dwellings that were partially or totally destroyed (roughly 50,000 low-income homes were ruined), high losses stemmed from the very high costs of retrofitting or replacing existing infrastructure to reduce community vulnerability. For example, in the northeast, dams are often engineers' main recourse for reducing flooding, while recovery efforts in Rio de Janeiro concentrate on soil nailing and hill stabilization to prevent future landslides. Regardless of the approach, both are costly and require specific and highly technical engineering-based interventions.

After housing, the transport sector was the second most affected by direct impacts, provoking lasting physi-

10 Value adjusted for 2011 prices.

Figure 2.4. Damage and losses versus state fiscal revenues*



*Fiscal data refer to the relevant year given the date of the ocurrance of the disaster in each state.
Source: World Bank estimates based on official figures and National Treasury Secretariat.

cal damage to high value network assets and indirect costs that caused significant travel delays, impacting local economic activities in the region. Note in Figure 2.3 that the estimated proportion of damages and losses for the transport sector is highly unbalanced. (Also note that this data may be partially incomplete: exact figures on indirect impacts on the transport sector are difficult to obtain and rarely identified in research).

In short, well over a third of total estimated costs stem from the housing and transport sectors. Such findings underscore the urgent need to target both sectors through use of a practiced, holistic DRM approach for reducing community vulnerabilities and potential losses in case of disaster.

2.3 DAMAGE ASSESSMENT SYSTEMS AND DATA QUALITY ISSUES

In Brazil, conducting damage and losses assessments is part of the broader list of procedures that affected cities have to follow in order to receive funding from the GoB after a disaster. Each municipality must submit a damage and loss assessment (based on official forms) within 5 days after the occurrence of the event. Before 2012, hard copies of such forms had to be submitted by the affected municipalities to the State and Federal Governments. These files were recently digitalized and since 2012 the system was upgraded to an online platform, the Integrated System on Disaster Information (S2ID), and the AVADANS (Damage Assessment Forms) was replaced by a simpler version (details of the past and current damage and losses assessment systems are presented in annex 5).

These forms are the primary source of information of most historical datasets on the occurrence and costs of disasters in Brazil, but their role in the process of releasing emergency funds has implications on the quality of the data available. Firstly, the fact that the damage and loss assessments must be carried out within five days, and during the emergency phase, makes it very hard for local authorities to produce accurate estimates, since carrying out such assessments while most of financial and human resources are devoted to the immediate

response and when access to many affected locations might be restricted, imposes major constraints on the quality of the analysis.

As a result, consolidating the historical data on material and human losses has been a difficult task, since inaccuracies and inconsistencies have been frequently found in the data. To date, only the information on the human toll has been consolidated and detailed official data on material losses are not available.

To address the abovementioned difficulties faced by the affected cities, a simplified version of the damage and loss assessment form was adopted in 2012. This means that from 2012 onwards the primary sources will not be as complete as in the original AVADAN format. Moreover, each municipality uses its own valuation criteria for affected assets, and this remains an issue under the new format. Another concern is the fact that these forms are mandatory only for the cities requesting financial support from the GoB. This means that the national datasets on disasters miss data from the richer states that usually do not request federal financial support.

At the same time, using data from the insurance sector, typically an important resource for disaster planning, is not an option. Insurance penetration among low-income populations is limited and as a result the quality of information available from the insurers concerning the economic impacts of disasters is still limited.

Simplifying the procedures and requirements to be met by the affected communities is a very positive step. However, detailed information about the damage and losses in both public and private sectors are still needed for appropriate reconstruction planning and for developing an adequate DRFI strategy. Further adjustments on the damage assessment framework are therefore still needed to reconcile the different features of the different post-disaster phases[11], and the data requirements for the development of improved DRFI instruments.

As a next step, consolidating the existing data on material damage and making it available to the general public, as was done with the human losses data, would allow for improved fiscal and economic risk assessments. The Ministry of National Integration has already made great progress collecting the existing data, and the final consolidation of historical material losses data would be useful to many public and private stakeholders. This exercise would also inform about the further adjustments needed in the current damage and loss assessments protocols, thus enhancing data quality in the future.

2.4 PRELIMINARY FISCAL RISK ASSESSMENT

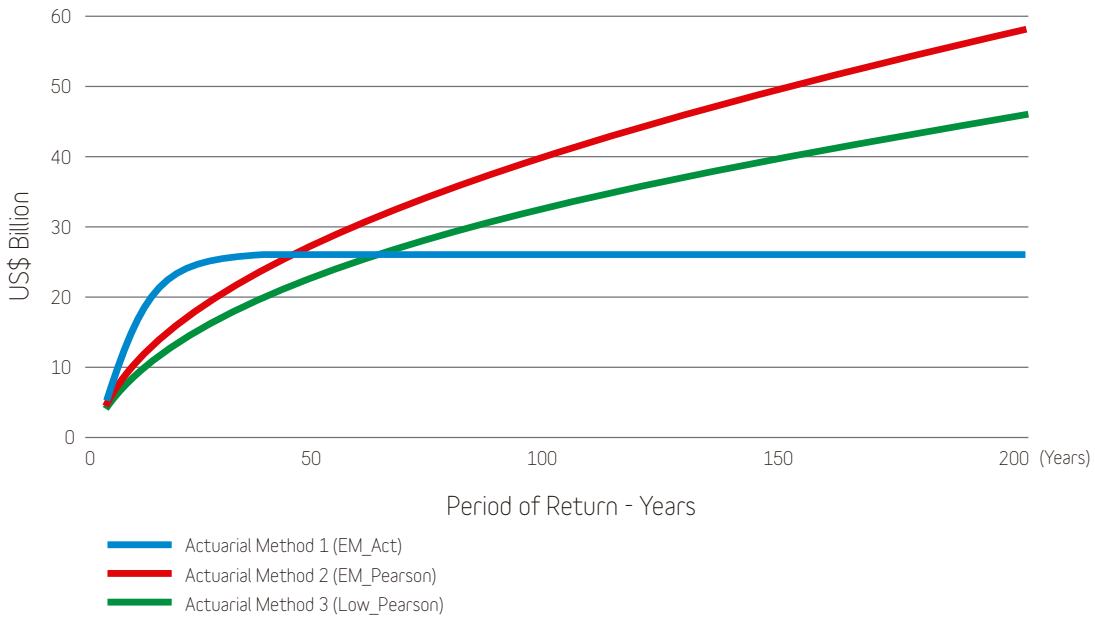
This section presents a preliminary assessment of the fiscal disaster risk profile of Brazil which is built on actuarial analyses of available historical disaster impact data and on findings from the four abovementioned case studies. The risk profile includes, at the aggregate level of public and private sectors, metrics about Loss Exceedance Curves and a corresponding Average Annual Loss (AAL).

These risk metrics have been widely used as inputs for the design of disaster risk financing strategies. For instance, based on a PML analysis, Colombia has found that natural hazards and corresponding disasters are the second most relevant source of contingent liabilities (after legal contingent liabilities) and has decided to shape the country´s disaster risk financing strategy accordingly. Similarly, based on a Loss Exceedance Curves (LEC) analysis, Honduras was able to assess its financial vulnerability to disaster risk, even as the result of frequent and recurrent events (GAR, 2013).

In order to assess the annual probability of occurrence (return period measure) of potential losses from events of a specific frequency and severity, an estimated LEC for Brazil[12] is presented in Figure 2.5 below. Full details of the analysis are presented in Annex 3. Based on the following results it is possible to assess what is the probability that, in a given year, disaster losses in Brazil amount to, for instance, US$5 billion. According to Table 2.3, the probability that disaster losses add up to US$4.8 billion or more in a given year is 20%. This means that Brazil is expected to suffer disaster losses amounting to at least US$4.8 billion every 5 years. Under the hypothesis that public costs account for 40% of the total losses[13], even a relatively likely event, with a 5 year period of return, has a public PML of at least US$1.9 billion (R$4.5 billion).

11 Emergency response, recovery and reconstruction.
12 Cummins and Mahul (2009) define the LEC as the amount that may be equaled or exceeded with a specific probability. The Loss Exceedance curves show that the historical maximum annual loss observed in the last 50 years is US$25.8 billion. With the AAL estimation, we can see that the value obtained using the fitted EM_DAT (EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université catholique de Louvain – Brussels – Belgium), for a period of return equal to 50 years is 7% higher, but for the mixed data (the uses both EM-DAT and extrapolation from States) it is lower by 11%. Again, a conservative estimation obtained with the EM-DAT database is preferred.
13 According to the case studies presented above, public costs correspond to about 50% of total costs. However, given the omission of many private sector due to the lack of available data, a 30-40% share of public costs is assumed in the fiscal risk assessment.

Figure 2.5. Loss Exceedance Curves



Similarly, the LEC estimates suggest a Probable Maximum Loss associated to a 10 year period of return (i.e. annual probability of 10%) event in Brazil is in excess of US$9.4 billion (R$21.6 billion). Assuming government liability corresponds to 40% of the total costs, then in a given year there is a 10% probability that disaster related public costs amount to at least US$3.7 billion (R$8.5 billion).

The AAL (Average Annual Loss) was estimated at US$3.9 billion (R$8.7 billion). If the government liability corresponds to 40% of the total costs, that means that in a given year the Average Expected Public Loss is US$ 1.7 billion (R$3.6 billion). These values are comparable with the most recent disaster related budgetary resources (final allocations, at the federal level) shown in Chapter 3. However, these estimations are based on incomplete data, suggesting that in reality the public AAL might be even higher and, therefore, that response funding gaps might be an issue to be addressed in Brazil.

Table 2.3. Probable Maximum Loss estimates (US$ Million)

Period of Return	**Probability of event in a given year**	**Total PML (US$ Million)**	**Public PML (US$ Million)**
5 years	20%	4,857	1,943
10 years	10%	9,397	3,759
25 years	4%	18,201	7,280
50 years	2%	27,720	11,088
100 years	1%	40,639	16,256
200 years	0.5%	58,087	23,235

CHAPTER 3. FISCAL MANAGEMENT OF NATURAL DISASTERS

Currently, Brazil heavily relies on ex-post sources of funding for disaster response. Issuing extraordinary credits after the occurrence of natural disasters has been the most common budgetary practice, since annual budgeting is usually insufficient to meet the disaster response needs. Multi-year reserves are not used at the federal level, while some states have already regulated their own disaster funds. Regulating the established (but not operational) national calamity fund (FUNCAP) is an ongoing discussion in the National Congress. Evidence indicates recurrent financing gaps for recovery and reconstruction, suggesting that there is room for improving the financial schemes being used. Advancing a national disaster risk financing and insurance strategy could strengthen the fiscal resilience of both Federal and subnational governments, closing funding gaps that amplify the effects of natural disasters on economic activity and welfare.

This chapter aims to discuss the adequacy and efficiency of the current fiscal management of the natural disasters framework. First, a description of disaster risk financing arrangements currently in use and under discussion in Brazil, with emphasis on the changes recently proposed for the FUNCAP (Special Fund for Public Calamity) is presented. A brief overview of the financial instruments used by local governments is also shown, as well as a preliminary retrospective public funding gap analysis in Brazil.

The discussion presented below has as reference the World Bank framework for disaster risk financing and insurance, according to which the various sources of financing in the aftermath of a disaster can be categorized as ex-post and ex-ante instruments. The ex-post instruments are those that do not require planning in advance, such as in-year budget reallocations, donor assistance and credit. On the other hand, ex-ante financing schemes require planning in advance and include contingent credit, multi-year reserves and risk transfers mechanisms (World Bank, 2011a).

3.1 FEDERAL GOVERNMENT'S EX-POST DISASTER RISK FINANCING PRACTICES AND ARRANGEMENTS

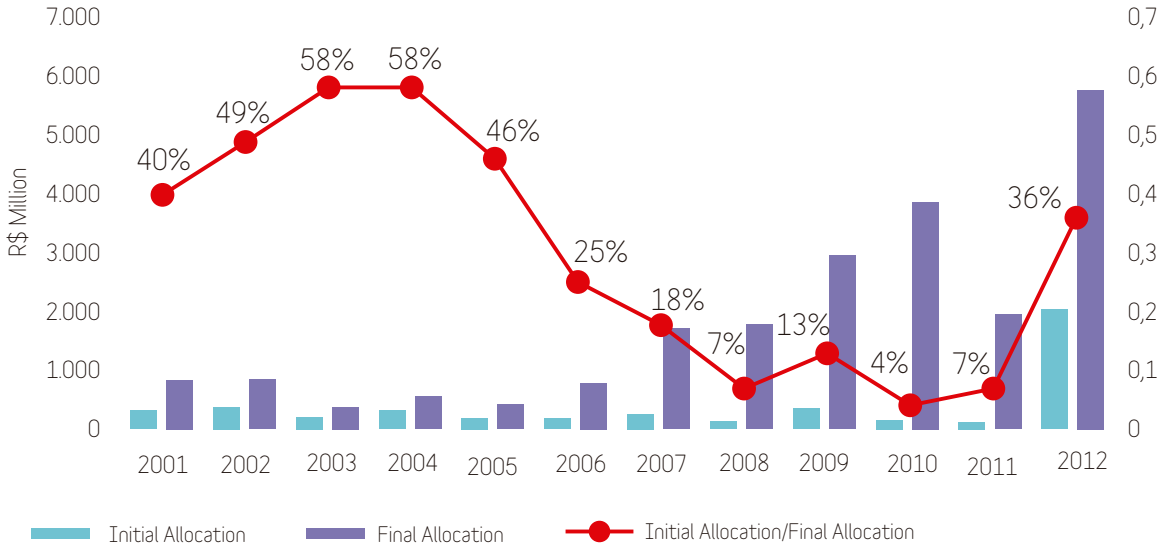
This section presents the main ex-post sources of funding currently used in Brazil and discusses the excessive reliance on urgent budgetary reallocations in the aftermath of a disaster.

IN-YEAR BUDGET REALLOCATION

Regarding the budgetary allocations, the first relevant aspect to be considered is the initial allocation defined by law. This allocation is an indication of how much money the government expects to earmark to disaster response.

However, in the specific case of disasters, it is important to consider not only the initial budget allocation, but also the in-year budget reallocations. This is especially the case of those of an exceptional nature, the so-called créditos extraordinários (extraordinary budget credit), that are used to adjust the Annual Budget Law (LOA) in unforeseen and urgent circumstances, such as those resulting from public calamity situations. In the case of DRM, these in-year budget reallocations make the majority of the budget due to the difficulty in precisely anticipating an 'emergency' event and the resources needed. Prior to 2012, disaster related initial allocations

Figure 3.1 Disaster related initial and final budgetary allocations



Source: author´s compilation using original data from SigaBrasil.

were so low that virtually all the major and many minor events had to be financed through in-year budget reallocation instruments such as extraordinary credits.

The 2012 initial allocation indicates a trend towards a strategy more focused on planned financing mechanisms, as shown in figure 3.1, however the need for additional resources was such that the initial budget accounted for only about 36% of the total budgetary resources for disasters.

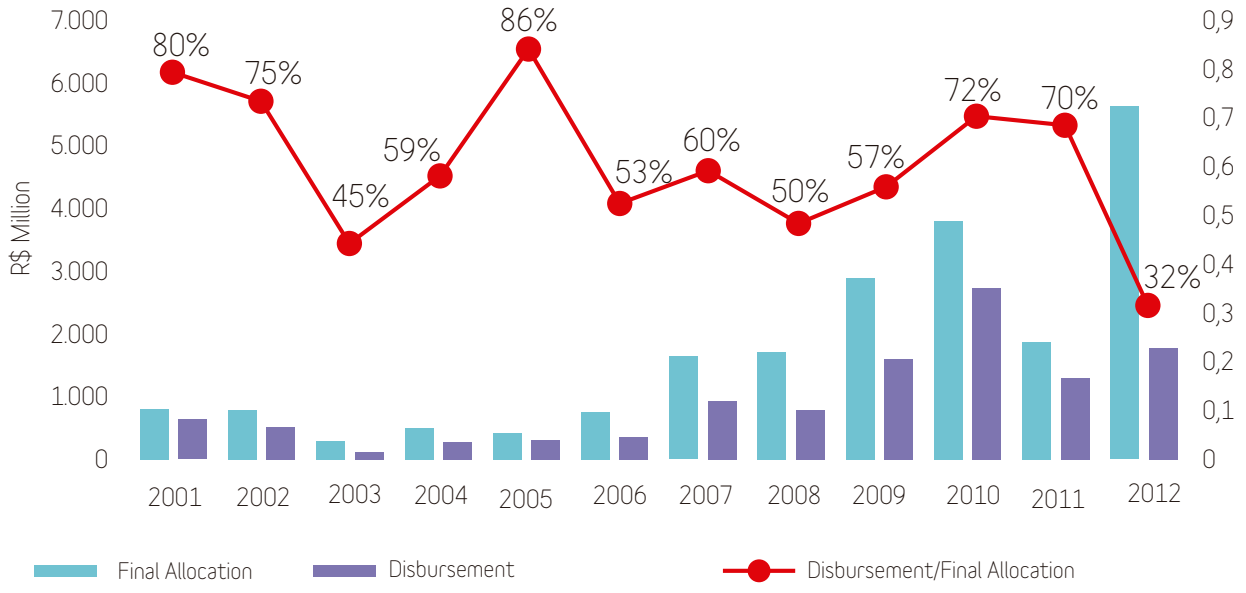
To issue extraordinary budget credits, the Ministry of National Integration (MI) submits a request to the Ministry of Planning (MPOG) for additional resources based on its damage, losses and needs estimates. The MI requests funding for emergency services and assistance, as well as reconstruction, but avoids including preventive measures in the extraordinary budget request, which is enacted through a Medida Provisória or Provisional Measure (PM), which is an executive order with immediate effect, but which has to be approved by Congress within 180 days. The MI also defines the beneficiaries of such resources and consolidates a proposal that is passed through the Ministry of Finance, Ministry of Planning and the Chief of Staff of the President of the Republic. The proposal, based on the estimates provided by the MI (based on technical criteria), set forth: the amount of extraordinary budget credits, the distribution between the beneficiaries and the amounts that can be used in between current and capital expenses.

Given the amounts requested by the MI, the Ministry of Planning determines the sources of the funds, which are usually composed of financial surplus revenues from previous years rather than new debt. In the absence of surpluses, the revocation of other allocations can be suggested. At present, the governing body that would have its allocations revoked must agree to the proposal, but the in-year realignment of investment budgets is rare and unlikely.

The PM is valid for three months, extendable for an additional three if not voted into Law. After six months, if it is not passed into Law, the PM is canceled. During its passage into Law, the terms of the PM can be modified. If the PM is canceled, the blocked resources remain as a financial surplus.

It is important to note that a key benefit of this whole process is that it takes place within a few days, ensuring that funds for immediate response and relief are available in a timely manner. However, the fact that relief, recovery and reconstruction resources are usually released through the same process implies that reconstruction activities cannot be planned accordingly. Thus, following a disaster, the Federal Government must respond to the immediate aftermath in a matter of days and at the same time prepare a reconstruction financial plan under far from ideal circumstances while a broad analysis of the real impacts from the disaster still has to be conducted.

Figure 3.2 Disaster related final budgetary allocations and disbursement



Source: author´s compilation using original data from SigaBrasil.

Moreover, as the budgetary execution is carried out by both national and local executive institutions (e.g. while the reconstruction of federal roads is managed by the Ministry of Transport, reconstruction of schools is normally executed by the state education secretariat), disbursement, monitoring and accountability issues have an additional dimension, which is to accommodate this multi-level feature.

As for disbursement, following the official recognition of a disaster, special arrangements are made to speed up funding flows. These procedures have already been simplified in recent years, but local governments in particular still find it cumbersome to satisfy all the legal and technical requirements for project approval. The execution rate has shown significant variation over the years, but with no clear trend from 2001 to 2012 (Figure 3.2). According to the data below, in 7 of the 12 years considered the execution rates were between 45% and 60% of the final allocations, which suggests that improving budget execution could lead to more effective responses to disasters. Moreover, given that most of these resources correspond to reallocations, it is necessary to investigate whether low budget execution is also determined by sub-optimal distribution of the resources among the affected sectors/regions.

Monitoring the use of disaster funds is also particularly challenging when execution happens at the state level and, in order to tackle this issue, the Ministry of National Integration has implemented the Civil Defense Payment card, which can be used only at pre-authorized suppliers and has already proven to induce more cost-effective spending. However, while successful in tracking spending during the emergency stage, the card cannot be used as a monitoring device for reconstruction.

In this context, the establishment of a facility especially designed to manage funding with such different characteristics could allow the Federal Government to better plan and execute disaster related policies, while optimizing collaboration with local institutions.

TAXATION

At the federal level specific taxation is not currently used to raise revenues for disaster prevention, preparedness and response/recovery/reconstruction. On the contrary, following a disaster the national and local governments usually adopt tax exemptions to support recovery, generating a reduction of the revenues along with the new expenses requirements. A variety of these exemptions

has been used over the years: from property tax exemptions to benefits awarded to the industrial, agricultural and commercial sectors, but an analysis on the impacts of such measures has not been done.

INTERNATIONAL ASSISTANCE

From a national perspective, international donor financial assistance is not particularly relevant in Brazil. Recovery and reconstruction costs are usually much higher than the international assistance inflows, but at the local level this source of funding is more substantive. For example, following the 2008 Santa Catarina floods and landslides donor assistance (not exclusively international) was sufficient to fund the temporary cash transfers program to eligible households. International donor assistance also supported the reconstruction of low-income housing in that state. However, this is not the main source of funding: local governments rely more on assistance from the Federal Government than on international donations.

OTHER EX-POST DISASTER FUNDING RESOURCES

Depending on the sectors most affected, a diverse range of funding resources can be used to support recovery and reconstruction. For example, extended loan repayments and subsidized loans have been used to support farmers. Small business recovery programs and special loans are also among the measures taken to support economic activity recovery in some affected municipalities. Even investments in marketing to support the tourism sector were made by the government following the 2008 event in Santa Catarina (the floods occurred just before the peak tourist season, raising concerns about

tourism sector performance in 2009).

3.2 FEDERAL GOVERNMENT'S EX-ANTE DISASTER RISK FINANCING PRACTICES AND ARRANGEMENTS

This section discusses the use of ex-ante sources of funding in Brazil. Fiscal data indicates that annual budgeting procedures could be improved to better accommodate disaster related public expenditure. The ongoing discussion about the regulation of a national disaster fund suggests that the need for a multi-year platform for sovereign disaster risk financing is recognized.

ANNUAL BUDGETING

In Brazil, whether or not there is a disaster-specific budget appropriation depends on the multi-year plan (PPA) established by the Ministry of Planning every four years. Since 2004, the approved guidelines have included programs specifically designed to track disaster prevention and response policies, while prior to that only general Civil Defense appropriations were included in the multi-year plans. Nevertheless, even though the recent years budgetary guidelines are more precise in allocating resources for disaster prevention and response, relevant disaster related allocations are also made through non disaster-specific lines. Any analysis of available and used public funds must therefore take into account additional appropriations.

In order to address this issue, details of each multi-year plan were taken into consideration and a more comprehensive methodology for public resources and expenditure tracking (at the federal level) was developed (for details see appendix 3). The line ministries involved are the Ministries of Transport, National Integration, Justice, Cities, Defense, and Science, Technology and Innovation.

These adjusted measures of disaster related budgetary allocations corroborate the change in the mindset after the 2011 Rio de Janeiro State flash floods and landslides: not only the focus has changed from response to prevention and preparedness, but also the traditionally low initial budget allocations have significantly increased in 2012, providing evidence that the Federal Government has recognized the importance of a disaster risk financing strategy in a more comprehensive disaster risk reduction (DRR) agenda.

In accordance with Brazil´s legal framework, budgetary provisions last for one fiscal year, except for committed resources that are carried over to the next budget year, the so- called Restos a Pagar or carry-overs.

MULTI-YEAR RESERVES

At the federal level, a multi-year reserve mechanism has not been established to date. The FUNCAP (Special Calamity Fund), created in 1969, is the proposed multi-year facility, but since its establishment it has not been operational given the lack of appropriate regulation. Major changes are currently under debate, but have not yet been approved. See box 2.1 for details.

Other than the non-operational FUNCAP, if the extraordinary budget credits are issued in the last four months of the year they can be carried over the next fiscal year under special budgetary procedures. The PPA could serve as multi-year budget tool, ensuring resources in the medium term for the needs of the line ministries. However the budget practices have undermined the credibility of the PPA as a medium term resource envelope, which explains why several line agencies have resorted to short term stop-gap methods such as the so-called fundos financeiros.

CONTINGENT LOANS

Contingent loans are not currently used in Brazil. The Federal Government retains risk based on the premise that the costs of natural disasters can be accommodated in the budget either through annual or in-year budgetary reallocations, always in the expectation of regular tax revenues or other financial inflows, without having to rely on contingency credit operations.

RISK TRANSFER

Traditional insurance of public assets and parametric sovereign insurance has not been developed for Brazil, and the Federal Government's strategy to date has been to retain risk by self-insuring its assets. 'Catastrophe bonds'[14] have not been issued in Brazil either.

14 "High-yielding, insurance-linked security providing for payment of interest and/or principal to be suspended or cancelled in the event of a specified catastrophe, such as an earthquake" (Cummins, D.; Mahul, O., 2009)

On the other hand, housing projects financed by the Minha Casa, Minha Vida program are covered against damage caused by natural disaster as part of the broader insurance component of this program, including insurance against household income fluctuations or default caused by death. Damage-related claims are very low compared to the other events covered by insurance.

In addition, since 2008 a set of policies and regulations for property microinsurance is back on the Superintendence of Private Insurance (SUSEP)'s agenda, aimed at promoting development in Brazil through financial innovations.

Any insurance or risk transfer mechanism for the government should seek to go beyond insuring the physical assets of the GoB and also include new instruments such as parametric solutions to hedge a portion of the economic / fiscal exposure to disasters. Details of this and related topics (such agricultural insurance policies) are part of the insurance market review in chapter 4.

Box 3.1 The FUNCAP as it is

Brief history: The FUNCAP (Fundo Especial para Calamidades Públicas) was created by Decree 0590 (in 1969), with resources originally from the Federal Government budget, donations, available funds allocated to civil defense actions and other ad hoc sources of funding.

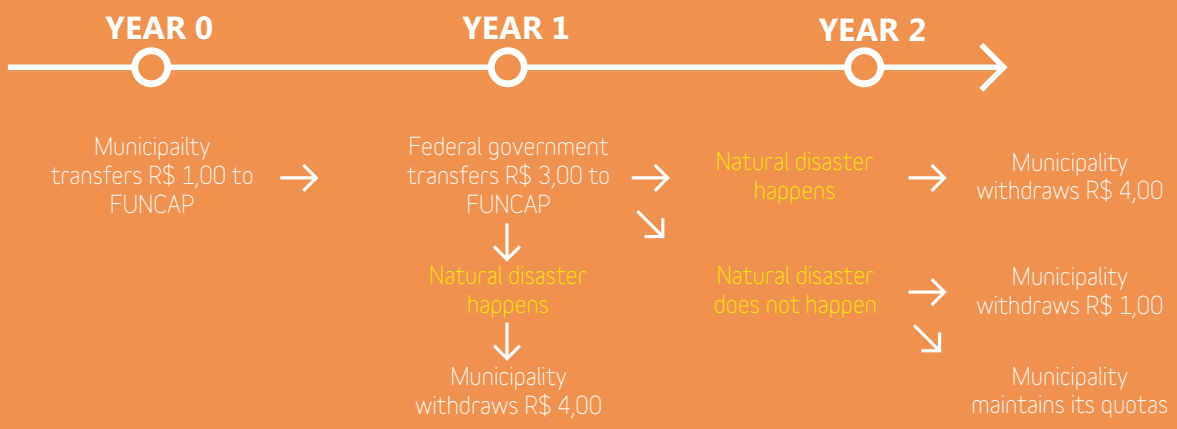
Sources of funding: FUNCAP is currently a fund divided into quotas which can be bought by states and municipalities via a voluntary transfer of resources. It is structured in the form of a matching grant fund, in which for each Brazilian real (BRL) transferred by a state or municipality to the fund, the Federal Government must transfer three BRL. In the event of a disaster, subnational governments can withdraw resources from it only up to the extent of their quotas.

Furthermore, the Federal Government is entitled to make voluntary transfers to FUNCAP in order to encourage participation by local governments. However, FUNCAP has not received any financial resources since 1995.

Goals: FUNCAP must finance the reconstruction of areas that have been affected by natural disasters. In exceptional cases, the resources can be used to finance immediate rescue operations, aid to victims and the reestablishment of essential services.

Use of funds: if no natural disaster occurs, the invested quota may be withdrawn after two years have elapsed from the time of the investment. In case of no disaster, the local government is not entitled to the corresponding contributions made by the Federal Government.

The chart below explains this mechanism:



Box 3.2 Proposals for a new FUNCAP (law 3.084/2012, with amendments)

Expansion of funding sources: Regarding funding sources, the main proposals are to include a 2.50% share of federal lottery receipts* (from the Caixa Econômica Federal) and a Federal Government investment of R$ 5,00 in FUNCAP for each R$ 1,00 obtained in this way from lottery cash. While these funds would not purchase additional FUNCAP quotas, they would add value to the existing municipal and state quotas.

As an illustration, given the federal lottery revenues in the past years, FUNCAP would have had lottery revenues according to the table below:

Table B.1 FUNCAP expected lottery revenue

Year	R$ Million
2008	143.50
2009	184.00
2010	220.25
2011	243.25
2012	262.25
2013*	291.93

Source: author's elaboration. (*)Forecast

Extension of FUNCAP's goals: The funds may be withdrawn to finance rescue operations, reestablish essential services and provide aid to victims. The original goal (reconstruction of natural disaster areas) is expanded. Article 8 of Law 12.340 (2010) would include civil defense preparedness and financing for disaster prevention as part of FUNCAP's objectives, subject to certain restrictions: the resources invested by the GoB must be allocated to prevention and preparedness and at least 50% of the resources withdrawn must be allocated to (i) identifying risk areas, (ii) re-greening risk areas, (iii) implementing urban drainage systems, (iv) hydrometeorological monitoring, (v) implementing the Civil Defense Contingency Plan, and (vi) training civil defense agents.

* Currently a share of the federal lotteries revenues is distributed to a series of culture, sports, education, health and security programs.

3.3 LOCAL GOVERNMENTS' DISASTER RISK FINANCING PRACTICES AND ARRANGEMENTS

ANNUAL BUDGETING

At the state level the same budgetary process apply, meaning that specific disaster related budget appropriations are defined within the context of each state's multi-annual plan. In terms of gathering fiscal data at the state level, given the lack of access to detailed information, the best approach is to focus on the budgeted and executed expenses recorded in the more general Civil Defense government sub-function.

An interesting finding is that at the local level disaster related (Civil Defense) initial budget allocations have been oscillating around higher (compared to the GoB's numbers) levels since 2006 (for details, see appendix 2). However, relative to likely needs, budgetary provisions are very limited at the state level as well, which is not surprising given the response capacity of local governments. Looking at the expenditures in each of the states, there are some key points to be emphasized. Considering the period between 2006 and 2012, three of the states respond for more than 50% of the entire amount allocated (initial and updated), committed and paid off in the Civil Defense sub-function, to all the states together.

Rio de Janeiro allocates approximately 29% of the paid-off expenditure in the period and Pernambuco and Paraná allocate 20% and 10% respectively. Moreover, it is important to stress that the initial allocation of Pernambuco has been considerably lower than the final allocation over the past few years. This indicates that this state allocates resources for dealing with disasters essentially by in-year budget reallocation.

Table 3.1. Total of the States' expenditure with the sub-function 'Civil Defense' for the period 2006-2012* (including intra-budgetary expenditure, R$ million)

Year	Initial Allocation	Final Allocation	Committed	Verification*	RAPs (carry-over)
2006	542,13	574,80	421,39	415,74	-
2007	658,25	791,80	580,28	507,10	71,27
2008	745,37	1.092,44	865,58	763,71	100,25
2009	1.026,18	1.462,59	1.256,59	1.141,55	75,57
2010	874,28	2.028,22	1.556,18	1.298,10	238,06
2011	1.221,45	2.168,93	1.405,46	1.281,45	116,34
2012	1.306,05	1.970,79	1.359,15	1.159,88	186,42
TOTAL	6.373,69	10.089,57	7.444,62	6.567,52	787,91

Source: Budget Execution Summary Report – SISTN/CEF. The Civil Defence sub-function does not include security spending, which are listed under a separate sub-function. * Intermediate step between commitment and financial disbursement that refers to the verification that goods or services were provided accordingly. Only after liquidation the financial payments can be made.

A second key piece of evidence to note is the large amount registered as carry-overs of Civil Defense expenditure commitments, henceforth RAP (Restos a Pagar)[15], in some of the states. Alagoas is alone responsible for almost 34% of the total RAP in the Civil Defence sub-function in the states, which indicates this state faces difficulties in executing and paying expenditures related to disasters. After Alagoas come the states of São Paulo (16%), Minas Gerais (15%), Rio de Janeiro (11%) and Paraná (9%). Altogether these states account for 84% of the total RAP registered between 2006 and 2012. It is also important to notice that there is a lack of budget data in the State of Rio Grande do Sul in 2008, where it did not record any amount for Civil Defence in any of the sources examined.

15 In Brazil, following the initial allocation of resources (and reallocation when required), the budget execution process includes the commitment, the verification and the financial disbursement stages. Only after verifying the adequate provision of goods or services the Government proceeds with the financial disbursement.

MULTI-YEAR RESERVES

At the local level, disaster (calamity) funds have been used to finance the costs of natural disasters, and with these facilities states and municipalities are able to carry over resources for the following fiscal years and, therefore, manage multi-year reserves. However, even where these local funds are operational, resources allocated are usually very limited compared to recovery and reconstruction needs. Another interesting feature of local disaster funds is that some of them exist with revenues linked to specific taxes. Such a difference in the approach taken by the Federal and local Governments suggests that where the impacts of disasters are actually felt, the need for improved disaster risk financing instruments has been identified and is already leading to institutional change. See annex 3 for details on the established local disaster funds.

TAXATION

Following a natural adverse event, tax increases are uncommon at the local level as well. Following the 2008 floods and landslides in Santa Catarina, the state government attempted to temporarily increase taxes to raise funds for reconstruction, but this policy was rejected by the population and could not be implemented successfully. As happens with the Federal Government, tax exemptions to specific sectors, on the other hand, are often used as an instrument to support recovery.

CONTINGENT LOANS

At the state level, contingent credit operations are not being used. DRM components of broader World Bank loans are usually focused on preventive measures, equipment acquisition and technical assistance, not including contingent credit products. Following the 2011 floods and landslides in Rio de Janeiro State, a US$ 485 million Development Policy Loan (DPL) was approved and disbursed to finance reconstruction efforts in the mountainous hinterland. However, this project was already under preparation as the result of the floods and landslides that hit the state before 2011 (the region is affected annually by this type of event), so that by January 2011 a series of necessary procedures was already in place. In the absence of this project preparation, the Rio de Janeiro state government could have faced additional difficulties in accessing liquidity.

3.4 FUNDING GAP ANALYSIS

Recovery and reconstruction gaps exacerbate the negative impacts of disasters on socioeconomic outcomes and for this reason we estimate post-disaster needs funding gaps in Brazil from 2006 to 2010. In this period, the financing gaps in a given year was, on average, of R$ 1.4 billion, or 30% of the estimated average disaster related government liability. These numbers are preliminary and based on a series of assumptions (see Box 2.3), but they corroborate anecdotal evidence from the field, suggesting that improving both disaster risk financing arrangements and damage and loss assessment systems are needed for resilient and timely reconstruction. Given that delays in recovery and reconstruction exacerbate the negative impacts of disasters on socioeconomic outcomes, one issue that arises is whether the financing instruments currently employed provide the affected cities with the necessary response resources in a timely and cost effectively manner.

Anecdotal evidence from the field suggests that recovery and reconstruction funding gaps are major and have significant implications in terms of welfare in Brazil. In

order to evaluate whether the budgetary resources are sufficient to fund recovery and reconstruction costs we carry out a preliminary retrospective funding gap analysis in this section.

More specifically, for the purposes of this study we define a funding gap as the difference between the budgetary resources available to finance disaster response (from both federal and state budgets) and the estimated government liability due to natural disasters in a given year. We do not make explicit considerations about emergency relief funding gaps based on the premise that this kind of financing need is met by the local and Federal Governments.

Given the lack of an appropriate budgetary tracking system and even of historical data on damage and losses caused by disasters in Brazil, the following analysis must be considered in light of important caveats and simplifying assumptions. First, a time series of aggregate government liability is built based on partial information and on a set of assumptions that can be adjusted as additional data becomes available.

Second, the disaster related fiscal dataset was built in accordance with a detailed budgetary process review. The employed methodology was meant to be as comprehensive as possible, but given the lack of better tracking systems some approximations had to be made, especially at the state level. The details on the estimation hypotheses and procedures are discussed in Annex 2 and the basic assumptions summarized in box 3.3 below.

Box 3.3 Funding Gap Analysis: Underlying Assumptions

The government Liability Estimates are based on actual and simulated data. Available data are the annual number of affected people in Brazil, and historical data on the number of damaged and destroyed dwellings in Paraná State, based on which the historical number of damaged and destroyed dwellings in Brazil is simulated.

Other parameters were assumed as well: based on the 2010 dwellings/public schools ratio and on the dwellings/public health are defined to approximate the number of affected schools and health centers.

The following three scenarios are defined in order to estimate funding gaps under low, medium and high costs assumptions. For each affected dwelling and person a multiplier is associated to the cost assumptions detailed below in order to generate three series of annual government liability (at current values) in the social sectors (housing, education and health).

Table B.2. Unit Cost Assumptions

Type of Asset	Unit Costs to the Public Sector - (R$ 1.00, at 2012 values)		
	Low Costs	Medium Costs	High Costs
Destroyed Dwellings	40,114.29	40,114.29	40,114.29
Damaged Dwellings	2,005.71	4,011.43	8,022.86
Affected Schools	25,000.00	50,000.00	100,000.00
Affected Health Center	12,500.00	25,000.00	50,000.00
Affected Person	250.00	500.00	750.00

These assumptions capture part of the public damage and losses in the social sectors (housing, health and education).

The high fiscal burden associated to the recovery and reconstruction of the infrastructure sectors is not taken into account because average costs are very poor approximations for the true parameters given the high heterogeneity of the variables underlying the distribution of public infrastructure recovery costs.

Since in-year budgetary reallocations (through budgetary reallocations) are the main source of funding for post-disaster recovery and reconstruction needs, we analyze funding gaps with and without extraordinary credits. As shown in figure 3.3, compared to the disaster related initial budgetary allocations the financing gaps are significant even under conservative assumptions. Resources within the annual budget account for 60% or less of total estimated government liability under the low cost assumptions, 33% or less under the medium costs assumptions and 21% or less under the high costs assumptions.

Figure 3.3. Funding Gap Analysis: Before in-year Reallocations

Source: author´s elaboration with data from SigaBrasil and Civil Defense.

When taking into account budgetary reallocations that are commonly issued following more severe disasters, the funding gap for recovery and reconstruction is smaller but still considerable: figure 3.4 shows that under the low cost assumptions funding gaps have not been observed since 2007, and medium or high costs assumptions produced funding gaps estimations, for example, as high R$ 5.3 billion in 2009.

Figure 3.4 Funding Gap Analysis: After in-year Reallocations

Source: author´s elaboration with data from SigaBrasil and Civil Defense.

Even when considering the budgetary reallocations following major events, moderate assumptions suffice to indicate that most of the time the resources made available through these budget lines are not enough to finance full recovery and reconstruction in the affected communities. See table 3.2 for a detailed exercise.

Table 3.2. Budgetary Provisions as a % of Estimated Government Liability

	Allocated Resources/Estimated Government Liability (%)					
	Before In-year Reallocations			After In-year Reallocations		
Year	Low Costs	Medium Costs	High Costs	Low Costs	Medium Costs	High Costs
2006	61.28%	32.44%	21.08%	87.95%	46.56%	30.25%
2007	55.83%	29.40%	18.98%	110.86%	58.37%	37.69%
2008	47.51%	25.48%	16.22%	157.42%	84.42%	53.76%
2009	42.95%	23.42%	14.92%	124.01%	67.64%	43.09%
2010	38.46%	20.64%	13.35%	202.68%	108.79%	70.35%

Source: Author's compilation with SigaBrasil and Civil Defense data.

It is of major importance to point out what is not being taken into account in the above exercise. First, we are not explicit about including the costs of emergency and relief operations, which can for example be high during floods and mass movements. Additionally, these estimates do not include a proxy for the impacts on the transport sector, which is a major component of public damages according to the case studies presented earlier, or for the impacts on any other public infrastructure. Moreover, the costs of urgently required vulnerability reduction and adaptation measures following a disaster, as well as the impacts on the economic sectors are not considered. Therefore, the analysis above cannot be seen as a definitive figure, but instead as a preliminary exercise in which we sketch lower bounds based on different assumptions for the government liability and funding gaps from 2006 to 2010 regarding the social sectors only.

Besides that, ideally we would carry out a dynamic funding gap analysis, meaning that we would estimate recovery financing gaps separately from reconstruction financing gaps. The inclusion of this time dimension is important because both liquidity and financing needs to differ substantially depending on the post-disaster phase. However, the nature of the budgetary process in Brazil is such that the most detailed accessible budget lines are still too general to allow for these dynamic considerations. Moreover, given the recent changes noticed in 2012 it would be important to expand this analysis beyond more recent periods. However, the absence of available data on the occurrence of disasters since 2011 rules out such expansion at the moment.

Finally, given the fact that reconstruction programs could be financed through the realignment of investments plans, it is possible that some resources have not been tracked. The methodology developed for the fiscal indicators was built with the goal of avoiding underestimating the public resources available for disaster response. However, given that they are an approximation, the numbers obtained might differ from the resources actually raised.

With these considerations in mind, the key messages from the analysis above are:

- Even based on conservative assumptions and taking into account extraordinary credits made available during the fiscal year, there is evidence of actual government liability being regularly higher than the public resources available to the affected cities and states during the past years.

- The determinants of these funding gaps have to be further studied since it is not clear to what extent the lack of available resources reflects institutional, technical and/or financial constraints. However, the unstructured budgetary process suggests that the establishment of a multi-year platform such as the FUNCAP could be used to formalize funding flow arrangements to different line ministries and state level calamity funds.

- Moreover, the inclusion of missing data would more than likely reveal a worse situation that is consistent with anecdotal evidence from the field. This preliminary assessment was based only on several assumptions and simulated data, and the availability of improved primary sources of information would significantly enrich an analysis such as the one presented here. The availability of improved data management systems, as suggested above, could further enrich these kinds of analysis and improve the accuracy and timeliness of funding gap monitoring.

CHAPTER 4. INSURANCE MARKET OVERVIEW

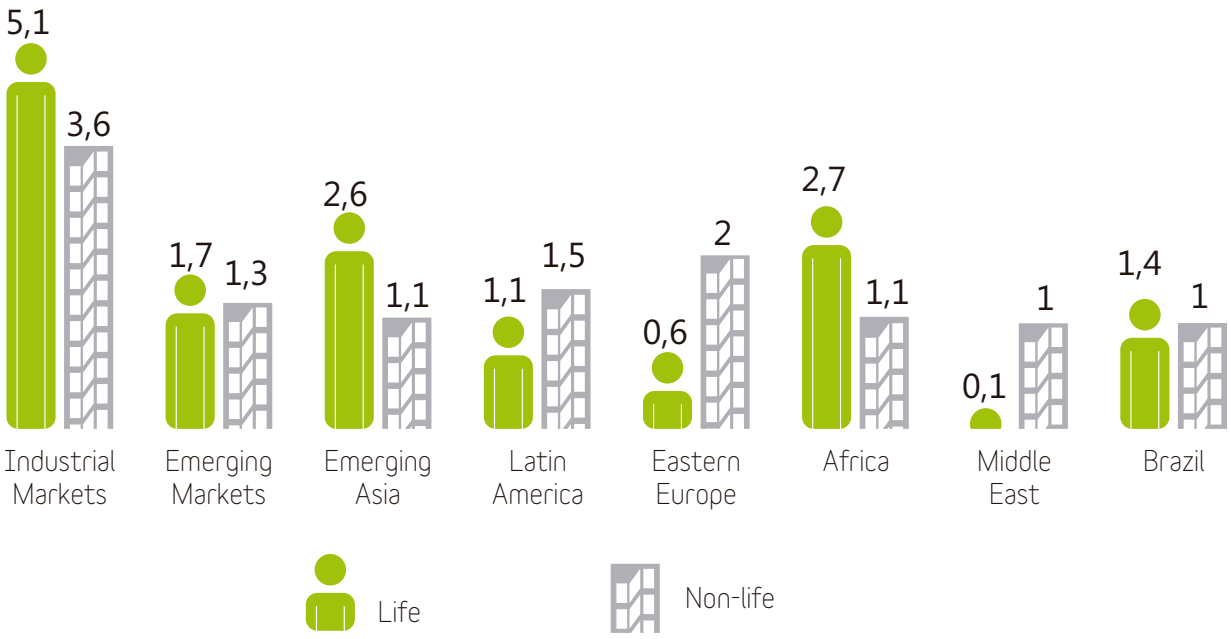
Brazil has the largest non-life insurance market in Latin America, but penetration rates are still low (1.08% of GDP) compared to developed economies (3.6% of GDP). Agricultural insurance penetration rates have increased since 2003, when a government subsidies program (PSR) was launched. Disaster property insurance is usually covered by comprehensive policies and a framework for disaster microinsurance still awaits approval. Several of the GoB's temporary cash transfer programs are used in the aftermath of disaster, and like the PSR, the development of a broader DRFI strategy could make these programs more cost-effective.

This chapter overviews the most relevant catastrophe insurance market segments in Brazil, namely agricultural, property and microinsurance. In general, catastrophe related insurance markets are relatively undeveloped. Agricultural insurance is the most developed segment, sustained by a GoB subsidies program and enforcement policies linking insurance to credit.

In addition, cash transfers programs play the role of microinsurance both in the property and agricultural sectors. These programs have become more important over recent years, but the establishment of a comprehensive DRFI framework could make them more cost-effective.

4.1 NON-LIFE INSURANCE MARKET OVERVIEW

Figure 4.1 Insurance Penetration Rates (% of GDP)



Source: Zurich Seguros and Swiss RE, 2011.

With a share of over 20% of the Latin American non-life insurance premiums (around US$23 billion in 2012), Brazil is the largest market in the region, followed by Mexico and Puerto Rico, with US$10 billion each.

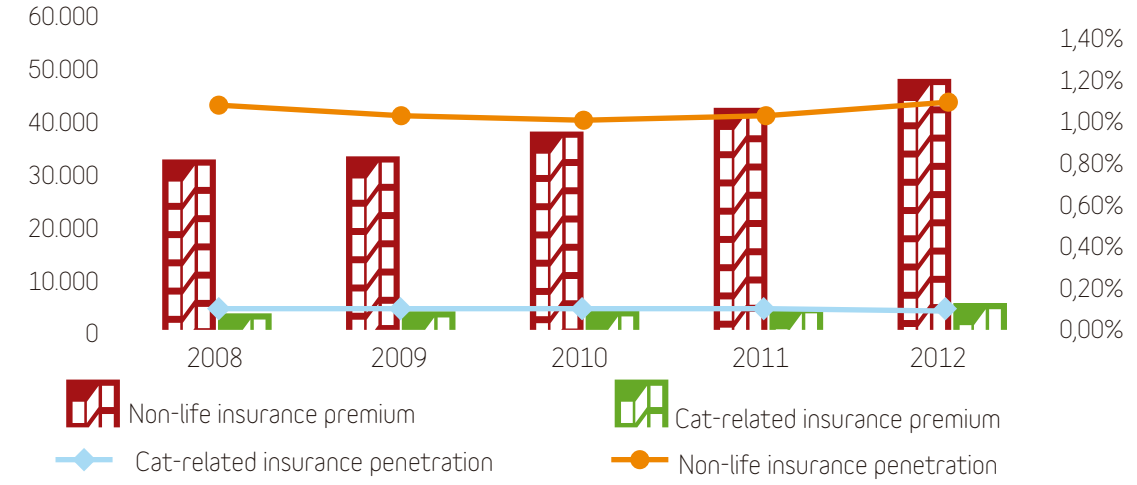
Compared overall with Latin America, Brazil´s average penetration rates are fairly strong, but still much lower than those in developed economies (Figure 4.1).

The catastrophe insurance share of the non-life sub-sector is also low. Since 2008, non-life insurance penetration has been around 1.00% of GDP, while the catastrophe insurance penetration (considering rural, property and microinsurance) has been less than 0.2% of GDP[16].

Given these low penetration rates and the recent economic and regulatory developments, private insurers still see great potential for a continued expansion of the non-life insurance market in the country.

16 It is important to note, that in the property sector in particular coverage against catastrophic events is usually included in more general, comprehensive insurance policies, unless explicitly stated otherwise. For the purpose of this study, comprehensive insurance policies against general damage are considered as catastrophe insurance as well. The auto sub-sector is not considered to be catastrophe insurance in the above calculations, but auto policies might cover damage caused by natural disasters as well (depending on the details of each contract). Therefore, it is not possible to present a complete assessment of the market size and penetration rates of catastrophe insurance in Brazil.

Figure 4.2 Non-life and catastrope insurance: premiums (R$ million) and penetration rates (% of GDP)



Source: Susep, Axco and IBGE.

Regarding the market structure, in recent years a number of insurers have entered the market, at the same time as a trend towards consolidation among major insurers. (Table 4.1). In 2011, 116 insurance companies were operating in Brazil, but about 60% of the total non-life premiums were concentrated on the 7 largest insurance groups (Axco, 2013).

Table 4.1. Leading non-life insurance groups: market share

Insurance Group	Non-life insurance market share
BB-MAPFRE	14.30%
Itaú Unibanco	14.10%
Porto Seguro	11.40%
Bradesco	10.50%
Santander	3.80%
Caixa	3.50%
SulAmerica	2.20%

Source: Axco.

Another important recent trend has been the opening of the Brazilian reinsurance[17] market. The monopoly of the IRB (Brazilian Reinsurance Institute) was terminated in 2007, and international reinsurers were allowed into the Brazilian market, although under special conditions, i.e. a reserve for local reinsurance companies. This characterizes the Brazilian reinsurance sector as a not entirely free market.

As a result, over the past years the number of domestic reinsurers (which might be owned by international groups) has increased to 10, driving the market share of the IRB from 100% before the opening of the market to about 30% in 2012 (A.M. Best, 2013). This might have significant implications, for instance, on the agricultural sub-sector given that the country is highly exposed to systemic risks and reinsurance cessions in this sector can be as high as 80% (World Bank, 2010).

17 Reinsurance is an operation by which insurers transfer risk to reinsurer(s). If an insurer is obliged to pay compensation to its clients, the reinsurer would pay for the insurer losses (according to the terms of the reinsurance policy), therefore protecting the insurer from major financial losses.

4.2 AGRICULTURAL INSURANCE

This section aims at initiating a discussion on how agricultural insurance schemes currently available in Brazil could be further developed to improve the Federal Government´s fiscal management of both ex-ante and ex-post programs designed to support farmers exposed to natural hazards and to enhance private insurers´ ability to compete in the insurance markets.

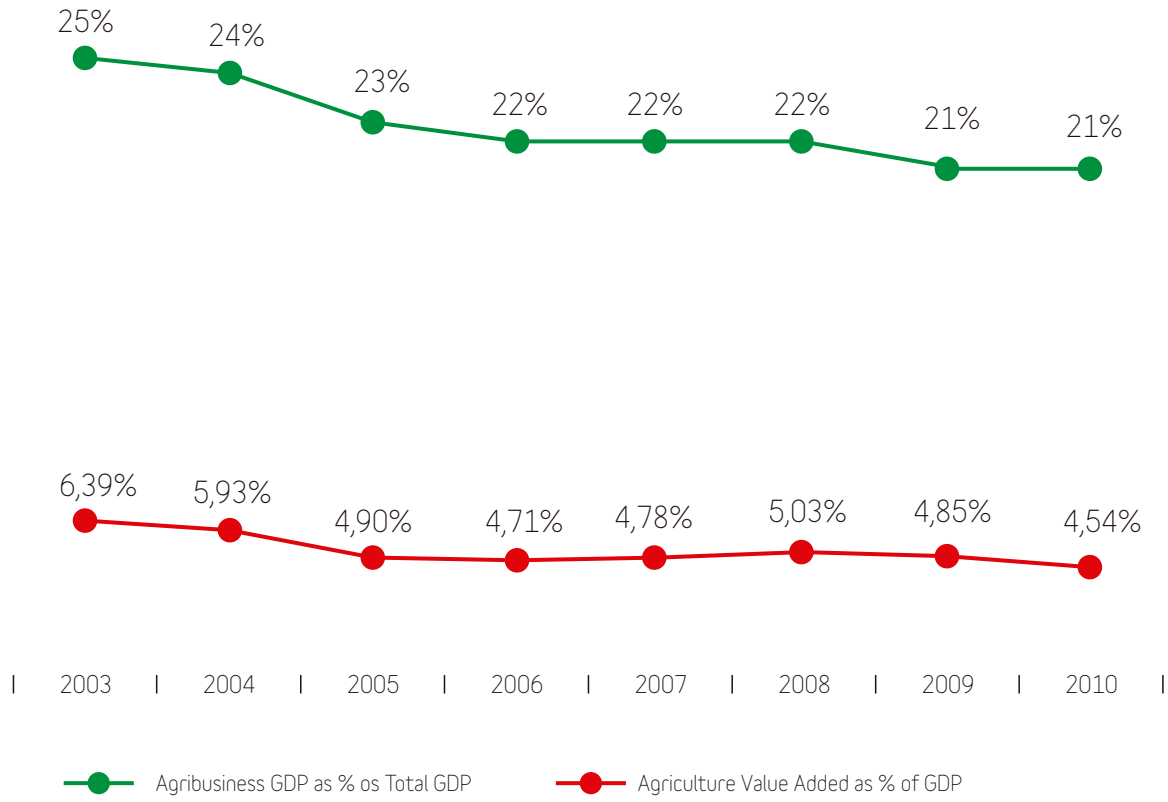
IMPORTANCE OF THE AGRICULTURAL SECTOR

Among the most important agricultural producers in the world, Brazil has a strong tradition in the agricultural sector and a long history of droughts, floods and hailstorms. In recent years many policies and institutional changes have been introduced to improve risk management in the sector, especially in states highly vulnerable to droughts, such as those in the northeastern and southern regions.

This is not surprising given the importance of the agriculture sector to the economy. When considering the full agribusiness supply chain, the agribusiness share of GDP was 21% in 2010, while the agriculture value-added as a percentage of the national GDP was approximately 4.5% during the same period.

Public sector support to agricultural insurance in Brazil is substantial when compared to other Latin American countries, but policies involving public subsidies and institutional frameworks can still be better tailored to achieve the government´s goal of increasing farmers´ resilience to natural disasters while preserving the fiscal balance of the governmental support programs.

Figure 4.3 Agriculture GDP as % os Total GDP



Source: IBGE and Esalq.

Box 4.1. Agriculture insurance: products available

In Brazil, crop, livestock, aquaculture and forestry insurance are available both with and without guarantee from an agriculture insurance stabilizing fund (FESR, described below). According to SUSEP (Superintendence of Private Insurance), in addition to protecting production, farmers can also insure assets and inputs against damage. This type of insurance can be specifically tailored depending on whether or not such assets are collateral to rural credit operations. A specific life insurance is also available for rural producers with financial liabilities and some receivables can also be insured against default.

Multi-peril crop insurance (MPCI) and indemnity-based (named peril) crop insurance are the most common types of agricultural insurance in Brazil. The first type establishes an insured yield (given by a chosen measure) and if actual yields are below the insured level, an indemnity is paid to cover the losses. The second type offers cover against a specific hazard, and claims are based on the extension of the damage in the field.

Area-yield index-based crop insurance, which offers coverage according to the average yield of a larger area that includes more than one insured party, was used in Rio Grande do Sul State by maize farmers, but the program was discontinued after 2009 (World Bank, 2010). Livestock, aquaculture and forestry insurance is also available and eligible for subsidies as well, but penetration rates are estimated at much lower levels than those for crop insurance products (World Bank, 2010).

Crop insurance and credit related operations constitute the bulk of the agricultural insurance market in Brazil. However, the relative share of credit linked insurance operations has decreased since 2003. This is partially related to the public subsidies program launched in 2003 which significantly reduced the cost of insurance premiums to farmers (Figure B.4.1).

Figure B 4.1. Rural Insurance Products

Source: Susep. *Partial data..

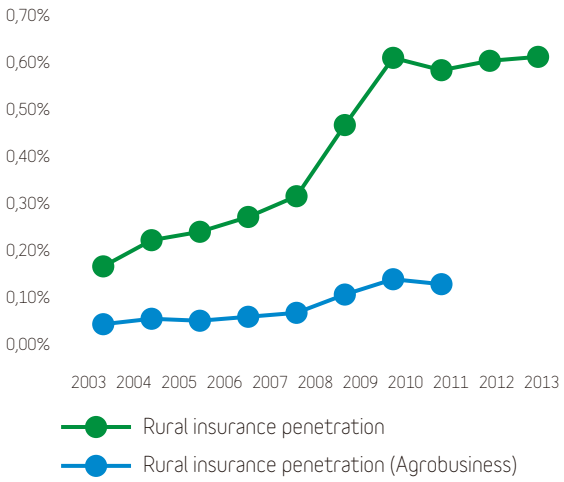
Mutual insurance schemes, arrangements in which the insurers are also the policyholders, have also been successfully developed in Brazil. In Rio Grande do Sul state, for example, AFUBRA (Associação dos Fumicultores do Brasil) protects farmers against hail and windstorm hazards. Other groups such as the Batavo, Coamo and Irga Cooperative (rice producers association) are also among the main mutual insurance groups (Buainain and Vieira, 2011). These small-scale arrangements can be used to protect farmers against more severe, but less frequent and non-systemic hazards such as hail in southern Brazil (World Bank, 2010).

PENETRATION OF AGRICULTURAL INSURANCE

The fivefold increase in total agricultural insurance premiums was accompanied by a corresponding upswing in penetrations rates, which increased from under 0.2% in 2003 to 0.6% in 2012 (taking into account total rural insurance premiums over agricultural valued added).

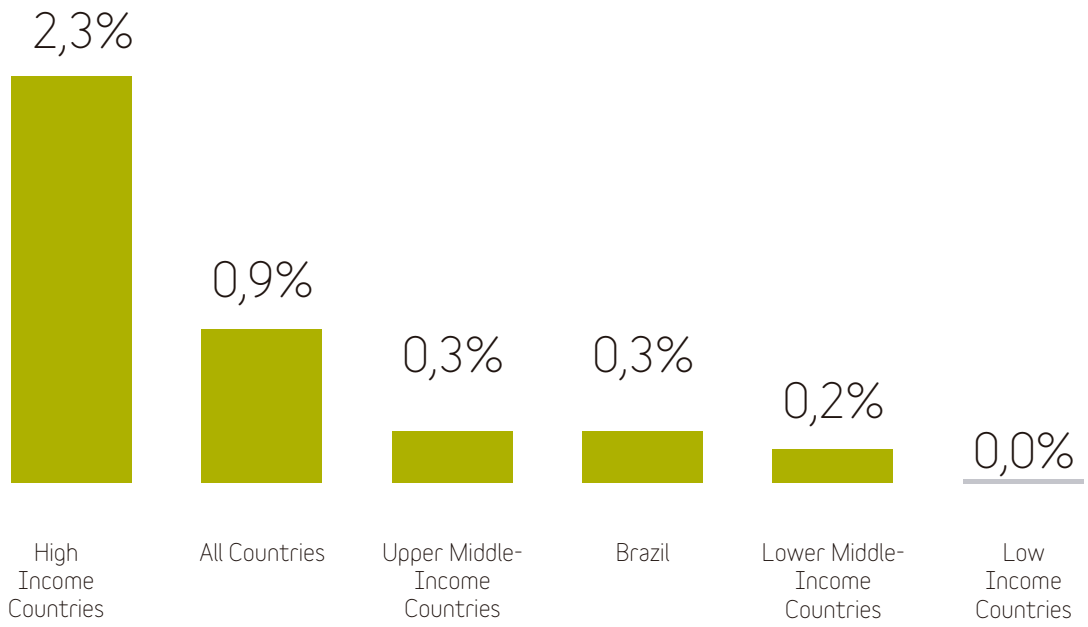
This increase in penetration rates is significant: in 2007, when agricultural insurance penetration rates in Brazil were about 0.3%, the country was comparable to Panama, the Windward Islands and Paraguay. By then, more advanced markets such as Mexico and Chile had agricultural insurance premiums corresponding to 0.6% of their agricultural GDP, while the remaining countries in the region had penetration rates of less than 0.1% of agricultural GDP (World Bank, 2010).

Figure 4.4 Rural Insurance Penetration



However, it is important to note that despite recent improved performance, penetration rates are still far from those observed in high income countries (Figure 4,5). Despite being a relatively developed market, agricultural insurance penetration varies from region to region in Brazil, with the southeastern and central-southern parts of the country having much higher levels of agricultural insurance penetration than the northeastern states characterized by dry-land mixed-farming systems (World Bank, 2010).

Figure 4.5. Comparative Agricultural Insurance Penetration



Source: Stutlev and Mahul, 2010.

Box 4.2. Market Concentration

As for the number of insurers operating in the market, while Uruguay, Paraguay, and Chile had in the recent years four insurers operating in the agricultural sector, and concentration was absolute in Costa Rica, the Dominican Republic, Guatemala, and the West Indies - each with only one insurance company offering agricultural insurance (World Bank, 2010) - Brazil seems to have a market structure more similar to the Argentinian one (which had over 27 agricultural insurers in 2007).

Brazil had about 25 groups offering agricultural insurance in 2012 (SUSEP). However, most groups with different names run joint operations and the largest groups concentrate a very high share of the market (P&C, 2013). In other words, despite an apparent competitive structure, the market is actually concentrated on the few players with better distribution channels and agricultural credit operations.

In Brazil, even though insurance brokers are highly specialized in agricultural insurance delivery, linking insurance to rural credit and therefore using bank branches as distribution channels has been an important strategy to increase coverage and make the subsidies program effective (World Bank, 2010 and Adami and Ozaki, 2012). This suggests that delivery costs might be an important driver of market concentration.

GOVERNMENT SUPPORT PROGRAMS

Along with Mexico, Brazil provides a high level of public sector support to risk management in the agricultural sectors. Indeed, three of the government programs available in Brazil (PROAGRO, SEAF and Fundo Garantia Safra) are the only ones which follow a full government-intervened model in Latin America (World Bank, 2010). Furthermore, in 2003 Brazil established a subsidies program for private agricultural insurance, since then penetration rates increased significantly. The support provided to the private insurance market also includes a stabilization fund (FESR) and a public-private partnership insurance facility. This catastrophe fund (not the FUNCAP) was approved in 2010 but still requires further regulation.

a) Government support programs to private insurance:

PSR (Programa de Subvenção ao Prêmio do Seguro Rural): The PSR subsidizes private agricultural insurance bought from authorised insurers. The national program is financed by the Ministry of Agriculture and the benefit can be complemented by local (state) programs where available.

The share that is subsidized varies according to the food crop and the season. The insurance premium subsidy ranges from 30% to 70%, with a cap of R$ 96 thousand per crop insured. The PRONAMP (Programa Nacional de Apoio ao Médio Produtor Rural) program can add a 20% subsidy to medium-sized producing units, organic crops and selected crops in priority regions.

Launched in 2003, the PSR is a leading government program to support agricultural risk management in Brazil. Since 2003, budgetary resources allocated to the program and the amount of subsidies has increased significantly, especially after insurance was linked to major rural credit programs (table 4.2).

Table 4.2. PSR: Evolution of Main Performance Indicators 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
Market Demand (R$ million)	-	61	114	158	272	460	526	717
Approved Budget (R$ million)	10	61	100	160	272	328	406	329
Available (R$ million)	10	61	100	160	172	238	255	329
Total Subsidies (R$ million)	2.3	31	61	158	260	198	254	318
Insured Capital (R$ million)	127	2,869	2,706	7,209	9,684	6,542	7,339	8,782
Insured Area (millions of hc)	0.07	1.56	2.28	4.76	6.67	4.79	5.58	5.24
Insured farmers (unit)	849	16,653	27,846	43,642	56,306	38,211	40,109	43,538
Average subsidies per beneficiary (R$ 1.00)	2,709	1,867	2,187	3,608	4,610	5,189	6,319	7,307

Source: MAPA.

However, from 2009 onwards the high demand for subsidized agricultural insurance and the lower than expected annual budgetary provision (as projected by the triennial program plans[18]) have imposed financial difficulties on the program (Adami and Ozaki, 2012).

According to Adami and Ozaki (2012), since 2009 the PSR has delayed due payments to private insurers and the triennial plans are no longer totally relied on for the resources made annually available to the program. In 2010, R$ 90 million due in subsidies were not paid to the private insurers. In 2011, the transfers due to the latter were as high as R$ 163 million. These liabilities shrank the resources actually available to the market in the following years. The budgetary provisions were below expectations at the same time.

Despite being the major program responsible for increasing the penetration of agricultural insurance in Brazil, the financial management of the PSR has been a challenging task. Such instability creates additional uncertainty for private insurers, potentially impacting the provision of agricultural insurance for farmers (both through prices and quantities).

Policies with the potential to reduce insurance prices, such as improved risk assessment tools and distribution channels, and a better regulatory framework for insurers and reinsurers, could reduce the costs of the program. Moreover, more transparent financial schemes could strengthen the programs reputation and therefore reduce risks for the private insurers, possibly leading in addition to improved pricing schemes.

FESR (Fundo de Estabilidade do Seguro Rural): designed to act as a stabilizing institution, the Fund can provide insurers with financial support if the claims correspond to 100% to 150%, or more than 250% of the premiums. Insurance claims of more than 150% but less than 250% of the premium must be covered by reinsurance contracts since they are not covered by the FESR.

Sources of funding are the budgetary provisions from the Federal Government in the event of deficit and profits exceeding technical profitability caps imposed on rural insurance operations. The corresponding Legal framework is the Decree-law nº 73, from November, 21st, 1966.

Catastrophe Fund: Approved in 2010, the Catastrophe Fund is not yet operational due to the lack of regulation. The idea is to replace the FESR in a way that allows for the private sector to participate in the fund. The initial proposal indicates an initial investment of R$2 billion from Federal Government budgetary resources and R$ 2 billion from bond issues.

Legal framework: Complementary Law No. 137, August 26th, 2010.

18 The triennial PSR plan gives the guidelines for the agricultural insurance subsidies program and presents estimates of the available funds during the corresponding three years.

b) Programs fully intervened[19]

PROAGRO (Brazilian Guarantee Program): targeting small and middle sized producing units, this program exempts farmers from paying specific financial obligations in the event of natural disasters that reduce farmers payment capability.

Sources of funding: budgetary provision from the Federal Government, rural producers' contributions and revenues from financial surpluses.

The corresponding legal framework is Law 5.969/1973, Law 8.171/1991, Decree 175/1991, NMC (National Monetary Council) Rural Credit Manual (MCR-16).

"Proagro Mais"/SEAF (Insurance for Family Agriculture): public insurance facility small sized producer units operating under the PRONAF (Programa Nacional de Fortalecimento Agricultura Familiar). The program covers financial liabilities plus a share of the expected revenues in the event of a disaster not occurring. The corresponding legal framework is the NMC (National Monetary Council) Resolution nº 4.186, January 31st, 2013.

Programa Garantia Safra: a welfare program for small farmers located in certain specific areas of the northeastern and southeastern regions that pays a fixed amount (currently R$ 850) to partially cover losses (if at least 50% of eligible crops are lost) caused by droughts or floods in participating municipalities.

Bolsa Estiagem: for the farmers not covered by the Garantia Safra, the Bolsa Estiagem is a cash transfer program for agricultural producers with monthly income of up to two minimum wages that are affected by natural disasters, including droughts. The program transfers a fixed amount (currently R$ 400) in five installments.

c) Technical Assistance

Climate Agriculture Risk Mapping: a technical assistance program run by the Ministry of Agriculture that annually maps crops suitable for each region, taking into consideration climate and soil features of the studied areas. The program monitors 40 different types of crops in 24 Brazilian states. In order to be considered for the PROAGRO and other public insurance and credit programs producers have to meet with the recommendations of the annual risk assessment.

GeoSafras: CONAB (Companhia Nacional de Abastecimento) uses satellite imagery and other advanced technologies to monitor and forecast cultivated areas and yields. Published reports are available to the industry as a whole. Within the scope of this project, policies to improve risk assessment and pricing in the insurance sector could be further developed. The most recent version of the published report refers to 2010; more up-to-date information about the continuity of the program is not available.

The agriculture sub-sector is relatively more advanced than other areas in terms of data management. According to Silva (2011), the introduction of the Climate Agriculture Risk Mapping Program has changed the focus of policies such as the PROAGRO, which now fosters technological innovation and improved risk management among farmers. According to Assad (2004), the program has saved the PROAGRO program up to R$ 150 million since the use of agricultural risk maps leads to lower claims being made.

OPTIMIZING THE GOVERNMENT OF BRAZIL PROGRAMS THROUGH A DRFI STRATEGY

While the number of public policies that support risk management in agriculture shows that the relevance of disaster risk financing in the sector is recognized as a matter of public interest, it is important to note that the absence of a coordinated approach to DRFI undermines the performance of such programs.

For example, while producers covered by the abovementioned fully intervened programs have to comply with the Agriculture Risk Mapping recommendations, neither PROAGRO nor Garantia Safra use the information available to determine pricing or define their risk financing strategy. Instead, financial management of such programs are based on weak assumptions and parameters, such as indemnity payments and contributions that are often politically determined. This results in deficits (related to what is raised with the farmers' contributions) financed by the GoB.

Private insurers, government institutions and the private agribusiness sector moreover complain that although the coverage of PROAGRO and Garantia Safra is increasing, the actual products and coverage are failing to address producer needs and representing the risks faced by farmers. While the financial performance of these programs could certainly be improved, they could also better focus on the real needs of their customers.

19 Fully intervened programs, also referred to as pseudo-insurance programs, are those fully funded and managed by the federal government. These programs can involve contributions from the beneficiaries but do not follow regular insurance practices such as for example the use of actuarially fair prices. They are welfare programs that transfer income to farmers affected by disaster and for this reason are sometimes referred to as "insurance".

The design of these programs, while currently mitigating the financial impact of catastrophes on small farmers, also creates a contingent liability for the government. As experience with flood insurance has shown in the United States, this fiscal exposure, if left unchecked or not reinsured, can grow significantly over time.

With regard to private agriculture insurance, no clear strategy exists for engaging private insurers and, as discussed above, the only program (PSR) with this role cannot be fully relied upon. The PSR has for example presented serious disbursement issues over recent years, creating uncertainty for both farmers and private insurers.

In conclusion, while the need for disaster risk financing in the agricultural sector has been recognized by the GoB, the implementation of a broader DRFI strategy involving the use of an adequate risk layering approach and a stronger partnership with the private insurers could significantly improve the effectiveness and efficiency of public resources allocated to these programs.

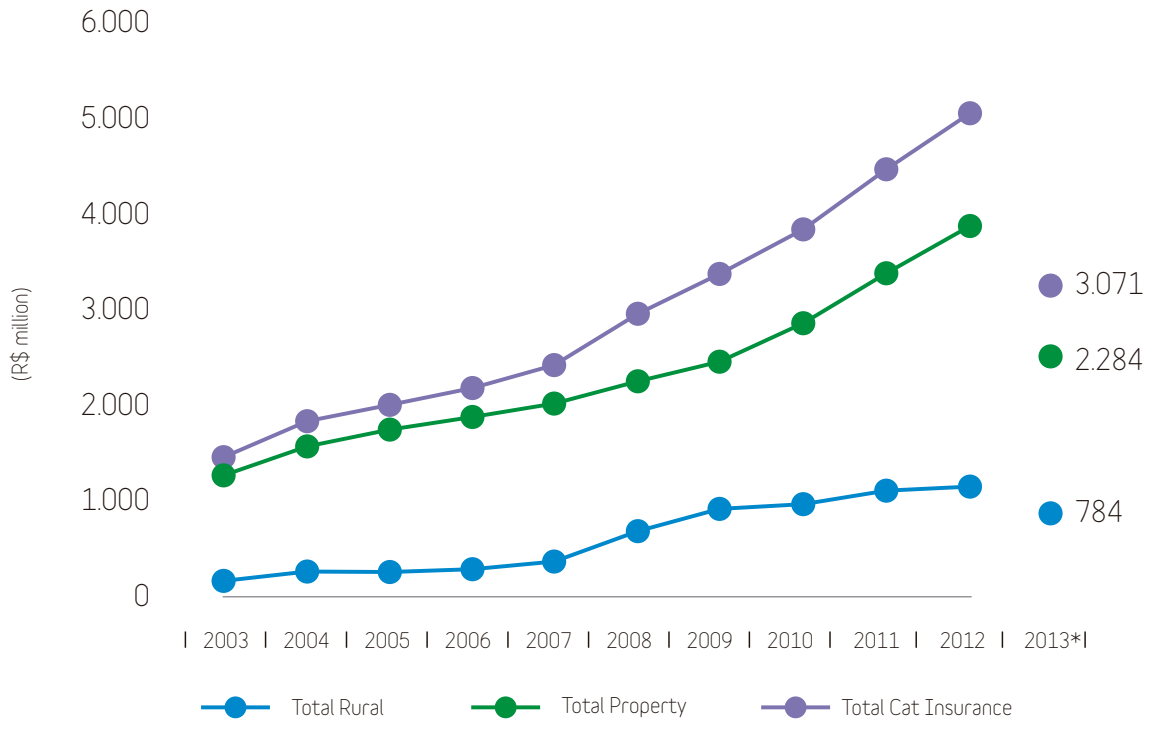
4.3 PROPERTY INSURANCE, MICROINSURANCE AND TEMPORARY CASH TRANSFERS

PROPERTY INSURANCE MARKET

While property insurance is the main component of the non-life segment, coverage against natural hazards is usually arranged through comprehensive policies, i.e., policies offering broad coverage against unspecified peril[20].

One problem associated to this feature is that, since "catastrophe" risk is covered by existing property policies, the current data collected by insurance companies is unlikely to facilitate modeling of catastrophic perils since the premiums and losses attributed to catastrophes alone are not separated.

Figure 4.6 Catastrophe Insurance Premium by Sub-Sector



Source: SUSEP. *Jan-August only.

20 In figure 4.6, these ''all-risks" policies are considered as catastrophe-related property insurance, although their coverage goes beyond that (property named peril insurance policies are not offered, except for specific engineering and operational risks at e.g. industrial facilities).

From a more critical public policy viewpoint, this also raises the question of whether local insurance companies are properly pricing for catastrophe risk and setting aside sufficient reserves to pay for future catastrophe-related claims. At the moment natural hazards are generally not explicitly taken into account in the property insurance market and, within this framework improvement of the design, pricing and delivery of such products is especially challenging.

Notwithstanding the many problems, private local and international insurers see great potential in this market segment given that, apart from residential insurance, a whole range of businesses vulnerable to natural hazards (from small businesses and service providers to large utility companies) are not currently covered.

One of the main bottlenecks pointed out by the insurance industry is the lack of access to relevant information such as historical disaster losses, current risk maps, hazard models and climate monitoring tools. Without accurate data, adequate pricing in the property insurance sector is not possible and, as a result, conservative pricing methods are likely to drive prices up to prohibitive levels.

Table 4.3. Estimated outreach of microinsurance: millions of risks covered

	2006	2011
Asia	66	350 to 400
Latin America	8	45 to 50
Africa	4-5	18 to 24
Total	78	<500

Source: Munich Re Foundation, 2012

As for residential insurance, another key issue is that many low-income potential customers do not possess the property titles required for insurance coverage. Given that property insurance is not mandatory in Brazil, insurers find it difficult to diversify their portfolios. In general it is only high-risk clients who tend to buy insurance.

MICROINSURANCE

The microinsurance market expansion is a global trend (Table 4.3) driven mainly by government support and, while disaster microinsurance could benefit from this general trend, the role of catastrophe related microinsurance in a broader disaster DRFI is still being established. In developing countries the first pilot programs and projects are still being formulated and evaluated by governments and private insurers.

As with microcredit, developing and consolidating microinsurance programs requires a tailored design to tackle key issues such as how to overcome the difficulties involved in accessing and evaluating the target population. A further problem is how to set about encouraging homeowners, farmers etc to engage in risk reduction activities despite being insured.

In Brazil, up to 2012, microinsurance policies were offered by the few institutions authorized to operate in this segment by SUSEP and the lack of a broader and specific range of rules and regulations precluded other insurance companies from investing in the microinsurance segment.

To fill this gap, SUSEP recently approved a regulatory framework that is expected to open up opportunities for the microinsurance market. The process was given an additional boost in 2008 when a public-private commission was established to assess the needs of the microinsurance sector.

As a result, SUSEP published Resolution 244 in 2011. This was subsequently regulated by complementary norms in June and September, 2012. In August 2013 the final version of the Microinsurance draft law (3.266/08) that addresses tax exemption issues was approved by the commission responsible for the project and it is now ready to be submitted to the National Congress (See table 4.4 for details).

Table 4.4. Recent regulatory framework for microinsurance

Date	Normative	Description
2008	Law Proposition 3,266	Rules tax exemption on microinsurance operations.
2011	CNSP Resolution 244	Overall definitions and guidelines focused on product, market and prudential regulations. Regulates special microinsurance delivery channels.
2012	Susep Circular 439	Establishes requirements and standards to be met by entering microinsurance companies.
2012	Susep Circular 440	Establishes the general features of microinsurance policies, including marketing policies through remote delivery channels.
2012	Susep Circular 441	Establishes the overall guidelines for the marketing of microinsurance policies by financial institutions and their intermediates.
2012	Susep Circular 442	Regulates microinsurance correspondents.
2012	Susep Circular 443	Regulates the associated use of capitalization-structured products.
2012	CNSP Resolution 262	Establishes technical provisions and collateral assets requirements.
2012	CNSP Resolution 263	Establishes minimum capital requirements.

Source: SUSEP.

The above regulatory framework explicitly addresses non-life catastrophe microinsurance. Property, named peril, catastrophe microinsurance can be offered by private insurers under these guidelines: residential buildings and their contents, as well as commercial buildings and equipment of small businesses can be insured against wind storms, hurricanes, cyclones, tornadoes, hail, landslides and floods. However, to date these products have not been authorized and it is not clear whether the industry will offer comprehensive and/or named-peril policies. Microinsurance against income losses, unemployment and rent liabilities are also defined in the new regulatory framework, but it is not clear if natural disasters could be named as the events causing income loss insured by these policies.

TEMPORARY CASH TRANSFERS

Frequently used by the GoB, temporary cash transfers have been used to provide assistance to vulnerable populations in the absence of adequate property, agriculture and microinsurance. For example, cash transfers have been made to families that had their dwellings totally or partially destroyed in the 2008 Santa Catarina floods and in the 2011 Rio de Janeiro landslides. In some circumstances these benefits were extended until the affected families were resettled. In addition the Bolsa Estiagem is a program available for supporting small farmers suffering losses due to natural hazards that are not covered by the PROAGRO or the Garantia Safra (previously explained).

Many features of these programs (compensations, duration, sources of funding and other conditions) vary considerably depending on the event and the lack of coordination between them. This could result in high costs for the GoB since different line ministries and institutions might be targeting the same areas and acting without exploring synergies and economies of scale. At present, it is difficult to access the financial data on these transfers since they are managed by different institutions.

The current arrangements for such transfers make it harder for the GoB to optimize the financial management of these programs and create the right incentives for disseminating prevention. Therefore, an extension of the AAL and PML analysis above to this specific spending, both at the national and subnational levels, would be a concrete step towards an improved DRFI strategy. Based on the resulting risk metrics, the line ministries and state secretariats involved could in due course enhance their financial performance. Moreover, this analysis could be used by the Ministry of Planning to explore the possibilities for adopting a centrally-managed risk pool as a basis for a broader DRFI strategy.

CHAPTER 5. OPTIONS FOR DISASTER RISK FINANCING IN BRAZIL

Developing a national DRFI strategy could increase Brazil's financial response capacity to adverse natural events while reducing the associated fiscal burden as response programs become more cost-effective. Brazil may work to strengthen the current risk retention approach by operationalizing a national multi-year disaster fund, by optimizing the insurance subsidies and temporary cash transfers programs, by carrying out detailed fiscal risk assessments, developing catastrophic risk models and by improving the current damage and loss assessment procedures and data management systems.

Disaster risk financing and insurance is a key pillar of a comprehensive DRM (Disaster Risk Management) strategy. As prevention and mitigation efforts cannot fully protect a country against adverse natural events, the main goal of a DRFI strategy is to increase financial response capacity while reducing the fiscal burden generated by the government liabilities associated to natural hazards.

In order to support countries that are vulnerable to natural hazards to design a DRFI strategy adequate to their hazard profiles, the World Bank has developed a DRFI framework (box 5.1) that takes into account different layers of risk that a country might be exposed to and considers the financial instruments that are the most appropriate for financing response to disasters. Countries such as Indonesia, Vietnam, Mexico, Colombia and others have successfully designed and implemented sovereign catastrophe risk financing strategies, as well as risk transfer programs.

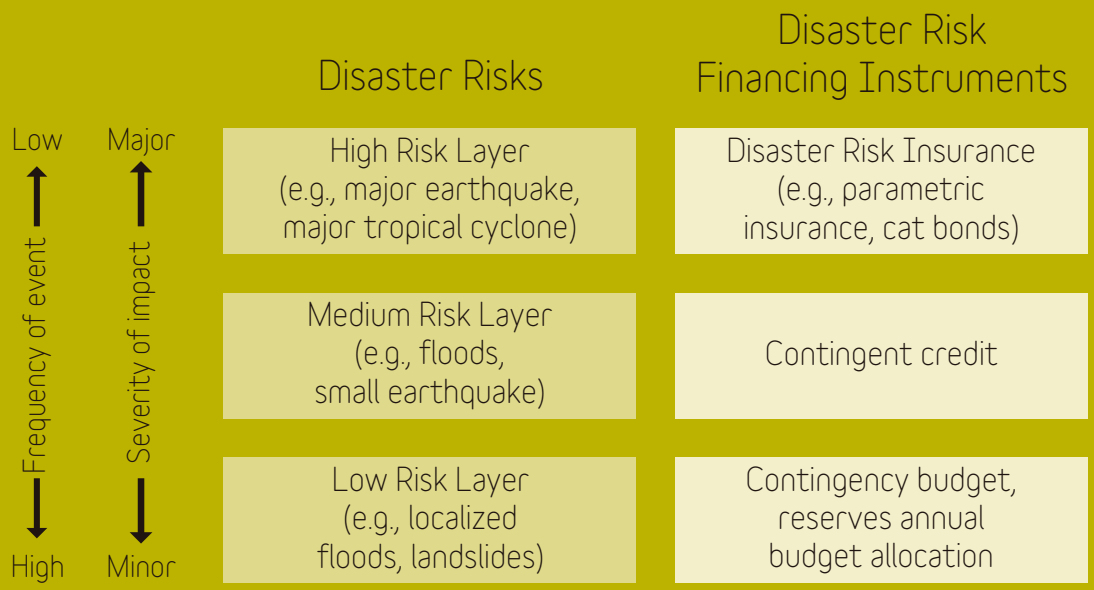
Given Brazil's hazard profile, the low layer of risk (i.e. those associated to small-scale, but more frequent events) may be appropriately prioritized. Addressing these layers of risk call for a risk retention strategy based on reserve funds, budgetary allocations and contingent funds. The design of the details of the risk retention strategy are important to avoid financing gaps and ensure a cost-effective and timely use of disaster response funds, while promoting the right incentives for prevention and the adequate conditions for resilient reconstruction.

Within this context, this chapter lists a set of actions to be considered as part of efforts to establish a broader DRFI strategy in Brazil. Establishing a multi-year financial platform, extending fiscal risk assessments, further understanding the governments liability associated to temporary cash transfers and improving damage and loss assessment procedures and data management systems could be next steps to be taken by government bodies such as the Ministries of Planning, Finance and National Integration.

Box 5.1 The World Bank Framework for Disaster Risk Financing and Insurance

The World Bank has supported countries such as Mexico, Indonesia, Vietnam, and others implementing disaster risk financing and insurance strategies based on the risk-layering approach shown in the figure below.

Figure B.5.1 Three-tier financial strategy against natural disasters



Source: World Bank Disaster Risk Financing and Insurance Program 2010.

The DRFI framework identifies risk layers according to risks in a particular country and then structures different financial tools accordingly:

- Low risk layer (with a return period of up to 4 years): annual budget allocation and contingency budgets could finance more frequent, recurrent and lower losses.

- Medium layer (with a return period of between 4 and 20 years): contingent credit finances less frequent but more severe events.

- High risk layer (return period of over 20 years): low frequent and severe risk can be transferred to the private sector.

Details of a strategy are tailored to each countrys specific features. In Brazil, evidence suggests that the priority should be to improve financial instruments for the low and medium risk layers, since catastrophic events are not the main component of the country's hazard profile.

5.1 IMPLEMENTING A NATIONAL DISASTER FUND

The regular occurrence of financing gaps, the excessive reliance on ex-post funding sources, and a still cumbersome process for disbursement at the local level are some of the issues previously highlighted in the current institutional framework for disaster response. The Ministry of Planning (MPOG) by completing the standard operating procedures and by formalizing the funding flow arrangements between FUNCAP and local institutions, such as the state-level calamity funds, would help address these weaknesses.

Based on this new platform, the MPOG could promote awareness of fiscal impact, as well as support correct capital reserve funds by proposing annual allocations to calamity funds that reflect the AAL and by ensuring that top-ups made for major events meet reconstruction needs. Building on successful international experiences such as the Mexican FONDEN (box 5.2), FUNCAP could become a facility flexible enough to manage disaster related resources in a manner that takes into consideration different liquidity and planning needs, as well as the vertical flow of funds between national and local institutions.

One difficulty that has been precluding FUNCAP from becoming operational concerns the sources of funding. As with the previous proposals presented since its establishment, the current proposal also reserves a share of Federal Government revenues to the fund, but in this case indexed by what is raised from lottery revenues. This particular feature still encounters resistance in the political arena, and the current proposal for FUNCAP likewise might not be approved. Therefore, actually operationalizing FUNCAP will necessarily involve a difficult discussion on how to address the controversial proposal for linking tax revenues to the fund.

Monitoring and accountability mechanisms could be strengthened as a means to reduce reconstruction gaps as well. Improved institutional capacity might increase and speed up access to recovery and reconstruction resources, while reducing corruption and waste. These are factors that might be more important determinants of financing gaps for recovery and reconstruction than the availability of resources per se.

The use of the Civil Defense card is a successful example. It has been used to release and track resources during the emergency stage. If recovery and reconstruction activities were also financed through mechanisms with features similar in nature to those of the Civil Defense Payment card, the related savings may be significant.

Box 5.2 FONDEN: Mexico's National Disaster Fund

In order to handle the continuous need for ex post budget reallocations for disaster response, the Government of Mexico established the Fund for Natural Disasters (FONDEN) in 1996 with the aim of providing adequate financial resources for reconstruction without compromising committed government spending.

Since then, the fund has evolved from an ex ante budgetary tool to a major component of Mexico's disaster risk management strategy. Its operation relies on a framework for damage and loss assessments, resources allocation, funding channels and implementation timelines between federal and state institutions. To manage high variability of disaster losses, since 2004 FONDEN has been allowed to use risk transfer instruments. This is part of the Government of Mexico's DRFI strategy covering different risk of layers to complement the FONDEN's risk retention coverage.

FONDEN finances 100% of the reconstruction of federal assets and 50% of local assets the first time it is required. Since 2006, FONDEN has had a specific program to finance disaster risk reduction activities such as producing risk maps and undertaking small structural interventions. The "build back better" principle that allows for reconstruction at higher standards and the relocation rebuilding of assets was also introduced to FONDEN, as well as an Emergency Relief Fund to cover activities immediately before and after a disaster. A brief comparison between the current FUNCAP structure and the FONDEN is presented in table B.5.2 below.

Table B.5.2. FUNCAP versus FONDEN

	FUNCAP	FONDEN
Objective	Rehabilitation and reconstruction of areas hit by natural catastrophes. Under special circumstances, relief in the aftermath of a disaster.	Relief in aftermath a disaster; Rehabilitation and reconstruction of: • federal and state infrastructure • low-income houses Funding prevention activities such as: • Risk assessment • Risk reduction • Local community capacity building around disaster prevention
Sources of funds	• Voluntary transfers from the Federal Government • Voluntary transfers from states and municipalities • Involuntary transfers from the Federal Government (it must provide three times the funds provided by the local governments)	At least 0.40% of the federal budget
Coverage	100% of reconstruction costs (note that the local governments are responsible for 25% of FUNCAP's funding.	100% of reconstruction costs for federal assets and 50% of those for local assets (this percentage declines if insurance is not purchased for the reconstructed assets)
Funds can be used by	Municipalities and state governments	Federal and State Governments (states traditionally restores municipal assets)

Source: World Bank, 2013b and author's compilation

5.2 OPTIMIZING SUBSIDIES AND TEMPORARY CASH TRANSFER PROGRAMS

Agricultural insurance is relatively well established in Brazil, and since 2003 a subsidies program (PSR) supports the observed increase in penetration rates. In addition, public transfers solutions for small farmers are also commonly used. Apart from in the agriculture sector, temporary cash transfers are used as a response to damage in the housing sector. Funded by the Federal Government (with some exceptions in the housing sector), linking these programs to a broader DRFI strategy could increase their cost-effectiveness.

As mentioned above, financial management of the subsidies program (PSR) has been challenging, which may curtail expansion of agricultural insurance penetration in the country. Assessing the government subsidy programs for natural hazard insurance, particularly in the agriculture sector (PSR), and updating these schemes after defining the optimal relationship between insurers, banks, beneficiaries, and the Government, could provide the condition for expanding coverage at reduced cost.

Cost-effectiveness in the temporary cash transfers, both in the agriculture and housing sectors, may be enhanced by a better understanding of the contingent liabilities (AAL and PML) associated to the cash transfer programs such as the PROAGRO, Garantia Safra, Bolsa-Estiagem, and the cash transfers for temporary housing programs. The possibility of consolidating these payments into a stand-alone risk pool that can be managed through risk retention or risk transfer schemes may also be considered.

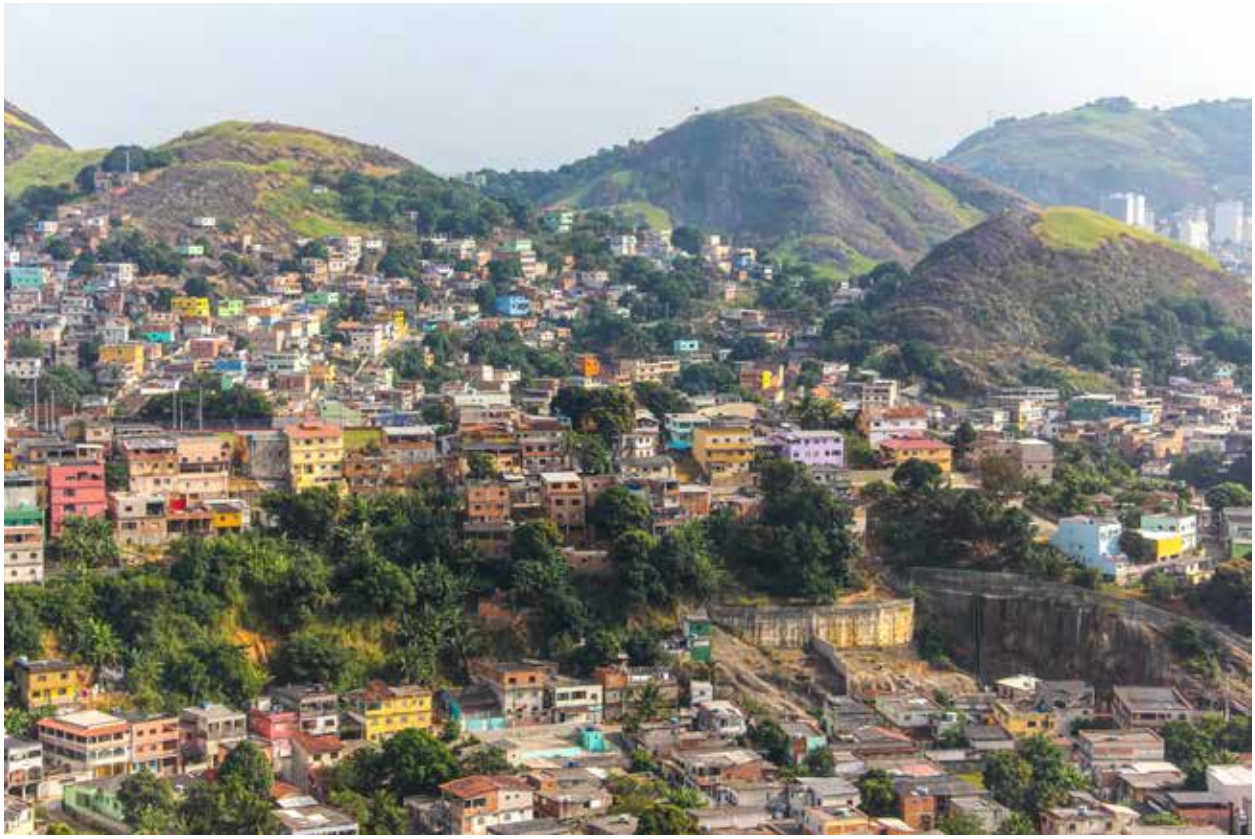
5.3 IMPROVING FINANCIAL RISK ASSESSMENT ANALYSIS AND DEVELOPING CATASTROPHE RISK MODELS

Countries such as Colombia, Mexico and Honduras have been updating and strengthening their DRFI strategies. To do this they have carried out fiscal risk assessments and developed catastrophe risk models to assess contingent liabilities associated to more severe, but less

frequent, events that cannot be analyzed based on historical data.

The financial risk assessment presented in Chapter 2 is a preliminary analysis based on incomplete historical series of disaster material losses. The data does not account for many of the less severe but frequent events that characterize Brazil's hazard profile. Therefore, in order to successfully design and implement a broader DRFI strategy, it is recommended that the MPOG and MoF carry out an improved fiscal risk assessment, potentially focused at the State level. The resulting risk metrics could then be used to inform how transfers to local governments should be managed and in the budgetary management of the FUNCAP.

Beyond assessing damage and losses from actual events, the development of a national exposure database and hazard modules for major perils would be very useful for policy makers interested in assessing the fiscal impacts of specific or possible events. They could be used, for example, by the Ministries of Planning and Finance to develop financial catastrophe risk models and use them to prepare annual budgets and analyze risk transfer strategies. In fact, a recent trend has been to produce hybrid LEC curves that use



both historical data and hazard modelling to assess the PML associated to both high frequency and rare events. This information would also be useful for private insurers interested in offering affordable catastrophe insurance to improve product development and pricing methods. This would be a more costly initiative however that, if not feasible in the short-run, could be maintained as a medium-term goal.

5.4 ENHANCING DISASTER DATA MANAGEMENT SYSTEMS AND DAMAGE AND LOSS ASSESSMENT PROCEDURES

Adopting an objective damage and loss assessment methodology would provide both (i) a clear guideline for allocating disaster response funds, and (ii) the appropriate basis for the data collection efforts that are needed to keep track of the historical material losses, which in turn are inputs required to design and update a DRFI strategy.

Allocating response resources based on damage and loss assessment methodology can help to speed up disbursement processes and keep track of disbursed resources. The idea is that the use of a damage and loss assessment methodology based on objective cost estimates can support the objective allocation of funds and reduce political competition for resources in the aftermath of a disaster: when the criteria are not well defined, line Ministries and local Governments might overestimate their funding needs knowing that the requested amount will not be fully allocated. If an objective damage and loss assessment methodology and resources tracking systems are adopted, rationalizing post-disaster funding allocation and disbursement could become an easier task.

Once again Mexico provides a good example of how improving damage and loss assessment procedures has helped to strengthen the country's response capacity. In Mexico, a damage assessment committee (DAC) is established before the declaration of natural disaster is formally issued (24 hours following the technical confirmation of a disaster). The DAC comprises sectorial subcommittees composed of members of both federal and local institutions. Each subcommittee has a maximum of 20 working days to complete fieldwork, to document and photograph (using GIS devices) damage, and to itemize reconstruction needs and the related costs. While the full damage assessment is being completed,

federal and local agencies have 7 days to request funding for the emergency phase, which guarantees immediate liquidity and at the same time enables the DAC to complete the full damage and loss assessment free from the pressure for immediate resources.

The MI has already taken important steps in this same direction: a simplified version of the damage assessment form has been recently implemented to allow for timely provision of funds in the immediate aftermath of a disaster. A series of training sessions on the DaLA (Damage and Loss Assessment Methodology) was provided to the Finance and Planning State Secretariats, as well as to local Civil Defense institutions. Meanwhile discussions on standardizing damage and loss assessment procedures continue at the national level. Future discussions could focus on how to establish a standard damage and loss assessment procedure, how to track historical material losses, and how to ensure that this information is made available to planning and finance institutions to facilitate designing, updating and assessing of a national DRFI strategy for Brazil.

As for the availability and quality of data on historical material disaster losses, it was necessary to rely on very restrictive assumptions in order to carry out the preliminary analysis presented above. Despite every effort to make reasonable assumptions, the results obtained might be sensitive to changes in these hypotheses, with possible implications on how a financial strategy for disaster response should be calibrated to the country's hazard profile. A consolidated data set on disaster material losses could therefore be a valuable input in the design of a DRFI strategy.

The private insurance sector could also benefit by improving agriculture and property insurance pricing, expanding coverage and reducing prices. As a result, (i) the PSR (agricultural insurance subsidies) could become more cost-effective and (ii) a higher coverage of property insurance in the commerce and industry sectors could also reduce the Governments liability regarding these sectors.

By consolidating the historical material losses this would also inform the MI about the main issues involved in the current damage and loss assessment procedures: as flaws in the historical series are detected, the current system could be updated to prevent these same flaws from infecting future data. The Ministry of National Integration has already taken steps to build disaster historical data, but only information on the human toll has been made available to date. Taking the next step and providing data on historical material losses could generate the positive abovementioned externalities.

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ANNEX 1. STATE AND MUNICIPAL DISASTER FUNDS

Brazil: Overview of Local Calamity Funds

Sub-national Unit	Level of Government	Name	Creation	Does it finance prevention?	Does it receive funds from any binding tax revenue?
Santa Catarina	State	FUNDEC	1990	Yes	Yes
Rio Grande do Sul	State	FUNDEC	2010	Yes	No
Rio de Janeiro	State	FECAP	2011*	No	No
Minas Gerais	State	FUNECAP	1977	No	No
Belo Horizonte	Municipal	FEMCAP	1979	No	No
Florianópolis	Municipal	FUMDEC	2008	Yes	No
São Luís	Municipal	FUNDEC	1996	Yes	No
Blumenau	Municipal	FUNMDEC	2000	Yes	No
Osasco	Municipal	FUMDECO	2005	Yes	No
Guarulhos	Municipal	FMDC	2012	Yes	No
Joinville	Municipal	FUMPROC	2011	Yes	No
Itajaí	Municipal	FUNMDEC	2009	Yes	No
Juiz de Fora	Municipal	FMECAP	1986	-	No
Balneário Camboriú	Municipal	FMAS	2011	-	-
São Leopoldo	Municipal	Special Account	2006	No	No
Lages	Municipal	FUMDEC	2010	Yes	No
Caxias do Sul	Municipal	FUMDEC	2006	Yes	No
Novo Hamburgo	Municipal	FUMDEC	2004	Yes	No
Ponta Grossa	Municipal	FUMDEC	2012	Yes	Yes
SeteLagoas	Municipal	FUNSOCIAL	1984	No	No
RibeirãoPreto	Municipal	FUMDEC	2010	-	No
Brusque	Municipal	FUNDEC	2008	-	No
Atibaia	Municipal	-	2013*	Yes	No
Tubarão	Municipal	FUMCAP	2011	Yes	No

* Law Proposition

Source: author's elaboration based on official records.

ANNEX 2. FUNDING GAP ANALYSIS

Values Before In-year Reallocations (R$ current million)

Year	Federal and State Budget Resources	Estimated Government Liability (Low Cost)	Funding Gap (Low)	Estimated Government Liability (Medium Cost)	Funding Gap (Medium)	Estimated Government Liability (High Cost)	Funding Gap (High)
2006	655	1,068	-414	2,018	-1,364	3,107	-2,452
2007	810	1,451	-641	2,756	-1,946	4,268	-3,458
2008	869	1,828	-959	3,409	-2,540	5,353	-4,485
2009	1,396	3,251	-1,855	5,961	-4,564	9,357	-7,961
2010	1,043	2,713	-1,670	5,054	-4,011	7,816	-6,772

Values After In-year Reallocations (R$ current million)

Year	Federal and State Budget Resources	Estimated Government Liability (Low Cost)	Funding Gap (Low)	Estimated Government Liability (Medium Cost)	Funding Gap (Medium)	Estimated Government Liability (High Cost)	Funding Gap (High)
2006	940	1,068	-129	2,018	-1,079	3,107	-2,167
2007	1,609	1,451	158	2,756	-1,147	4,268	-2,659
2008	2,878	1,828	1,050	3,409	-531	5,353	-2,476
2009	4,032	3,251	781	5,961	-1,929	9,357	-5,325
2010	5,499	2,713	2,786	5,054	444	7,816	-2,317

ANNEX 3. ASSESSING THE RISK PROFILE OF BRAZIL

The objective of this Technical Note is to develop a risk profile for natural hazards for the whole country of Brazil. The Risk Profile will include metrics about Average Annual Loss (AAL) and Loss Exceedance Curves at the aggregate level of Public and Private sectors.

The analysis presented below is based on the historical and adjusted EM-DAT dataset and by simulating[21] 100,000 years of losses on the ground of conservative criteria[22]. Given Brazil's hazard profile (a low, but increasing, frequency and severity of events) and the lack of natural disaster modelling[23] a particular procedure is proposed and can be replicated in other countries that share those circumstances.

There are two main restrictions to perform a Risk Profile analysis for Brazil: the lack of complete historical databases at national level and the lack of natural hazard modelling.

However, it was possible to have access to two sources of information:

The EM-DAT database: records disasters, as defined, since 1948. It is important to notice that the criteria[25] used to define a disaster are as follows:

- Ten (10) or more people reported killed.

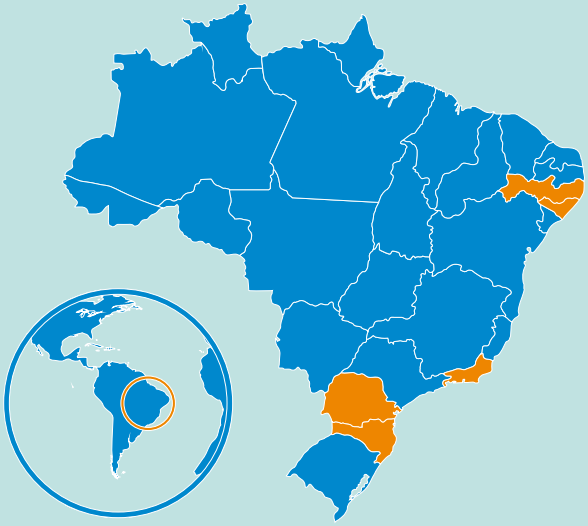
- Hundred (100) or more people reported affected.

- Declaration of a state of emergency.

- Call for international assistance.

State-level historical losses: It was possible to access historical loss information for five states: Pernambuco, Alagoas, Rio de Janeiro, Parana and Santa Catarina, as projected in the Figure A.3.1. Using some of this information it was possible to develop a proxy for the missed left hand side of the loss distribution at national level.

Figure A.3.1: Map of Brazil with projected States



Finally, given the lack of availability of natural disaster modelling, by fitting continuous, fat right-hand side theoretical distributions, it was developed the complete loss distribution.

PROCEDURE PROPOSED

EM-DAT database[24]

The EM-DAT database contains information on both natural and man-made disasters; therefore the information about man-made disaster was removed. A descriptive analysis of the database is provided in section 2.4, this technical note focus on the development of the AAL and LEC.

We are particularly interested in the financial values of the EM-DAT (field Est. Damage) and use it in the aggregate as an indication of the Aggregate Annual Loss. The version of the database used is Current Values in US$ million. The time series starts in 1948 and ends in 2012, and as can be observed in Table A.3.5, from the 65 years only 31 years record losses.

21 Simulation was based on a Pearson VI distribution using @Risk.
22 Under the assumption of a Pearson distribution on the mixed historical losses, the expected annual loss is slightly under-estimated while the average obtained with the same distribution obtained with the EM_DAT is slightly over-estimated. The EM_Pearson estimation, applied to the EM-DAT, of the AAL is preferred on the ground of conservative criteria.
23 In year 2000 EQECAT produced a model for wind and in year 2009 EQECAT and RMS produced an earthquake model, but in the past 60 years there is almost no historical record of such events.
24 EM-DAT: The OFDA/CRED International Disaster Database – www.emdat.be – Université catholique de Louvain – Brussels – Belgium.
25 For more details see: http://www.emdat.be/criteria-and-definition

State-level historical losses

A methodology[26] was used in order to extrapolate possible national-level government losses using state-level losses. Basically the extrapolations to national level was made by using states-level data about affected people, damaged and destroyed houses and damaged and destroyed schools and hospitals.

The aggregate values for the years 1991-2010 can be found in table A.3.6, which are expressed in current US$ million and with three assumptions about the cost.

It is important to note that for this 20 years period estimation the EM-DAT database records no loss in six years, i.e. a 30%. Besides that, as several relevant drought events are not recorded in this dataset (and given the relevance of this type of event for the Brazil's hazard profile), it is important to keep in mind that the metrics obtained should be seen as lower bounds to be refined as detailed and comprehensive data becomes available.

This is a natural situation since the EM-DAT records only the disasters as per its definition. The two secondary effects are:

- The loss distribution obtained from EM-DAT is not conditional on the occurrence of a disaster, therefore the years with no records should be no considered in order to not underestimate the risk metrics.

- The loss distribution obtained from EM-DAT is censored (in its left hand side tail) by its definition of disaster. So it makes sense to explore some form of joining both sources of information.

Distributions fitting[27]

In order to account for both inflation and increase in the exposure, the current values were adjusted by a factor[28] obtained by: $\frac{GDP_{2012}}{GDP_{year}}$, the GDP figures was obtained from the web-site of the World Bank[29].
Such factor was applied to three main datasets:

1) EM-DAT

2) Extrapolation from States

3) Mixing the two previous datasets by considering the maximum value observed in each particular year .The maximum amount was used instead of adding up the values to avoid double counting.

The following is a summary of some statistics obtained from such datasets:

Table A.3.1: Summary of historical losses under different assumptions

Statistic	EM_Act	States_ Low_Act	States_ Med_Act	States_ High_Act	Low_Act	Me- dium_Act	High_Act
Minimum	8.79	0.42	0.80	1.24	0.42	0.80	1.24
Maximum	25,802.31	2,268.40	4,159.06	6,528.88	25,802.31	25,802.31	25,802.31
Mean	3,611.17	1,046.53	1,949.54	3,019.49	3,374.46	3,805.22	4,313.44
StdDev	6.34E+03	6.65E+02	1.24E+03	1.93E+03	5.80E+03	5.68E+03	5.61E+03
C.V.	1.76	0.64	0.64	0.64	1.72	1.49	1.30

Note: Amounts in US$ million, values at 2012 prices.

26 More details about the methodology in section x2.
27 The fitting was made using the software @Risk.
28 ASEAN Advancing Disaster Risk Financing and Insurance in ASEAN Member States: Framework and Options for Implementation, Vol. 1: Main Report. The World Bank.
29 See http://data.worldbank.org/indicator/NY.GDP.MKTP.CD

The expected value obtained in EM-DAT is higher (with the exception of Medium_Act and High_Act) than the calculated with the other distributions, the maximum annual loss observed in EM_DAT is greater than or equal to the other six distributions. Anyway, the coefficient of variation of EM_DAT is greater than the obtained for the other six distributions.

For each of the seven datasets a fitting was made, the three best ranked-by fit test[30]- distributions for each dataset are as follows:

Table A.3.2.: Summary of distributions fitted

Dataset	Distribution 1	Distribution 2	Distribution 3
EM_ACT	Loglogistic(8.5,797.48,0.74899	Pearson6(0.44106,2.315 1,11610,RiskShift(8.5))	Lognorm(14002.7,305 255.5,RiskShift(8.5))
States_Low_Act	Expon(1046.1,RiskShift(0.4))	Lognorm(29904.5,2639 251.6,RiskShift(0.4))	Pareto(0.14443,0.4)
States_Med_Act	Expon(1948.7,RiskShift(0.8))	Lognorm(144307.1,3639 3082.6,RiskShift(0.8))	Pareto(0.1459,0.8)
States_High_Act	Expon(3018.3,RiskShift(1.2))	Lognorm(94576.9,9259 850.9,RiskShift(1.2))	Pareto(0.14522,1.2)
Low_Act	Pearson6(0.58106,2.4647 ,8854.7,RiskShift(0.4))	Loglogis- tic(0.4,1198.1,0.92016)	Lognorm(17249.3,333 720.7,RiskShift(0.4))
Medium_Act	Pearson6(0.53249,9.6256 ,61669,RiskShift(0.8))	Loglogis- tic(0.8,1660.8,0.89407)	Expon(3804.4, Shift(0.8))
High_Act	Expon(4312.2,RiskShift(1.2))	Loglogis- tic(1.2,2091.1,0.90745)	Lognorm(27073.9,525 682.8,RiskShift(1.2))

Based on the fit tests, rationale of the result and a conservative approach it was defined that the Pearson Type VI distribution[31], when applied to the EM_DAT dataset, provides with a reasonable picture about the Brazil's risk profile.

Another fit with reasonable results was obtained, again, with a Pearson Type VI distribution when applied to the mixture of Low estimation from States and the EM_DAT, that is, to Low_Act. However the figures obtained for the Average Annual Total Loss and the Loss Exceedance Curves are less conservatives than the obtained with EM_DAT.

RESULTS OBTAINED

Based on the historical and adjusted EM-DAT dataset and by simulation[32] 100,000 years of losses for the two best distributions obtained we have the following:

30 There are: Akaike, Bayesian, Chi-square, Kolmorogov-Smirnov and Anderson-Darling tests.

31 The pdf is defined by: $f(x)=\frac{1}{\beta B(\alpha_1+\alpha_2)}\cdot\frac{(x\beta)^{\alpha_1-1}}{\left(1+\frac{x}{\beta}\right)^{\alpha_1+\alpha_2}}$, where a_1 and a_2 are shape parameters, b is scale parameter and B() is the Beta function.

Table A.3.3.: Statistics on EM-DAT and simulation

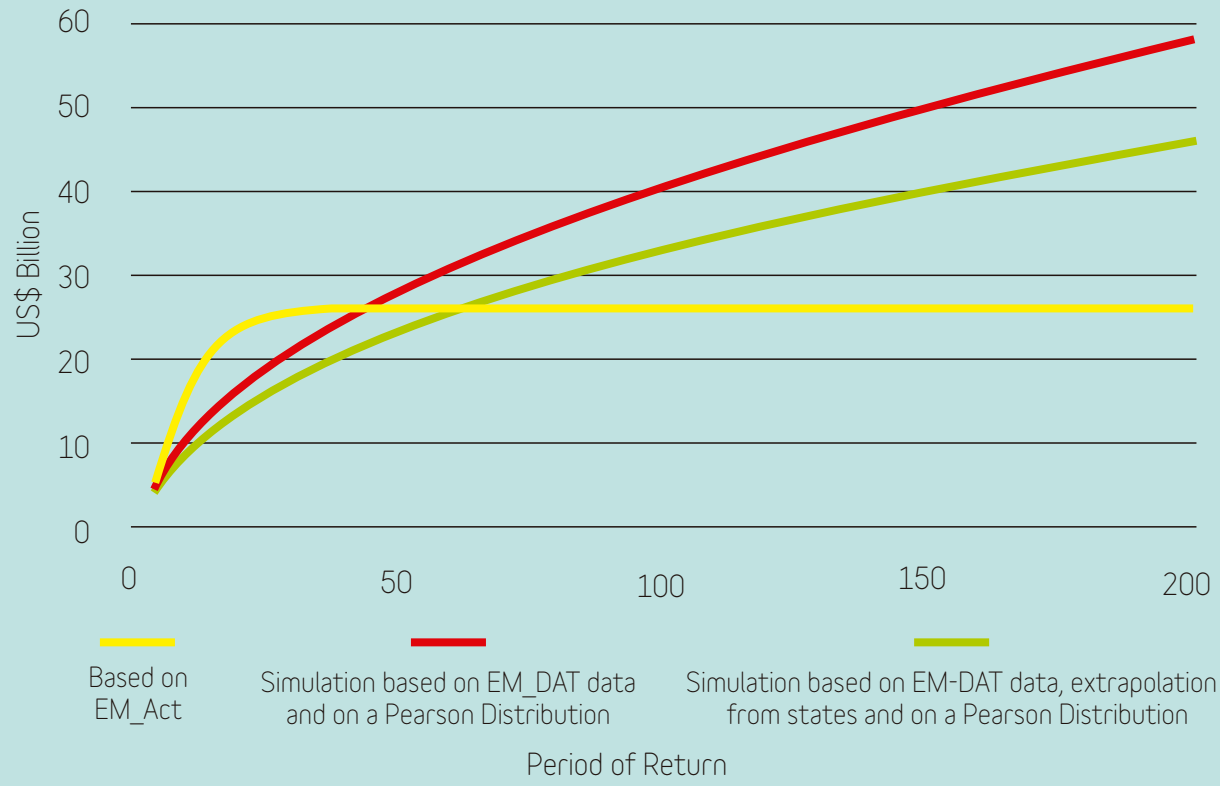
Statistic	EM_Act	EM_Pearson	Low_Pearson
Minimum	8.79	8.50	0.40
Maximum	25,802.31	1,212,757.24	822,210.89
Expected Value	3,611.17	3,896.85	3,511.10
StdDev	6.34E+03	1.16E+04	8,812.64
C.V.	1.76	2.98	2.51

Under the assumption of a Pearson distribution on the mixed historical losses, the expected annual loss is slightly under-estimated while the average obtained with the same distribution obtained with the EM_DAT is slightly over-estimated.

The EM_Pearson estimation, applied to the EM-DAT, of the AAL is preferred on the ground of conservative criteria.

With respect the loss Exceedance curves we have the following:

Figure A.3.2.: Loss Exceedance Curves



32 Simulation was made with @Risk, Pearson VI distribution is not supported in Excel.

Table A.3.4.: Loss Exceedance Curve (Historical, Simulated)

Period_of_Return	EM_Act	EM_Pearson	Low_Pearson
5	5,073	4,857	4,637
10	14,173	9,397	8,416
15	20,756	12,843	11,215
20	23,253	15,708	13,512
25	24,613	18,201	15,493
30	25,519	20,430	17,254
35	25,802	22,459	18,851
40	25,802	24,335	20,318
45	25,802	26,079	21,679
50	25,802	27,720	22,953
75	25,802	34,793	28,410
100	25,802	40,639	32,869
125	25,802	45,701	36,698
150	25,802	50,208	40,124
175	25,802	54,307	43,205
200	25,802	58,087	46,041
225	25,802	61,628	48,665
250	25,802	64,912	51,152
275	25,802	68,048	53,466
300	25,802	71,060	55,652

Note: amounts in US$ million, 2012 prices.

The historical maximum annual loss observed in the last 50 years is US$25.8 billion, as with the AAL estimation, we have that the value obtained using the fitted EM_DAT (for a period of return equal to 50 years) is 7% higher but for the mixed data is lower by 11%.

Again, on the ground of a conservative approach, the estimation obtained with the EM-DAT database is preferred.

Period of Return	Probability of event in a given year	Total PML	Public PML	Period of Return	Probability of event in a given year	Total PML	Public PML
5	20.00%	4,857	1,943	75	1.33%	34,793	13,917
10	10.00%	9,397	3,759	100	1.00%	40,639	16,256
15	6.67%	12,843	5,137	125	0.80%	45,701	18,280
20	5.00%	15,708	6,283	150	0.67%	50,208	20,083
25	4.00%	18,201	7,280	175	0.57%	54,307	21,723
30	3.33%	20,430	8,172	200	0.50%	58,087	23,235
35	2.86%	22,459	8,984	225	0.44%	61,628	24,651
40	2.50%	24,335	9,734	250	0.40%	64,912	25,965
45	2.22%	26,079	10,432	275	0.36%	68,048	27,219
50	2.00%	27,720	11,088	300	0.33%	71,060	28,424

COMPLIMENTARY DATA: HISTORICAL AGGREGATE ANNUAL LOSSES, CURRENT AND ADJUSTED

Table A.3.5.: EM-DAT database Aggregate Annual Loss

Year	EM_DAT	Year	EM_DAT	Year	EM_DAT
1948	0	1970	46.1	1992	25.8
1949	0	1971	5.2	1993	0
1950	0	1972	0	1994	566
1951	0	1973	16	1995	3
1952	0	1974	121	1996	0
1953	0	1975	854.9	1997	0
1954	0	1976	0	1998	159
1955	0	1977	0	1999	0
1956	0	1978	2,300.00	2000	75
1957	0	1979	0	2001	45
1958	0	1980	0	2002	11
1959	0	1981	0	2003	303
1960	0	1982	0	2004	2,000.37
1961	0	1983	350	2005	0
1962	0	1984	2,000.00	2006	0
1963	0	1985	851	2007	125
1964	0.5	1986	5	2008	1,013.00
1965	17	1987	62	2009	745
1966	60.94	1988	1,030.00	2010	802
1967	15.3	1989	0	2011	0
1968	0	1990	0	2012	0
1969	5.77	1991	2		

Note: current US$ million

Table A.3.6.: Country-wide estimation of losses based on States data

Year	Low_Cost	Medium_Cost	High_Cost
1991	0.39	0.74	1.13
1992	0.51	0.96	1.53
1993	0.08	0.16	0.24
1994	101.23	180.88	282.1
1995	312.52	587.54	906.44
1996	169.05	321.11	498.72
1997	365.86	670.45	1,047.82
1998	395.56	727.53	1,117.44
1999	150.49	284.88	434.72
2000	209.83	368.89	571.69
2001	404.23	748.37	1,147.21
2002	330.53	629.72	965.61
2003	391.93	716.21	1,094.00
2004	587.99	1,108.05	1,747.95
2005	634.66	1,211.69	1,858.66
2006	490.94	927.45	1,427.55
2007	745.26	1,415.37	2,191.75
2008	995.26	1,855.97	2,914.60
2009	1,631.49	2,991.29	4,695.71
2010	1,542.76	2,874.22	4,444.52

Note: current US$ million

Table A.3.7.: EM-DAT Data to fit

Year	EM_Act	Year	EM_Act
1964	53.1	1988	7,022.59
1965	1,757.47	1991	11.06
1966	5,072.65	1992	148.81
1967	1,126.63	1994	2,334.18
1969	346.99	1995	8.79
1970	2,453.43	1998	424.46
1971	238.06	2000	262.06
1973	454.63	2001	183.12
1974	2,592.57	2002	49.14
1975	15,567.15	2003	1,235.47
1978	25,802.31	2004	6,788.84
1983	3,878.09	2007	206.01
1984	21,554.13	2008	1,380.04
1985	8,598.70	2009	1,035.84
1986	42.01	2010	843.03
1987	474.92		

Note: current US$ million

Table A.3.8.:Extrapolation from States, Data to fit

Year	States_Low_Act	States_Med_Act	States_High_Act
1991	2.17	4.1	6.24
1992	2.95	5.51	8.82
1993	0.42	0.8	1.24
1994	417.46	745.96	1,163.39
1995	915.54	1,721.20	2,655.45
1996	453.53	861.47	1,337.95
1997	946.01	1,733.58	2,709.36
1998	1,055.97	1,942.21	2,983.11
1999	577.67	1,093.49	1,668.66
2000	733.16	1,288.94	1,997.55
2001	1,644.91	3,045.29	4,668.28
2002	1,476.69	2,813.33	4,313.98
2003	1,598.07	2,920.30	4,460.72
2004	1,995.53	3,760.49	5,932.18
2005	1,620.61	3,094.06	4,746.10
2006	1,015.63	1,918.64	2,953.20
2007	1,228.24	2,332.62	3,612.15
2008	1,355.87	2,528.44	3,970.64
2009	2,268.40	4,159.06	6,528.88
2010	1,621.68	3,021.25	4,671.89

Note: current US$ million

Table A.3.9.: MAX[EM-DATyear, extrapolation from statesyear], Data to fit

Year_WD	Low_Act	Medium_Act	High_Act
1964	53.1	53.1	53.1
1965	1,757.47	1,757.47	1,757.47
1966	5,072.65	5,072.65	5,072.65
1967	1,126.63	1,126.63	1,126.63
1969	346.99	346.99	346.99
1970	2,453.43	2,453.43	2,453.43
1971	238.06	238.06	238.06
1973	454.63	454.63	454.63
1974	2,592.57	2,592.57	2,592.57
1975	15,567.15	15,567.15	15,567.15
1978	25,802.31	25,802.31	25,802.31
1983	3,878.09	3,878.09	3,878.09
1984	21,554.13	21,554.13	21,554.13
1985	8,598.70	8,598.70	8,598.70
1986	42.01	42.01	42.01
1987	474.92	474.92	474.92
1988	7,022.59	7,022.59	7,022.59
1991	11.06	11.06	11.06
1992	148.81	148.81	148.81
1993	0.42	0.8	1.24
1994	2,334.18	2,334.18	2,334.18
1995	915.54	1,721.20	2,655.45
1996	453.53	861.47	1,337.95
1997	946.01	1,733.58	2,709.36
1998	1,055.97	1,942.21	2,983.11
1999	577.67	1,093.49	1,668.66
2000	733.16	1,288.94	1,997.55
2001	1,644.91	3,045.29	4,668.28
2002	1,476.69	2,813.33	4,313.98
2003	1,598.07	2,920.30	4,460.72
2004	6,788.84	6,788.84	6,788.84
2005	1,620.61	3,094.06	4,746.10
2006	1,015.63	1,918.64	2,953.20
2007	1,228.24	2,332.62	3,612.15
2008	1,380.04	2,528.44	3,970.64
2009	2,268.40	4,159.06	6,528.88
2010	1,621.68	3,021.25	4,671.89

Note: current US$ million

ANNEX 4. DISASTER RELATED PUBLIC EXPENDITURE

This technical appendix presents the details on how the disaster related public expenditures dataset was built. Section A.4.1 briefly introduces the current Brazilian budgetary framework and section A.4.2 explains how, building on this framework, it was possible to create proxies for the disaster related public expenditures of both the GoB and the local governments.

A.4.1 AN INTRODUCTION TO THE BRAZILIAN BUDGETARY SYSTEMS

According to the 1988 Constitution, the Union is responsible for permanent defense against public disasters, i.e. through civil defense actions. Since the new Constitution was introduced (1988) certain important laws have been consolidated in the realm of financial accountability, especially the Law of Fiscal Responsibility (Supplementary Law No. 101 of 2000). Federal resources and actions can be best elucidated from the governments own budgetary Laws.

Federal Government: Budgetary classification of disaster prevention and relief expenditures. Public spending falls into three main categories: economic, institutional and functional/programmatic. The economic classification is the most relevant for the macro-classification of expenditure (e.g. to distinguish current from capital expenditure). The institutional classification allows for the identification of sources of funds and their destination among the public sector agencies. In order to identify the expenditure on disasters, the functional/programmatic category provides information regarding the purpose for which the spending is being designated. A summary of the different categories in the functional/programmatic classification is provided below:

Table A.4.1. Functional/programmatic expenditure categories

Category	Description
Function	Function is related to the institutional mission of the agency responsible for the administration and execution of the activities in the area. In the case of the Federal Government, function is closely related to the work of line ministries.
Sub-function	This represents the area of work in a more detailed way, but it is not limited to a subset of the category 'function'. A sub-function can be related to several functions (for instance, the sub-function "education", related to the Ministry of Education, includes the sub-function "early childhood education", but the same sub-function exists under "legislative" which covers any activity related to the Congress.
Program	This is the articulation of a group of activities aimed at solving a problem or to meet a specific need or demand of society; the program integrates the plans set out in the budgetary laws and in the actual budget.
Activity	Activities are operations from which products (goods or services) result. They contribute to achieve the goals of a program.
Subtitle	This is an indicator of the activity localization, the place where the activity was implemented. It can provide relevant information, but the description criterion is not standardized. Therefore it is important use this classification as a reference with great care.

Source: National Expenditure Manual, 2008.

A.4.2 DISASTER RELATED PUBLIC EXPENDITURE

Of these expenditure categories, sub-function, program and activity were used to identify disaster-related expenditure. The first basic criterion of spending includes the traditional sub-function of Civil Defense (sub-function 182), which includes specific Civil Defense programs, Nuclear Security programs and some minor training activities designed to prepare personnel for work during emergencies. This sub-function might be sufficient for estimating the actual spending given that it is the criterion used by the government itself. It is not however a strict classification, and expenditure under different budget lines can also be interpreted as being related to disasters.

By analyzing programs and activities it was possible to identify other disaster-related expenditure, such as emergency works on roads and highways and in areas where housing was at risk, using as references the descriptions in the Multi-annual Plans (PPAs) and the annual budget bills (LOAs). Another group of expenditure that could be considered involves the use made of the army in civil defense activities such as Program 0636 "Assistance and Cooperation of the Army for Civil Society". However, this program does not clearly delineate the target of the expenditure: none of the expenditure categories presented could point to the activity compatible with the expenditure related to civil defense. Given that these programs did not represent a significant part of the total amount, and in order to avoid overestimation in the series, they were disregarded. The following table summarizes all the programs and activities taken into consideration in building the expenditures series, including: I) traditional civil defence programs (under sub-function 182); II) spending on nuclear safety registered separately, given its unique and specific expenditure; III) spending out of sub-function 182, interpreted as disaster-related activities.

Table A.4.2. Programs selected to build the expenditure series on disasters in the period 2001-2012

PROGRAM	PERIOD*	ACTIVITIES
Civil defense programs (including expenditure of sub-function 182 and others)		
0667 – Civil Defense	2001 to 2003	All included in the program
1027 – Prevention and preparedness for Emergency and Disasters	2004 to 2011	All included in the program
1029 – Disaster Response	2004 to 2011	All included in the program
2040 – Risk Management and Disaster Response	2012	All included in the program
Use of auxiliary forces (include expenditures only in sub-function 182)		
8032 – Training, and support of Armed Forces	2005 to 2006	All included in sub-function 182
2070 – Public Safety and Citizenship	2012	All included in sub-function 182
Works in high-risk areas (not included in the sub-function 182. Included in other sub- functions)		
1128 – Urbanization, land-titling and slum integration	2005 to 2012	0572 – Support for risk prevention and eradication in slums
Works on roads and highways (not included in sub-function 182. In other sub-functions)		
0220 – Maintenance of the Federal Highway Network	2001 to 2012	2841 – Highways preventive, routine, and emergency maintenance 5384 – Highways Emergency Works (there are other equivalent activities over the years with different names, but always referred to as "emergency works")
0663 – Public Safety on Federal Highways	2001 to 2012	5394 – Elimination of Critical Points
Nuclear Safety (includes expenditure only in sub-function 182)		
0504 – Nuclear Safety	2001 to 2003	All included in sub-function 182
1113 – National Program on Nuclear Activities	2004 to 2011	All included in sub-function 182
2059 – Nuclear Policy Program	2012	All included in sub-function 182

Source: SIGA Brasil, Multiannual Plans (PPAs) (2000-2003, 2004-20007, 2008-2011 and 2012-2015) and the Annual Budgetary Laws (LOAs) (2001 to 2012).

*Refers to the period covered by the Multiannual Plan (PPA). Programs can include expenditure in other fiscal years because of the RAP.

Given this budgetary framework it was possible to approximate a data series for disaster- related public expenditure, numbers that for many years have been obscured by a complex budgetary system. Tables A.4.3 and A.4.4 present the estimated series for the Federal Government. As mentioned above, the lack of planning was a main feature in Brazil up to 2011. In 2012 Federal Government resources allocated in the regular budget significantly increased, although additional resources were needed and extraordinary credits issued.

Table A.4.3. Budgetary allocations for disaster-related policies (Current R$ 1.00)

Year	Initial Allocation	Authorized	Additional Credits	Supplementary Credits	Special Credits	Extraordinary Credits
2001	345,444,707	864,477,307	519,032,600	-	-	511,000,000
2002	421,196,385	860,680,673	439,484,288	-	-	445,771,404
2003	223,486,351	385,164,321	161,677,970	-	-	-
2004	333,211,000	575,236,698	242,025,698	105,500,000	-	135,242,698
2005	210,245,076	455,695,566	245,450,490	-	1,000,000	217,235,590
2006	204,758,291	812,765,476	608,007,185	19,681,440	-	590,706,414
2007	305,995,000	1,719,242,768	1,413,247,768	2,825,000	-	1,424,040,768
2008	124,681,108	1,786,725,954	1,662,044,846	3,561,489	-	2,018,483,357
2009	371,892,235	2,964,661,517	2,592,769,282	120,000	-	2,806,222,388
2010	170,008,718	3,873,300,086	3,703,291,368	-	-	4,050,799,483
2011	137,459,479	1,956,041,179	1,818,581,700	16,515,453	-	1,857,581,700
2012	2,080,959,659	5,754,478,039	3,673,518,380	632,096,694	90,000,000	3,025,768,707

Source: author's elaboration with original data from SigaBrasil.

Despite the need for additional resources, by the end of the year disbursements (R$ 1.8 billion) amounted to less than the initial allocation (R$ 2 billion), at levels way below the total (R$ 5.75 billion) allocations.

Table A.4.4. Expenditure stages for disaster-related policies (current R$ 1.00)

Year	Committed	Acquisition, verification and certification	Actual acquisition, verification and certification	Payments
2001	804,583,574	563,923,589	696,093,149	695,456,645
2002	704,204,300	492,429,202	715,404,318	641,304,617
2003	252,164,645	151,230,309	194,941,299	173,795,869
2004	382,117,929	179,380,648	255,065,182	339,668,010
2005	411,484,282	234,362,300	398,493,456	389,665,256
2006	562,802,405	290,311,932	413,290,093	432,477,969
2007	1,357,974,864	715,417,447	1,040,269,364	1,036,812,779
2008	1,046,482,371	459,869,267	869,302,261	885,510,562
2009	2,178,112,059	1,301,726,280	1,700,163,756	1,689,191,950
2010	3,513,755,317	2,353,585,468	2,802,522,718	2,781,537,473
2011	1,347,440,321	764,922,140	1,263,987,643	1,360,469,062
2012	3,685,211,793	1,581,845,966	1,923,607,963	1,865,397,154

Source: compiled by author with original data from SigaBrasil.

State Governments: datasets and selection criteria

Gathering sub-national data was by no means a simple task, either due to lack of information or of standardization. Fortunately changes in the law over the past decade have gradually reduced the lack of standardization, but the access to data prior to this period remains a problem. Taking this into consideration, it was possible to select a more appropriate source to analyse the expenditure of the states.

One of the most widely used sources of data for the states is the "Tables of States' Consolidated Accounting Data". The tables are presented by the National Treasury (STN) in an annual historical series from 1995 to 2011 (last update) in the State Budget Execution[33], which contains (in one of its tables) the expense data segregated by function and sub-function. However, these data have two constraints: they present only commitments, and indicate the sub-function 'Civil Defence' only under the function 'Public Safety', ignoring the values for other functions.

To deal with these limitations we used data from the Budget Execution Summarized Report (RREO) of the States, which was introduced as a mandatory requirement by the Fiscal Responsibility Law (Complementary Law nº 101/2000). Annex II of the Report contains the Statement of the Expenditures Execution by function/sub-function, which was the source used to build the consolidated annual series for the states. Unfortunately, the RREO was standardized in this format after 2006, thus it was only possible to obtain a reliable historical data series after 2006. Nonetheless, the evaluation of the last 7 years is sufficient to obtain a contextualized idea of the expenditure related to disasters in the states.

33 Available at https://www.tesouro.fazenda.gov.br/pt/prefeituras-governos-estaduais/sobre (For Portuguese readers)

Table A.4.5. Total States' expenditure with the sub-function 'Civil Defence' for the period 2006-2012 (no intra-budgetary expenditure, R$ million)

Year	Initial Allocation	Updated Allocation*	Committed	Acquisition, verification and certification	RAPs**
2006	542,13	574,80	421,39	415,74	-
2007	642,39	775,71	565,63	492,44	71,27
2008	733,99	1.082,79	856,01	754,19	100,21
2009	1.017,64	1.452,14	1.246,24	1.131,21	75,57
2010	869,26	2.022,19	1.550,21	1.292,19	238,01
2011	1.214,44	2.152,95	1.389,63	1.265,63	116,34
2012	1.296,92	1.937,40	1.326,17	1.126,97	186,35
TOTAL	6.316,76	9.997,98	7.355,30	6.478,37	787,74

Source: Budget Execution Summary Report – SISTN/Caixa Econômica Federal (CEF)

* Initial Allocation with additional credits (extraordinary, supplementary, and others)

**RAP un-processed, not available for 2006.

Table A.4.6. Total of the States' expenditure with the sub-function 'Civil Defence' for the period 2006-2012 (including intra-budgetary expenditure, R$ million)

Year	Initial Allocation	Updated Allocation	Committed	Acquisition, verification and certification	RAPs
2006	542,13	574,80	421,39	415,74	-
2007	658,25	791,80	580,28	507,10	71,27
2008	745,37	1.092,44	865,58	763,71	100,25
2009	1.026,18	1.462,59	1.256,59	1.141,55	75,57
2010	874,28	2.028,22	1.556,18	1.298,10	238,06
2011	1.221,45	2.168,93	1.405,46	1.281,45	116,34
2012	1.306,05	1.970,79	1.359,15	1.159,88	186,42
TOTAL	6.373,69	10.089,57	7.444,62	6.567,52	787,91

Source: Budget Execution Summary Report – SISTN/CEF

The 'Civil Defense' sub-function is perhaps the most accessible approximation for data that cover all the Brazilian States. However, it is not perfect. It can include expenditure that is not necessarily related to activities on prevention or disaster relief, as well as disregarding expenditure on these activities when it is not described as Civil Defense. In addition, states may not classify their expenditure in the same way. In order to obtain precise data, it would be necessary to gain access to detailed data on the large expenditures category (such as institutional, economic and functional/programmatic) for every state - not an easy task. Nevertheless, the sub-function 'Civil Defense' is a good proxy, considering these limitations and the total volume of expenditure.

Looking at the amount of the expenditure in each of the states, there are some key points to be emphasized. First, considering the period between 2006 and 2012, three of the states count on more than 50% of the entire amount

allocated (initial and updated), committed and paid off in the sub-function Civil Defence, to all the states together. Rio de Janeiro concentrates approximately 29% of the paid-off expenditure in the period and Pernambuco and Paraná concentrate 20% and 10% respectively. Moreover, it is important to stress that the initial allocation of Pernambuco has been considerably lower than the updated allocation in the last years. This indicates that this state concentrates resources for dealing with disasters essentially on additional credits.

A second key piece of evidence to observe is the large amount registered as overhang of expenditure commitments, hencefort RAP (Restos a Pagar), in some of the states. Alagoas is alone responsible for almost 34% of the total RAP in the sub-function of Civil Defence in the states, which indicates this state faces difficulties in executing and paying expenditures related to disasters. After Alagoas come the states of São Paulo (16%), Minas Gerais (15%), Rio de Janeiro (11%) and Paraná (9%). Altogether these states sum 84% of the total RAP registered between 2006 and 2012. It is also important to notice that there is a lack in the State of Rio Grande do Sul in 2008, where it did not record any amount for Civil Defence in any of the sources examined.

Finally, the series shows an apparent decline in expenditure in 2011 and 2012 compared to 2010, despite an increase in allocations earmarked for Civil Defense. Detailed series would help to explain this behaviour more accurately. An optimistic explanation would be that there exists better preparation for natural disasters, with more resources allocated and less expenditure needed. However, it is necessary to control for other variables to know exactly the reason for such a decline in expenditure. Another explanation could be that the Federal Government is spending more directly on natural disasters.

ANNEX 5. DISASTER DAMAGE ASSESSMENT SYSTEM

The largest organization involved in disaster risk management and response is the Civil Defense (Defesa Civil, in Portuguese). It is important to emphasize that the term does not have the military connotation that it usually has in English. In 1988 the Brazilian Constitution ruled on the creation of a National System for Civil Defense (SINDEC) and its composition was set forth in the same year by Decree 97.274. Since then it has gone through many minor changes, and at present its structure is as established by Decree 5.376 (2005). It consists of: i) the National Civil Defense Council (CONDEC) as the superior body; ii) Special Secretariat for Civil Defense (SEDEC) as the main operational body (linked to the now extinct Ministry for Regional Integration); iii) Civil Defense Regional Coordinating Office (CORDECs); iv) Civil Defense State Coordinating Office (CEDECs); and v) Municipal Commissions for Civil Defense (COMDECs). In 2012 a law reformulating the entire system was passed, but is still not in force. In more general terms we can say that CONDEC is the central political body while SEDEC is the core operational body. These two coordinate branches in almost all the Brazilian municipalities (COMDECs) through intermediate regional and state level bodies (CORDECs and CEDECs). These municipal branches have responsibility over immediate of monitoring and preventing disasters as well as giving emergency assistance.

Another set of agencies of concern to us are the CEPEDs (University Study and Research Centers on Disasters). There are currently four in Brazil and the data we used in this report was provided by the State of Santa Catarina CEPED, connected to the Federal University of Santa Catarina. CEPEDs´ mission is to compile information, undertake research and provide guidance on disaster risk management to the Brazilian Government.

Declaring a State of Emergency or Calamity

The Brazilian Federal Constitution establishes that it is a federal duty to "plan and promote permanent defense against public calamities, especially droughts and floods". According to Federal Government Decree 7257 of August 2012, in order to help municipalities in post-disaster situations the government must first recognize one of two special situations that can be declared by the affected region: a state of public calamity (more severe) or a state of emergency (less severe[34]) . Concern exists that municipalities could declare one of these states as a means of obtaining extra funds from the central government even when they are not entitled to it. Thus the law establishes that both the State of Public Calamity and the State of Emergency:

i) Should be as short as possible, lasting only for as long as is strictly necessary for reestablishing normality.

ii) Should include strictly only the areas affected by the natural disaster referred to in the declaration.

The procedure for declaring one of the above states is, in simplified terms, as follows: The Mayor of the affected municipality declares the state and sends a homologation request to the State Government. Once the State Government homologates the request, the Federal Government must approve and decide the size of the affected areas before the state of emergency or calamity takes effect. The Federal Government also decides on the disaster's severity level. Funds sent to the affected areas will be based on this severity classification.

Damage and Loss Assessment Procedure

Once a state of emergency or calamity is officially recognized, the local Civil Defense unity works with the municipal government to send the required reports and, if necessary, to request help from higher level (State and Federal) bodies. The first form to be sent to the higher authorities is the NOPRED (Preliminary Disaster Notification Form). It must be completed within 12 hours of the disaster and its main goal is to officially alert authorities at the state and federal levels about the disaster.

Until recently, the second main form to be completed is called an AVADAN (Damage Assessment Form), a form that records the characteristics of the natural disaster, the affected area, human, material and environmental damage and

34 Decree 7257 formally defines:
i) State of emergency: abnormal situation caused by disasters that cause damages and losses, and grave enough for the local government to be partially unable to respond.
ii) State of public calamity: abnormal situation caused by disasters that cause damages and losses and grave enough for the local government to be substantially unable to respond.

the economic and social loss caused by the disaster. The current disaster losses historical dataset was based on the records contained in these forms. The AVADAN must be filled in by hand and sent from the affected municipality to the central government. It records the characteristics of the natural disaster, affected area, human, material and environmental damage and the economic and social losses caused by the disaster. It must be completed within 120 hours (5 days) after the disaster and sent to the SINDEC (National System for Civilian Defense) coordinating bodies. See Table A.5.1 for details on the information covered by these reports.

Table A.5.1. Instructions for Completing the Damage Assessment Form - AVADAN

Form Item	Description
1. Type of Disaster	enter the disaster code and denomination according to the Disaster General Classification and CODAR (Annexes to the National Civilian Defense Policy)
2. Date	enter the day, month, year and, when possible, hour of the disaster occurrence.
3. Locality	enter the State and name of the municipality affected by the disaster. Only one municipality permitted per form.
4. Affected Area	describe the affected areas delimiting them with maximum accuracy. Attach a map or sketch representing the areas.
5. Cause of Disaster	describe the adverse event which triggered the disaster (rain, fire, earthquake, etc.) and inform its characteristics and intensity.
6. Human Toll Estimate	enter the number of people affected in some way as a result of the disaster, detailing:
Pregnant Women	women of any age, at any stage of pregnancy
Displaced	people whose homes were damaged or destroyed but who do not necessarily need temporary shelter
Without Shelter	displaced people in need of temporary shelter
Evacuee	people who migrate away from the area affected by the disaster (migrants)
Missing	people lost in the disaster
Dead	fatalities caused by the disaster
Sick	number of people whose sickness is a result of the disaster
Slightly Injured	injured people not in need of hospitalization
Seriously Injured	injured people in need of hospitalization
Affected	total number of people jeopardized in some way by the disaster. A person may suffer more than one type of damage or does not fit in any damage category specified above. Examples: 1. A displaced and seriously injured person counts only as one affected person. 2. A person whose home was partially destroyed by the disaster counts as affected but is not included in any of the categories above. Therefore, the number of affected people is not necessarily equal to the aggregate human toll.
7. Material Damage	specify the number of buildings damaged and destroyed by the disaster, the cost, in thousands of Reais, to recover or rebuild, dividing the buildings according to the following categories:
Low-income housing	homes belonging to low-income families (up to two minimum wages)

Other Dwellings	homes belonging to families in a better economic situation who can rebuild and/or repair them without government support
Public - Health	public health facilities: hospitals, health centers and other
Public - Education	public education facilities: schools, high-schools, colleges and other
Public - Infrastructure	
Bridges and Sewage	bridges, viaducts, sewage system, culverts and other
Roads	all non-urban roads: local roads, municipal, state or federal, within the city damaged by disaster
Urban Paving	urban roads with all types of pavement
Private - Health	private health facilities: hospitals, health centers and other
Private - Education	private education facilities: schools, high-schools, colleges and other
Community	community facilities: community centers, day care centers and other
Rural	rural facilities: silos, bunkers, warehouses, sheds and other
Industrial	plants and industrial facilities
Commercial	commercial facilities and other facilities that provide services: shops, banks, supermarkets and other
8.Environmental Damage	for each of the following categories mark with an X the intensity of the environmental damage caused by the disaster, according to the intensity (No Damage, Low, Medium, High and Very High) and also enter the estimated cost, in thousands of Reais, for recovery of the affected ecosystems.
Water	inform whether surface or subsurface water supplies have been affected and the degree of pollution and/or contamination
Soil	inform whether the soil was affected by the factors mentioned or other degradation mechanisms
Air	inform whether the air quality was affected
Flora	inform whether the biota was affected
Fauna	inform whether the fauna was affected by the disaster or other factors, such as Predatory Hunting
9. Economic Losses	inform economic losses, detailing the quantity, (noting the unity of each item) and the value of the corresponding damage in thousands of Reais, focusing on:
Agriculture	enter the amount of production affected by the disaster, in tons, for the various types of farming
Animal Husbandry	enter the amount of sick or dead animals
Industry	enter the amount of industrial production affected
Services	enter the amount of service providers affected by the disaster
10. Social Losses	register the essential services that have been damaged or disrupted by the disaster and the estimated cost, in Reais, for their recovery:
Water Supply	report the damage to the water supply network, treatment stations and water sources

Power Supply	report the damage to the power supply network and the number of people affected by power outages caused by the disaster
Transportation	report the damage to roads, stations and vehicles
Communication	report the damage to the network and relay stations
Sewage	report the damage to the sewage collection network and sewage treatment stations
Natural Gas	report the damage to the distribution network
Waste Management	report the damage to waste collection, disposal and treatment agencies
Health	report the damage to preventive care and medical assistance.
Education	enter the product: number of students x (times) number of classes missed
Staple food	report, in tons, the amount of staple foods (rice, beans, powdered milk, sugar, salt and oil) damaged/destroyed by the disaster
11. Information on the Municipality	enter the affected municipality's population and economic indicators according to official statistics.
Population	as provided by the last available IBGE Census
Annual Budget	inform, in Reais, the official Annual Budget as approved by the Municipal Law
GDP	enter last year's IBGE provided municipal GDP
Tax Revenue	enter last year's official municipal Tax Revenue
12. Conclusive Assessment on the Disaster's Intensity	analyze the damages and losses according to the main and aggravating criteria.
Main Criteria	indicate the severity of each Main Criteria marking an X in the corresponding field, according to the severity scale specified in the document:
Damage Severity	the intensity of human, material and environmental damages varies depending on the response capacity of the municipality affected by the disaster.
Importance of Losses	the importance of the economic and social losses varies depending on the economic response capacity of the municipality, as measured by official indicators.
Need for Supplementary Resources	the need for supplementary resources varies depending on the economic response capacity of the municipality, as measured by official indicators.
Aggravating Criteria	Indicate the severity of each Aggravating Criteria marking an X in the corresponding field, according to the severity scale specified in the document:
Secondary Disasters	whether the occurrence of disasters that emerged as a result of the major disaster was verified
Local Civil Defense level of Unpreparedness	an assessment of the local civil defense's financial and technical unpreparedness or inability to respond to the disaster
Situation's Level of Vulnerability	unfavorable scenario features that contribute to worsening the disaster
Community's Level of Vulnerability	community's unpreparedness to deal with the disaster
Disaster's Evolution Pattern	disaster's Evolution Pattern: Gradual and predictable, gradual and unpredictable; sudden and predictable or sudden and unpredictable

Aggravating Tendency	if the disaster has shown a tendency to get worse
Conclusion	based on the General Classification of Disasters, conclude by evaluating the intensity level of the disaster:
Disaster's Intensity Level	I – Small Disaster or Accident
	II – Medium Disaster
	III – Serious Disaster
	IV – Major Disaster
13. Informing Institution	identify the name of the institution and the person responsible for the information provided here, title, phone number, date and signature.
14. Informed Institutions	indicate which SINDEC (National System for Civilian Defense) agencies were informed about the disaster.
15. Complementary Information	inform the currency used in the completion of this form and the conversion rate to US dollars on the date of the disaster occurrence. This will be used to aggregate historical values.

While the format of such forms is very complete and aims at gathering a lot of information that could be useful for both planning the response and also for designing prevention policies, in reality local governments used to find it cumbersome to collect all the required data in such a short period of time and under the difficult circumstances that characterize post-disaster phases. At the same time, filling such forms was a requirement for receiving emergency funds and, as a result, quite a lot of the information collected in the past is not reliable and will require a lot of effort and resources to consolidate these datasets.

Introduction of a new system

Given these difficulties, the Brazilian Government introduced in late 2012 a new disaster tracking system, the Integrated System on Disaster Information (S2ID) and on January 1, 2013, it stopped receiving the old form (AVADAN). Thereafter usage of the new system became mandatory[35]. The form replacing AVADAN in the new system is called FIDE. It is shorter and more focused than the old one. For more details on the information that it requires please refer to Table A.5.2. The main objective in developing S2ID was to unify and digitalize all official disaster related information. It is hoped that the new system will simplify and speed up the process of disaster reporting and damage assessment, and thus foster timely and efficient response efforts. However, while less demanding for the affected municipalities, the new model puts more emphasis on recovery needs, it is less detailed in terms of information about damage and losses in the private sectors and it is not designed to assemble the information needed for reconstruction planning and funding allocation. Therefore, while the new system is certainly an improvement since it is more consistent with the realities faced by the affected communities, complementary data collection systems are still needed to fully support both the public institutions involved in disaster risk financing and the development of the risk market infrastructure that could promote private catastrophe insurance growth.

35 FIDE (Disaster Information Form) is the new online form that replaces the AVADAN. For details on FIDE see Table A.5.2.

Table A.5.2. Disaster Information Form - FIDE

NATIONAL SYSTEM FOR CIVIL DEFENSE – SINPDEC					
DISASTER INFORMATION FORM – FIDE					
1. Localization					
State:		Municipality:			
Population:	GDP (Annual):	Budget (Annual):		Tax Revenue (Annual):	
	R$	R$		R$	
Net Current Revenue – RCL					
Total by Year: R$		Monthly Average: R$			
2. Type of Disaster		3. Date of Disaster			
COBRADE	Name (Type or Subtype)	Day	Month	Year	Time

4. Affected Area/Occupation	Does not Exist/	Not Affected	Urban	Rural	Urban and Rural
Housing					
Commercial					
Industrial					
Agriculture					
Animal Husbandry					
Logging/Rubber Extraction					
Environmental Protection Area					
Mining					
Tourism and Other					

Description of the Affected Area (Indicate if Urban and/or Rural):
5. Disaster Causes and Effects – Describe the event and its characteristics:

6. Human, Material or Environmental Damage		
6.1 – Human Damage	Type	N° of People
	Dead	
	Injured	
	Sick	
	Displaced	
	Without Shelter	
	Missing	
	Affected in Other Ways	
	Total	
Human Damages' Description:		

6.2 – Material Damage	Type	Destroyed	Damaged	Value (R$)
	Housing Units			
	Public Health Units			
	Public Education Units			
	Other Public Units			
	Public Community Units			
	Public Infrastructure Construction Sites			
Material Damage Description:				

6.3 – Environmental	Type	Percentage of Municipal Population Affected
Damage	Air Pollution	( ) 0 to 5% ( ) 5 to 10% ( ) 10 to 20% ( ) More than 20%
	Water Pollution	( ) 0 to 5% ( ) 5 to 10% ( ) 10 to 20% ( ) More than 20%
	Soil Pollution	( ) 0 to 5% ( ) 5 to 10% ( ) 10 to 20% ( ) More than 20%
	Decrease or Extinction of Water Sources	( ) 0 to 5% ( ) 5 to 10% ( ) 10 to 20% ( ) More than 20%
	Wildfire	Affected Area ( ) Up to 40% ( ) More than 40%
Environmental Damages Description:		

7. Public and Private Economic Losses		
7.1 – Public Economic Losses	Essential Public Services	Cost to Reestablish (R$)
	Public Health and Medical Assistance	
	Drinking Water Supply	
	Sewage Collection and Treatment Systems	
	Urban Cleansing and Waste Management	
	Biological Pest Control	
	Electric Power Supply Generation and Distribution	
	Telecommunications	
	Transportation	
	Distribution of fuels, especially for domestic use	
	Public Security	
	Education	
	Total	
Public Economic Losses Description:		
7.2 – Private Economic Losses	Economic Sector	Value (R$)
	Agriculture	
	Animal Husbandry	
	Industry	
	Commerce	
	Services	
	Total	
Private Economic Losses Description:		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