FACT SHEET 7

Building Sovereign Financial Resilience in Middle-Income Countries

Disaster Risk Financing & Insurance Program

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Component 4: Data, information and analytics for sovereign risk financing

Topic 7: Data and Information for Sovereign Disaster Risk Financing

OVERVIEW

This Fact Sheet introduces Component 4, which examines data, information and analytics for sovereign disaster risk financing. As countries seek to strengthen their financial situation against disasters and climate shocks, they can implement a suite of policies and use financial instruments to pre-arrange funding to manage such shocks. These instruments are best structured using a risk-layering approach, which helps governments to match the instruments to release finance when needed. This would be done in accordance with the frequency and severity of expected disaster events, as illustrated in Figure 1.

Governments rely on analytics to structure their risk-layering strategies and design robust financing solutions that reflect their risk management priorities. For example, governments need to understand and quantify the scale of potential disaster losses in deciding how much of post-disaster costs they are willing to finance, transfer or retain. Therefore, they will need sound, reliable information to best target their post-disaster finance program (in terms of people in need or location of assets to reconstruct). They will also need to design a financing solution that disburses quickly where and when most needed.

This Fact Sheet discusses the ways in which data, analytics and risk information can be utilized in sovereign disaster risk finance and financial planning. The amount of data and information is constantly growing world-wide. As such, it can be overwhelming and difficult to navigate. This Fact Sheet suggests how to approach this challenge from a business need perspective. In this regard, it showcases practical examples of using data and information for disaster risk finance (DRF).

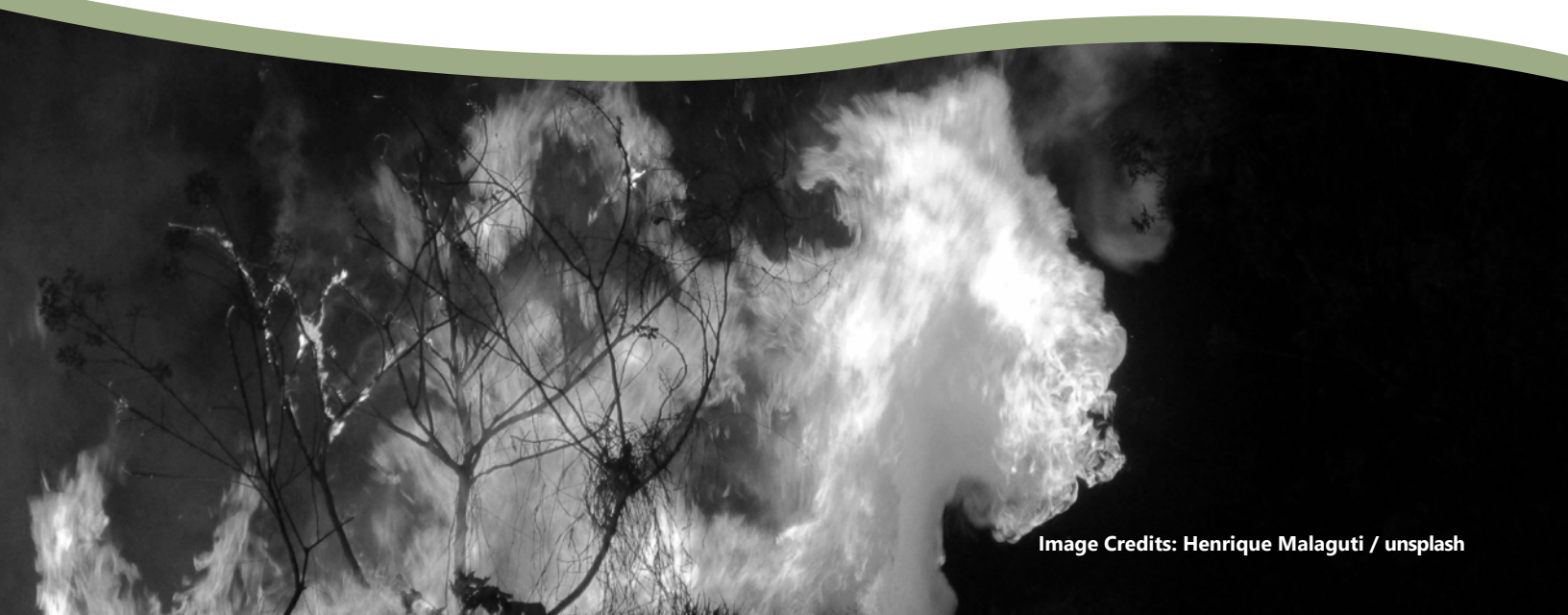

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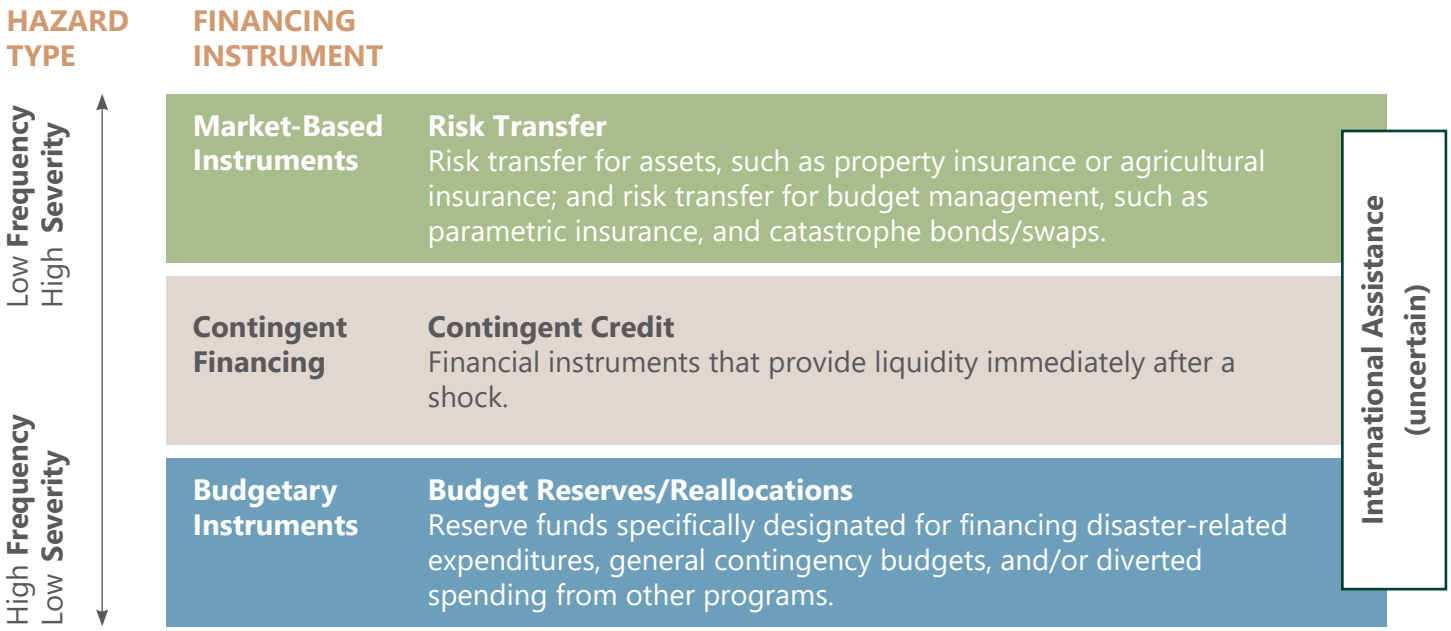
FIGURE 1: LAYERED APPROACH TO RISK FINANCING



Source: The World Bank Disaster Risk Finance and Insurance Program.

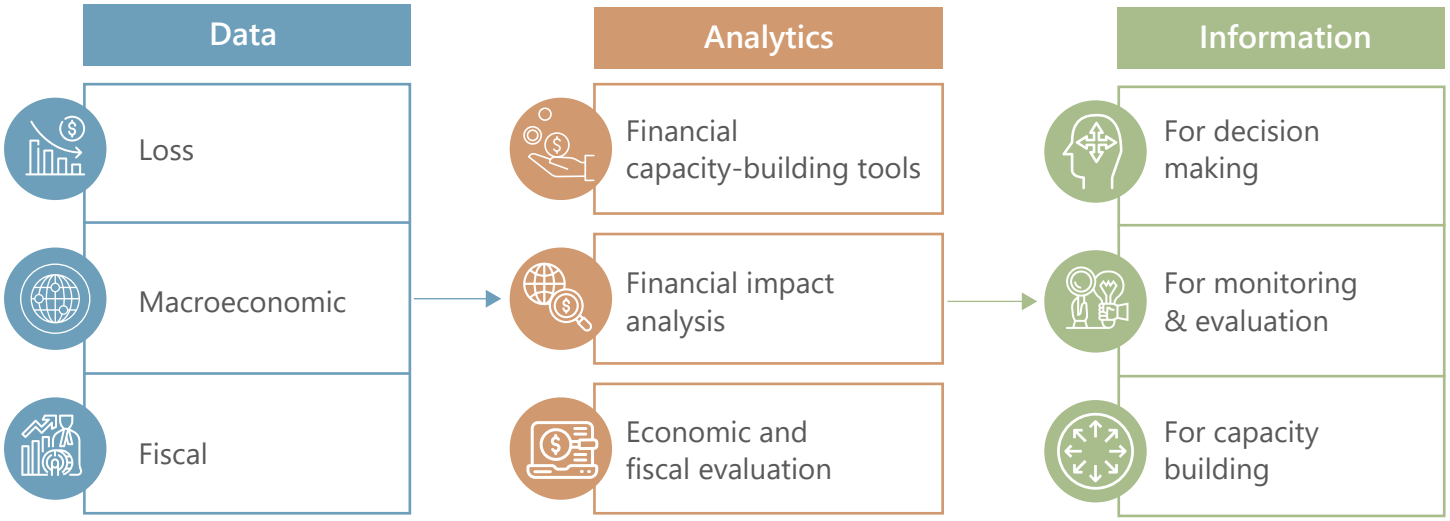
BACKGROUND

The Role of Data and Information in Disaster Risk Finance

Disaster risk finance aims to protect development gains, people's livelihoods, and countries' economies by increasing the financial preparedness of governments, businesses, households, and the most vulnerable to meet the cost of disasters and crises. This would be achieved through sustainable and cost-effective financial protection policies and instruments.

The right information is needed to make sound financial decisions. For example, information is needed in aiding a government to decide between different combinations of risk transfer and risk retention instruments. Without suitable background knowledge, information, and the right quantitative analysis, governments would be unable to properly determine whether certain strategies provide more effective financial protection over others, how cost effective they would be, and how suitable these would be in a country-specific context. This includes the amount of budget allocations and contingent financing to secure, as well as the role and value for money of an insurance purchase. Figure 3 shows how data and information feed into and inform DRF analysis, strategies and decisions; in fact, it is an iterative process whereby analyses, decisions and outputs feed into each other.

FIGURE 3: HOW DATA AND ANALYTICS INFORM A DRF DECISION-MAKING FRAMEWORK



Source: The World Bank Disaster Risk Finance and Insurance Program.

Data-driven decisions are increasingly important for DRF, and the world is seeing a constant growth in new types of data — often produced using the most advanced technologies. As a result of the large amounts of data being developed, both current and emerging, a gap increases between the availability of raw technical data and the capacity of stakeholders to use it to make better decisions about financial resilience. For this reason, there has been significant demand from governments and other DRF stakeholders for high-quality analytics that translate new and at times complex technical data into useable information. Thus, they can be empowered to make better decisions based on new risk information.

THE PRINCIPLES OF DRF ANALYTICS

Data only adds value when it informs decisions. The principles of DRF analytics can help stakeholders to navigate the abundance of data. These principles can be structured into 5-steps, as shown in Figure 4, and explored in more detail below.

FIGURE 4: DRF ANALYTICS WORKFLOW

The engagement of key stakeholders throughout these steps is crucial in the development and eventual use of the DRF analytics.

Source: The World Bank Disaster Risk Finance and Insurance Program.

These steps can be iterated at any point and do not have to progress linearly. For example, when reviewing the analysis, this may prompt a change to the question, which would then require further data to be collected and analytics to be performed.

Define the question

How Analytics can Support Governments

The first step in navigating the vast amounts of ever-increasing data and information is defining the question. Different governments, situations and contexts will have different objectives and priorities. Here are some examples of typical questions that data and analytics could help governments to answer:

01 What are the potential fiscal costs and gaps resulting from climate and disaster shocks?

02 How often do such shocks materialize, and which are the most frequent disasters to focus on?

03 What would be an optimal combination of risk retention and risk transfer instruments?

04 What may be a better alternative risk transfer product in terms of value?

05 What would be the fiscal cost of a scalable social protection program? Include alternatives for different coverage or product design.

06 Which reinsurance proposal would best suit the DRF objectives? What cost savings might be achieved through the pooling of sovereign or subnational risk?

07 What is the capital requirement for the establishment and/or maintenance of a catastrophe risk pool?

08 What would be the costs and benefits of a property insurance scheme?

09 What would be the costs and benefits of a more comprehensive national insurance program?

Governments will need to formulate a clear question in determining how to narrow the data and information required, as well as how the analytics can (and should) be performed. At the outset, this can also determine if further studies/reports/explorations need to be conducted to obtain more information where the data may not already be available. This can lengthen the time to completion of the project. Where there is a hard deadline, it may be appropriate to complete the project in phases.

Understanding the objectives and what is possible can assist governments in building a clear road map of what is possible at a given point in time. It can also assist in managing expectations around timings and deliverables.

Collect
Risk Data

Data Requirements

Analytics help in translating data into useful information. Therefore, before determining what kind of data are needed, it is also important to have an idea about the type of analysis needed. For a more in-depth analysis, larger quantities of data or more detailed data may be required. The value of the analytics is only as good as the data that feeds into the analysis. There are three key questions to ask in this process:

1. **What** type of data is needed?
2. **Where** can this data be found? Is the source reliable, or would it need to be cross-checked with additional sources?
3. Is the data available **fit** for purpose?

What type of data is needed?

The type of data that is needed again relates to the question that is to be answered. For example, if the question relates to a particular region and/or a particular peril, then aggregating loss data for all historical perils at the national level will not be sufficient. Some common forms of data include the following:

- Risk/loss data (for example, historical losses from cyclones).
- Financial exposure data (for example, economic districts, residential buildings, and crop footprints).
- Macroeconomic data (for example, gross domestic product [GDP] growth).
- Fiscal/financial data (for example, annual government expenditures).

Image Credits: Russ McElroy / pixabay

Where can the data be found?

A good starting point for determining what kind of data is available is by looking at the data that can be easily obtained by government agencies. This may include information, such as yearly budget and expenditure reports. Once the data from easily obtainable sources has been exhausted, other sources of information outside of government data should be explored. This could include data from the following sources:

Public sources

Humanitarian organizations

Risk modelling firms

Insurance (and other private sector) companies or insurance regulators/federations

Statistical offices

Academia and research centers.

Companies and/or service providers can also be commissioned to assist in data collection. For example, satellite imagery firms may have access to data relevant to understanding crop failures. Engaging external experts could also be useful at this stage. With new and emerging technologies, this could help to understand the landscape of new offerings. In addition, it can be especially helpful if suitable data is not readily available.

When searching for data, it is useful to look at what other people/sources may have already collected, such as development agencies, data specialist firms, and so on. Where such data has already been collected, it would be a better use of resources to engage and utilize (and potentially adapt) this information.

Is the data fit for purpose?

Once the data has been obtained, it is important to understand how good this data is in answering the initial question. Other questions include: What are its limitations? Are any adjustments required? How could the available data restrict the type of analytics performed? Some things that should be considered when using data sources.

Adjustments to combine data from multiple sources

Scaling data to current time period

De-trending to remove trends in historical data over time

Removal of unreliable data points

When assessing the suitability of data, the following questions should be considered:

01 Is the data up to date? Is it comprehensive?

02 Is the format usable for risk management purposes?

03 Does it reflect the world today (or, better yet, the future)?

04 What other things should be considered? For example, this could include climate change considerations, improvements in building structures, recent, and significant investments in risk reduction projects.

Being clear on the data to be used for analysis will provide a better view and understanding of the results, as well as the limitations of the analysis.

Image Credits: Katharine Loster / pixabay

Understanding the analysis

What can analytics reveal?

Analytics translates the data into a set of outputs or information. Understanding what analytics can do is easier illustrated using an example (Box 1).

BOX 1: HOW ANALYTICS TRANSLATES DATA INTO INFORMATION

STEP 1

The question

As the Minister of Finance in charge of developing a DRF strategy, it is important to manage the cost of future disasters. This includes understanding the potential disaster-related costs that the government could face. The primary financial driver of a disaster response is supporting the people who are affected.

STEP 2

Finding the data for the analysis

Historical records concerning the number of people impacted by disasters from 2004 to 2018 are available.

STEP 3

Performing the analysis

This historical information has been used by a technical colleague to complete a probabilistic risk assessment of the financial cost of the impact of disasters.

STEP 3

Understanding the analysis

The Minister has been presented with a simple quantitative tool to evaluate the potential costs based on the historical number of people affected by disasters. Using this tool, the Minister would be able to see the various costs of disasters to the government.

The government can use the outputs from the tools to determine when funds will be required, where the funds could come from and what the funding gap might be at different loss levels. It also details the potential cost of alternative financial instruments or other DRF strategies.

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Inform DRF Decision Making

Turning Data into Decision Making

Once the analytics is completed, the results can be used to answer the question posed in Step 1. Following the previous example (in step 4), this can lead to answering questions such as:

01 Should funds be set aside in a dedicated line of reserves, and how large should this reserve fund be?

02 Should a line of credit be established, which can immediately be drawn upon if a disaster were to occur?

03 How can proposals for risk transfer products, such as disaster insurance or catastrophe bonds, be evaluated?

04 Can other contingent budget reallocations be relied upon in case of disaster?

05 Are there other financial mechanisms available (for example, insurance) that would help to absorb a share of the losses?

The available data is rarely perfect, and the analytics have no limitations. Regarding the decision-making step, it is important to understand the limitations of the data, as well as the attendant analytics and results. Thus, it is common to perform some sensitivity testing to highlight the key assumptions and other reasonable scenarios. This will aid in determining the possible resulting variations.

This step can also identify any improvements to data or analytics that could be made in the future. As such, it feeds well into the iterative process of DRF analytics.

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Monitor and Evaluate

The Iterative Process

Monitoring and evaluation are important at each step because DRF analytics are produced through an iterative process. This includes consideration of the initial question and the objectives of the analysis, as well as probing the data collected and the resulting analysis. For example, details of the four questions that should be asked after the analytics have been performed, but before the decision-making process is finalized, are shown below

What is the **purpose and significance** of the analytics information, including the consequences and implications of its use in decision making?

How sensitive is the analytics information to changes in assumptions?

Who prepared the analytics information and is there any incentive to mislead?

Has the analytics information been **peer reviewed** by a technical expert?

Some pieces of analytical work can be bespoke and occur only once. However, the majority of analytical work happens at regular intervals. Therefore, it is important that additional information, and new data and analytical techniques are incorporated into subsequent iterations of the analysis.

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Case Studies: Government Use of Data and Information for Financial Planning and Analytics

Serbia – Using Data for Public Asset Insurance and Infrastructure Development

Setting the scene

Serbia faces substantial disaster risks and hazards, such as earthquakes, extreme temperatures and floods that have affected over 18,000 people[1] annually. The frequency and magnitude of these hazards have increased in recent decades due to a rise in population densities, rapid urbanization, and environmental degradation. The direct economic damage from hazards can be above US$ 2 billion[2] for a single disastrous event. Public asset losses often comprise a large share of post-disaster costs. In this context, the reconstruction of public assets and reinstatement of public services is usually the responsibility of the government.

What question does the Government of Serbia (GoS) want to answer?

The GoS is exploring the option of public asset insurance, including how it can be used in a cost-effective way to increase the financial resilience of the government when disasters hit. At such times, it can provide finance for the reconstruction and/or damage of critical assets.

What data does the GoS need?

The GoS needed data for two key reasons:

01 Governments are the owners of public assets, as well as the policyholder of the potential insurance to be purchased. As such, policy makers need to understand the risk exposure and makes decisions about the areas and level of coverage that best fits with their overall strategy (that is, the government's priority assets).

02 The quality of data increases the reliability of the analysis, which in turn will strengthen the government's position when dealing with insurers, risk modelers, intermediaries/brokers and other stakeholders who would demand this data to understand the risk and to price it appropriately.

Data is essential at every stage of insuring public assets. Hence, it is important to capture sufficiently detailed data and information to ensure that the information recorded is fit-for-purpose. In assessing various risk-financing strategies, historical losses will be required such that strategies are designed to fit the requirement of the GoS in terms of identifying levels of risk retention versus risk transfer. Furthermore, the structure of the risk transfer (for example, insurance), the level of coverage, and the types and features of risk transfer schemes should also be considered.

[1]According to the Emergency Events Database (EM-DATP data at: public.emdat.be/data

[2]The 2014 riverine flood incurred more than US$ 2 billion in economic losses.

The GoS aims to build a public assets registry as a single source of information about assets in Serbia. This is necessary for the implementation of a public asset insurance scheme, as well as for broader public asset management. A public asset registry is a digital database that assists in effective, government-wide planning by providing a single source of information about all non-financial government assets, along with their geolocations, physical characteristics, asset value, and asset life. It usually includes data about the asset lifecycle (for example, data about asset creation, capitalization, valuation, depreciation, repair and maintenance, transfer, decommissioning, and retirement). This data can be used for a variety of purposes, including: to conduct a physical inventory of public assets; to maximize their value by optimizing the way in which the assets are used, leased, or sold; to conduct disaster risk assessment; and to prioritize assets for operational and financial protection. Third-party data sources, such as academic research reports, can be used to supplement the data where it is scarce. In addition, other government agencies may have useful data concerning disaster risks.

What analytics can be performed and what will the results reveal?

The data and information collected, and analytics performed, can be different. For example, at a design stage of assessing the feasibility of public asset insurance, data can be used to support internal planning and decision making. Information can provide an overview of historical experience of the country's assets to previous disasters, the financial impacts of these events on the budget, as well as the use of the reserve fund, the contingency fund and risk transfer mechanisms. It can also provide an overview of the social and economic consequences. In this earlier stage, the data collected (and summarized) will support the initial discussion regarding the rationale of the proposed strategy, as well as discussions between stakeholders concerning the financial planning aspects of the proposed public asset insurance program. Thus, the data can be used for informing a risk-transfer strategy and for providing evidence to insurers of mature asset management. This in turn could be rewarded by lower insurance premiums.

Image Credits: ID 12019 / pixabay

In the development stage of a public asset insurance program, the breadth and depth of evidence gathered is used to build the risk profile. It will determine how much confidence can be placed in the identification and estimation of the financial gap faced, and the appropriate retention-transfer options available. This will require some form of loss estimation, as well as a decision about which hazards are most material to the loss potential.

Analytics is conducted in various forms, including an experience rating and an exposure rating for risk-based pricing. Experience rating is a method used to quantify and project the expected loss by estimating the level of damage caused to public assets by historical disasters. By listing all the historical events that may have caused damage to the public assets, the frequency — which indicates how often public assets are affected by disasters in an average year — can be derived. The severity assumption, which indicates the average loss size, can also be measured with data about historical damage to public assets. Combining the frequency and severity assumptions provides the expected loss. This is also sometimes referred to as the annual average loss (AAL). Knowing the level of annual average loss and how sensitive it is to variation of all the input factors is crucial, as it is often the basis component of insurance pricing[3].

When building DRF strategies it is necessary to understand the losses which the government may face. This can be difficult when there is limited historical information on disasters. Box 3 details how the GoS dealt with this challenge.

BOX 3: HOW COULD THE GOS APPROACH LIMITATIONS ON DATA?

When historical data is limited (for example, data concerning severe/infrequent disasters), the exposure rating based on catastrophe models can be very useful in estimating the frequency and severity of potential events, helping to quantify associated damages and losses.

Serbia's most recent significant earthquakes occurred in 1983, 1998, and 2010[4]. In other words, Serbia experiences almost one earthquake every 10 years, considering only the historical data. It is challenging to quantify risk with less than 5 data points for a 30-year period. Therefore, catastrophe modelling considering historical experience, as well as the current exposure and other risk measures, can help to provide a well-rounded view of the potential damage that disasters can cause. This requires the integration of data that can represent the key risk equation components (hazard, vulnerability, exposure) within a financial risk framework. This would allow for the quantification of loss potential, and in most cases, representation of the potential or actual insurance coverage terms and conditions to be employed (that is, the financial structures).

Source: World Bank Group

[3]Insurance premiums typically contain the following components: (1) annual average loss, (2) expense, (3) acquisition cost and (4) return on capital loading, of which the annual average loss very often comprises a major proportion of the insurance premium.

[4]The International Disaster Database https://public.emdat.be/ and https://en.wikipedia.org/wiki/Category:Earthquakes_in_Serbia

Morocco: A Forward Looking Evaluation of Extreme Climate Events for the Financial Sector

What question did the Government of Morocco (GoM) want to answer?

The GoM is interested in how physical, climate-related risks affected the banking sector in particular. This is a broad endeavor, which prompted policy makers to disaggregate the actions into specific objectives. This would be done to help clearly define actions through a mutually agreed road map.

The phases of the project were disaggregated into 3 parts:

Part 1

Assess vulnerabilities and transmission channels regarding physical climate risks.

Part 2

Develop scenarios for current and future physical climate risks.

Part 3

Perform stress-testing regarding key assumptions.

What data was needed to answer this question?

Key pieces of data were needed in Part I to assess the climate risks/vulnerabilities, including how they affected the banking sector. This involved sourcing information about historical climate events, specifically how they impacted the banking sector (and through which transmission channels). Climate risk is ever evolving. Therefore, it was also important to understand the evidence regarding current and future climate risks, such that the modelling would be relevant. This involved including the latest climate science from the Intergovernmental Panel on Climate Change (IPCC) and the Food and Agriculture Organisation (FAO) of the United Nations.

Short-term, direct impacts were captured by the catastrophe models, which looked at climate exposure and hazards. A direct economic assessment was then conducted based on extreme future scenarios. For example, what would be the impact of a 1 in 500-year flood — allowing for the vulnerability of a particular region/sector and integrating the future modelled impact of climate change? Building on the substantial technical assistance work done by the World Bank in Morocco since 2008, it was possible to extract key characteristics of plausible/ current worst-case scenarios. This was then calibrated and verified against comprehensive historical loss datasets.

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Indirect effects, both short and long term, were captured from macro-economic modelling. Indirect impacts were then propagated through a macroeconomic model customized to the Moroccan economy, through multiple entry points such as:

- Capital stock destruction;
- For floods: capital flow interruption (proxied by duration of transportation network disruption) and labor productivity (proxied by the number of people affected); and
- For droughts: increased crop imports (due to lower production) and decreases in labor productivity (through unemployment and a workforce affected by extreme heat).

These indirect impacts affect the economy, credit markets and public finances, while also interacting with the macroeconomic model.

Supplementing the data, it was also important to understand how this affected key stakeholders. For example, when did the banks start to see the impacts to their business after a climate event occurred? This may have been seen first through certain customer segments. This was done through stakeholder interviews.

What analytics were performed?

In order to assess the risks, detailed climate scenarios were used. These models used the latest climate science and catastrophe risk modelling to build future extreme climate events (both acute and chronic) in terms of geographies, likelihoods, magnitudes. It was also done through forward-looking, plausible, worst-case scenarios, taking into account future modelled impacts of climate change. As such, the effects on Morocco were identified and then incorporated, looking at how this may impact the country's macroeconomic position. Direct economic impacts from specific perils (for example, crop production deficits, capital stock destruction), and additional dimensions of short-term impacts (for example, capital flows/business interruptions from prolonged flood events) were modelled.

The other key component of the analysis was to understand the transmission channels and how the banking sector was impacted. Specific macroeconomic modelling frameworks were developed with external partners to understand independent views concerning the transmission channels. These assessments were then integrated into a single modelling framework, adapting both models (the climate model and the transmission model) to account for the actual sequence of events. Key affected sectors, economic agents and the most vulnerable assets to Morocco was identified. This then provided links to how these effects could be transmitted through macroeconomic channels to affect the banking sector. The macroeconomic model captures the interplay between risks. In addition, it highlights transmission channels and identifies the most vulnerable sectors and populations through multiple dimensions of socioeconomic and financial impacts.

It is important to note that the quality of data drove the type of analytics that could be performed. In the case of Morocco, more complex, compound modelling could be done due to the detailed level of data available.

What did the analytics tell the GoM?

The analysis showed the GoM how the banking sector could be impacted after a physical risk, including the various channels through which these impacts would come. The various scenarios indicated the degree of severity of the impact, depending on the level of the disaster. This allowed the government to understand the size of the impact that may be experienced by the banking sector. One of the advantages of modelling through scenarios is the ability to input assumptions that the government believes to be reasonable and possible. These assumptions play an important part in the modelling. However, any model will not be able to represent the real work in a complete accurate manner. Thus, an important aspect of understanding and challenging the model is to be able to understand the impact of significant assumptions on the result. As a result, stress-testing was performed on the key assumptions underlying the modelled scenarios, and the impacts on core financial metrics were shown. These metrics include things, such as non-performing loans or probability of default. As such, they give the government an indication of how the results could vary.

This comprehensive analysis, including climate risk scenarios, can have other uses. Thus, they can assist the GoM in building resilience. Examples of further applications include:

- Disaster risk financing strategy for Morocco's Ministry of Finance;
- Determining appropriate insurance and other risk transfer products;
- Sector-specific, financial resilience applications (for example, agriculture or critical infrastructure); and
- Informing climate adaptation investments and associated cost-benefit analyses.

What now?

In 2022, some work remains to be done in refining the financial sector impact component of the modelling process. After this is completed, there are plans to examine alternate climate scenarios and potentially use this model for specific partner banks.

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Part 4: Lessons Learned

Implementation work in developing countries to date highlights a number of key considerations and lessons learned, as follows:

Necessity of in-depth country engagement to develop relevant, demand-driven analytics for informed decision-making, as well as to manage expectations concerning expected outcomes, while also paving the way to new applications;

High potential of new risk information sources (for example, social media, satellites, big data) and technologies (for example, artificial intelligence, high-capacity data processing facilities, mobile phone coverage) to provide unique insights into complex risks;

Difficulty of designing a single set of tools or data platforms, considering the diverse group of users involved within the government (these may include highly technical users to those decision makers with a more high-level understanding);

Importance of tailor-made capacity development programs to inform the design of the data and information products, as well as accompany the development and delivery phases with quality assurance and validation; and

Importance of a monitoring and evaluation (M&E) framework, as part of the continuous enhancement of analytics tools and financial instruments.

Image Credits: pixabay

Sovereign Disaster Risk Financing and Insurance Program Webinar Series

FACT SHEET 7: DATA, INFORMATION, AND ANALYTICS FOR SOVEREIGN RISK FINANCING

Test your understanding and record your insights through this easy, DIY worksheet!

Activity 1: Given below are few statements about use and importance of data, information, and analytics for sovereign disaster risk. Identify if the statements are true or false.

#	Statements	True	False
1.	Information is critical in aiding a government to decide between different combinations of risk transfer and risk retention instruments.	◯	◯
2.	There is a significant demand from DRF stakeholders for high-quality analytics that helps translate new and complex technical data into useable information.	◯	◯
3.	Data only adds value when it informs decisions.	◯	◯
4.	While navigating through vast amounts of data that can aid DRF decision making, it is essential to define the question governments are solving.	◯	◯
5.	It is important to determine what kind of data are needed before determining the type of analysis needed.	◯	◯
6.	To ensure accuracy and relevance, when searching for data, it is useful to start collecting data from scratch, instead of looking at sources that may have already collected the data.	◯	◯

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Activity 2: From the common forms of data listed below, identify the types of data needed to address a specific peril in your country context.

Peril Type & Region:

Type of Data	Required	Not Required
Risk/loss data	◯	◯
Financial exposure data	◯	◯
Macroeconomic data	◯	◯
Fiscal/financial data	◯	◯

Activity 3: Given below are list of data providers. Match the data providers to how best the government can contract with the provider.

#	Provider			How Can Govt. Contract with Provider
1.	Multilateral Development Banks	Select One	Select One	Analytics information provided to support design, selection, and execution of a financial instrument
2.	Donors	Select One	Select One	Analytics information provided to support design and selection of an insurance contract
3.	Insurance companies	Select One	Select One	Technical assistance provided through development loans or trust funds
4.	Financial intermediaries/Brokers	Select One	Select One	Technical assistance provided through projects
5.	Consultants	Select One	Select One	Technical support provided under an individual or firm contract

Activity 4: Reflections

[1] My Top 2 Takeaways from this Factsheet are:

[2] Two concepts/ideas I would like more information on are:

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