SABZ ADVOGADOS

WHERE IS MY umbrella?

A sunny future for climate catastrophe insurance in Brazil

Summary

I. Introduction: dry and wet

Every year, Brazil is hit by harsh rain events. They are not uniform, neither in intensity nor in the locations involved. Therefore, such events are, in some sense, unpredictable. Nevertheless, it is certain that, most likely between December and March, an uncertain Brazilian location will be invaded by water with immeasurable damages to both people and infrastructure.

On the other hand, the country suffers from persistent drought in some particular regions, e.g., Northeast and the far South. Such climatological situation is deeply connected to "social diseases" such as hunger, poverty and all the sores derived from them. Moreover, considering that the Brazilian energy matrix is highly dependent on hydroelectric power plants, the absence of rain is intimately correlated to higher energy prices, thus with basic inflation.

Amid such scenario, both because of extreme wet and dry conditions, Brazil losses due to climatological or meteorological events average BRL 9 billion (~USD 2 billion) per year[01] , which belies the general thought that Brazil is safe from natural catastrophes.

In 2021 and 2022, the appointed contradiction stroke the country severely. Due to La Niña[02], while persistent drought was observed – with negative impacts on agriculture and electricity prices –, the 2021-2022 summer rain season was intense and marked by flood and destruction in many regions. South of Bahia[03] and Rio de Janeiro Mountain Region[04] were the most affected areas, where more than a hundred people died and thousands became homeless. So far in 2022, the phenomenon is still impacting social life, as hard rains hit Alagoas and Pernambuco States.

Every climate catastrophe comes from a combination of somewhat unpredictable natural and predictable social variables. If a storm hits the Atacama Desert or the Artic with not one person or facility around, it is not a catastrophe, only a severe natural event.

The aim of the present report is to analyze the available data on such events and its social impacts and draw lessons from them. Such lessons are expected to improve the way people and structures can be prepared to deal with future contingencies of this nature to mitigate its consequences. That is the stage where catastrophe insurances, such as parametric, life, property, and business interruption, activity plays a leading role.

01 **Relatório de danos materiais e prejuízos decorrentes de desastres naturais no Brasil: 1995-2014.** [*Report of material damages and losses resulting from natural disasters in Brazil: 1995-2014*]. CEPED-UFSC. Available at: <https://www.ceped.ufsc.br/relatorio-de-danos-materiais-e-prejuizos-decorrentes-de-desastres-naturais-no-brasil-1995-2014/> Access: mar.28.2022.

02 **O fenômeno la niña está de volta. O que isso significa para o clima do Brasil e da região.** [*The la niña phenomenon is back. What does this mean for the climate of Brazil and the region*]. BBC Brasil. Available at: <https://www.bbc.com/portuguese/geral-58966796>. Access: apr.20.2022.

03 **Chuvas deixaram 18 mortos e 16 mil desabrigados no sul da Bahia.** [*Rains left 18 dead and 16,000 homeless in southern Bahia.*] CNN Brasil. Available at: <https://www.cnnbrasil.com.br/nacional/autoridades-na-bahia-emitem-novos-alertas-apos-chuvas/> Access: apr.19.2022.

04 **Petrópolis registrou a maior tempestade de sua história.** [*Petrópolis recorded the biggest storm in its history.*]. CNN Brasil. Available at: <https://www.cnnbrasil.com.br/nacional/petropolis-registrou-a-maior-tempestade-de-sua-historia/>. Access: apr.20.2022.

II.

An x-ray of disasters in Brazil

Climate catastrophes: a neglected data

2022

ALAGOAS

The volume of rain in two months amounted to what was forecast for the whole year in the State of Alagoas, according to data from the state government, which resulted, by early July, in 51 deaths. The federal government transferred more than BRL 2.4 million in funds to five affected municipalities.

PERNAMBUCO

The rains that hit part of the state of Pernambuco, including the Recife Metropolitan Area, in May 2022, left 126 dead and over 9 thousand homeless by early June, with damages reported in at least 51 municipalities.

2021

SOUTH OF BAHIA

175 cities were hit by heavy rains and floods, which resulted in more than 27 thousand people homeless, 153 injured and 26 dead. The economic impact of repairing the damage was estimated by the state government at BRL 2 billion, with a credit of BRL 700 million having been opened by the federal government

2020

MINAS GERAIS

256 municipalities declared a situation of emergency or public calamity during the rainy season, with 74 victims of landslides, floods and burying between 2019 and 2020, in addition to 53 thousand people affected, including homeless and injured.

2019

RECIFE (PE)

After storms between June and July, there were 20 deaths directly related to flooding and 11 due to landslides, in addition to 1,600 people displaced from their homes.

BAIXADA SANTISTA (SP)

Heavy rains on the coast of São Paulo resulted in 45 deaths caused by landslides and blockages of the main highways in the state.

2011

RIO DE JANEIRO MOUNTAIN REGION (RJ)

The rains resulted in 918 deaths and around 30 thousand people homeless, in what is considered the biggest natural disaster in Brazil. According to estimates by the World Bank, the economic impact was around R$ 4.8 billion.

SANTA CATARINA

Heavy rains hit 83 cities, resulting in 6 deaths, 172 injuries and 26 thousand people homeless. The economic impact, according to an estimate made at the time, was BRL 413 million.

2010

RIO DE JANEIRO AND SÃO PAULO

In January 2010, heavy rains in the states of Rio de Janeiro and São Paulo resulted in 75 deaths, hundreds of injuries and approximately 4 thousand people displaced. In Angra dos Reis - RJ, 35 people died.

ALAGOAS AND PERNAMBUCO

In June 2010, 30 municipalities in Alagoas and Pernambuco were affected by rains that caused 40 deaths and left more than 80 thousand homeless.

NITERÓI (RJ)

In April 2010 heavy rains caused 168 deaths and left 7 thousand homeless.

ANGRA DOS REIS (RJ)

A storm resulted in the burying and death of 53 people.

SÃO LUIZ DO PARAITINGA (SP)

São Luiz do Paraitinga, a historic city with the highest number of properties listed as Historic Heritage in the state of SP, was affected by rains that displaced nine of the eleven thousand residents of the city, resulting in 140 historic properties affected and more than 70 people dead.

2009

MANAUS (AM)

In 2009, the Negro/Solimões/Amazonas rivers system suffered a flood that lasted 244 days and caused economic, social and environmental damages to the inhabitants of Manaus, in addition causing at least 14 deaths.

2008

SANTA CATARINA

A typhoon with strong rains hit 60 municipalities intensely, leaving 150 dead and about 80 thousand homeless.

Bahia's foretold flood: a representative sample

According to the National Meteorology Institute ("INMET"), on December 7th of 2021 there was the heaviest rain in the south of Bahia since 1961. Furthermore, according to Metsul Meteorology[05], the rain was the most extreme of the planet in one region.

Last year, the Federal Government announced some aid of BRL 200 million to reconstruct the cities that were the most damaged. According to the Civil Superintendency of Defense and Protection ("SUDEC") until December 29th of 2021, 21 deaths were registered, and 91 thousand people became homeless.

At least 66 cities were in a state of emergency; the southern and southeastern regions of the State were the most affected. 25 bridges were damaged, leaving communities in isolation.

Data shows that at least 378,986 people were affected in some way by the rains.

And the most important question remains: what is the explanation for the cause of the rains? The first point is a natural phenomenon: a group of clouds that travels from the Amazon rainforest to the South Atlantic, called South Atlantic Convergence Zone ("ZCAS"), that is usual that time of the year, located in the Southeast of Brazil. The same phenomenon relates to the rains in Minas Gerais in 2020, and also those in the mountain region of Rio de Janeiro in 2011.

According to Wagner Ribeiro, a Geography Professor at the University of São Paulo (USP)[06], global warming has a part to play in this situation.

Another explanation is the *La Niña* phenomenon that means a decrease in the temperature of oceans.

In these cases, there's a critical social vulnerability event, because many people live in risk zones. We should look out for those people in danger. We should learn from the past years to prevent a new catastrophe.

The Federal Government should create a more resilient infrastructure, look at other areas that have not been affected yet, and try to

05 METSUL. **Rain in Bahia is the most extreme on the planet in December.** 29/12/2021. Available in: https://metsul.com/chuva-na-bahia-e-a-mais-extrema-no-planeta-em-dezembro/. Access: 06/07/2022.

06 RIBEIRO, Wagner apud MONCAU, Gabriela. **Entenda o que está causando as chuvas que deixaram o sul da Bahia embaixo d'água**, Brasil de Fato, 28 dec. 2021. Available at: https://www.brasildefato.com.br/2021/12/28/entenda-o-que-esta-causando-as-chuvas-que-deixaram-o-sul-/da-bahia-embaixo-d-agua. Access: 06/07/2022. [In Portuguese]

anticipate and predict the expansion of the affected areas.

Previous studies are needed to prevent new tragedies from happening in other states. The climate change is a social issue, and it is directly connected with social inequality.

There are cities that have already created measures to prevent damage from climatic events; furthermore, countries in developing process like Mozambique and others in the African continent, managed to make simple adaptations. In Santos City (SP), a plan called Santos Municipal Climate Change Plan – "AdaptaClima" was created, that looks at not just the affected areas but potential new ones.

Porto Seguro - BA (December 12th, 2021).

. Credits: Palácio do Planalto / Isac Nóbrega/PR.

An effective system must be built on two pillars: **(i)** first, design measures to prevent new catastrophes; and **(ii)** second, develop structures to mitigate damages. For example: most Cities or States have neither alert systems (prevention), nor shelters for people in danger zones or those dislodged (mitigation).

The State of Bahia tried to warn the population, but still it wasn't effective. And even if the State provides tracking, sometimes it is insufficient. The importance of looking at previously unaffected areas is precisely to anticipate catastrophes in new states, because this is the only way to prevent more damage.

Given the lack of urban planning and the absence of preventive measures, widespread issues in Brazil, damage caused by natural disasters has become increasingly common. It is necessary to create effective damage contingency measures. Flood warning systems are among the measures that have proven to be effective and have been adhered to by some states; however, it is necessary to apply such measures across the country.

Some states are in the planning stages for coping with extreme situations like these. Scholars point out the need for the permeabilization of cities. In other words, it is necessary to ensure that rainwater passes through the ground and is absorbed – and does not accumulate on the surface. Examples of permeable areas are large green spaces (such as parks) and places with bare soil or undergrowth (gardens, lawns, shrubs etc.).

Other important measures are the maintenance of river basins, the recovery of riverside forests, and the implementation of housing policies that make it feasible for residents to leave risk areas.

Crunching insurance data on natural disasters

There is no average or single climate existing in the country. Due to the large geographic extension, there are localized weather patterns that have their own regional characteristics. However, by and large, it rains heavily in most parts of the country, except in those subject to the semiarid climate that is typical in some parts of the Northeast.

However, due to a combination of climatic events and lack of public urban policies, several hydrological events of extreme water flow happened, causing a hard economic impact over the country.

These hydrological events are: **(i)** floods; **(ii)** flash floods; and **(iii)** flooding.

> *From 1995 to 2014, they costed the country BRL 72 billion[07].*

The result is that one out of five Brazilian cities suffers from those problems and their economic and social costs[08].

Floods in general make up 40% of the damages related to natural disasters in Brazil. In particular, in the North and Southeast of Brazil, which were more severely affected, the damages were of 93% and 62%, respectively[09].

From 1995 to 2014, the State of Rio de Janeiro was the most economically affected, with losses mounting to BRL 10 billion related to "just" 420 events. In the same period, the State of Santa Catarina dealt with losses of BRL 9,7 billion, spread over 1274 events and the State of Minas Gerais registered BRL 8 billion of losses in 1754 events[10]. These data show the events in Rio de Janeiro were the most violent and damaging.

Particularly in the Southeast, there is a point of interest: from 1995 to 2014, the maximum damages were registered in 2009, at about BRL 3 billion. There was, however, an outlier: the year 2011 registered around BRL 6,5 billion in losses, more than double the previous maximum of the period. This was probably connected to the extreme weather events that hit the Mountain Region of Rio de Janeiro in January of 2011.

Besides this unprecedented surge in the Southeast, other episodes of hydrological events keep happening in certain periods every year, according to the characteristics of each region of the country: **(i)** in the Central-West, between February and April; **(ii)** in the Northeast, between April and June; **(iii)** in the North, between February and May; and **(iv)** in the Southeast, between December and January[11].

07 CEPED-UFSC; SCHADEK, Rafael (org.). **Relatório de danos materiais e prejuízos decorrentes de desastres naturais no Brasil: 1995 – 2014**. Florianópolis: CEPED UFSC, 2016, p. 202.

08 FIORAVANTI, Carlos. **Enchentes: as águas encontram saídas.** Pesquisa Fapesp, São Paulo, v. 1, n. 103, p. 80, jul. 2004.

09 CEPED-UFSC; SCHADEK, Rafael (org.). *Op. cit.*, p. 229.

10 Ibid., p. 202.

11 Ibid., pp. 202-212.

This overview tells a worrying tale, because of the frequency of the hydrological phenomena. However, it also highlights that it is possible to take measures to mitigate damages. Among the available measures, insurance stands out, because of the quick availability of money and the support granted to recover the damages timely.

Unfortunately, the number of policies issued, and the total indemnity paid, does not match the needs of the affected regions.

Let's take a closer look at the event in the Mountain Region of Rio de Janeiro as an example: in 2011, the aforementioned hydrological event caused the largest losses of the assessed period. Nevertheless, according to SUSEP data[12], insurance indemnity for the inhabitants of that region did not increase proportionally in comparison to previous years. Namely: **(i)** in 2011, total indemnity paid amounted to BRL 81 million, against **(ii)** BRL 57 million in 2010 and **(iii)** BRL 19 million in 2009.

If the payment of insurance claims had been proportional to the increase in damages experienced from 2010 to 2011 (more than double), total indemnity in the latter year should have been at least of BRL 114 million, instead of the registered BRL 81 million.

This pattern is also found in the South. In 2008, due to the strong rains in the State of Santa Catarina, there was an increase in damages from around BRL 500 million to BRL 5 billion, a tenfold increase compared to previous year[13].

Again, from the insurance point of view, the gap remained. In 2008, indemnities paid amounted to BRL 3,7 million. In the previous year (2007), the amount was BRL 3,1 million; in the following year (2009), BRL 4,8 million. If the population had home insurance policies, indemnities should have escalated in similar parameters to the damages verified between 2007 and 2008, reaching around BRL 30 million.

The same trend is noticed in the Central-West, where a spurt happened between 2012 and 2013. Losses related to hydrological events in said period spiked from around BRL 100 million to BRL 800 million.

According to SUSEP, the States of Mato Grosso, Mato Grosso do Sul and Goiás together had indemnities in home insurance policies estimated at BRL 29 million in 2012 and BRL 22 million in 2013. These numbers show a decrease in claims payment in a period when losses increased eightfold[14].

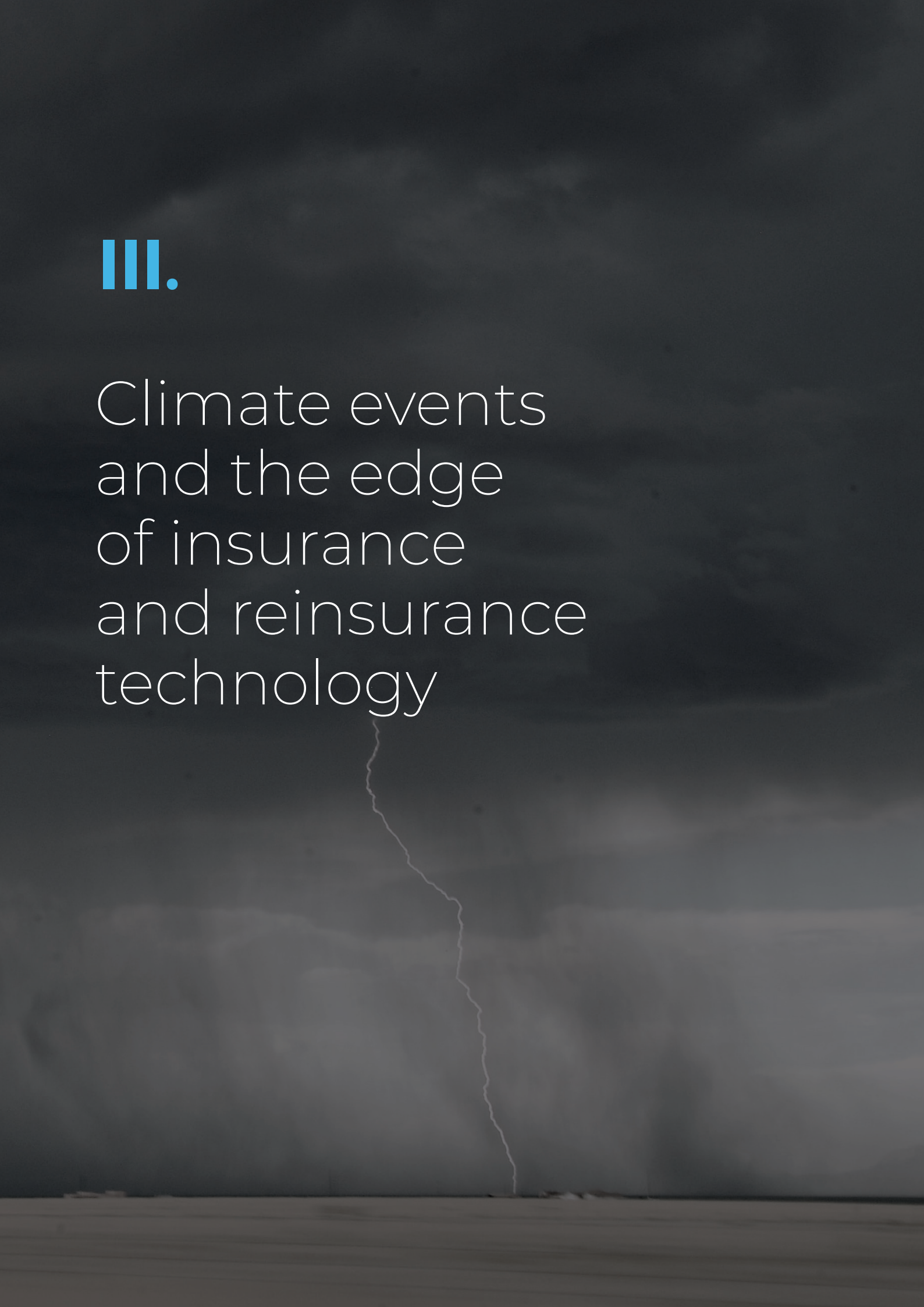
> *Despite the differences between regions, these localized studies allow us to clearly identify a national tendency of underinsurance.*

In other words, people (both in urban and rural areas) either do not buy insurance policies or buy them without the necessary covers and limits of liability. That is a huge problem to be addressed.

12 **SUSEP is the Brazilian Superintendence of Private Insurance** [*Superintendência de Seguros Privados*]. Available at: https://www2.susep.gov.br/menuestatistica/SES/principal.aspx. Access: 06/07/2022.

13 CEPED-UFSC; SCHADEK, Rafael (org.). Op. cit., p. 212.

14 Ibid., p. 204.



III.

Climate events and the edge of insurance and reinsurance technology

Insurance's key tools

The above data may seem disheartening: a recollection of tragic events that doubles as an omen of unprecedented catastrophes. But that's not how it should be read.

Humanity has always faced unknown perils, and luckily for us, each new generation is better equipped to deal with them than prior ones. Long have we defied fate, at first with all sorts of prayers, and later with more mundane methods. Among them, **insurance is deserving of the spotlight** as a leading tool in mitigating risks and losses.

At its simplest, **insurance is a contract** between (usually) two parties, in which one – the insurer – guarantees the other – the insured – against damages related to predetermined risks. But not only: **insurance is also the economic operation** that ties all these individual contracts together in a financially stable (and hopefully profitable) business.

Folk wisdom teaches that "sharing is caring". This simple concept is at the core of insurance. By assuming risks and collecting premium from a large number of individuals, the insurance company creates (and administers) a pool of resources that will be used to indemnify claims that occur among the insureds. It works because pulverizing risks among a broad sample allows the actuaries to estimate the odds of an unfortunate event happening and put a price tag on it, which is then split between the policyholders. **That's the magic of insurance and it's called mutualism.**

> *Mutualism is a key concept in understanding why insurance plays an integral role in the war against catastrophes.*

Flood, drought, windstorms, and other climatic events affect millions of people in Brazil and worldwide, with varying degrees of frequency and severity. In turn, despite their catastrophic potential, these risks allow for spreading among an enormous and diverse collective of insureds.

Furthermore, insurers have optimal alternatives at their disposal to minimize their own losses: **reinsurance and retrocession**, and **securitization (cat-bonds)**. Significant parts of the risk held by insurers is actually "shipped" (at least, in financial terms) to (re)insurers worldwide or diluted by issuing titles in capital

markets. Thus, **no single (re)insurer will be sitting on an explosive pile of catastrophic environmental risks,** hoping it doesn't blow and lead the company to bankruptcy.

Insurance is, therefore, one of the best tools available in addressing environmental risks. Amongst its key advantages to the insureds are: **(i) predictable cost** – the premium; **(ii) flexibility** – policies can easily be adapted to policyholders' needs; **(iii) funds** – insurers pay (relatively) quickly; and **(iv) expertise** – managing risks and mitigating losses are the "bread and butter" of the insurance market.

Now that we established insurance as a viable option, a more concrete question arises: which policy (or policies) are we talking about? Over the years, hundreds of different products were created. In the following paragraphs, we'll point the ones most useful in countering environmental risks, both to individuals and businesses.

On the side of individuals, there are 3 (three) large risk-groups to account for: **(i)** life and personal accidents; **(ii)** health and **(iii)** property. **Life insurance guarantees** the insureds and/or their beneficiaries against risk of death or disability, providing these people relief money to face adversity during and in the immediate aftermath of a catastrophe. **Health insurance** grants the injured and/or sick quality treatment at private institutions, while preventing the collapse of local public health. **Property insurance** indemnifies damages to home, vehicle, and other assets (depending on the type of policy), allowing the insureds to recover swiftly from their losses.

On the side of businesses, **property insurance** is also relevant, as it covers material damage to buildings (be it a small store, a corporate office, an industry plant or anything in-between), providing business-owners with money to repair, reconstruct or move out to a new address. Furthermore, **business interruption insurance** is fundamental to prevent prolonged losses that could lead the company to ruin. Finally, **rural insurance** is also important in regions that are subject to extreme weather events.

In an ideal world, every person and business would have (at least) the above policies. As such, an **insurance safety network** would be formed, greatly contributing to recovering from environmental events and allowing for a quicker return to normalcy. However, the reality in Brazil is far less ideal. Insurance is an expensive, mostly ignored product that hardly crosses people's minds, particularly in the poor regions that are often afflicted by catastrophes.

The problem of underinsurance directs the spotlight to the government, both at local and national levels, which becomes the main provider of relief to affected families and businesses.

Teresópolis - RJ (January 13th, 2011).

. Credits: Agência Brasil / Vladimir Platonow/ABr.

Aware of the pressure it places on public budget and treasury, insurers have developed a product that could relieve the government in these situations: **parametric insurance**.

At the core of parametric insurance, lies a simple premise: indemnity will be paid by the insurer if the parameter elected in the policy falls below (or rises above) a predetermined threshold (called "trigger"). It's precisely this open nature that makes parametric insurance so valuable in countering environmental risks, as these are always related to some quantifiable parameter.

A government could buy a policy indexed on rainfall, on wind speed, on earthquake magnitude and/or on any other parameter that translates (at certain thresholds) to natural disasters, effectively "hedging" its losses in case of a catastrophe. For example: if Bahia had a parametric insurance that paid when rainfall exceeded critical levels, it would have received immediate funds to bolster the emergency efforts following the tragic floods that devastated the state.

Naturally, there are other paths open to governments, such as pooling resources in advance of disasters or subsidizing insurance to people and/or businesses. In any case, at least until our insurance culture is developed to a much higher degree, it would be wise for governments to study alternatives to mitigate environmental risks.

The absence of an insurance culture in Brazil: how to deal with that?

Recent data on the penetration of insurance worldwide sends a clear message our way: **Brazilians don't buy insurance**[15]. There is, for lack of a better term, a **culture of underinsurance** deeply ingrained in our population. Despite some recent advances, Brazil is still far behind many developed (and even developing) countries in insurance protection rates[16].

It's hard to pinpoint the cause of underinsurance, particularly because a multitude of factors contribute, in varying degrees, to the result. To begin with, a huge chunk of the population simply **lacks any knowledge** of insurance. Furthermore, there is the **inherent optimism** of Brazilians, that translates to a misperception of risk: "it won't happen to me". Not to mention the simple fact people have other, more immediate **financial priorities**[17]. Finally, much like with banks, there is a **distrust in insurance** companies.

These roadblocks must be removed if we are to ever develop a healthy insurance culture. To do so, a collective effort is required; insurers, brokers, government, legislators, and many other stakeholders have a role to play[18]. The pillars to any strategy are, without a doubt: **(i)** knowledge; and **(ii)** funds.

Providing **quality information is imperative**. Most Brazilians meet insurance through the lens of an account manager trying to "force" products down their throats. Better trained staff at banks, stores and other common insurance selling points, more active insurer/broker advertising and governmental campaigns could help enlighten the population on the topic of insurance.

> *Alas, knowledge will only take us so far. Even if Brazilians see insurance in a different light, it's all for nothing unless we have the funds to pay the premium without compromising our (and our families) livelihood.*

To make matters worse, natural disasters strike the hardest in poorer areas: 91% of deaths worldwide happened in underdeveloped

15 According to a recent study by Zurich in cooperation with the University of Oxford, 54% (fifty four percent) of Brazilians interviewed said they have **no insurance of any kind** (ZURICH INSURANCE COMPANY LTD. and UNIVERSITY OF OXFORD, **People protection: insights on empowering an agile workforce**, 2021, p. 8. Available at: https://www.zurichintermediary.co.uk/advice-matters/people-protection-insights-on-empowering-an-agile-workforce. Access: 06/07/2022)

16 LLOYDS. **A world at risk: closing the insurance gap**, 2018. Available at: https://assets.lloyds.com/assets/pdf-lloyds-underinsurance-report-final/1/pdf-lloyds-underinsurance-report-final.pdf. Access: 06/07/2022.

17 It is symptomatic that Brazilian's top financial worry is paying monthly bills, suggesting a lack of revenue to look beyond immediate necessities (ZURICH; OXFORD; Op. cit., p. 26)

18 KUNREUTHER, Howard. **Causes of underinsurance against natural disasters**, in The Geneva Papers on Risk and Insurance, v. 9, no. 31, April 1984, pp. 206-220. Available at: https://www.jstor.org/stable/41950120. Access:

Santo Amaro hill - Rio de Janeiro - RJ (March 9th, 2022).

. Credits: Unsplash / @fsergiobr.

countries[19], that lack the resiliency (structurally and financially) to withstand such events.

To tackle the funding issue, **governmental programs are an important measure**. Worldwide, subsidies (either direct – for example, financing – or indirect – for example, state reinsurance) are employed to raise penetration of insurance (and other risk management strategies) in the lower strata of the population.

We have a **homegrown successful example**: PROAGRO, which covers farmer's debts in case of significant loss of revenue due to nature events (rains and droughts, plagues etc.), against payment of an entry premium[20]. A similar model might prove effective in addressing extreme weather events.

Furthermore, the government (in all Federative levels) could also be a policyholder of catastrophe insurances, particularly those built on **parametric models**.

The quick payment of indemnity without the hassle of a regular claim adjustment, which is extremely inefficient when large scale damages are involved, is the ideal response to necessities in the aftermath of a disaster.

19 According to the WORLD BANK, "Of all of deaths from weather, climate, and water hazards, 91% occurred in developing economies, according to the United Nations country classification from 1970 through 2019. The proportion remains similar for the World Bank country classification, according to which 82% of deaths occurred in low and lower-middle-income countries. (Available at: https://www.worldbank.org/en/topic/disasterriskmanagement/overview#1. Access: 06/07/2022) That strongly correlates to the insurance protection gap in developed vs. developing vs. underdeveloped countries: "There are few reliable figures on insured losses vs. total economic losses from catastrophes; those often quoted are approximately 50% in developed countries, 10% in emerging economies and 1% in Africa. These figures would suggest there is a very considerable protection gap." (INSURANCE DEVELOPMENT FORUM. **Defining the protection gap**. Available at: https://www.unisdr.org/files/globalplatform/591d4fcfd34e8Defining_the_Protection_Gap_Working_Paper.pdf. Access: 06/07/2022).

20 Information about the program is available at: https://www.gov.br/agricultura/pt-br/assuntos/riscos-seguro/programa-nacional-de-zoneamento-agricola-de-risco-climatico/proagro [in Portuguese].

IV.

Parametric insurance and public policy

Parametric insurance around the world

Alongside traditional insurance policies, governments, organizations and companies have been managing extreme weather events through parametric insurance tools since the last quarter of the 20th century.

In the companies' level, the usage of parametric policies has been disseminated specially in the agribusiness and energy industries. Losses are prevented through index-based coverages providing the reduction of uncertainty and improving stakeholders' confidence in the companies' guidance and results.

Among governments and organizations, parametric insurance has added value in the framework of public policies design. Many spread-out, unorganized, uncovered risks have become insurable thanks to the new outlook brought by the index-based insurance. Some examples are emblematic:

AFRICAN RISK CAPACITY (ARC): it was created in 2014 within the African Union to provide the continent governments with a Pan-African risk pooling structure – mainly (re) insurance parametric tools –, to respond to natural disasters caused by extreme climate events as well as diseases, epidemics, and outbreaks. An advanced satellite weather surveillance and a software compounds its main operational system, the so-called Africa Risk View. 22 African countries are current members of ARC.

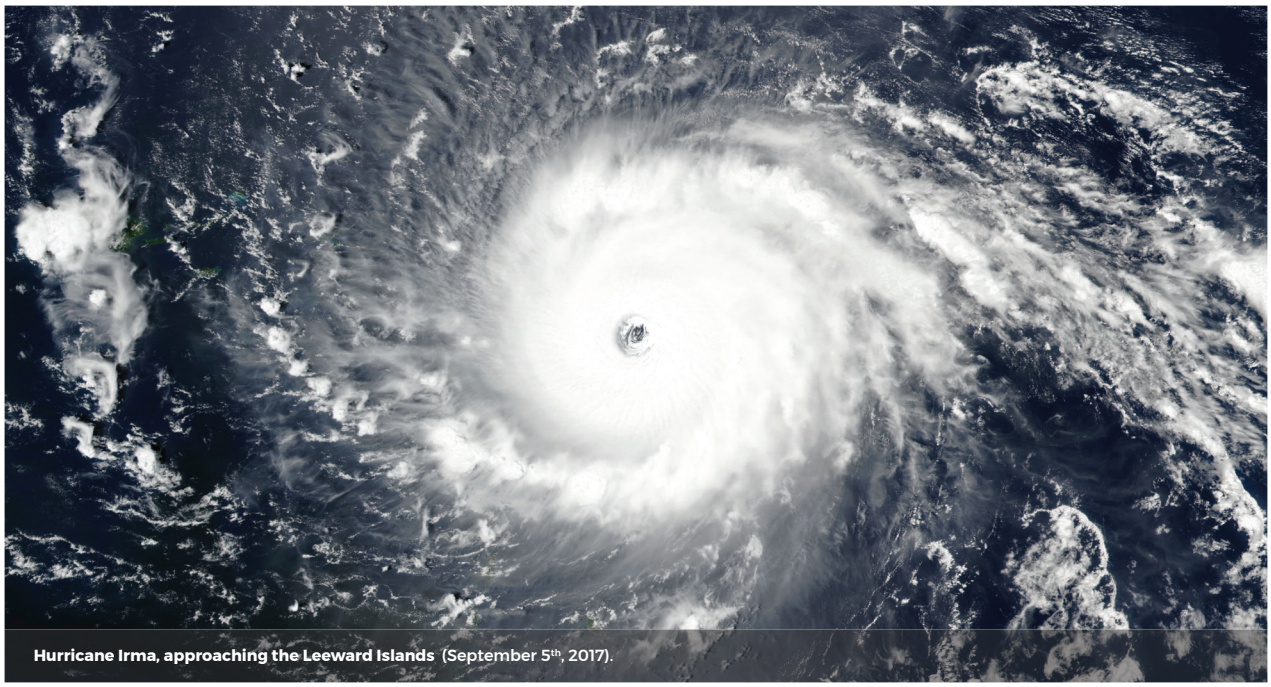
CARIBBEAN CATASTROPHIC RISK INSURANCE FACILITY (CCRIF): incorporated in 2007, it is the first multi-country insurance company in the world. It is composed of 16 Caribbean States and provides its members with financial capacity thorough parametric policies to face intense events such as hurricanes and earthquakes. It became famous after hurricanes Irma and Maria hit the region in 2017, leaving a destruction trail, and the entity indemnified the involved countries within only 14 days. It has paid out over USD 100 million in indemnity to its members since it was founded.

INDIAN NATIONAL AGRICULTURE INSURANCE SCHEME (NAIS):
targeted at agricultural risks, NAIS provides Indians farmers with insurance coverages and financial support in case of crop failures resulting from natural calamities, pests and diseases. It is operated by the Agriculture Insurance Company of India (AICI) Ltd., a state-owned company. NAIS' risk index is based on an area yield-based approach, which assesses production yield year by year and indemnifies all the farmers in the specific region where a crop shortfall is detected.

MEXICAN FUND FOR NATURAL DISASTERS (FONDEN):
it was created in 1996 by Mexican Government to provide the federal government, states and municipalities with mechanisms of rapid response to losses caused by natural catastrophes to infrastructure and low-income housing. It was originally a budget line allocated for post-disaster response expenditures. Since 2005 it became a very sophisticated state-owned insurance-like company combining risk retention and risk transferring instruments. The entity issues catastrophe bonds ("cat bonds") in collaboration with World Bank as part of its risk transfer strategy. The trigger of any payment is based on the analysis of a catastrophe magnitude under prefixed parameters which grants an impartial decision on the usage of the entity's funds.

The more such structures are developed, the more data inputs on many contingencies are collected by countries, improving their actuarial modelling of preventive measures, thus also their budgetary allocation.

In a long-term perspective, it is possible to conceive a risk managing platform – **locally calibrated and globally connected** –, able to predict and address different catastrophic risks which were, until a recent past, a disturbing natural uncertainty.



. NASA

Hurricane Irma, approaching the Leeward Islands (September 5th, 2017).

Parametric insurance as a public policy in Brazil: why not dream about it?

From a practical standpoint, the Brazilian Government has legitimate interest in organizing an actuarially balanced system of catastrophic risks management. The natural events mentioned in the first and second parts of this article and their consequences leave no doubt of such need.

Nevertheless, it is necessary to analyze, also from a legal perspective, whether Brazilian Federal Entities (Union, State and Municipalities) are legitimated to launch such a structure – to be calibrated to deal with BRL 9 billion/ year catastrophic risks –, and under what conditions.

Such legal design depends on the Brazilian Federal Constitution ("CF-88") guidelines. On this matter, Section 21, incise XVIII of CF-88 appoints the Union as the competent authority to "*plan and promote the permanent defense against public calamities, specially droughting and flooding*".

Considering the programmatic feature of CF-88 based on a "govern by policies" orientation, it means that the Union is expected to organize its organs, agents, and public activities to prevent and repair natural catastrophic events. Moreover, it is up to the federal legislator to create the legal framework for the concrete realization of such purposes.

Under such guidelines the Union published Law Nr. 12,608, of April 10th 2012, creating the National System of Civil Defense.

It consists in institutional multi-party mechanisms of monitoring, preventing, responding, and recovering against concrete consequences of natural catastrophes. Such system led Brazilian states and municipalities to organize their own mechanisms of defense, connected with the National System.

Besides other measures, such system created a systemic prevention structure coordinated between Union, States and Municipalities, that can provide climate forecasting, and flood and drought monitoring, thus allowing the development of a huge national-based prevention focused on the resilience of cities and its structures. In the responsive side, the system has been allowing some fast-track policies able to release rapid funding (mainly from Federal Treasury) for those municipalities affected by extreme events.

An in-dept analysis of the Brazilian

Civil Defense framework shows that the whole structure depends on budgetary revenues, in other words: taxpayer's money. **Not even one word regarding insurance or insure-like structures is mentioned in said system rules**.

This feature may be a trace of **inefficiency on money allocation**. A Lloyd's study of 2012 shows that "**an increase in insurance penetration of 1 percentage point would reduce proportion of the total damage resulting from a natural disaster borne by the taxpayer by approximately 22% of the total damage**"[21]. It occurs mainly due to (i) prices climbing after a catastrophic event, (ii) the inefficiency of contracting in spot prices in such moment and (iii) the public choice of improvement of infrastructures normally observed after such events. The obvious conclusion: a (re)insurance-based structure of catastrophes recovery is more efficient than a budgetary one.

Besides the improvement of cash allocation, an insured risk tends to be better managed by the insured and related parties than an uninsured risk, since any misconduct or voluntary risk increase (moral hazard) is punishable by loss of coverage. Therefore, preventive measures are expected to flourish if an insured-based risk management model boosts the Brazilian System of Civil Defense.

Last but not least: **this framework can be boosted by parametric tools, which neutralize the political bias of funding (or lack thereof) in the aftermath of a great loss**. Once one parameter is triggered, *e.g.* millimeters of rain within 03 days, number of deaths, number municipalities stroke etc., an indemnification is paid to de public administration in charge of the recovery. If no trigger is reached, no payment is due.

As predictability is assured through parametric tools, there is an increase in private agents' interest in such structure. A risk spread bond issued through the (highly developed) Brazilian capital market is also possible as additional tool, since Law Nr. 14,430, of August 3rd 2022 created the Risk Insurance Bond and defined the framework for a national *cat-bond*, which can be used to consolidate the model.

That is the challenge to be faced throughout Brazilian insurance market. Its success depends deeply on Public and private engagement. It is a great opportunity ahead for all insurance operators in this continental country.

21 Available at: <https://assets.lloyds.com/assets/pdf-global-underinsurance-report-global-underinsurance-report/1/pdf-global-underinsurance-report-global-underinsurance-report.pdf>. Access: 05/05/2022.

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Parametric insurance: other applications

Understanding parametric insurance is surprisingly simple, but one must throw away preconceived notions built upon traditional insurance branches. Parametric insurance does not belong to agricultural, property, business interruption or any other existing branches; or rather, it belongs to all of them. Depends on the perspective.

We like to think of parametric insurance more as a genre than a species. That is because, at its core, lies an indemnity equation that correlates to a previously selected index; by changing the parameters of said equation, any given interest can be insured. **Purely in terms of versatility and reach, it is the ultimate insurance**.

The applications are endless. While the most well-known example is related to agricultural risks, there are many other ingenious ways to employ parametric insurance. A business owner could insure against the fluctuation of exchange rates (or any other financial indexes). A hydroelectric power plant could avoid losses due to insufficient water flow. A government could be indemnified if the human development index falls below a certain threshold. **We can go as far as our creativity allows.**

Most important, parametric insurance is futureproof. The more technology advances, the more it will become an everyday solution. From computers monitoring the speed we drive, what we eat and our health routine to contracts run in the blockchain, the **21st century is the perfect breeding ground for an index-bound model.**

Conclusions

One thing the law of large numbers teaches us about risk is that, given an adequate sample size, it will occur. We may be unable to know in advance where, when or how; but we know it will happen. That holds true for extreme weather events, as a brief incursion in our recent history proves aplenty.

Year after year, Brazilians watch their cities get ravaged by rains, floods, mudslides, and other natural disasters, causing economic and human losses. However, a disturbing feeling of normalcy lingers. We simply lick our wounds and wait for it to happen again.

The rain-induced disaster in the South of the State of Bahia, that we chose as the background of this work, is a vocal example of the above. The event itself was inevitable, but its consequences could have been mitigated by better planning and effective measures by the Government directed at, for example, urban zoning and quality of construction. Lessons need to be learned.

Luckily for us, the tools to manage these risks are out there: insurance, reinsurance, mutualistic pools, subsidies programs etc. Parametric insurance deserves special attention for its **flexibility to adapt to any public policy**.

International examples show that parametric insurance should be an integral part of an effective anti-disaster system. With a fraction of the funds that would inevitably be spent, the Brazilian Government in all three levels (Federation, States and Municipalities) could buy insurance against recurring threats, in turn preserving taxpayer's money.

The table is set. The pieces are in our hands. Now it's on us to make the right moves and break the cycle.

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