



GNI-1: Alternative Risk Transfer and Government-Sponsored Risk Pools

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Catastrophe Bonds Provide Attractive Features in Limited Supply in the Reinsurance Market

- Fully collateralized
 - Full amount of protection invested in money market or other safe assets
 - Protects against counterparty credit risk
- Multi-year rate protection
 - Typically three years; varies from one to five years
- Flexibility of Occurrence vs. Aggregate; First vs. Second Event
 - Best fit within existing reinsurance structure
 - Multiyear aggregate structures have also been used
- Flexibility of Indemnity or Index triggers
 - May be based on cedant's losses (indemnity) or other metrics such as industry loss
 - Balance between minimizing basis risk to sponsor and maximizing investor comfort
 - Transparency and speed of trigger are key considerations

Catastrophe Modeling Services to Cat Bond Issuers

As Modeling Agent:

- Detailed loss analysis by perils, LOB and geography
- Documentation that “expertizes” the modeling processes, assumptions, and results
- Sensitivity and stress testing to satisfy the requirements of rating agencies
- Presentations, meetings and support to potential investors as part of a new issue’s “road show”
- Follow-up analyses including exposure and trigger resets and ongoing rating agency support
- Annual reset to maintain the initial probabilities of loss constant given evolution of the underlying exposure (cedant’s portfolio, industry exposure)

As Calculation Agent:

- Loss estimation or loss reporting, depending on trigger type



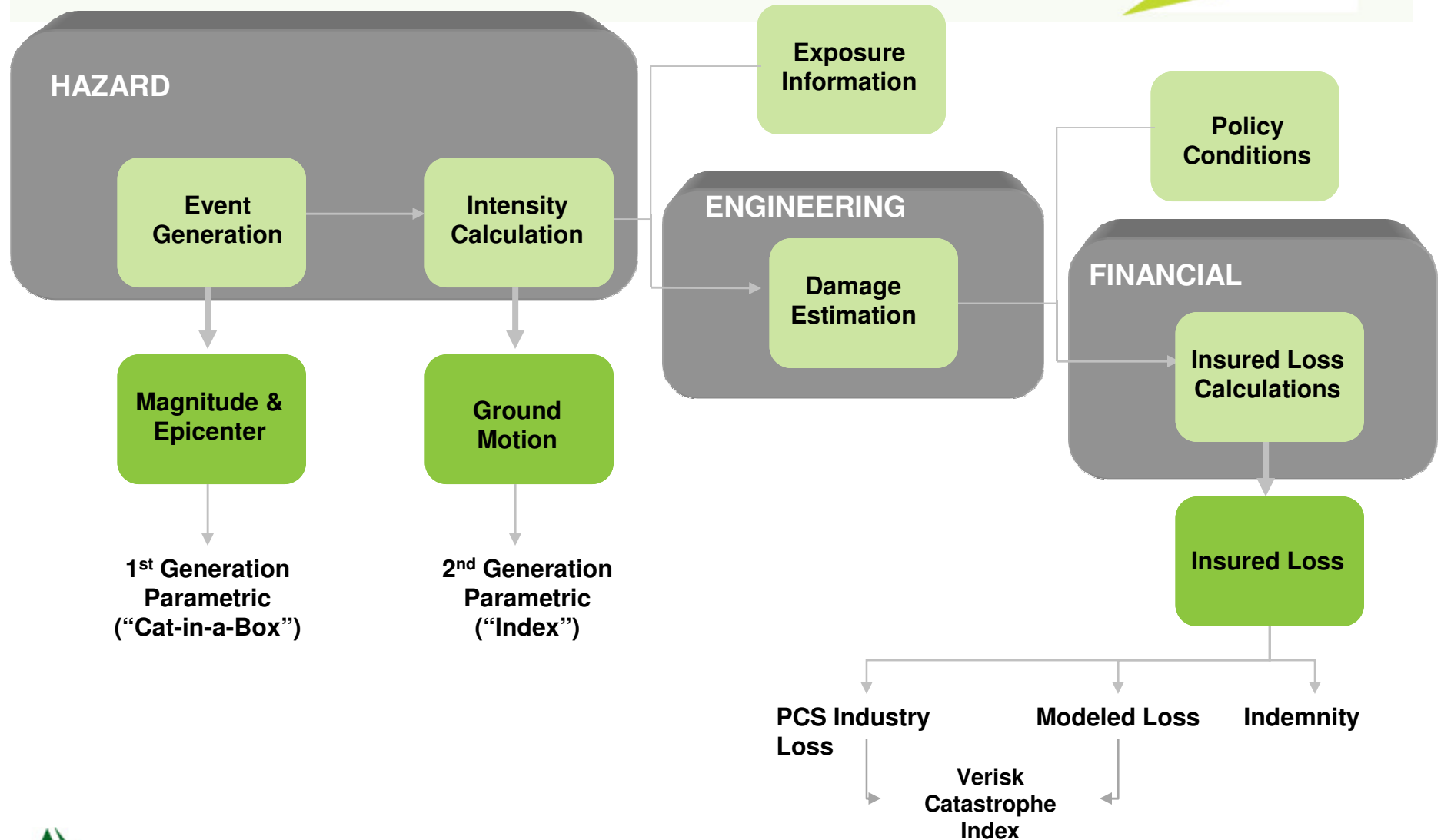
Before You Take the Plunge... Review Your Exposure Information

- How much detail you know about your exposure will impact the trigger types available to you
- Indemnity triggers cover your actual losses but require very high quality data, such as address-level information on each building to be protected
- Indemnity triggers also require that losses be precisely estimated post-event, which may not be timely or practical
- Transactions not directly based on a specific exposure set, such as parametric triggers, will benefit from a review and modeling of your exposure to identify and minimize basis risk

Basis Risk Can Be Minimized Through Optimization

- Basis risk is the difference between the losses you wish to protect against and the recoveries from the catastrophe bond transaction
- Minimizing basis risk helps ensure that you will receive a recovery when you really need it
- To quantify and minimize basis risk, you need to understand and align both the risk of your underlying exposure and the risk of the proposed transaction
- AIR can help you identify the risk to the assets you wish to protect (residual market portfolio, a country's entire building stock, crop damage, impact on vulnerable population)
- This helps you optimize your structure to maximize the fit between your loss potential and the bond's recoveries, minimizing your basis risk

Catastrophe Bonds Leverage the Catastrophe Modeling Framework to Meet Each Cedant's Needs



Public Finances Are Negatively Impacted by Natural Catastrophes

- As population and development clusters along coastal and seismic areas, the human and financial cost of tropical cyclones and earthquakes is increasing
- Government finances may suffer significant negative impact from the costs of emergency relief efforts and reconstruction
- Traditional means of financing disaster relief and reconstruction include issuing debt, budget reallocation and new taxes
- Insurers and reinsurers have the expertise to assess catastrophe risks, but covering both private and public costs from such events may lead them to be over-exposed

Catastrophe Bonds Are an Efficient Solution for Protection Against Disaster Costs

- The international capital markets provide insurers and governments with an alternative source of financing, through the issuance of catastrophe bonds
- Insurance through securitization reduces pressure on public budgets in the event of a natural catastrophe, while ensuring that adequate funds are in place for relief activities
- Through MultiCat Mexico 2009 Ltd., Mexico's disaster relief fund obtained \$290M of parametric protection against powerful hurricanes and earthquakes affecting its most exposed regions for a 3-year period
- The North Carolina Joint Underwriting Association & Massachusetts Property Insurance Underwriting Association each also recently issued catastrophe bonds to protect their portfolios of insured assets

ILS Structure Can be Customized to Accommodate the Unique Needs of Government Cedants

- Multi-country cat risk pools, such as the CCRIF in the Caribbean, can serve to syndicate risk
- “Cat-in-a-box” structures are less adapted to small island nations
 - A small deviation in the track of a storm has a substantial impact on actual losses
- Traditional second-generation parametric structures rely on dense networks of measuring stations unavailable in most island nations
- Simulated second-generation parametric triggers utilizes available parameters such as storm track or earthquake magnitude to simulate wind speed and ground motion at specific locations
 - The index formula and location weights are optimized to fit simulated losses
 - Tsunami damage can be accounted for by adding it to shake damage when calibrating the index, or by using a tsunami-specific index formula
- Modeled Loss triggers remain an option
 - Less basis risk than a simulated second generation trigger as the simulated loss curve was not fitted down to a single parameter
 - Can make better use of the high level of detail in the model

Industry Loss Estimates Protect Cedants Without Relying on Company Loss Estimates

- Property Claim Services® (PCS®)
 - U.S. industry losses by state and line of business
 - 60 years of experience, well-known to cedants
 - Widely used for catastrophe bonds, ILW, exchanges
- Verisk™ Catastrophe Index (VCI)
 - U.S. industry loss by county and line of business
 - Based on well-known PCS & AIR methodologies
 - Reduces basis risk by customizing covers to precise areas
- PERILS
 - Europe industry loss by CRESTA and line of business
 - Fills a need given exposure quality concerns in Europe
 - Reduces basis risk by customizing covers to precise areas
- Post Event Loss Calculation (Modeled Industry Loss)
 - Fastest estimate of industry loss, high resolution
 - Reduces basis risk by customizing covers to precise areas

Government Transactions Have Unique Advantages When Pricing ILS Risk Transfer

- Advantages
 - Reinsurers and investors familiar with CCRIF structure, World Bank, risk modeling
 - Large potential diversification benefits within the risk structure itself when pooling small, far-flung islands
 - Diversifying perils with likely low correlation with large countries
- Challenges
 - Reinsurers and investors unfamiliar with cat history, data quality and governmental environment in countries and regions not traditionally associated with large-scale reinsurance
 - With no previous history of cat modeling, benchmarking is limited to historical events
 - Pricing may become less favorable if a large catastrophe occurs before issuance

Modeling Can Assist Governments in Assessing Their Need for Protection

- An AIR study leveraged by Mexico based on catastrophic events in Central America shows that emergency costs can be estimated as a fraction of the ground-up damage, on average 23% for tropical cyclones and 16% for earthquakes
- Other relevant questions include:
 - *Which perils does each country want protection against?*
 - *How much risk is each country willing to retain?*
 - *How much protection does each country need?*
 - *What is the overall premium-paying capacity?*
 - *How should the premium be allocated between purchasing protection and building reserves?*

Mexico Leveraged AIR's Analysis to Identify Protection Meeting its Disaster Recovery Goals

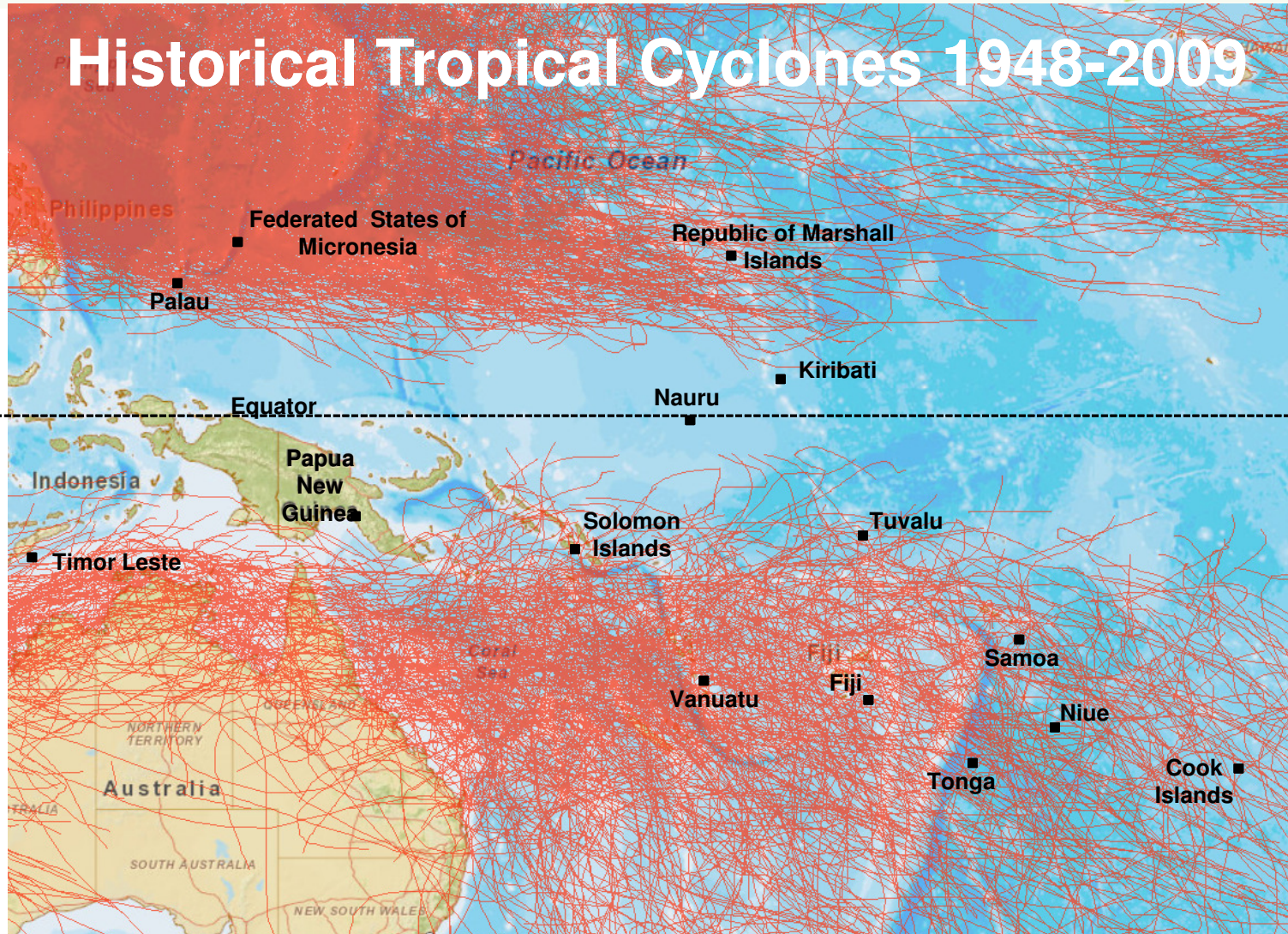
- AIR combined its detailed database of commercial and residential exposure in Mexico with its stochastic model of tropical cyclone and earthquake occurrence to identify the type of events causing the largest losses
- AIR then identified the areas of occurrence and physical parameters of events causing extreme losses
- Careful selection of the events and areas protected by the bond limited the probabilities of loss to investors, and thus lowered the cost of protection
- This allowed Mexico to limit its basis risk, meaning that the bond protects against devastating “worst case” scenarios while having limited exposure to storms causing damage Mexico could otherwise pay for

Residual Markets Can Leverage Catastrophe Bonds to Protect Specific Pools of Assets

- Parkton Re (2009), Johnston Re (2010)
 - Parkton was the first securitization of residual market pools
 - Offer multiyear indemnity protection to the North Carolina Joint Underwriting Association (NCIUA/NCJUA)
- Shore Re (2010)
 - Multiyear indemnity protection to the Massachusetts Property Insurance Underwriting Association
- Single-state nature make them desirable for investors thanks to relatively low correlation with Florida hurricane
- Indemnity securitization require high data quality, extensive disclosure
- Non-Indemnity alternative with low basis risk are also possible, such as using county-level industry loss structures

Many South Pacific Islands Are Exposed to Catastrophic Events Such as Tropical Cyclones

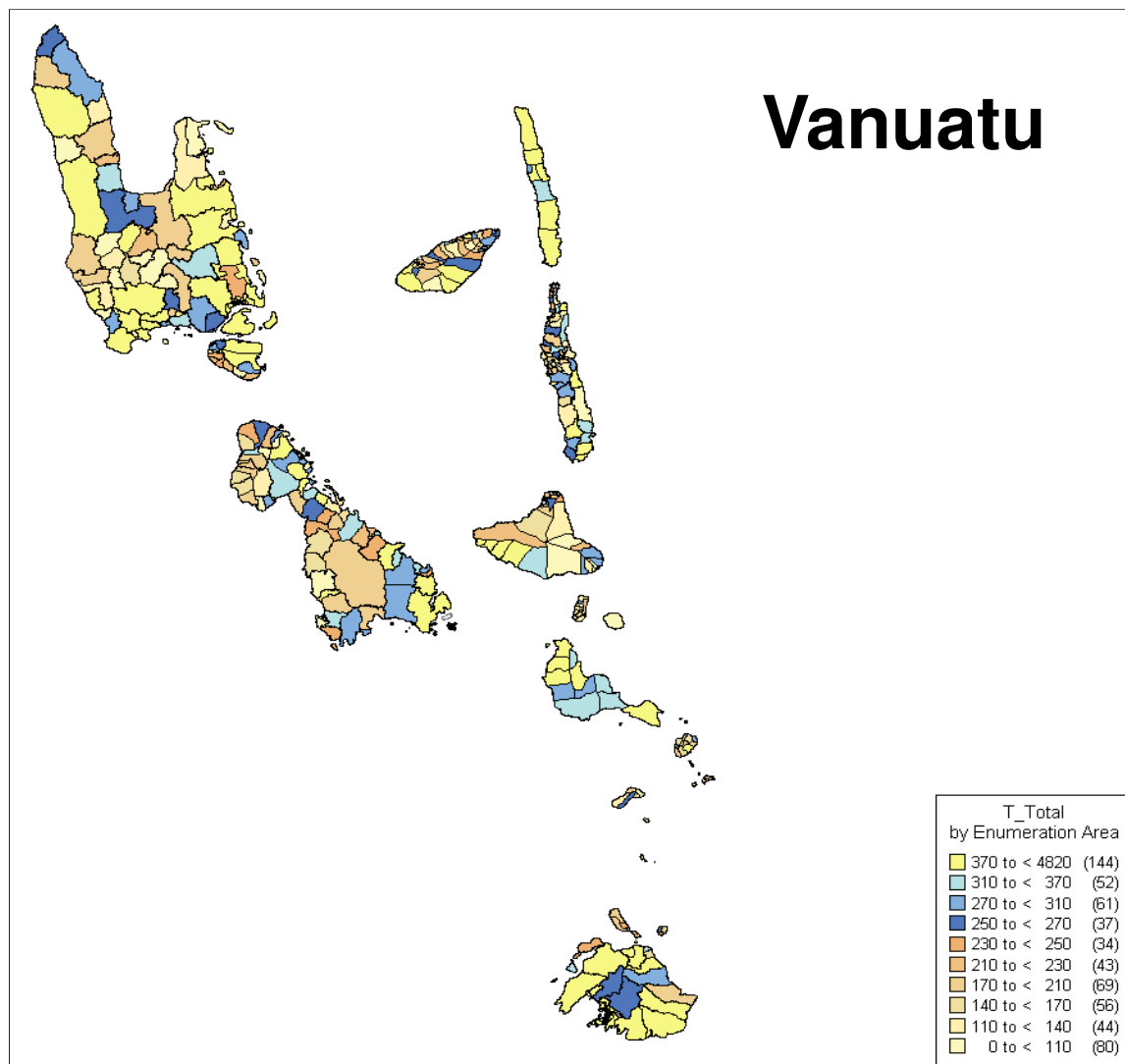
Historical Tropical Cyclones 1948-2009



Assessing Earthquake and Tropical Cyclone Risk to Population, Built Environment, and Major Crops



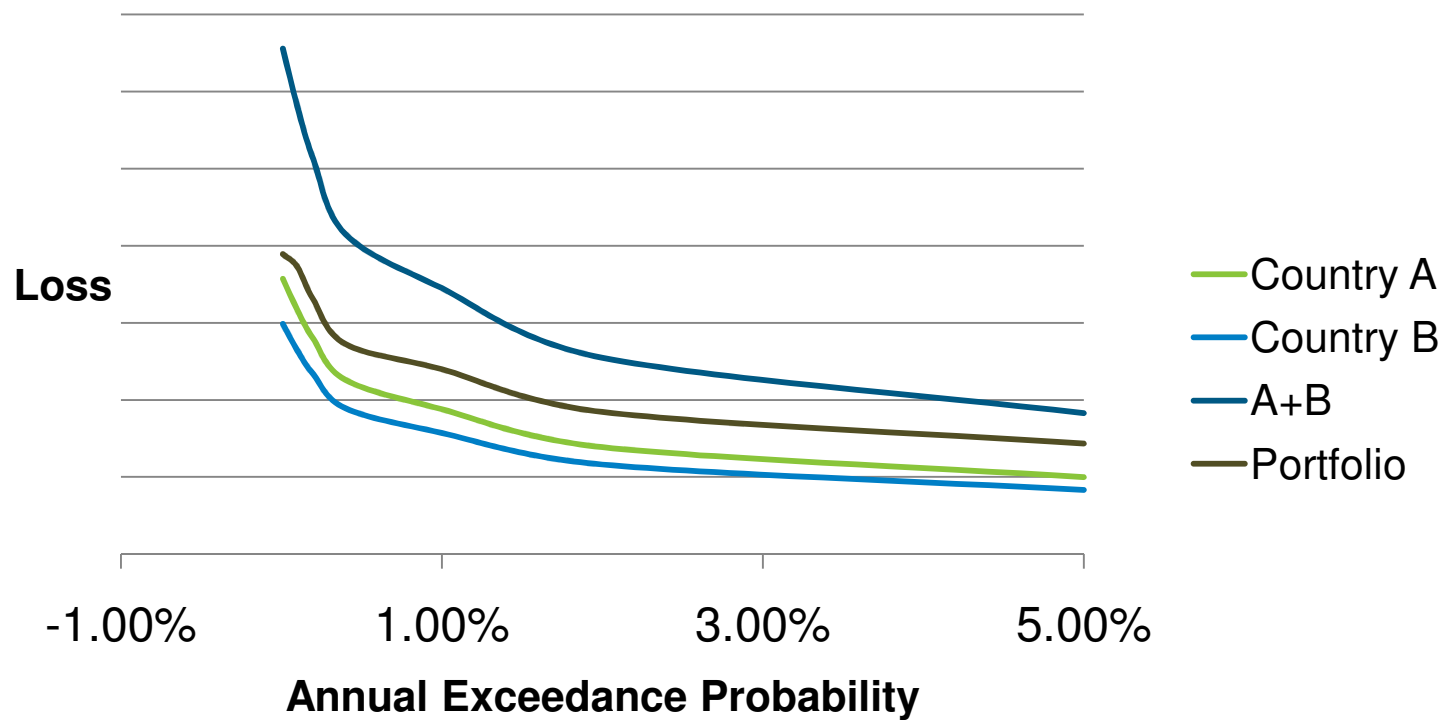
Exposure Database Development: Census Data



Extraction of Building Footprints from High-Resolution Imagery: Example for Dili (Timor Leste)



Country Risk Profiles and the Benefit of Pooling and Diversifying Risk



AIR Has Helped Sponsors Reach Alternative Markets

- The market has experienced rapid diversification
 - Securitization of non-peak perils: Mexico hurricane, earthquake
 - Securitization of diversifying regions within peak perils: North Carolina, Massachusetts hurricane risk
 - Development of entirely diversifying perils: South Pacific typhoon, earthquake, tsunami
- The market is expanding as new models for catastrophe-exposed areas are developed
 - Recent major updates to AIR's US hurricane, US earthquake, European extratropical cyclone and Japan earthquake models
 - Securitization of new, diversifying perils
 - Innovative trigger methodologies continue to be developed
- The market demands solutions that minimize basis risk
 - Verisk™ Catastrophe Index provides more granular losses to basis risk associated with standard industry-loss triggers
 - This leads to more accessibility of ILS markets to localized or specialized (re)insurers

