

SCOR Annual Conference

3 & 4 October 2019

The acceleration of Hubs, Networks & Connectivity

How to ensure sustainability of insurability and its development?

**(Re)insurance tools to support resilience
of economies and communities**

Vincent Foucart – Eric Le Mercier

Agenda



The Global Resilience Challenge



The Insurance Protection Gap



The role of (Re)insurance



The need for greater coordination and collaboration

Agenda



The Global Resilience Challenge



The Insurance Protection Gap



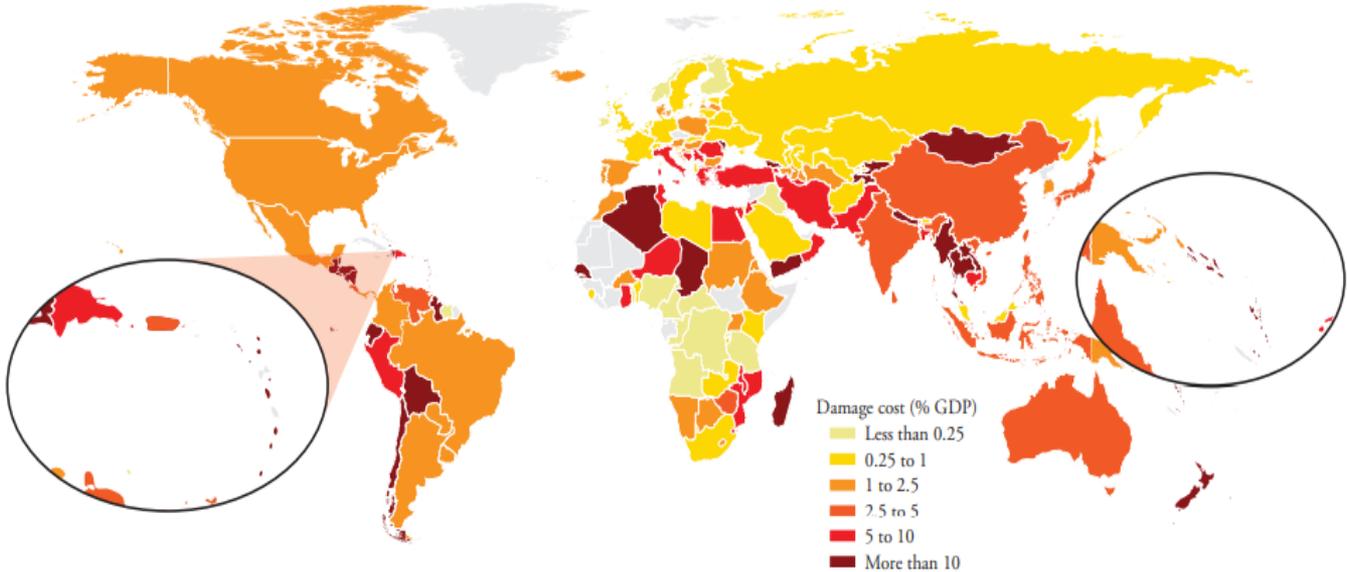
The role of (Re)insurance



The need for greater coordination and collaboration

Nat Cat losses create important macroeconomic challenges...

Natural Disasters: Maximum Damage (Maximum annual impact, 1950–2015, % of GDP)



... and man made losses too



Natural disaster shocks have the potential to undo years of development by destroying both human and physical capital across multiple channels

Effect of Tropical Cyclones on Tourism in the Caribbean, 1995–2006

	Deviation from Trend (%)			Change from Prior Year (%)		
	Receipts	Visitors	\$ per visit	Receipts	Visitors	\$ per visit
Cyclone, year <i>t</i>	-1.6	-0.9	-0.6	-1.0	-5	0.3
Cyclone, year <i>t</i> +1	-3.5	-2.8	-0.7	-1.8	-2.0	0.1
Cyclone, year <i>t</i> +2	-2.5	-0.9	-1.4	1.1	1.4	-0.3
Cyclone, year <i>t</i> +3	-3.0	-2.0	-1.0	...	...	...
Cyclone, year <i>t</i> +4	-1.8	-1.2	-0.7	...	...	...
Cyclone, year <i>t</i> +5	-0.4	-0.3	-0.2	...	...	...
Cyclone, year <i>t</i> +6	0.0	-0.9	0.6	...	...	...

... = data not available.

Source: Hsiang, Solomon. 2010. "Temperatures and Cyclones Strongly Associated with Economic Production in the Caribbean and Central America." *Proceedings of the National Academy of Sciences of the United States of America* 107 (35): 15367–72.

Average Effects a Year after Typhoon Exposure in the Philippines

Outcome	Average Rate of Decrease
Household income	-6.6*
Household expenditures	-7.1
<i>Meat</i>	-12.5
<i>Education</i>	-13.3
<i>Medical</i>	-14.3
Female infant mortality	1 death per 1,000 live births

* Compared against average savings rate of 15% in 2009.

Source: Antilla-Hughes, Jesse Keith, and Solomon Hsiang. 2013. "Destruction, Disinvestment, and Death: Economic and Human Losses Following Environmental Disaster." Social Science Research Network. doi:10.2139/ssrn.2220501.

Global Estimates of Macroeconomic Impacts of Natural Disaster Shocks

Study	Natural Disaster	Effect on Income (GDP per capita growth) (%)	
		Observed After	Observed After
Hsiang and Jina (2014)	1 standard deviation tropical cyclone	-3.6	20 years
	90th percentile cyclone	-7.4	20 years
	99th percentile cyclone	-14.9	20 years
Felbermayr and Gröschl (2014)	average cyclone	-0.16	on impact
	95th percentile cyclone	-1.75	on impact
	95th percentile drought	-0.34	on impact
Loayza et al. (2012)	Droughts	-0.6	1 year
		-3.0	5 years
Mendelsohn et al. (2012)	Tropical cyclones	\$26 billion or 0.04% of current global GDP, \$56 billion by 2100	annual
Fomby, Ikeda, and Loayza (2009)	Droughts	-1.7	year of the event
	Storms	-0.3	year of impact

Tropical cyclones impact under temperature Scenarios

	Temperature Effects on GDP Per Capita Growth by 2100 (%)				Cyclone Climate Growth Penalty ("Lost" Growth), 1970–2010
	RCP8.5	RCP2.6	Estimated Loss Using 5% Discount Rate by 2090	% of GDP, 2010 PPP*	
Philippines	-4.2	-1.0	\$ billion, 2010 PPP	81.5	-7.28
Viet Nam	-4.9	-1.2		57.9	...
Thailand	-5.6	-1.3		24.0	-2.17
Indonesia	-4.4	-0.9		1.1	-1.57
Malaysia	-4.8	-1.1		2.4	-0.25
Cambodia	-5.7	-1.4		30.6	...
Lao PDR	-4.7	-1.1		58.4	...
Developing Asia	-2.5	-0.5		...	...

... = data not available, GDP = gross domestic product, Lao PDR = Lao People's Democratic Republic, PPP = purchasing power parity, RCP = Representative Concentration Pathway.
* GDP 2010 PPP from World Development Indicators.

Sources: Authors' compilation from Hsiang, Solomon, and Amir Jina. 2014. "The Causal Effect of Environmental Catastrophe on Long Run Economic Growth: Evidence from 6,700 Cyclones." National Bureau of Economic Research Working Paper No. 20352; Lee, Minsoo, Mai Lin Villaluel, and Raymond Gaspar. 2016. "Effects of Temperature Shocks on Economic Growth and Welfare in Asia." ADB Economics Working Paper Series No. 501. Manila: Asian Development Bank.

Conscious of the increased risks generated by the combined human activities and natural disasters, UN has favored the emergence of the Sendai Framework for Disaster Risk Reduction and strengthened Resilience...

Chart of the Sendai Framework for Disaster Risk Reduction 2015-2030

Scope and purpose

The present framework will apply to the risk of small-scale and large-scale, frequent and infrequent, sudden and slow-onset disasters, caused by natural or manmade hazards as well as related environmental, technological and biological hazards and risks.
It aims to guide the multi-hazard management of disaster risk in development at all levels as well as within and across all sectors

Expected outcome

The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries

Goal

Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience

Targets

Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015	Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015	Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030	Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030	Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020	Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030	Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to people by 2030
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Source: UNISDR

...with concrete priorities for action and guiding principles calling for shared responsibility between Public Authorities and the private sector

Priorities for Action

There is a need for focused action within and across sectors by States at local, national, regional and global levels in the following four priority areas.

Priority 1 Understanding disaster risk	Priority 2 Strengthening disaster risk governance to manage disaster risk	Priority 3 Investing in disaster risk reduction for resilience	Priority 4 Enhancing disaster preparedness for effective response, and to «Build Back Better» in recovery, rehabilitation and reconstruction
Disaster risk management needs to be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment	Disaster risk governance at the national, regional and global levels is vital to the management of disaster risk reduction in all sectors and ensuring the coherence of national and local frameworks of laws, regulations and public policies that, by defining roles and responsibilities, guide, encourage and incentivize the public and private sectors to take action and address disaster risk	Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. These can be drivers of innovation, growth and job creation. Such measures are cost-effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation	Experience indicates that disaster preparedness needs to be strengthened for more effective response and ensure capacities are in place for effective recovery. Disasters have also demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of the disaster, is an opportunity to «Build Back Better» through integrating disaster risk reduction measures. Women and persons with disabilities should publicly lead and promote gender-equitable and universally accessible approaches during the response and reconstruction phases

Guiding Principles

Primary responsibility of States to prevent and reduce disaster risk, including through cooperation	Shared responsibility between central Government and national authorities, sectors and stakeholders as appropriate to national circumstances	Protection of persons and their assets while promoting and protecting all human rights including the right to development	Engagement from all of society	Full engagement of all State institutions of an executive and legislative nature at national and local levels	Empowerment of local authorities and communities through resources, incentives and decision-making responsibilities as appropriate	Decision-making to be inclusive and risk-informed while using a multi-hazard approach
Coherence of disaster risk reduction and sustainable development policies, plans, practices and mechanisms, across different sectors	Accounting of local and specific characteristics of disaster risks when determining measures to reduce risk	Addressing underlying risk factors cost-effectively through investment versus relying primarily on post-disaster response and recovery	«Build Back Better» for preventing the creation of, and reducing existing, disaster risk	The quality of global partnership and international cooperation to be effective, meaningful and strong	Support from developed countries and partners to developing countries to be tailored according to needs and priorities as identified by them	

To address the Resilience Challenge, the key is to move from 'ex post' build back to 'ex ante' disaster risk management

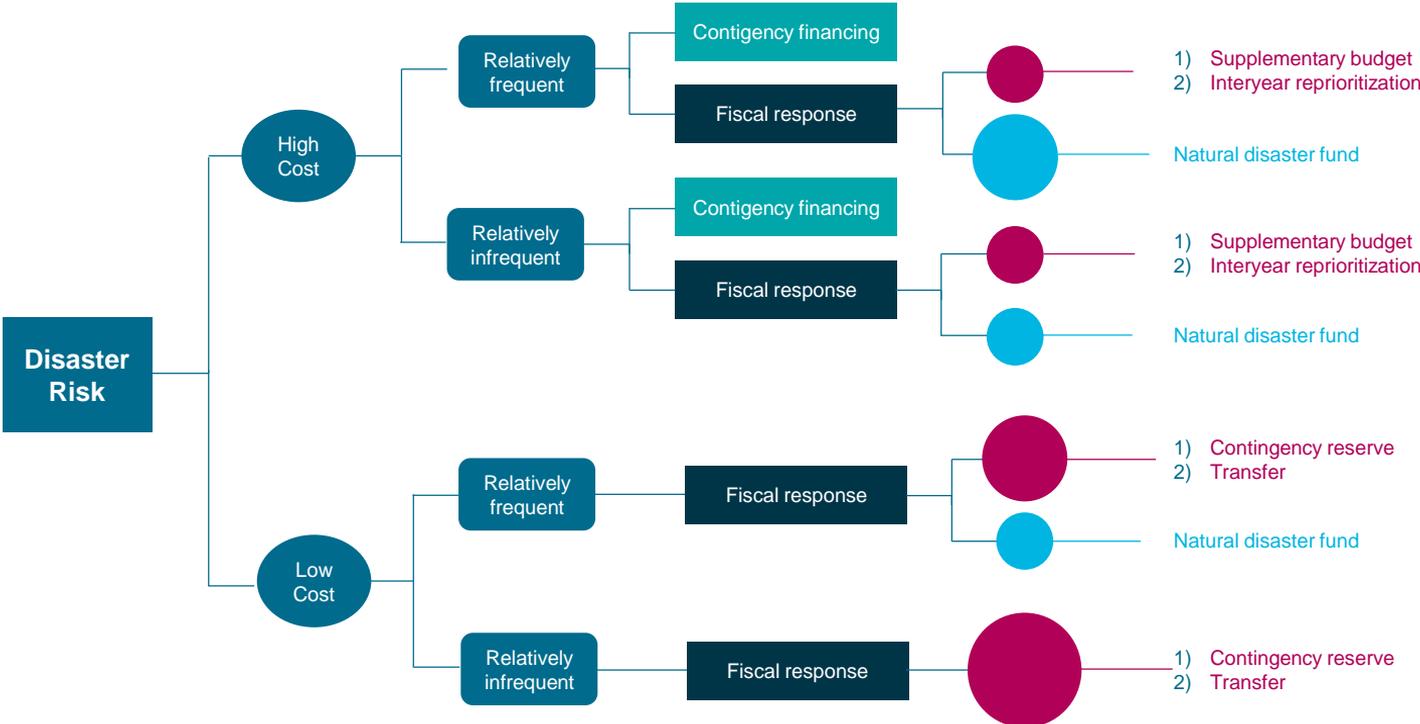
POST-DISASTER FINANCING

- International assistance
- Budget reallocations
- Debt issuance
- Post-disaster financing

PRE-PLANNED FINANCING

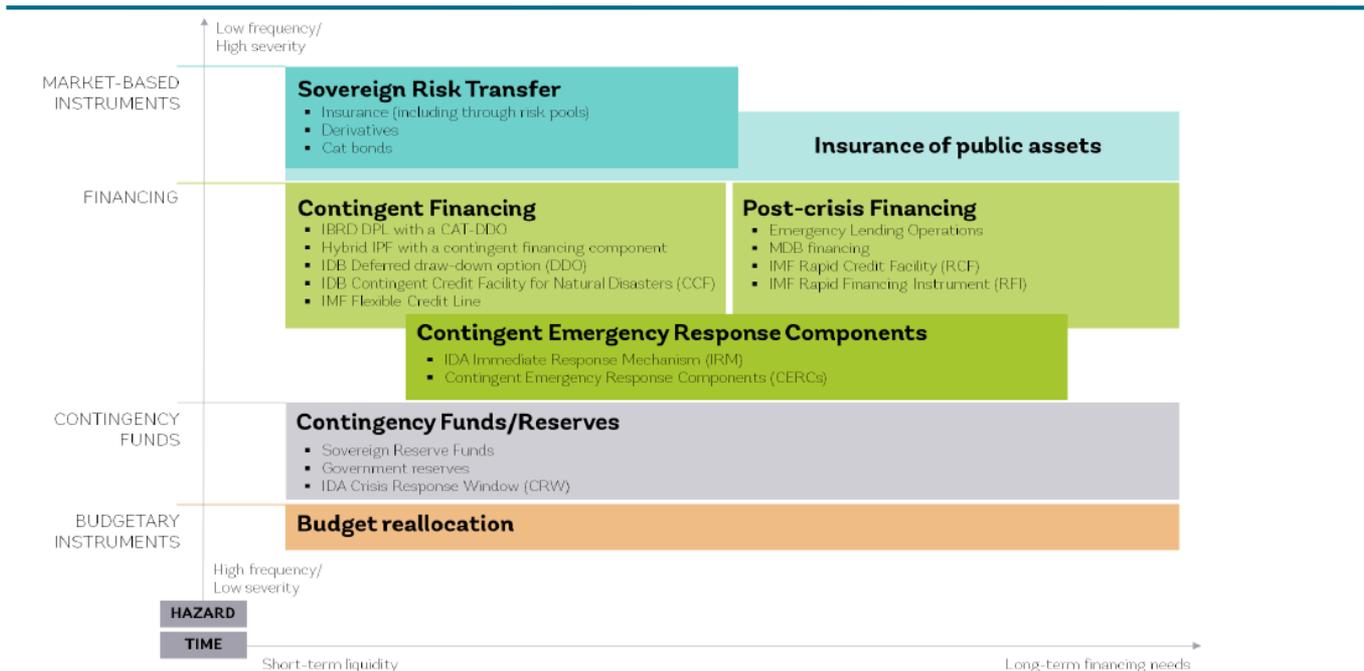
- Contingency/reserve funds
- Contingent financing
- Market-based risk transfer solutions
- Catastrophe risk pools

Macro answers combine a wide set of tools, mobilizing fiscal capacity and financial capacity (o/w public-private insurance mechanisms)



Financial protection best practices should lead public and private economic agents to Disaster Risk layering combining risk retention / financing / transfer techniques

Disaster Risk layering framework



Note: IBRD = International Bank for Reconstruction and Development; DPF = Development Policy Financing; IMF = International Monetary Fund; MDB = Multilateral Development Bank; IDA= International Development Association.

The Resilience Challenge is not only a matter of Governments and/or Supranational Organization but as well of local communities

the Resilient Cities Initiative

Over the last ten years, Resilient Cities has congregated around 4,000 participants from over 350 cities worldwide from 84 countries. Cities from both the Global South and the Global North have been represented at the Congress throughout the past years. Among them: Accra, Bangkok, Bogotá, Buenos Aires, Cairo, Cape Town, Copenhagen, Ho Chi Minh City, Istanbul, Jakarta, Luxembourg, Melbourne, Mexico City, Mumbai, Nairobi, Oslo, Paris, Singapore, Stockholm, Tel Aviv, Tokyo, Vancouver, and many others.



CiBIX
City Business Collaboration Accelerator

CiBIX workshops: cities and businesses tackling together a resilience challenge with a critical sustainability lens.



FINANCE FORUM

How can cities prepare bankable projects that attract investors? How can they partner with funders?



DISASTER RISK REDUCTION

How can cities reduce their risk? Where should they focus their attention and resources? Which examples can they follow?



INSURANCE

Climate change is aggravating the intensity and frequency of natural disaster worldwide. Is your city ready to cope with the risk? Can that risk be transferred?



INNOVATION

New challenges require new solutions. How can innovations in the resilient urban systems spur dynamic, desirable and healthy communities?



RESILIENCE PLANNING

Resilience planning is a holistic approach that takes into consideration future economic, social and environmental developments, including climate change.



RESILIENT FOOD SYSTEMS

A day-long food track on sustainable lifestyle, nutrition and waste, key elements for true resilient urban food systems!



GOVERNANCE

Addressing issues in a comprehensive and holistic manner through multi-stakeholder collaboration and multi-level governance.



NATURE-BASED SOLUTIONS

Why are biodiversity conservation and nature-based solutions important for physical and social resilience?

Agenda



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The Insurance Protection Gap



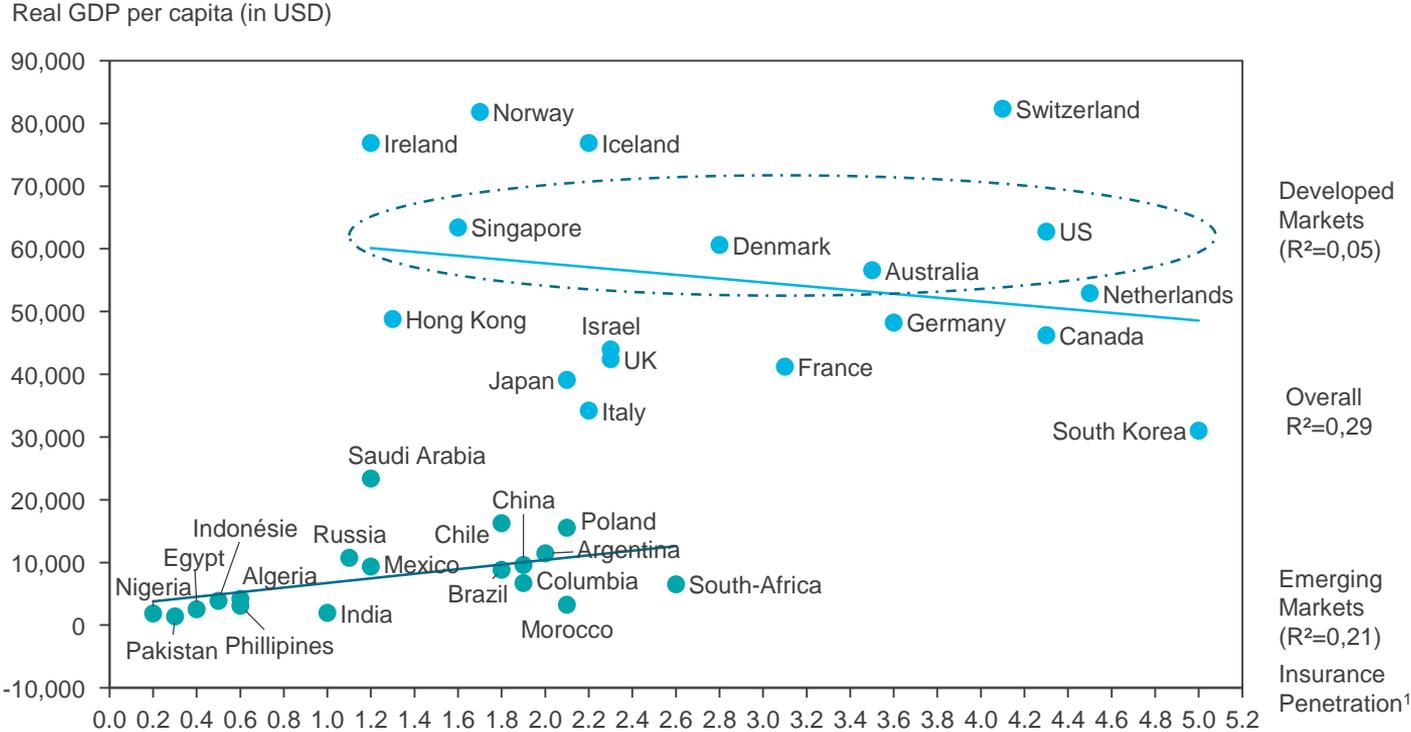
The role of (Re)insurance



The need for greater coordination and collaboration

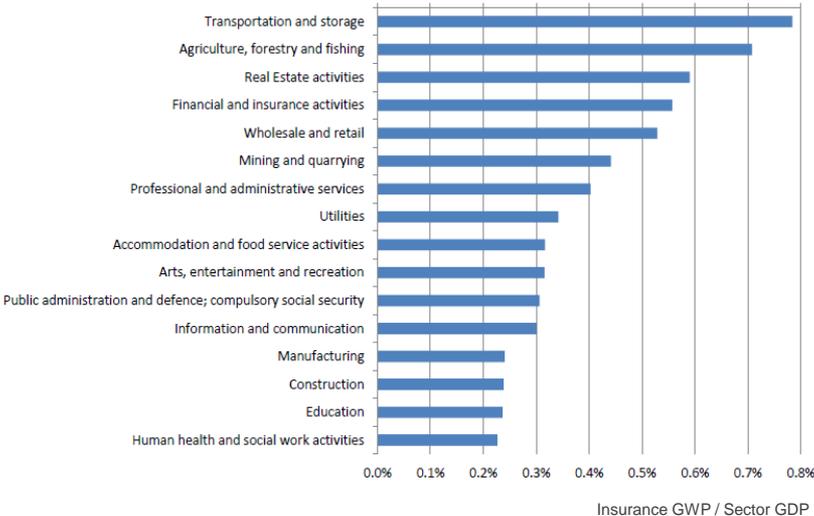
Individuals wealth is not the only driver of insurance penetration: regulatory and behavioral patterns, as well as Nat Cat frequency are also important

Insurance penetration over GDP per capita (2018)

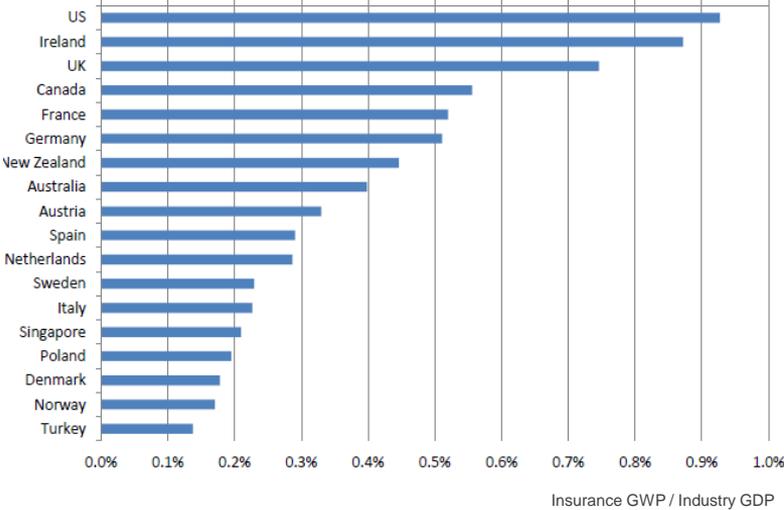


And insurance penetration vary by economic sector and by country

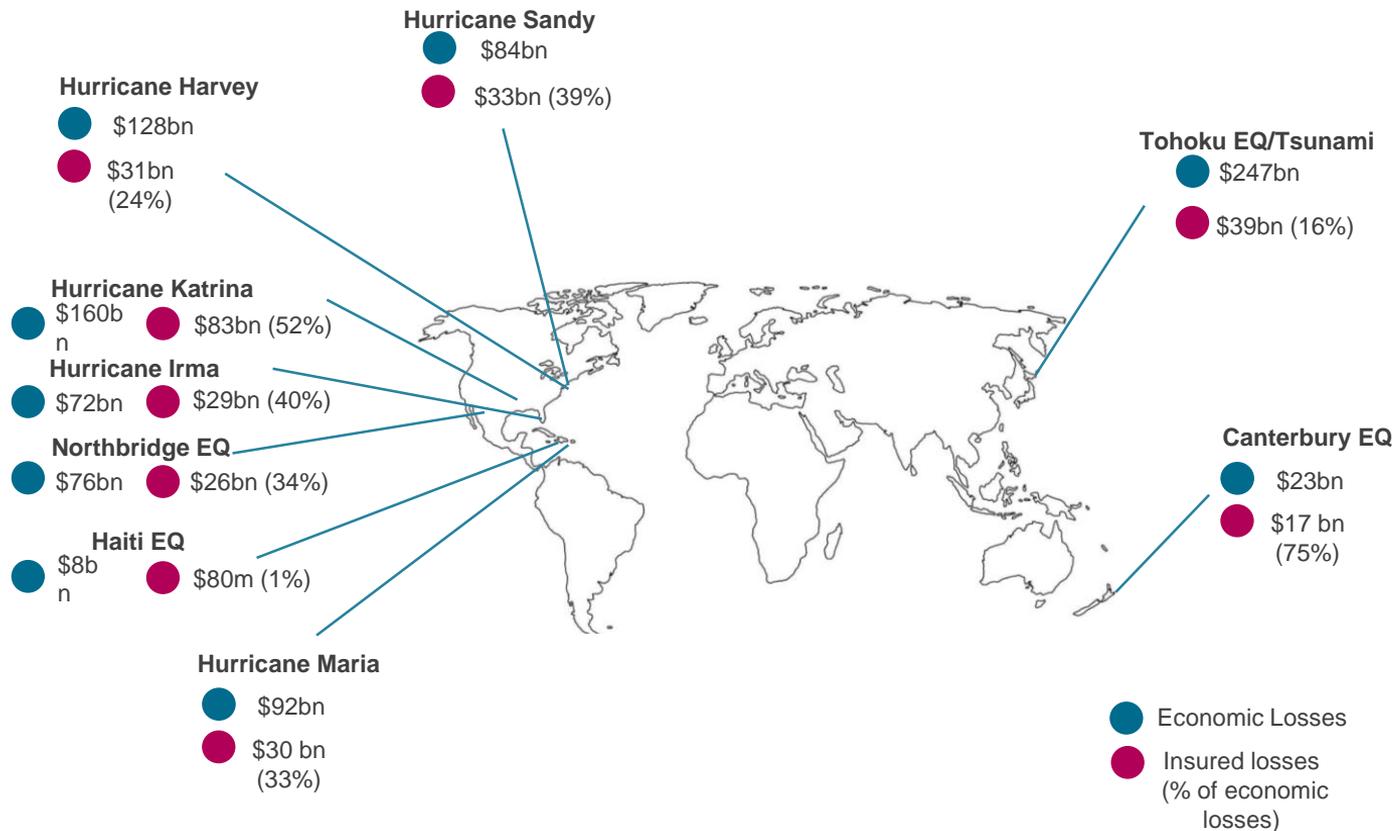
Insurance penetration per economic sector



Industry insurance penetration per country

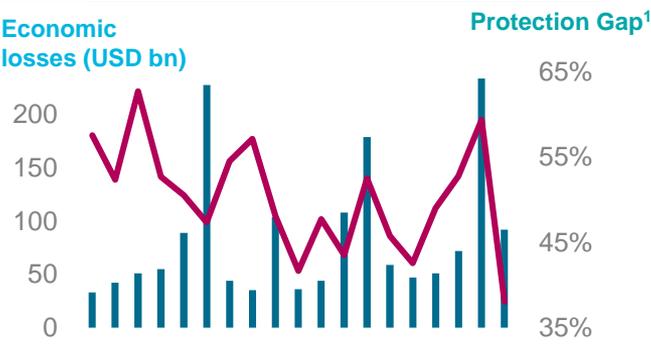


Even in the US and Japan, the largest economic losses stemming from Nat Cats are unevenly covered



Over the past 20 years, protection gaps tend to be higher, while levels are overall lower in the US than anywhere else

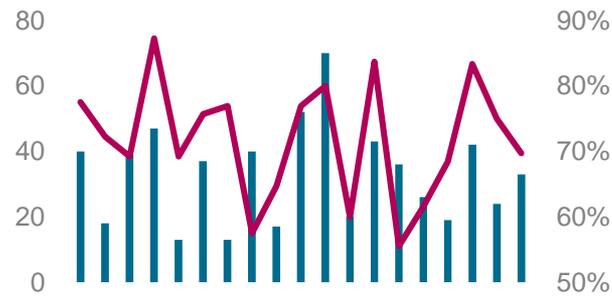
US Nat Cat losses (2000-2018)



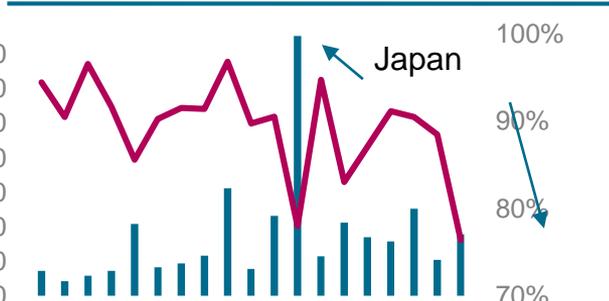
Americas (excl. US)



EMEA



APAC



Defining protection gaps

- “Difference between the amount of insurance that is economically beneficial and the amount of coverage actually purchased” (Geneva Association)
- Given issues to measure it, in practice, we replace it by an indicator comparing covered loss to total economic loss. As of today, it is mostly available for Natural and man-made catastrophes
- Such method overestimates the protection gap as it ignores self insurance – i.e. a certain level of risk retention makes economic sense

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The role of (Re)insurance



The need for greater coordination and collaboration

(Re)insurers are in a unique position to protect societies and the economy against climate change-related risks

- (Re)insurers have a pivotal role to play in facilitating comprehension, mitigation and protection with regard to the risks arising from climate change for 2 reasons:
 - their deep expertise in data analysis, risk modelling and risk transfer solutions
 - their shock-absorbing capability and fundamental function of pooling risks to optimize diversification benefits
- We need **to promote insurability and bridge the “protection gap”**. Addressing this global issue requires the combined efforts of governments and the private (re)insurance industry in the form of strong and innovative public-private partnerships. Pooling mechanisms will likely develop globally to share the peak risks across a wide pool of participants

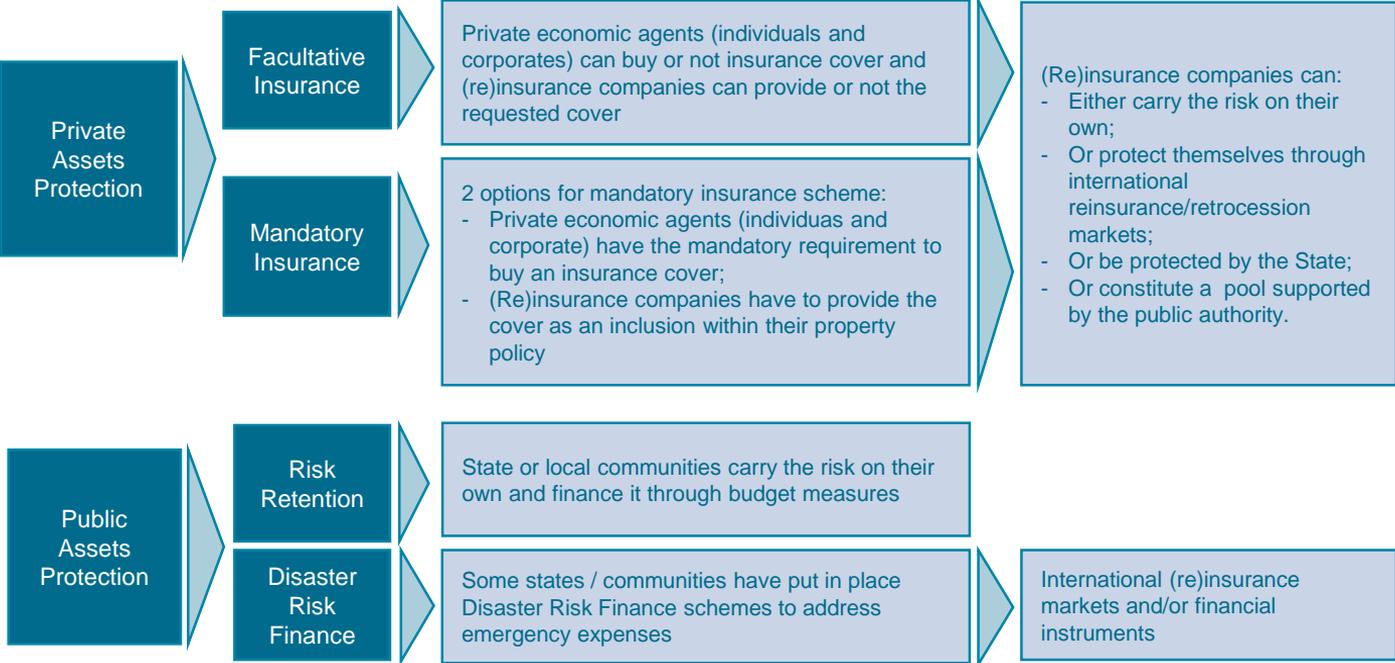


Protecting the welfare of citizens and communities is an integral part of the (re)insurance industry's corporate mission

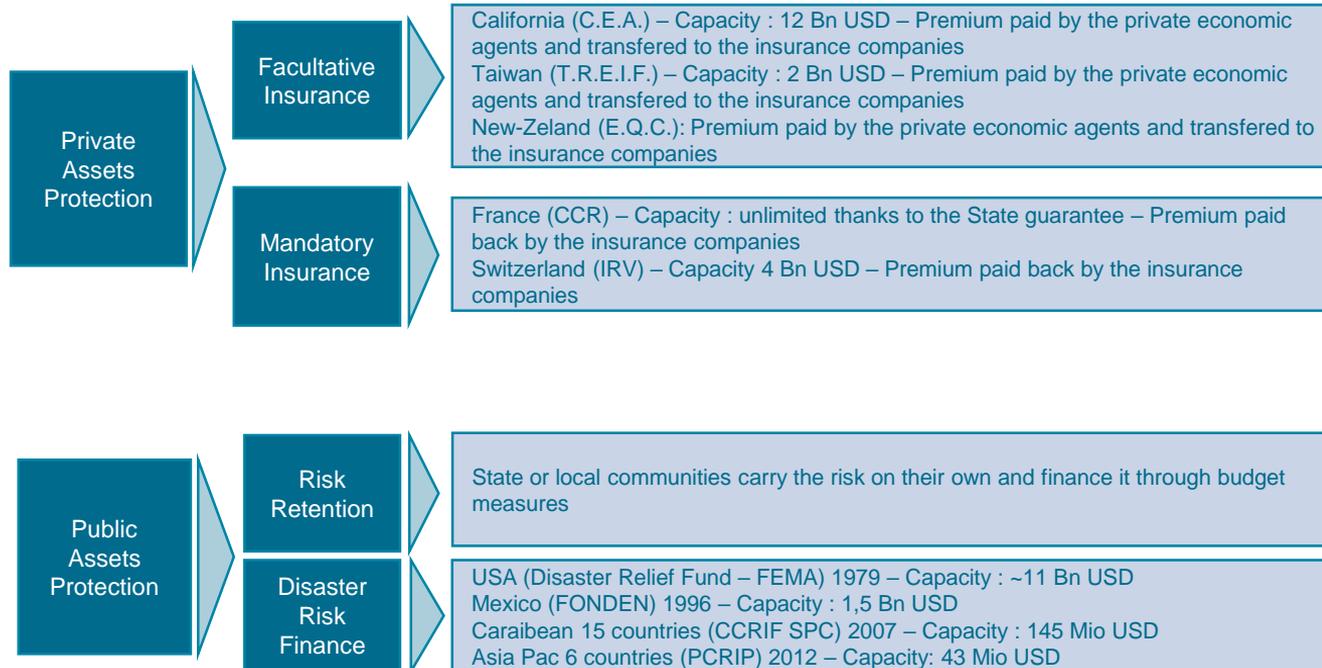
- The (re)insurance industry has been committed to contribute to the understanding of climate change and the protection against the associated risks for a very long time
- It supported the **Kyoto Declaration** in May 2009, under the aegis of the Geneva Association, stressing that the fight against the consequences of climate change needs to be a global commitment requiring the combined efforts of all (re)insurers as their fiduciary responsibility
- The 2012 UN Principles for Sustainable Insurance have led to the largest collaborative initiative between the UN and the industry: the **PSI Initiative**
- The **Insurance Development Forum** was set up in 2016 by the industry, the UN and the World Bank to foster modelling of extreme events and increase (re)insurance penetration



Coordination is required between Economic Agents and Public Authorities to face private and public assets protection gap



Few examples of successful insurance public private partnerships (PPP)



More efforts of PPP coordination are clearly required

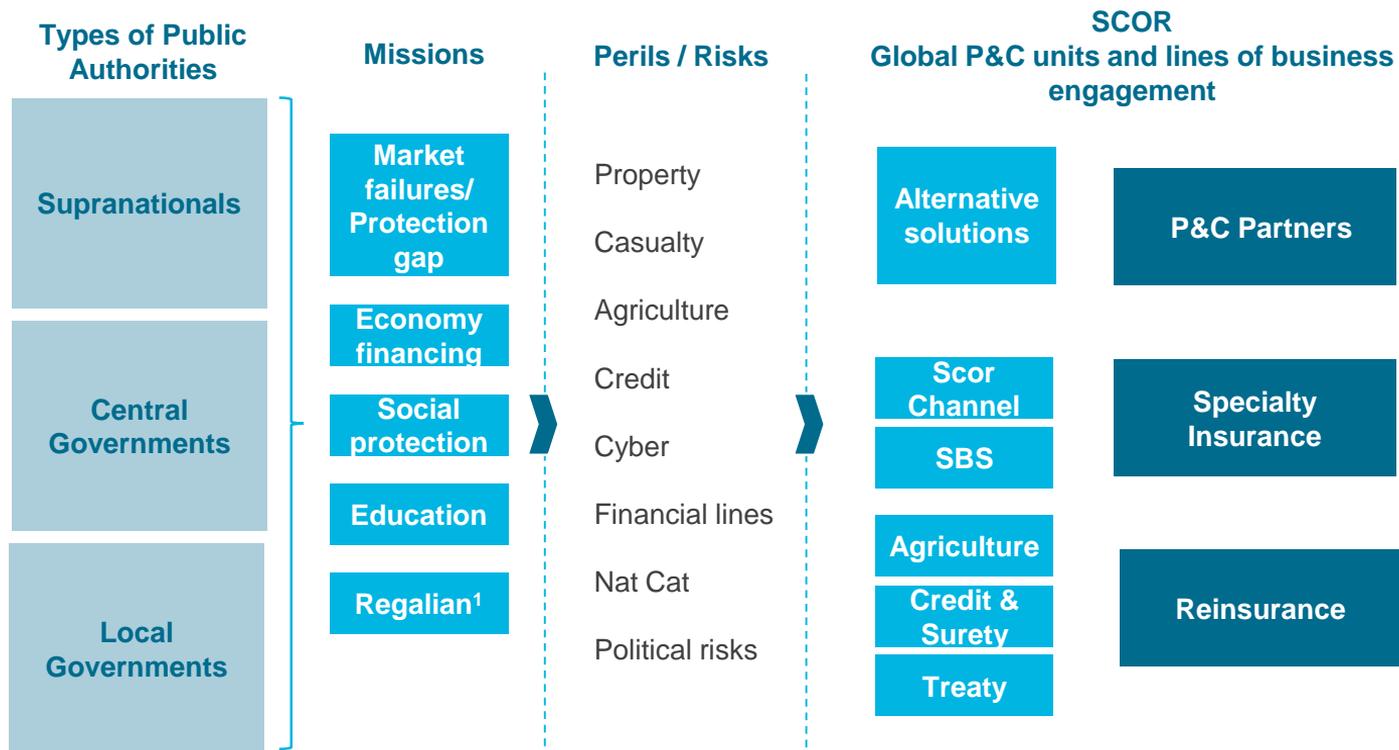
Measures	Stakeholders		Main objectives			Focus in risk chain		
	Insurers	Government	Affordability of coverage	Value of product	Access and distribution	Risk perception / Assessment	Risk reduction / mitigation	Risk transfer
Mitigation, Building standards and, zoning	✓	✓	✓			✓	✓	
Product design and innovation	✓		✓	✓	✓	✓	✓	✓
New technologies and distribution innovation (e.g. mobile distribution)	✓		✓	✓	✓	✓	✓	✓
Microinsurance	✓		✓	✓	✓	✓		✓
Developing the takaful sector	✓			✓	✓	✓		✓
Mandatory insurance programs	✓	✓	✓		✓			✓
Government-backed programs for risks that are not fully insurable	✓	✓	✓		✓			✓
Public sector insurance programs		✓			✓			✓

Bridging the protection gap is a core mission for SCOR Global P&C and the (re)insurance sector as a whole

- Changes in the macro-economic environment, technology, and data contribute to the growth of the sphere of insurable risks (incl. public goods, cyber, terrorism)
- **The challenge for insurers and reinsurers is to grow the sphere of *insured* risks**
 - Historically a lot of risks have been insured because their insurance coverage was mandatory
 - Affordability of coverage is a necessary but not a sufficient condition
 - Raising risk awareness and acknowledging behavioral factors are key
- Developing countries are characterized by higher growth potential with increased volatility in economic cycle, **generating wider protection gaps** than elsewhere



Public authorities' broad set of missions make them key partners to bridge protection gaps

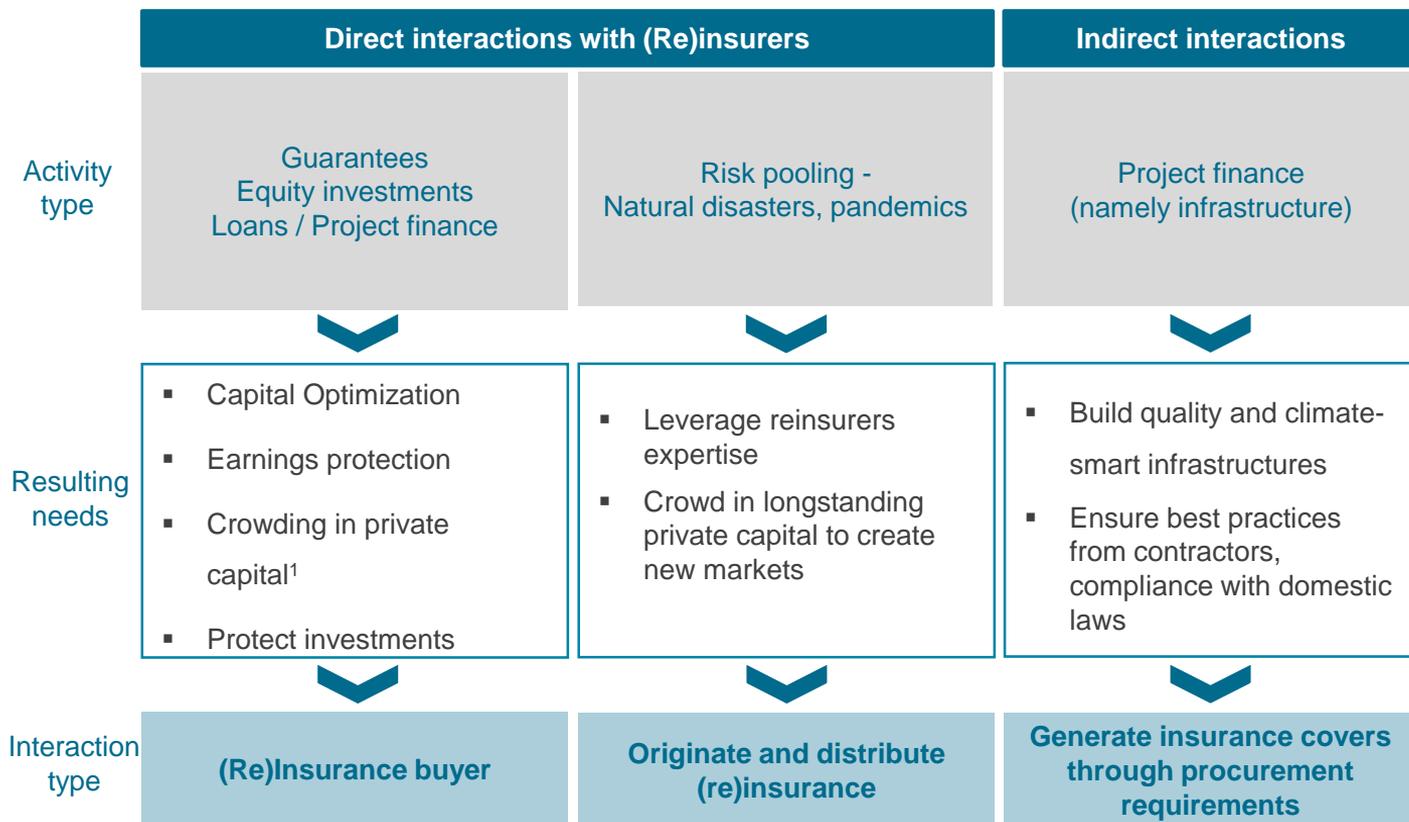


1) e.g., army, justice, police, diplomacy

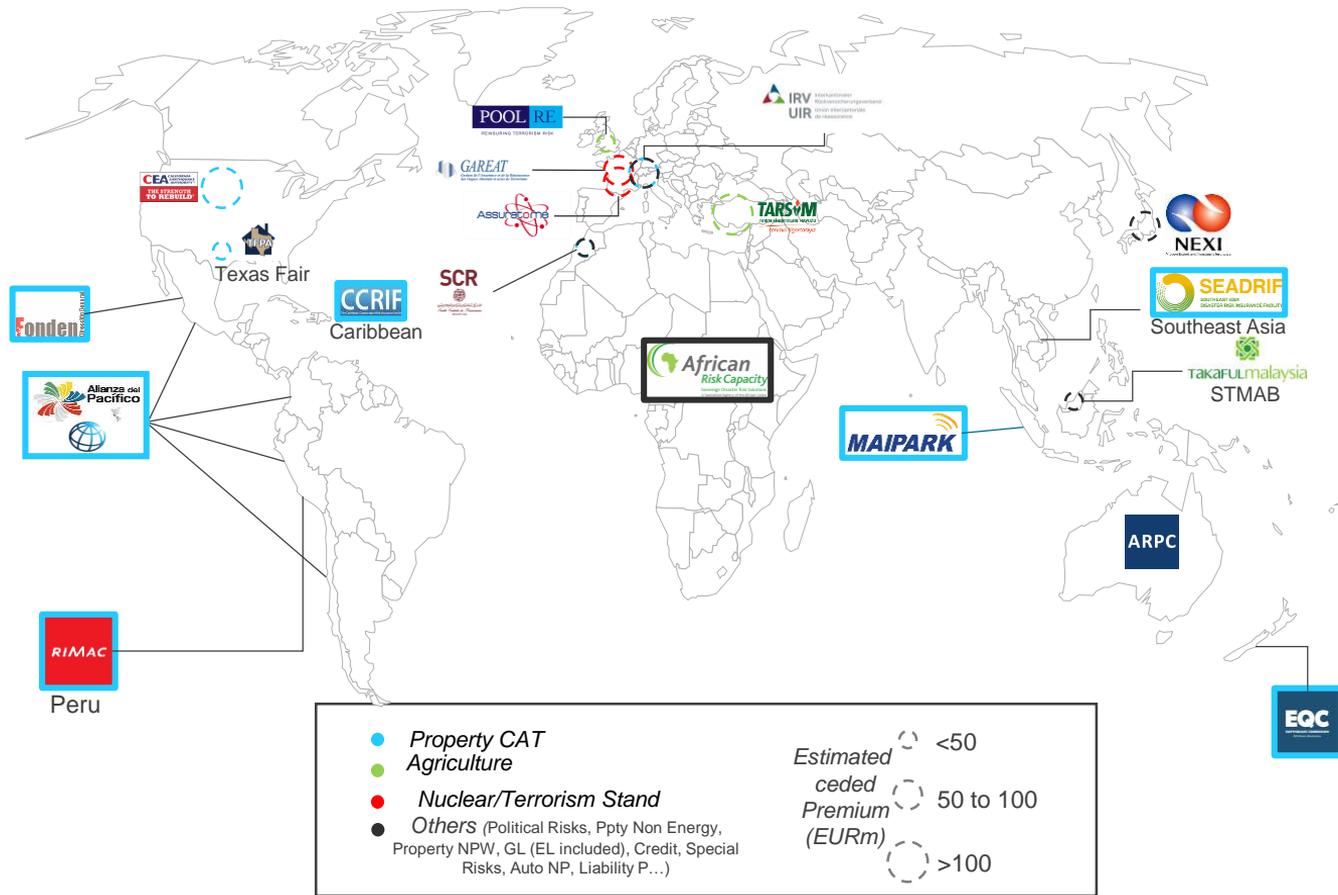
Amongst them, State-backed financial institutions are the most relevant players to partner with for (re)insurers

Type of institutions	Examples	Activities	Comments
Multilateral lending institutions (MLIs)		<ul style="list-style-type: none"> ▪ Sovereign lending for development purposes ▪ Private sector funding 	<ul style="list-style-type: none"> ▪ 7 AAA-rated institutions with a broad scope of intervention ▪ Recent capital increases ▪ Focus on climate change and infrastructure
Bilateral development agencies		<ul style="list-style-type: none"> ▪ Same as MLIs 	<ul style="list-style-type: none"> ▪ Same focus as multilateral institutions
Export credit agencies		<ul style="list-style-type: none"> ▪ Export finance 	<ul style="list-style-type: none"> ▪ Filling market failures in addressing trade finance issues
Domestic State-backed finance institutions		<ul style="list-style-type: none"> ▪ Infrastructure finance ▪ Sub-government funding 	<ul style="list-style-type: none"> ▪ Implementing public policies ▪ Increasingly driven by climate change

(Re)insurers can cooperate with public authorities on multiple fronts, namely through climate and infrastructure finance



A wide range of Public-Private partnerships help bridge the protection gap globally, covering mostly Agriculture and Property Cat risks



Risk-transfer schemes allow better insurance penetration, across policyholders, leveraging private capital appetite and government backstops



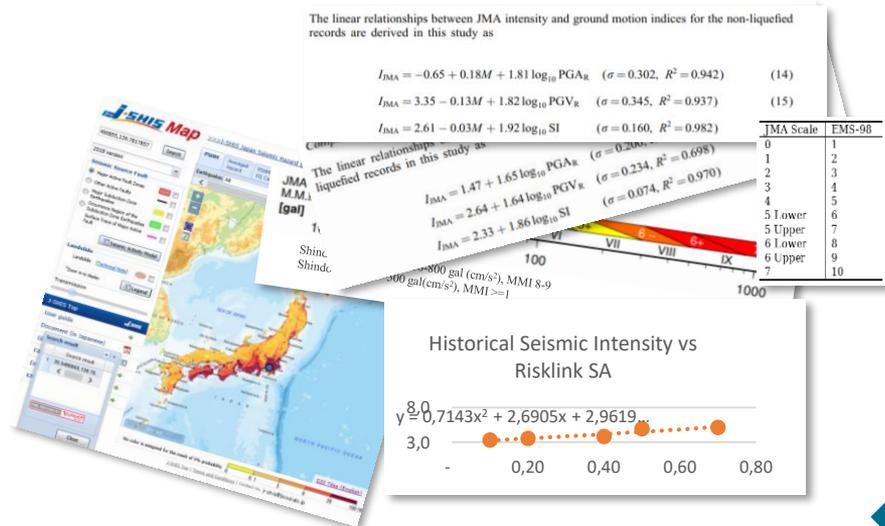
Parametric insurance products can be useful tools to bridge the protection gap

- From a macroeconomic standpoint, **parametric insurance can be a useful tool for developing countries**, as they are more vulnerable to Nat Cats:
 - Parametric triggers are easier to understand from a modelling perspective and allow to enlarge investor base and potential capacity available
 - Provides quicker disbursement, while liquidity is a key consideration for the financial system should a “systemic” Nat Cat happen
- Some examples:
 - Following economic crisis, Grenada purchased parametric insurance under, added a “hurricane bond” clause – cat-in-a-box structure e.g. cyclones, earthquakes, and excess rainfall.
 - More recently, Granada

Payout Function

	Earthquake Expense Cover
Payout Amount	For Shindo 6+ event: Payout Amount = Min([50]% of Policy limit, Insured Amount)
	For Shindo 7 event: Payout Amount = Min([100]% of Policy limit, Insured Amount)

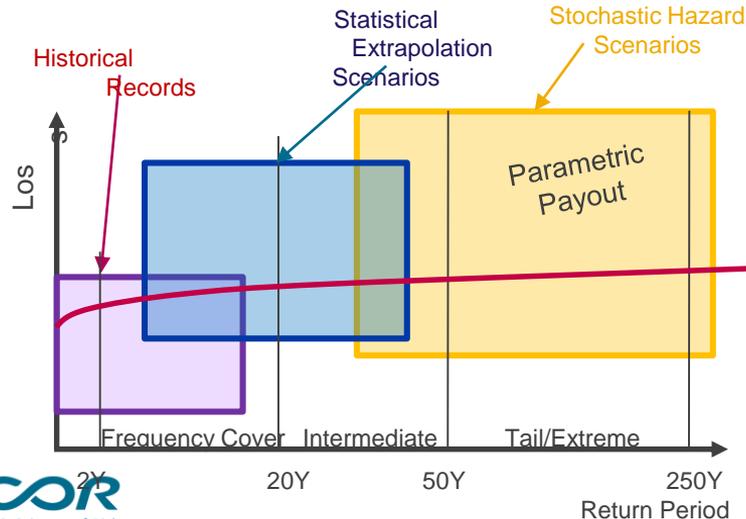
A multitude of modelling options



An Intensity Scale is a well accepted measure for natural catastrophe. It can lead though to some challenge in the modelling.

Intensity Scale	Characteristics	Application	Benefits / Challenges
<p><i>An expert measure of an event strength most used for Nat Cat</i></p>	<ul style="list-style-type: none"> Recognized unit within scientific community Measuring the intensity of an event Taking into account vulnerability of the assets at locations 	<ul style="list-style-type: none"> Nat Cat Earthquake: Mercali, Shindo Typhoon: Saffir-Simpson 	<ul style="list-style-type: none"> Most-used indices Reported in 3rd-party model outputs Intrinsically related to destruction power by size, duration, strength If not requiring expertise to translate index to model outputs Potential local vs regional discrepancy

From Experience to Stochastic Approach => Adapt to the context

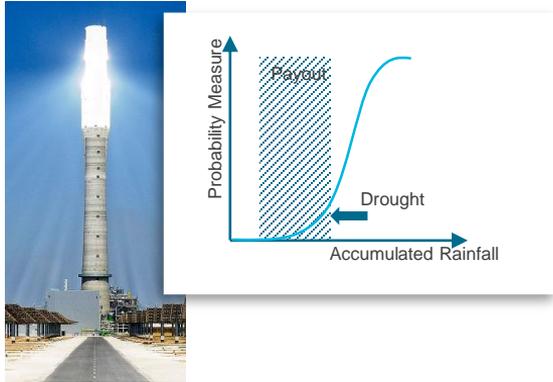


- Available Historical Time Serie length is “finite” and varies from
 - 20-50 years (consistent and homogenous weather stations depending on the parameter and the network density)
 - up to 100-500 years (historical earthquake source catalogue for large events)
- Pricing/assessing risk transfer requires that the time series is at least twice longer than the range of return period of the “mid-point.
- Statistical Extrapolation on the historical data and generate stress scenarios based on those time series can be used to extend the possible range of the parametric payout.
- For hazard location it is more complex to extrapolate/generate scenarios

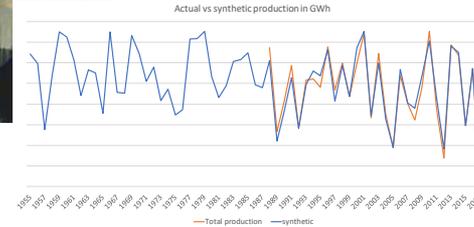
Indices can be tailored to the underlying risk. They are only limited by technology and risk adequacy.

Physical Measure	Characteristics	Application	Benefits / Challenges
<i>Flexible metrics for any type of Weather exposure</i>	<ul style="list-style-type: none"> Physical measurement of covered event Dependent on type of event Only limited by available technologies: on-site devices, weather stations, gridded data, satellite images Covers all types of occupancies Tailored to risk situation 	<ul style="list-style-type: none"> Very broad for Weather + Flood events All types of occupancy 	<ul style="list-style-type: none"> Very flexible Basis Risk to be mastered Complexity to be limited Not replacing risk mitigation Suitable technology required

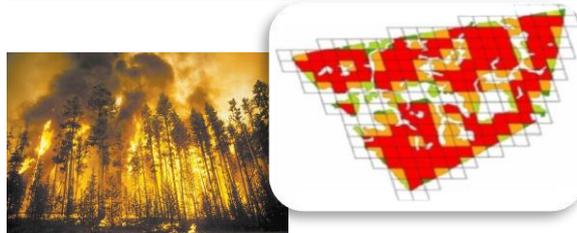
Lack of Rainfall: A New Solar Technology



Hydro-Powerplant



Wildfire using Satellite Images



Application at the city level, not only the state level: The challenge of resilient cities

Case study

A large city, in an earthquake prone area, looking for emergency fund.

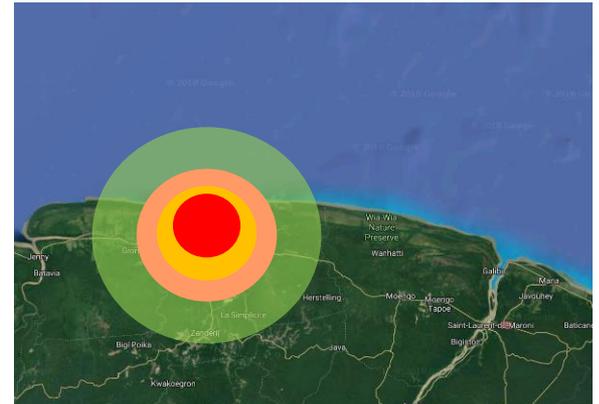
Solution

Based on Earth Quake modelling of the area, SCOR proposed a 4-level payout grid (ranging from 50 to 500M) based solely on the magnitude of the earthquake and its distance to the city center



Param. fixed value		Magnitude Mw																					
		5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.5	6.6	6.7	6.8	6.9	7.0	
Distance (km)	< 5	50	50	50	50	200	200	350	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	5-10	-	50	50	50	200	200	300	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	10-15	-	-	50	50	200	200	200	300	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	15-20	-	-	-	50	50	200	200	200	200	350	500	500	500	500	500	500	500	500	500	500	500	500
	20-25	-	-	-	-	50	50	200	200	200	200	250	350	500	500	500	500	500	500	500	500	500	500
	25-30	-	-	-	-	-	50	50	200	200	200	200	200	250	350	500	500	500	500	500	500	500	500
	30-35	-	-	-	-	-	-	50	50	200	200	200	200	200	200	200	300	350	500	500	500	500	500
	35-40	-	-	-	-	-	-	-	50	50	200	200	200	200	200	200	200	200	300	350	500	500	500
	40-45	-	-	-	-	-	-	-	-	50	50	200	200	200	200	200	200	200	200	200	300	350	500
	45-50	-	-	-	-	-	-	-	-	-	50	50	50	50	50	50	50	200	200	250	250	250	250
	50-60	-	-	-	-	-	-	-	-	-	-	50	50	50	50	50	50	50	200	200	200	200	200
	60-70	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	50	50	200	200	200	200	200
	70-80	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	50	200	200	200	200	200
80-90	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	200	200	200	200	200	
90-100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	50	50	50	200	200	200	200	

Illustrative figures and map



Benefit

Simple design, fast settlement. Can also be design for cities exposed to typhoon/hurricane/windstorm and flood.

(Re)insurers are equipped to manage portfolios of cities

Reinsured: Chinese insurance company

Original clients: City governmental bodies in Guangdong province

Form: proportional reinsurance of underlying parametric product

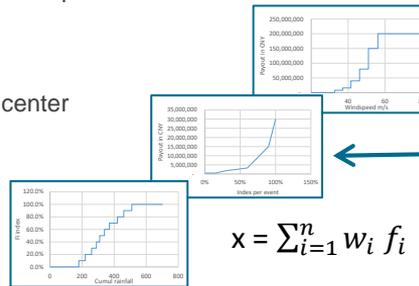
Term: 3 years



Trigger/Coverage example for 1 city

- **Typhoon:** max 2min average windspeed in a 90km circle
- Payout based on a table
- Measurement National meteo center

- **Rainfall:** 47 stations in Shantou City, measure from A to B
 - A when any station 3-day cumul >50mm
 - B when all stations cumul <50mm
 - Payout based on index for each event
 - Additional payout for stations with daily rainfall >300mm
 - Measurement Hydrological Bureau



Agenda



The Global Resilience Challenge



The Insurance Protection Gap



The role of (Re)insurance



The need for greater coordination and collaboration

To conclude

“There is no one group that can close the insurance gap on its own.

It requires action from all parties that have the expertise and tools to make a positive change ».

APPENDICES

CEA: removing earthquake risk from the market

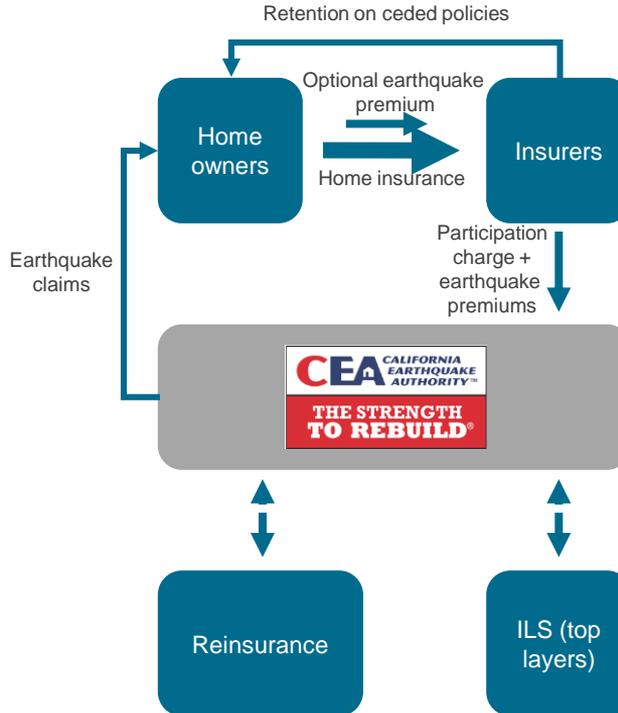
Structure

- The insurance is not mandatory for homeowners but it is mandatory for insurers to offer it.
- Rates are market-based (sound actuarial rate)
- Participation to the CEA is not mandatory for insurers
- Insurers pay a charge to participate in the CEA and then transfer the premium and the bulk of the risk to the pool. In turn, the CEA uses traditional reinsurance and ILS to cover itself against tail risks
- The CEA is covered through traditional reinsurance and ILS's but not the state
- Ongoing developments and discussions to develop parametric layer

Result

- 11% of homeowners have earthquake insurance in California while around 80% of insurers participate in the CEA
- The CEA solved the supply shortage but did not close the protection gap

Financial flows



Flood Re: distributing flood risk in the UK

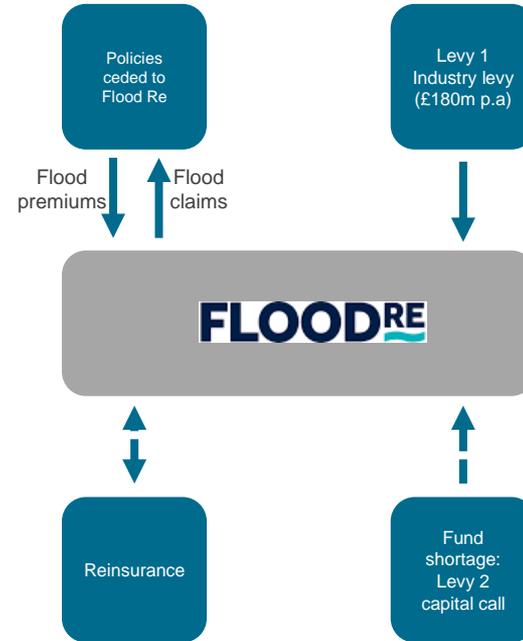
Structure

- The scheme is funded through an GBP 180m annual levy ('Levy 1') from all UK home insurers (pro rata of market share) for the first 5 years and reinsurance premiums from insurers to Flood Re
- There is an additional contribution from all UK home insurers if there is a shortage in fund ('Levy 2')
- (Re)insurance rates are based on the council tax bands of the risks
- Insurers decide which flood risks to cede to Flood Re
- The mechanism also uses outside reinsurance

Result

- As of Mar-2018, 60 insurers representing 90% of the UK household insurance market participate in the Scheme

Financial flows



ARPC: balancing risk removal and distribution for terrorist risk

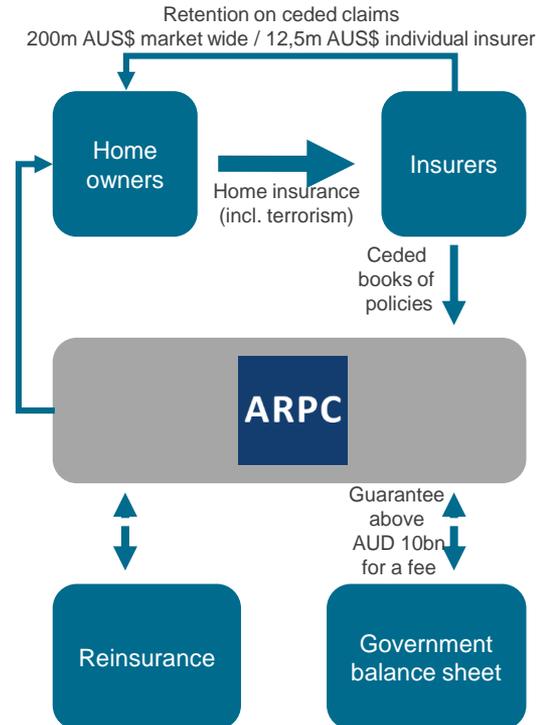
Structure

- The insurance is not de facto for homeowners as insurers cannot exclude it from traditional coverage. It is up to the state to define an event as a terrorist attack
- Rates are market-based
- Participation to the ARPC is not mandatory but binary: all or none of the policies must be ceded by the insurer
- Premium ceded follow 3 price tiers based on location (City center versus suburbs or rural areas)

Result

- Both insurer participation and coverage are very high
- Allows for gradual return to market capital

Financial flows



Caribbean Catastrophe Risk Insurance Facility (CCRIF) parametric protection

CCRIF

- CCRIF is a «pool» sponsored by 20 Caribbean and Central American Governments (Haiti, Bahamas, Jamaica, ...)
- Following Hurricane Ivan in 2004, these Governments rallied urgently to establish a disaster risk protection mechanism.
- A parametric protection contributes to the financing of the pool. It covers the risks of tropical cyclones, earthquakes and excessive rainfall.
 - First WB sponsored 30MUSD Cat Bond issued in 2014
- Benefits from parametric protection are calculated from a fixed payment table. The table reflects the expected intensity of the events.

2017 Hurricanes

- Hurricanes Irma and then Maria triggered the cover in 2017.



- ✓ 50+ millions USD have been paid in the aftermath of the storm season
- ✓ All payments made within 14 days (partial payments within 7 days)

Last developments

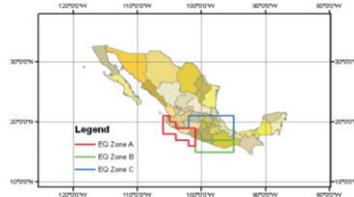
- All of the members have renewed their parametric risk transfer protection for the 2018-19 policy year
- 12 of the governments have increased their coverage
- 3 new members have joined the pool (British Virgin Islands, Montserrat and St. Maarten, 2018)

FONDEN (Natural Disasters Fund) parametric protection

FONDEN

- FONDEN Mexico's fund for natural disasters, established in the late 1990s to support the rapid rehabilitation of federal and state infrastructure after disaster.
- FONDEN resources are leveraged with market-based risk transfer instruments (parametric Cat Bonds and parametric reinsurance)
- Payment parameters are based on the magnitude of the earthquake or the minimum pressure for a storm.

Earthquake hazard



Zone	Zone A	Zone B	Zone C
Trigger magnitude (Mw)	>7.9	>7.4	>8.0
Trigger depth (km)	200	200	200

Latest issuance

- IBRD / FONDEN 2017 multi-peril cat bond issued in August 2017
- USD 360m coverage for 3 year
 - 150m for earthquakes,
 - 100m for a storm on the Atlantic side,
 - 110m for a storm on the Pacific side.

2017 Earthquake

- A magnitude 8.1 earthquake has struck off the coast of Mexico in September 2017
- Triggered the parametric protection for the maximum sum of 150 million
- yet limited losses



Latin America Parametric Earthquake Protection

Pacific Alliance

- Chile, Colombia, Mexico and Peru looking for insurance coverage to protect themselves from the financial impact of natural disasters



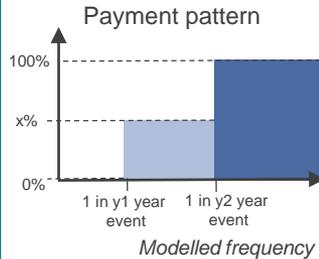
2018 record issuance

- Cat bond issuance issued through the World Bank's International Bank for Reconstruction and Development (IBRD) global debt facility
- USD1.36bn issued in February 2018 to cover
 - USD 400m Colombian earthquake
 - USD 260m Mexican earthquake
 - USD 200m Peruvian earthquake
- Largest single issuance of catastrophe bonds IBRD has ever facilitated, in fact the largest sovereign risk insurance transaction ever seen.
- Also the second largest issuance of catastrophe bonds on record, after the Florida Citizens USD 1.5bn Everglades Re transaction that was issued in 2014.
- Chile, Colombia and Peru first time access to the capital markets to source disaster risk insurance – as Mexico already has its Fonden program

Philippines GSIS Parametric Cover

Risk

- Philippines regularly swayed by natural catastrophes like typhoon, earthquake, flood
- Immediate recovery is key for local economy to get back on their foot
- Hazard map is very broad due to distribution of islands.



Solution

- Wide-spread coverage, covering 25 provinces most impacted by climate disasters
- Reduced basis risk thanks to targeted modelling for climate resilience. Post-event emergency loss model tuned for Asia Pacific by Air Worldwide
- Defined pay-out by provinces and overall as a function of the modelled return period
- Fast pay-out

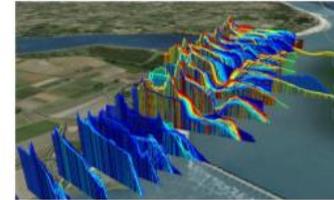
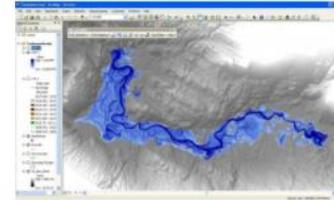
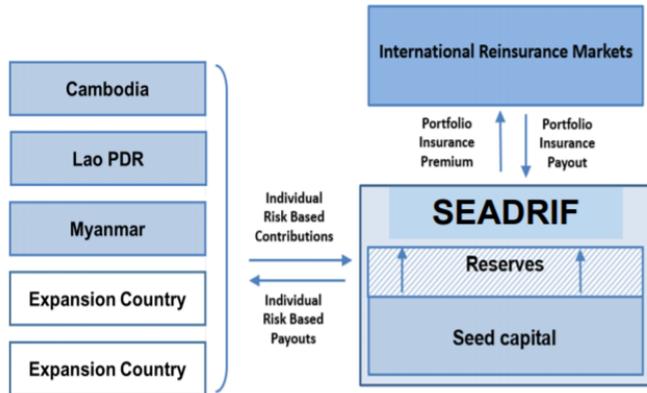
Coverage program

- Government of Philippines (GSIS) launched a 1 year program in July 2017
- Part of a multi-layered initiative to increase disaster resilience of Philippines
- The World Bank IBRD acts as an intermediary to transfer the risk to a panel of international reinsurers
- 206 m\$ coverage against losses
- May be renewed by the end of 2018



SEADRIF risk pool

- Southeast Asia Disaster Risk Insurance Facility (SEADRIF): regional catastrophe risk pool to provide rapid response financing in the immediate aftermath of a disaster
- Current members are Cambodia, Lao and Myanmar
- Philippines expresses interest to join
- Facility established with the assistance provided by the World Bank Group's Disaster Risk Financing and Insurance Program (DRFIP)

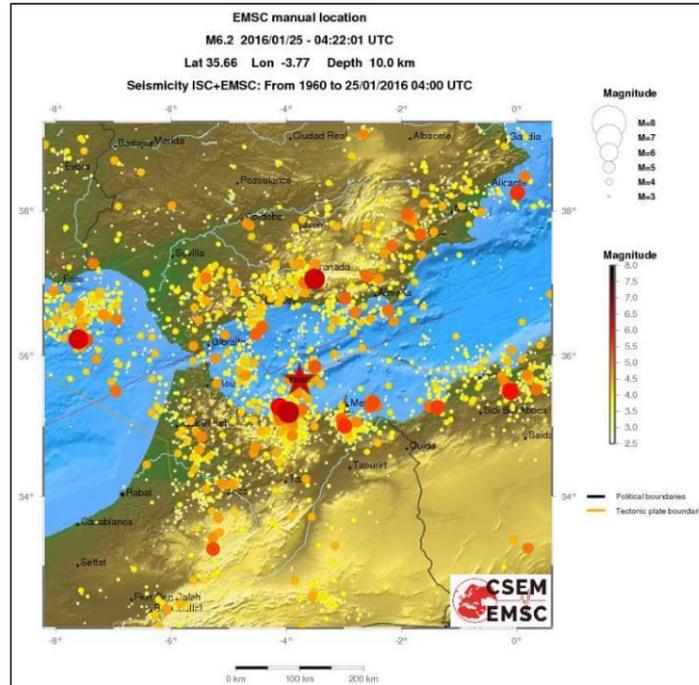


Examples of flood severity characterization, simulated through riverine and coastal models

Source: GFDRR

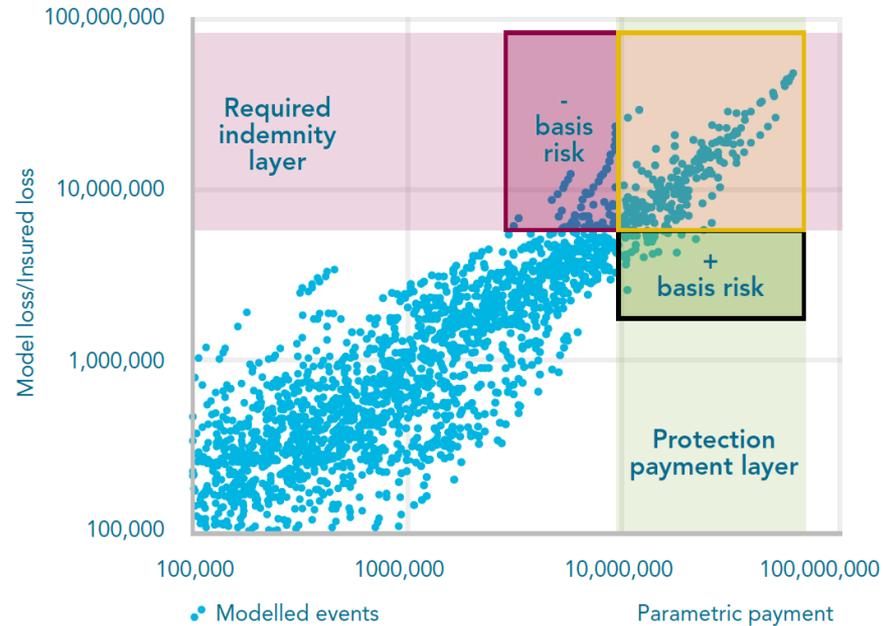
Morocco looking for parametric earthquake protection

- Morocco is building an “Integrated Disaster Risk Management and Resilience Program”, with the help of the World Bank
- Might issue parametric reinsurance to protect authorities and local insurers e.g. against earthquake risk



What is basis risk

Basis risk is the potential mismatch between the payout on a contract and the actual losses suffered by the policyholder.



Regulatory Aspects of Parametric Products – Insurance vs Derivative

Nature of a product (derivative vs (re)insurance) will determine the applicable legal and regulatory framework.

Classification as (re)insurance or derivative, will determine:

- **Licensing Requirement**

Provision of derivatives, direct insurance and reinsurance are each regulated activities, different licenses required and regulatory regimes apply.

- **Carrier Management**

Carriers are generally only licensed to offer specific products. Classification will determine which carrier may be used.

- **Accounting treatment**

Accounting treatment will differ depending on classification as derivative or (re)insurance

- **Tax**

Tax treatment may differ depending on classification as derivative or (re)insurance

Learning more about parametric re/insurance?

TECHNICAL NEWSLETTER

#48 - July 2019



INTRODUCTION TO PARAMETRIC SOLUTIONS

Almost as soon as human societies began to develop and monetize, re/insurance was developed to provide cover for goods and trade. Throughout the centuries, re/insurance products have evolved to become increasingly sophisticated. In recent years, the rise of modelling capability, product innovation and data availability have led to the development of solutions with an augmented range of perils and exposures.

What if the re/insurance industry could provide cover for previously uninsurable risks, in any part of the world and with fast and transparent payouts? While the novel characteristics of parametric products are progressively making them a staple of modern re/insurance, they are often surrounded by misconceptions that make them appear more complex than they really are. In this article, we describe the main concepts of parametric products and explore their areas of application.

PARAMETRIC (RE)INSURANCE: A STRATEGIC TOOL FOR THE MITIGATION OF NATURAL CATASTROPHE AND WEATHER RISK

MARKET OVERVIEW

The current market is mainly driven by public and industrial sectors, such as Energy and Agriculture, which are exposed to weather uncertainty risks. Indices are typically constructed around precipitation, temperature, wind speed, quake magnitude and hurricane category.

Sector	Risk Factor	Exposure
Public Authorities	Storms, flood, quake	Emerging and rescue expenses, infrastructure damage costs
Agriculture	Drought, temperature	Impact on yields
Energy	Barrel, temperature, wind, sunshine	Production capacity
Construction	Temperature, wind	Completion, safety costs and delay penalties
Health & Leisure	Barrel, rainfall, temperature	Cashflow volatility
Transportation	Ice, snow	Acces, cancellations
Sports & Events	Barrel	Cancellations

A PAYOUT-BASED PRODUCT

What is traditionally meant by "insurance" is typically defined as the relationship between an insured and an insurer over the protection of the insured against uncertain losses. In exchange for a premium, the insured submits a claim to the insurer, who indemnifies the insured for the loss sustained following a loss assessment by a claims adjuster.

A parametric product, on the other hand, does not rely on the assessment of the loss by a loss adjuster prior to payout, but on the observation of exogenous parameters.



While the traditional insurance contract used and a widely proposed starting point for the design of parametric solutions, the latter is more often used as a benchmark to describe the characteristics of the latter. In this article, we describe the main concepts of parametric products and explore their areas of application.

STRUCTURE
Parametric (re)insurance is a specific type of insurance product. The simplest parametric cover can be seen as a standard insurance policy, where the insured pays a premium to the insurer. However, the insured does not submit a claim to the insurer, but the insurer pays the claim based on the observation of exogenous parameters.

OUTLINE
We have seen that parametric products may provide a number of advantages over traditional insurance. In this article, we describe the main concepts of parametric products and explore their areas of application.

What if the re/insurance industry could provide cover for previously uninsurable risks, in any part of the world and with fast and transparent payouts? While the novel characteristics of parametric products are progressively making them a staple of modern re/insurance, they are often surrounded by misconceptions that make them appear more complex than they really are. In this article, we describe the main concepts of parametric products and explore their areas of application.

WORLD BANK CRITERION
The World Bank has developed a set of criteria to assess the creditworthiness of countries. These criteria are based on various factors, including economic growth, inflation, and government stability.

A SIMPLE EXAMPLE
A simple example of a parametric product is a weather index. The index is based on the average temperature over a specific period. If the temperature is above a certain threshold, the insured receives a payout.

WHAT IS BASIS RISK?
Basis risk is the risk that the actual loss is different from the loss assessed by the parametric product. This can occur due to various reasons, such as measurement errors or changes in the underlying risk.

CASE STUDY: HOW A THOROUGH UNDERSTANDING OF THE POLICYHOLDER'S NEEDS, GOING BEYOND ADVANCED MODELLING, CAN MAKE A DIFFERENCE
A case study illustrating how a thorough understanding of the policyholder's needs, going beyond advanced modelling, can make a difference in the design of a parametric product.



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By combining internal and public data, significant improvements can be made in the modelling, risk and underwriting of parametric products. This is particularly true for the design of weather indices, where the availability of high-quality data is crucial.

INDEX CONSTRUCTION
The index is the key element of a parametric product. It is a numerical value that represents the loss or exposure. The index is typically constructed based on a set of parameters, such as temperature, precipitation, and wind speed.

$$I(t) = \sum_{i=1}^n \max(0, R_i(t) - C_i)^{\alpha_i}$$

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