Introducing
Parametric Disaster Risk Financing

National Association of Insurance Commissioners

For educational purposes only

June 3, 2021

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Founder and Director Global Parametrics

Structure of Presentation

- Experience with parametric insurance
- Motivation for innovation in disaster risk financing
- Defining parametric disaster risk transfer
- Examples of parametric disaster risk transfer
- Potential role of parametric disaster risk transfer in the U.S.

EXPERIENCE

Experience

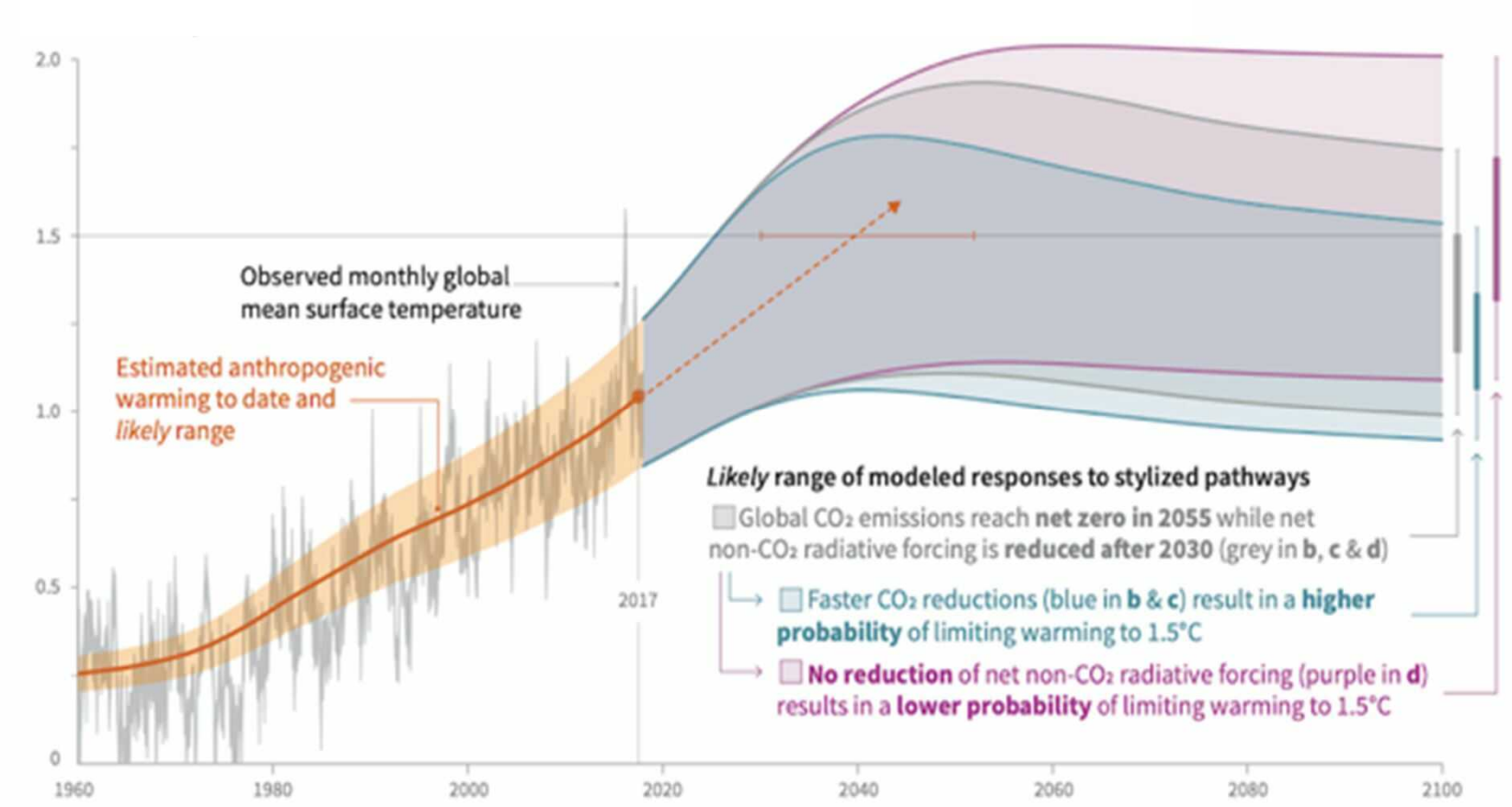
- **1990 to 1994** Parametric insurance for US crop insurance
- **1995 to 2001** World Bank disaster risk financing
- **2001 to 2016** Founder GlobalAgRisk www.globalagrisk.com
  - Mongolia Index-base livestock insurance (World Bank)
  - Peru Forecast index insurance for El Nino flooding (Gates Foundation)
  - Vietnam Index flood and drought insurance (Asian Dev Bank, Ford Foundation)
  - Indonesia Earthquake Index Insurance for MFIs (Ford Foundation)
  - Global Structuring disk risk financing for an MFI (Rockefeller Foundation)
- **2016 to present** Founder Global Parametrics www.globalparametrics.com
  - GP uses global data to structure risk transfer contracts using risk capital from a Natural Disaster Fund (NDF) supported by the British & German Gov'ts & HannoverRE
  - Global Parametrics is designed with developmental objectives to build resiliency for sectors in emerging economies to lead or follow the flow of capital

In every case, a focus on legal and regulatory issues has been carefully considered

MOTIVATION

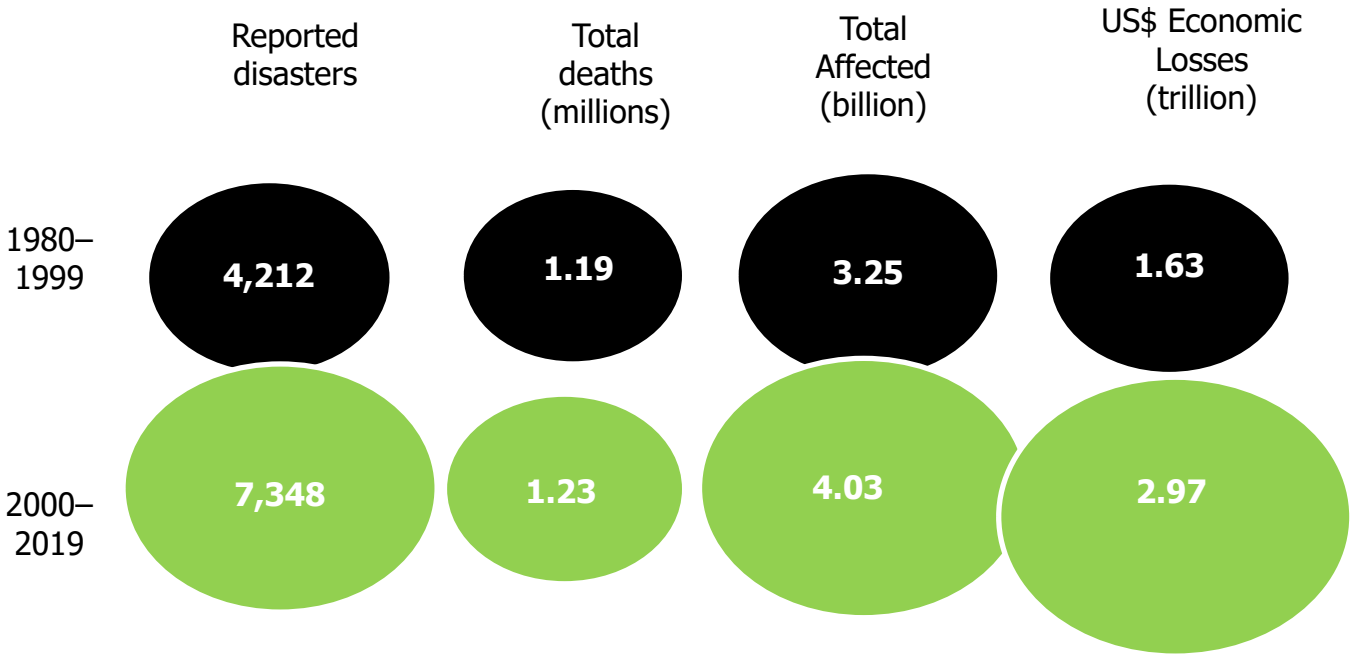
Gov’ts and Multi-Nationals are now focused on the link to climate change and financial risk for society

Global warming relative to 1850–1900 (°**C**)



https://www.federalreserve.gov/econres/notes/feds-notes/climate-change-and-financial-stability-20210319.htm

Climate change and more exposure due to human activity has created a sharp increase in natural disaster risk



Over the past 20 years there has been a **sharp increase in the number of reported natural disasters** and their impacts on human lives and economic costs.

Four Events in the USA make the top 10 for economic loss in 2020

Top 10 economic losses - 2020

China	Flood	17 billion	USA	Storm	6.8 billion
India	Cyclone Amphan	13 billion	USA	Hurricane Sally	6.3 billion
USA	Hurricane Laura	13 billion	Japan	Flood	5.8 billion
USA	Wildfire	11 billion	Croatia	Earthquake	5.6 billion
India	Flood	7.5 billion	Honduras	Hurricane Eta	5.0 billion

Source: UCLovain “Disaster Year in Review 2020” Issue No. 62 (May 2021)

Unknown: Did climate change increase the economic loss from these four events?

FED NOTES MARCH 19, 2021
Climate Change and Financial Stability

“Insurance markets:
Under many scenarios, climate change also increases the frequency and severity of natural disasters such as wildfires and major storms.[21] These disasters, in turn, could damage physical assets and create growing disruptions to local economic activity, raising the cost of insuring highly exposed properties and businesses. As a result, the price of that coverage would rise, and insurers' willingness to offer policies on some properties would fall. The risk of business defaults following natural disasters could increase as firms tend towards lower levels of insurance coverage. This pullback in insurance coverage could be a financial system vulnerability with a variety of second-order effects, many of which are beginning to be visible in the property and casualty insurance markets of some states”

GP’s business case was developed with a theory of change whereby innovation in financial markets for risk transfer will improve the flow of capital and the terms of trade for investments

Parametrics Risk Transfer Products are being used globally

- Over the past 25 years, global efforts in offering parametric insurance have accelerated in many jurisdictions throughout the world. In the best cases, these efforts have been organized within existing insurance law by carefully considering how to frame regulatory issues for parametric insurance.
- Beyond individual country innovation, there are multi-country risk pooling efforts that use parametric insurance products:
  - Caribbean Catastrophe Risk Insurance Facility Segregated Portfolio Company (CCRIF SPC) is an insurance company headquartered in the Cayman Islands that is pooling catastrophe risk for 16 Govt's.
  - The African Risk Capacity (ARC) is a Specialized Agency of the African Union established to help African governments improve their capacities to better plan, prepare, and respond to extreme weather events and natural disasters.

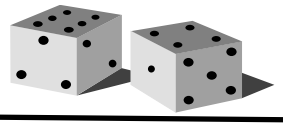
Would risk pooling structures improve access to global risk for hurricanes in the U.S.?

PARAMETRIC RISK TRANSFER

GLOBAL PARAMETRICS

Markets for Different Types of Risk

Incomplete Risk-sharing Markets for Natural Disasters



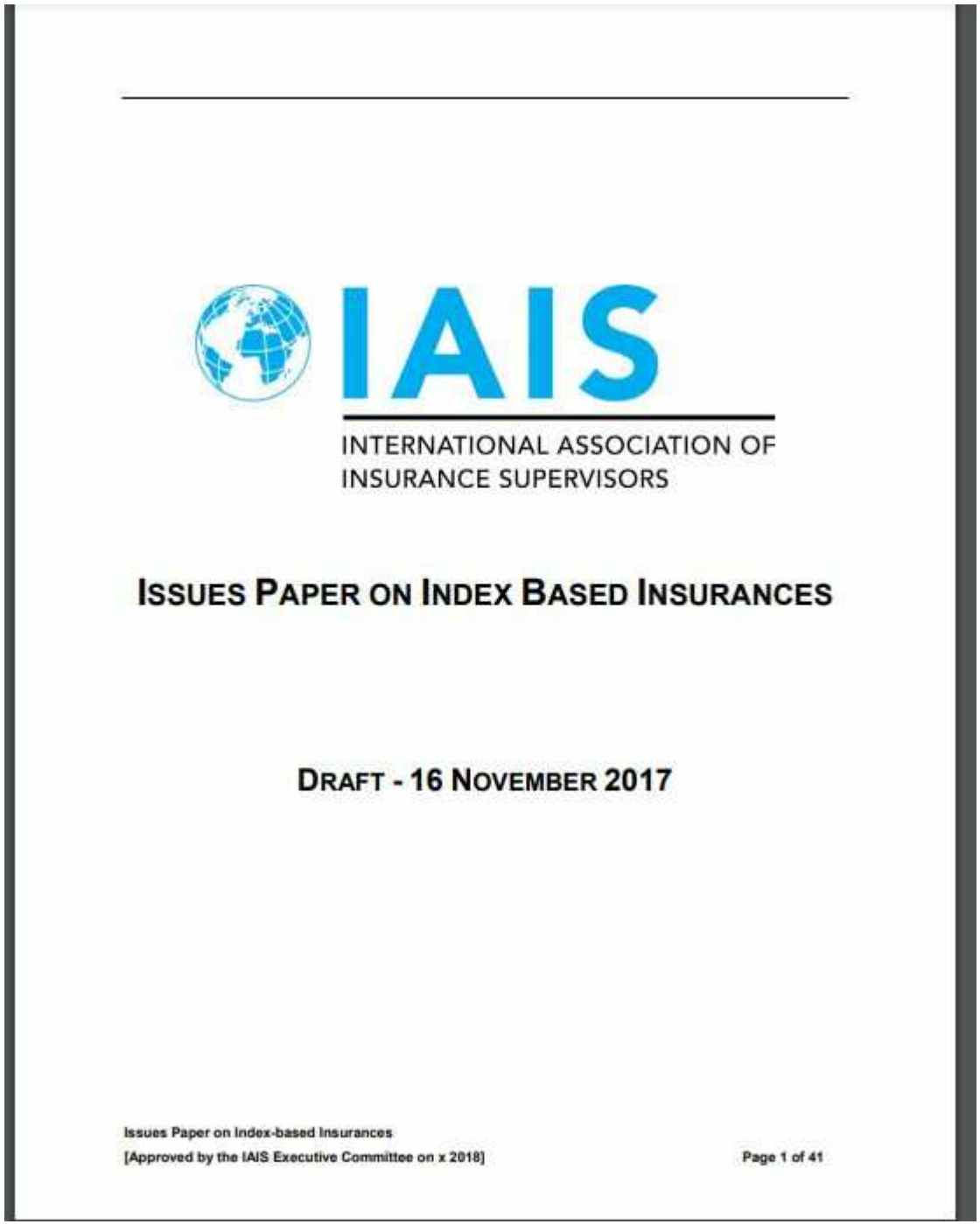
0% **100%**

Risk characterization -->	Independent Risk near 0%	In-between risk Correlated but not close to 100%	Correlated close to 100%
Examples -->	Auto accidents Life insurance	Earthquakes Drought Flood	Commodity prices Interest rates
Market/Gov't Institution -->	Insurance Markets	Gov't / Capital Mkts Specialized (Re)insurance Parametric Risk Transfer	Futures Mkts

Skees, J. R., and B. J. Barnett. "Conceptual and Practical Considerations for Sharing Catastrophic/Systemic Risks." *Review of Agricultural Economics* 21(1999): 424–441.

Indemnity vs Parametric Insurance

	Indemnity Insurance	Parametric Insurance
Core legal requirements	Insurable Interest Proof of loss	Insurable Interest
Nature of risk	Risk should be largely independent	Risk should be largely correlated
Payment determination	After the event loss assessment	Before the event pre-defined payments schedule
Actuarial Determination	With independent risk, the risk of an insurance pool is less than the risk of the individual	Historic time series of events is combined with the exposure to develop an expected loss for the parametric structure
Transparency	Can be challenged with complex exclusions, etc.	Can be fully transparent with good education for sophisticated clients
Moral Hazard and Adverse selection	The insured can influence the risk and will have more knowledge of their risk	The insured has no influence on payments but there can be adverse selection if sales closing is not properly set
Speed of payment	May take time to complete loss assessment	Can be made within a short time period
Core limitation	Higher cost for loss assessment and mechanisms to control adverse selection and moral hazard	Poorly designed products can fail to meet the needs when there is a loss or may even pay when there is no problem for the client (basis risk)
Flexibility	Sometimes constrained by requirements for proof of loss	Can cover a variety of financial risk that are difficult to prove use for business interruptions and good potential for the intangible economy



IAIS

INTERNATIONAL ASSOCIATION OF INSURANCE SUPERVISORS

ISSUES PAPER ON INDEX BASED INSURANCES

DRAFT - 16 NOVEMBER 2017

Issues Paper on Index-based Insurances
[Approved by the IAIS Executive Committee on x 2018]

Page 1 of 41

The report emphasizes that a requirement for index insurance should be 'insurable interest'

GP GLOBAL PARAMETRICS

Disaster risk financing products can take many legal forms

- Parametric Insurance
  - The IAIS paper emphasizes that "insurable interest" should be a core requirement
    this will mitigate concerns of speculation from a regulator
  - Insured selects a protection level (sum insured) and payments are predetermined as a rate of payment given certain levels of the event which is captured by a parametric index
  - To highlight this, consider a parametric insurance product that pays using Richter Scale:

Pay Structure	Richter Scale	Payment Rate	
Layer 1	5 to 6	Use Savings	Example: An insured has $1 M of protection (sum insured) when Richter Scale 7.6 earthquake impacts the insured exposure (geography), payment would be 60% x 1,000,000 or $600,000 --there is no requirement for proof of loss
Layer 2	6 to 7	Use Credit	
Layer 3	7 to 7.5	35%	
Layer 4	7.5 to 8	60%	
Layer 5	>8	100%	

- Derivative
  - A derivative contract can look exactly like a parametric insurance contract with no requirement to have an insurable interest – basis risk is common for derivatives
- ILS, CAT Bonds, Swaps
  - Global capital markets are using event-based structures in many legal forms

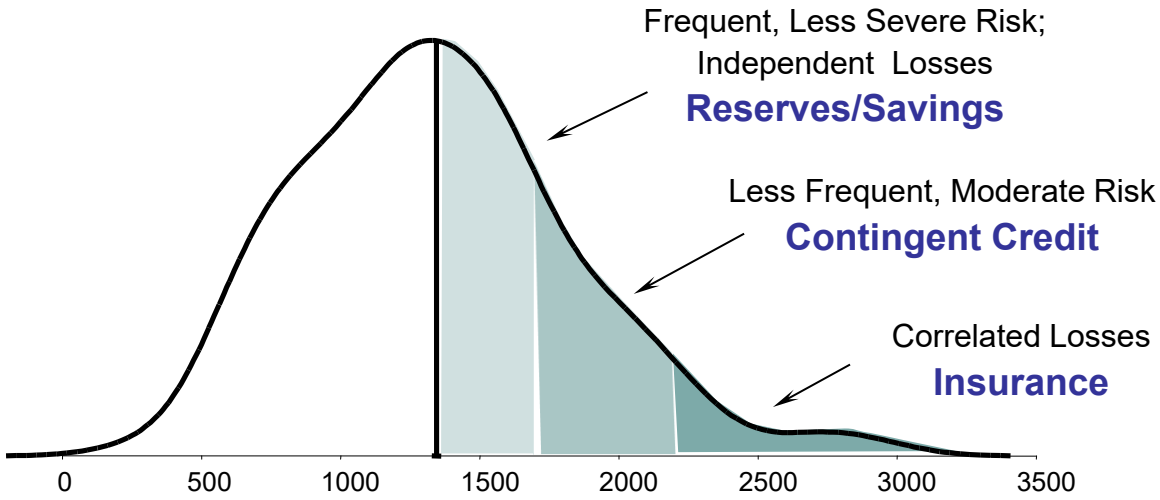
We will return to regulatory framing for the U.S. at the end of this presentation

Risk Layering principles are more straight forward

- The rank (severity) of the event can be used to trigger financing from different sources (layering risk)
  - 5-year event can trigger funds from a reserve/savings
  - 7-year event can trigger contingent credit
  - 10-year event can trigger risk transfer

Advanced ***parametric*** statistics are used to get the rank of an event-based financing structure

Thus, we call index risk transfer, parametric risk transfer



This structure is fundamental for protecting financial institutions

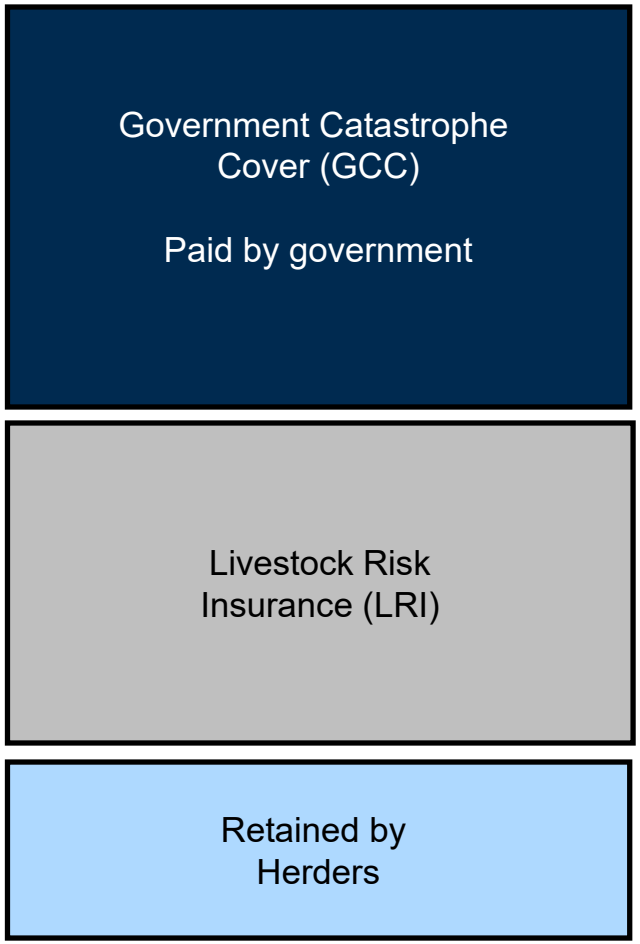
GLOBAL PARAMETRICS

EXAMPLES

GlobalAgRisk Case Study Mongolia
Index-based livestock Insurance

- The Risk — Severe livestock losses with harsh winter
- Target users — Herders in Mongolia
- Contract Structure — Payments based on rate of mortality at the soum

GlobalAgRisk Case Study Mongolia
Index-based Livestock Insurance — Risk Layering



GCC — Social Insurance

A layer of very infrequent risk where decision makers may have a cognitive failure problem

LRI — Commercial Insurance

Offered by private companies with reinsurance from government and now a global reinsurer

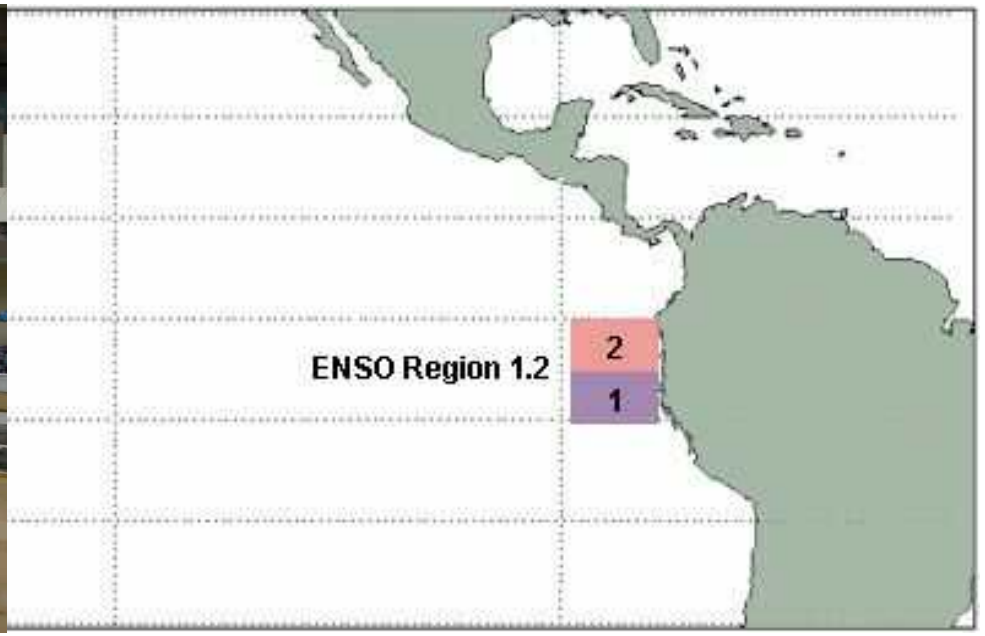
With soum mortality of 30%, herder with 100,000 sum insurance would be paid 30,000

This structure delivered subsidies at about 30% of premium for 1/3 the cost

GlobalAgRisk Case Study Peru
El Niño Forecast Insurance for Business Interruption

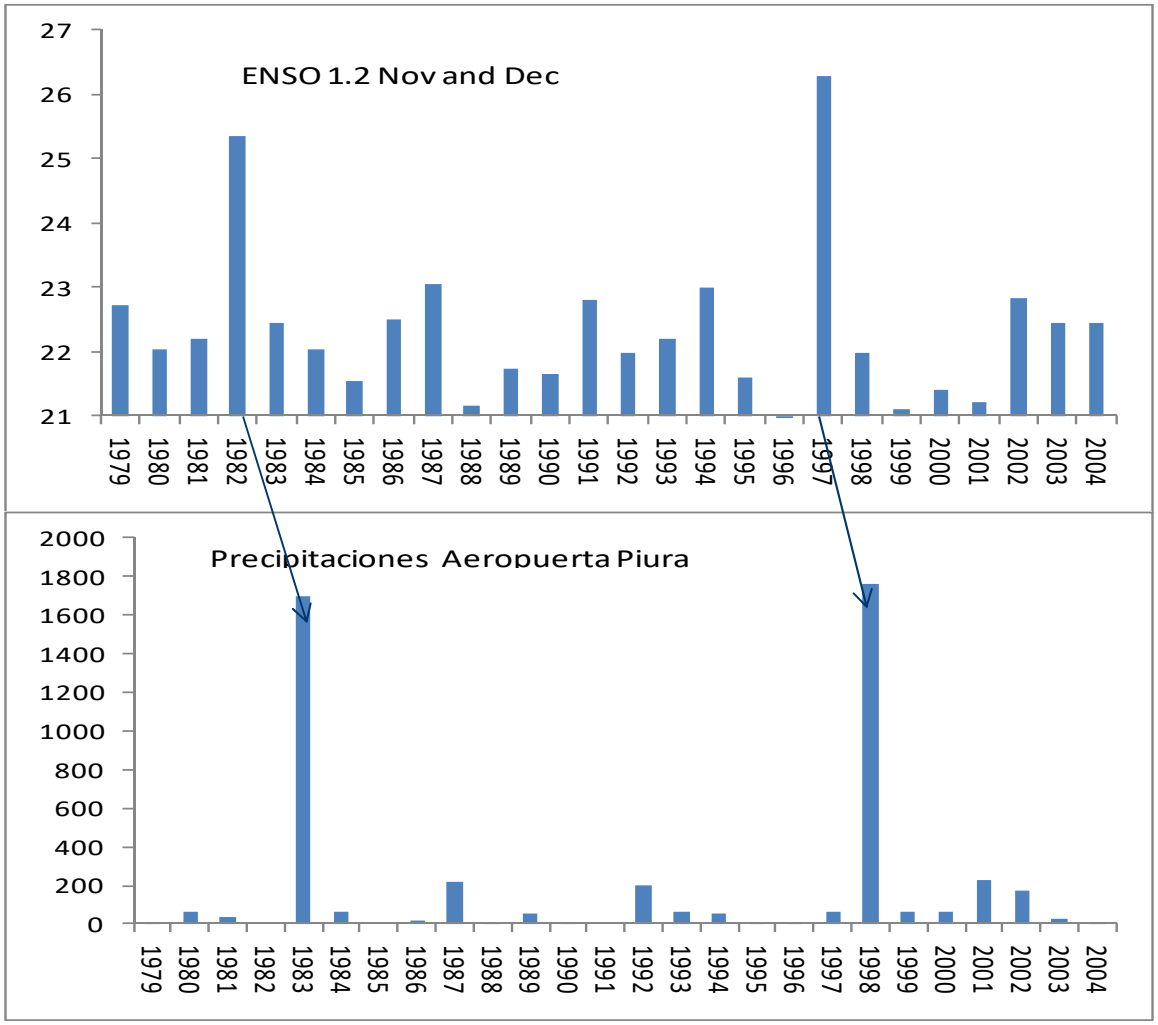
Gates Foundation Supported project:
Focus was to protect the balance sheet of MFIs operating in the North of Peru

Index uses 50 years of US NOAA Climate Prediction Center Sea Surface Temperatures for ENSO Region 1.2



GlobalAgRisk Case Study Peru
El Niño Forecast Insurance for Business Interruption

- SST using US NOAA ENSO 1.2 Nov & Dec matches the extreme rainfall and flooding



GlobalAgRisk Case Study Vietnam
Flood Index based on Water Level at Cambodia Border

- Mekong River flooding is primarily created by water in the system to the north of Vietnam
- Flooding has many direct and indirect losses for many potential clients
- Capturing the level of water at the Cambodia Border (station in lower left) was a good index for flooding that would occur throughout the system giving a 2-week lead time for Ho Chi Minh

Global Parametrics Risk Transfer Products

Core GP Products

DROUGHT & CROP STRESS

Parametric and modelled impact products focused on agricultural outcomes

TROPICAL CYCLONE

Parametric hazard, damage, or cat-in-box index structuring

WEATHER EXTREMES

Parametric hedging products for extremes in temperature, precipitation and other weather perils

FLOOD

Models capture extreme flooding within watersheds

EARTHQUAKE

Parametric hazard, damage, or cat-in-box index structuring

GP Products under Development

DROUGHT & CROP STRESS FORECAST

Forecast of agricultural impact products that provide opportunities for early financial interventions

RENEWABLE ENERGY

Protection against energy-production shortages (wind, solar, hydro)

FLOOD FORECAST

Products to get cash injections to mitigate impending problems

TROPICAL CYCLONE FORECAST

Anticipatory financing for impending hazard from wind, precipitation, and surge

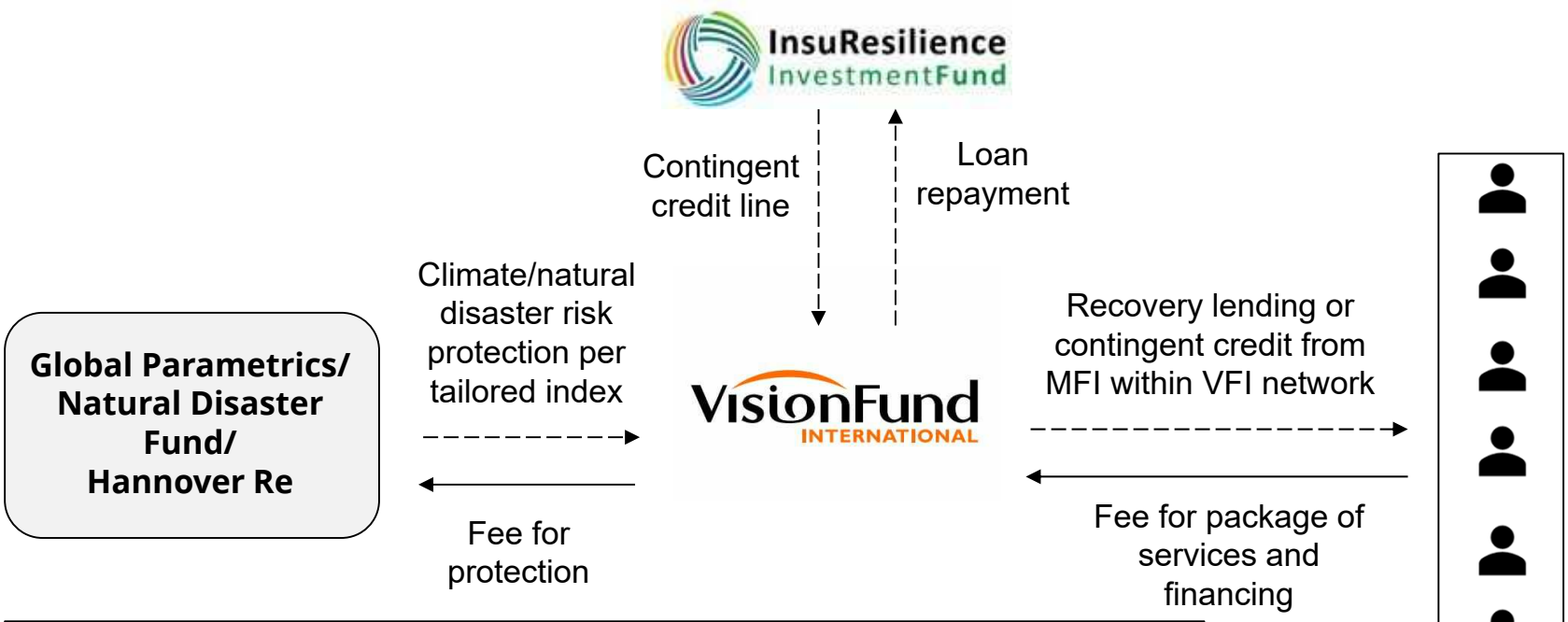
DISPERSIVE HAZARDS

Protection against wildfires, volcanic ash, sand storms, etc.

GP GLOBAL PARAMETRICS

GP Case Study 1: Resilient Credit Programs

- ARDIS recovery lending and contingent credit scheme launched in 2018 with 5 participating countries, now scaled to 15 countries across Africa, Asia and Latin America.
- In 2020, the ARDIS program was activated four times, providing a direct payments of **$315,000** from the NDF and access to up to **$3,950,000** of contingent credit supporting the recovery about **675,000** active borrowers



Hurricane Katrina and Sandy showed that financing dried up for SMEs

GP GLOBAL PARAMETRICS

GP Case Study 2: Reef Protection in Mexico

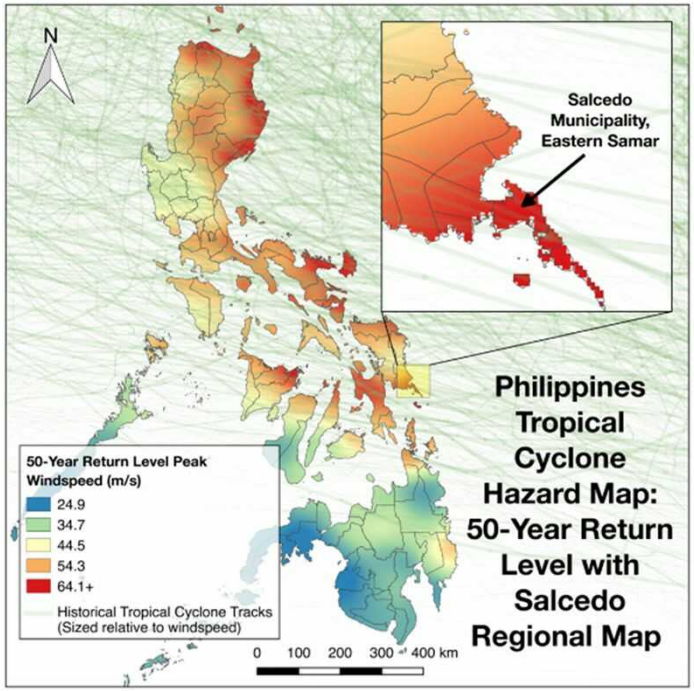
- The Mexico Reef Protection Program protects 60km of the Mesoamerican Reef, Quintana Roo in Mexico, against impact from tropical cyclone.
- Protecting the reef indirectly benefits local business and communities.
- Through local insurer Banorte, the gov't of Quintana Roo receives a pay-out based on a tropical cyclone on a pre-identified area of the reef.
- On October 7th, 2020 Hurricane Delta triggered a pay-out of 40% of the total limit on the policy. The pay-out went toward rapid restoration of the reef and its associated dunes and beaches.
- The Dec 5, 2020 New York Times covered this story.

The U.S. has many coastal areas where natural habitat is @risk from TC

GP GLOBAL PARAMETRICS

GP Case Study 3: Forecast based Financing

- **Aim**: Combine parametric forecast indices with digital finance to better protect vulnerable families from natural hazards
- **Resilience**: Cash payment prior to a disaster gives households the financing to evacuate, shore up infrastructure, move assets, etc.
- **Pilot**: Supported by OxFAM Novid, 1,000 households in 9 barangays in Salcedo Eastern Samar with high poverty, financial exclusion and vulnerable to typhoon
- **Event**: GP provided a reliable forecast of Typhoon Phanfone 24/25 Dec 2019 with 66 hour lead time

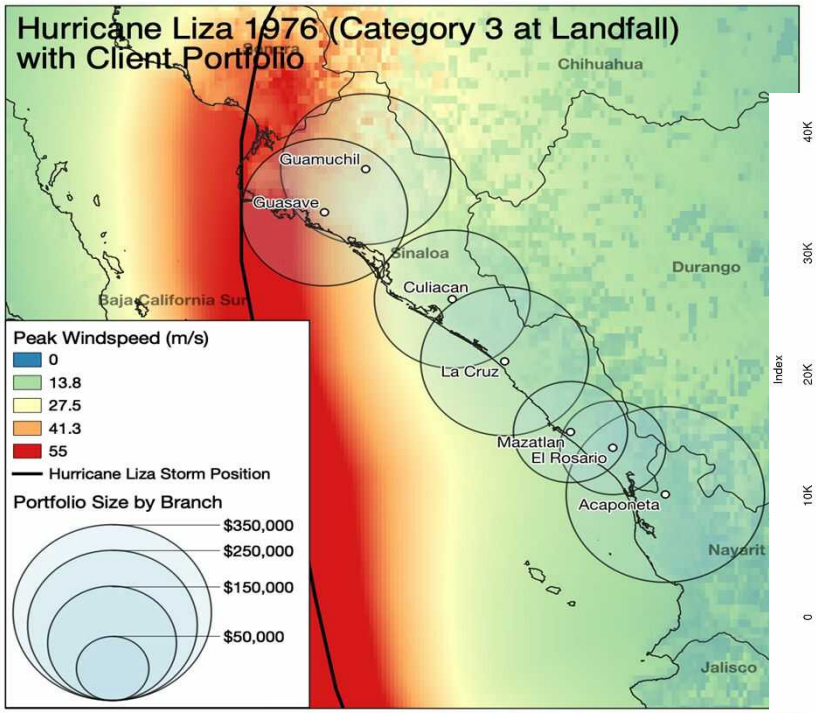


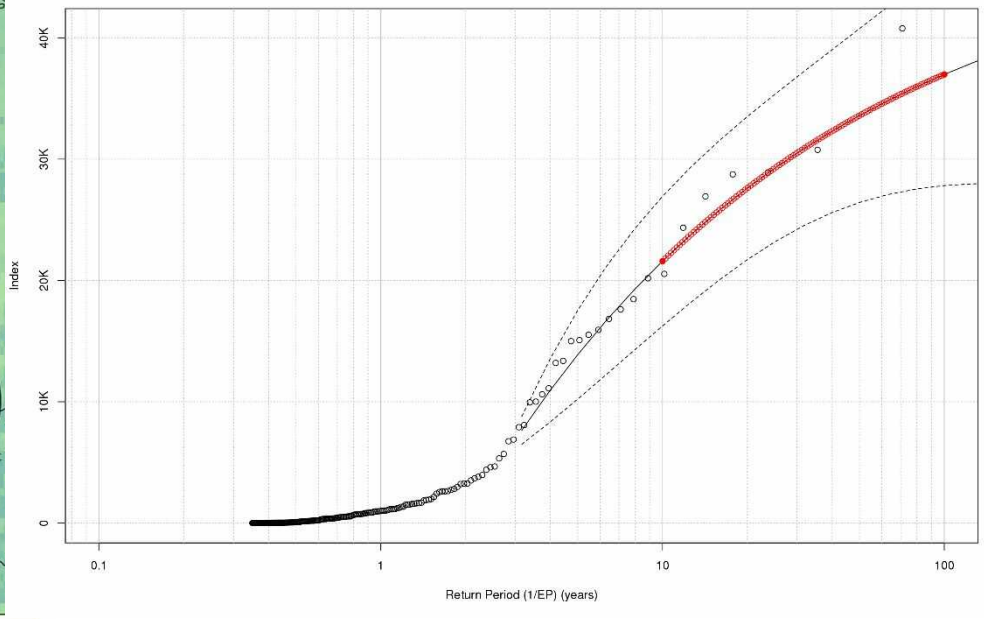
Event based forecast could facilitate financing to mitigate U.S. loss

GP GLOBAL PARAMETRICS

GP Case Study 4: TC Wind Intensity Index: Mexico Example

- **Client request:** financial recovery to a microfinance lender with exposure in the regions surrounding 7 branches from Tropical Cyclone risk
- **Solution:** Parametric index of maximum windspeed weighted to disaggregated exposures



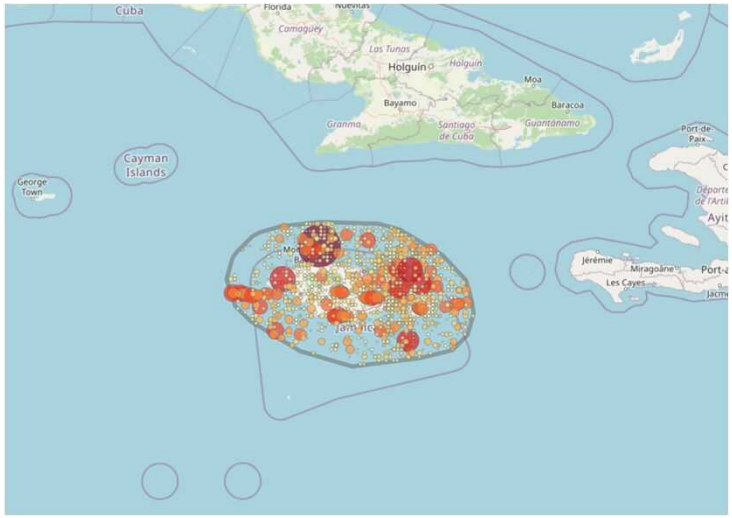


Many industries in the U.S. could use this form of protection.

GP GLOBAL PARAMETRICS

GP Case Study 5: Earthquake for client in Jamaica

A simple Cat in a Box

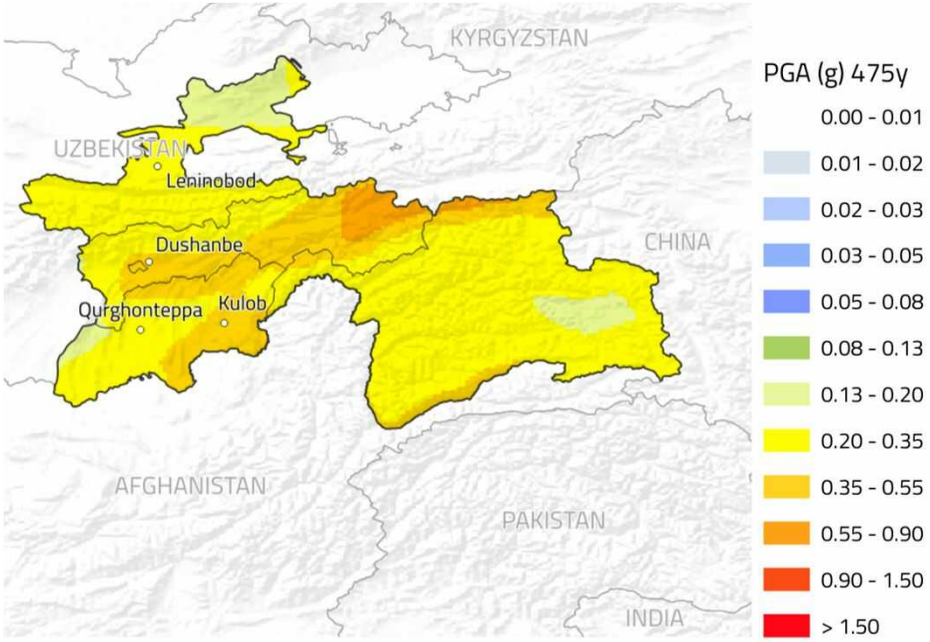


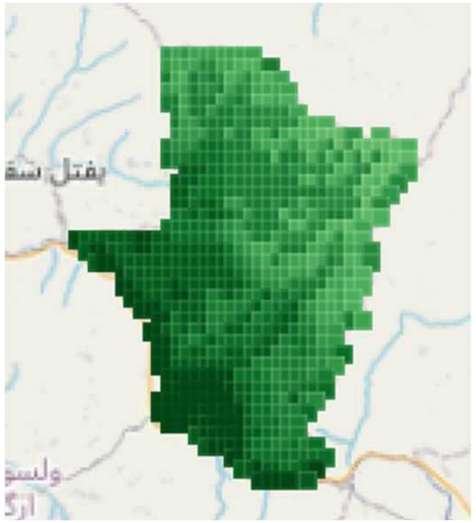
Magnitude	Payout	Frequency
[5, 6]	20%	0.1523
[6, 7]	60%	0.0229
[7, 8]	80%	0.0012
> 8	100%	0.0000

GP GLOBAL PARAMETRICS

GP Case Study 6: Central Asia Earthquake Intensity

- **Client request:** financial recovery for a large portfolio of vulnerable households in Tajikistan, Afghanistan, Kyrgyzstan and Pakistan from earthquake risk
- **Solution:** structure an index based on ground motion weighted to the client exposures. Risk assessment assisted by models from the **Global Earthquake Foundation (GEM)**





Average Annual Loss: Fayzabad, Afghanistan

Similar products have been approved for California EQ

GP GLOBAL PARAMETRICS

POTENTIAL FOR PARAMETRICS IN U.S.

GLOBAL PARAMETRICS

Examples in rest of the world could be applied in the U.S.

- Protecting the balance sheet of financial institutions
- Protecting the balance sheet of any number of U.S. Sectors
  - Real estate
  - Manufacturing
  - Transportation
  - Utilities (e.g., water treatment facilities)
  - Construction
  - Agricultural Value Chain Firms
  - Forestry firms
- Adding value in investments for nature-based solutions
  - Reef and mangrove protection
  - Forestry
  - Wildlife
- Forecast of Hurricane using a multi-state response fund

Core Products that could be used

- Hurricane intensity
- Earthquake intensity
- Forest fire imagery
- Drought measures
- Flood measures
- Extreme Heat

Technology opens the way for event-based risk transfer
big data / data platforms / block chain

General Conclusions about Where Parametric Products fit

Target should be risk aggregators

Significant care before offering products at the retail level

Excellent form of business interruption insurance

June 2, 2021: National Law Review "COVID-19 Shutdown, Related Litigation Put Pressure on Business Interruption Insurers"

Use of Parametric products to pay the 1st loss in front of an indemnity insurance product

Capturing fast payment from parametric and retaining value of indemnity

Pairing Parametric with Indemnity

Parametric would cover some of direct loss and business interruption allowing higher deductibles for indemnity insurance

Parametrics for the fastest growing sector – intangible assets

Parametrics, alternate risk for outbreaks, and a Heartbeat in the Fog - Daily Fintech

John Donald, Cyber adviser at AXIS Capital

Context for Parametric Insurance

Contingent insurance (life and dismemberment)

- Insured identifies an event where there is an insurable interest
- Insured selects the sum insured for the event (surgeon loss of eyes sight/ athlete loss of a limb)

Parametric products can be a form of contingent insurance

- An event triggers payments
- Insured selects sum insured to match their needed financing to events

Regulating Parametric Insurance

Regulator has at least three overlapping responsibilities

- ✓ Covering Prudential risk
- ✓ Consumer protection
- ✓ Creating an enabling environment for innovation to protect society

Insurance 101 – Core Requirements

- Payment of premium by one party (insured) to other party (insurer)
- Primary purpose – acceptance by insurer of uncertain event occurring (uncertainty may be whether or when it occurs)
- Uncertain event (insured risk) must be outside control of insurer and insured
- Insurer must agree to make payment or provide benefit to insured should insured event occur
- Contract must be in force for specified period
- Must be clear link between insured event and insured:
  - **insurable interest** or insured risk adverse to interests of insured (IAIS Paper)
- Principal purpose – transfer of risk

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