Implications of Climate Change for the Insurance Industry: 

*Risk or Opportunity?*

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Facing the Consequences of Climate Change in San Juan, Puerto Rico

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Climate variability is a fact of life; but the dice are loaded
$3.4 Trillion World Insurance Market

- World’s biggest industry; important to economic development
- Large employer
- Major player in financial markets
- Enormous political influence

Source: Swiss Re, Sigma No. 5/2005
Climate Change: Intersection with Insurance

Insurers are....
- integrators
- risk spreaders
- risk managers
- vulnerable
- selective
- potential part of solution
Insurance-relevant Consequences

Property Insurance
- Property damage
- Mold/moisture
- Forest products
- Agricultural products
- Business interruption
- Roadway

Life/Health Insurance
- Injury
- Infectious disease
- Heat stress
- Respiratory
- Pollutant releases
- Food poisoning
- Mental health
- Nutrition/water

Liability Insurance
- General
- Product
- Environmental
- Professional
- Political Risk
- Roadway
Insurance Industry is Concerned

“We'd be out of our minds if we wrote weather insurance on the opinion global warming would have no effect at all.”

- Warren Buffett
2006 annual Shareholder meeting
Insurance Regulators (via NAIC) are Concerned

“Global warming is upon us, and it poses unprecedented new threats to the insurance industry and vast segments of society that rely on insurance for peace of mind and financial security.”

- Michael Kreidler
  Washington Insurance Commissioner

- Tim Wagner
  Nebraska Insurance Commissioner
Disasters Look Different Through an Insurance “Lens”

Aggregate Global Impacts: 1980-2004

- Number of Events: N=14,216 (Non-weather-related: 40%, Other weather-related: 20%, Flood: 30%, Storm: 10%)
- Deaths: N=1,049,006 (Non-weather-related: 90%, Other weather-related: 10%, Flood: 1%, Storm: 0%)
- Total Economic Property Losses: $1,825 billion (Non-weather-related: 5%, Other weather-related: 20%, Flood: 75%, Storm: 0%)
- Insured Property Losses: $374 billion (Non-weather-related: 10%, Other weather-related: 20%, Flood: 70%, Storm: 0%)

E. Mills Science 309, 1040 -1044 (2005)
Uncertainty: Physical → Financial

Non-climate factors play a role, but...

- Trends *consistent* with observed change
- Why are non-weather losses level?
- Even worse without prevention efforts

Global Insured Weather-Related Losses Increasing Faster than Premiums, Population, or GDP

2004: $44.7 billion
2005: $75 billion (est.)

Notes: All economic values inflation-adjusted to 2004 levels. Losses from Munich Re NatCat Service; premiums from Swiss Re, Sigma. Values for 2005 are LBNL estimates.
Risk is OK
Volatility & Uncertainty is Not

The ratio of losses to premium revenues is increasing

Unknowns:
- Underwriting
- Competition
- Operations
- Investments
- Shareholders
- Reputation
- Regulation
- **Insurability**

Declining insurance industry capacity to absorb weather-related natural disasters

Relative ratio of global weather-related losses to total property/casualty premiums

Least-squares trend

Index: 1980=100

E. Mills Science 309, 1040 -1044 (2005)
Crop Insurance in Puerto Rico

Crop Insurance in Puerto Rico: 2006

- Vegetables
- Sugarcain
- Plantain
- Papaya
- Orange
- Coffee
- Citron
- Banana


- Premium $
- Losses $

Source: Puerto Rico Crop Insurance Profile, US Risk Management Agency

Cuerdas Insured: 66,222
2005 Insured value: $96 million
Net Loss: $65 million
Extremes Shift *More* Than Avg’s.

Implications for ENSO
Current and Projected SST Anomalies in Equitorial Pacific

Some model projections suggest more frequent El Niño-like conditions and stronger La Niñas as a result of climate change. Sea surface temperature (SST) deviations from normal in the equatorial Pacific are used to measure the strength of El Niños and La Niñas. These high resolution model projections by the Max Planck Institute suggest more SST deviations from normal and thus more frequent El Niños and stronger La Niñas in the future. The high bars in the center are occurrences of normal SSTs. In the projections in the right hand graph, these normal temperatures occur less frequently, while lower (La Niña) and higher (El Niño) SSTs occur more frequently. The Max Planck model is used here because it has been able to reproduce the strength of these events better than other models due to its physics and ability to resolve fine scale structure in the ocean.

Rare Extremes Cause Most of the Damages & Insured Losses

The European heat wave of Summer 2003

Event was “six-sigmas” outside of norm. 16°F above average in France and Germany was a 1-in-10,000 event to 1-in-46,000 event

“CATs” Play Role in Profitability

P&C Combined Ratios: 1982-2004
(excludes investment gains)

Note: Catastrophes are not the only climate change impact of concern

Source: AM Best, Aggregates & Averages
Small-scale, Indirect Events and Consequences Often Overlooked

Events
- Drought
- Hail
- Heat waves
- Ice Storms
- Lightning
- Sea-level rise
- Thunderstorms
- Tornados
- Torrential rains
- Wildfire
- Winterstorms

Consequences
- Blackouts
- Coastal erosion
- Crop/fishery damages
- Equipment breakdown
- Eroded air quality
- Eroded water quality
- Flooding
- Health impacts
- Mudslides
- Property loss
- Sinkholes/Subsidence
- Weather-related vehicle accidents

Greater combined impacts than CATs in an average year
Importance of Small-Scale Events

Mudslide in El Salvador (2001)
U.S. Power Outages

Power outages were a factor in slowness of draining New Orleans following Hurricane Katrina. Also important for business interruption.

U.S. total cost: ~$80B/year

Current insured portion unknown: most are below ISO/PCS threshold for being “worth” counting

RMS Scenario: $2.7B for NY
Temperature-Related Insurance Loss Experience

Lightning-related claims accelerate with temperature

Each symbol represents a lightning storm event

Source: Hartford Steam Boiler Inspection and Insurance Co.

Adapted from figure in Mills, Evan, 2005, Insurance in a climate of change, Science 309, pp. 1040-1044
Temperature-Related Insurance Loss Experience

Air-conditioning breakdown claims increase with cooling degree days: 1994-1999

Source: Hartford Steam Boiler Inspection and Insurance Co, 2001
Mold & Moisture Damages

Texas Homeowners Market in Face of Rising Mold/Moisture Claims

Number of Insurers in Market

Water Damage Losses as % of Total

Water Quality

Freshwater Lens Effect in Island Hydrology
Water Quality

Sea-level Rise

Sacramento-San Joaquin Delta

SAN FRANCISCO BAY

Reduced Sierra Runoff
Water Quality

Sea-level Rise

Salt Water Intrusion

Reduced Runoff

For Caribbean: See paper from Mark Jury, UPRM

http://baydeltaoffice.water.ca.gov/climatechange.cfm
Correlation of Disease Clusters with the 1997-1998 El Nino

El Nino expected to become more frequent under climate change

Source: Harvard Medical School, Center for Health and the Global Environment (Science)
Climate Change Liability: 
A Rapidly Emerging Issue

New IPCC Report has reduced the uncertainties
The Changing (Business) Climate

**Business Value**
- Negative impacts on company value, reputation & brand caused by ignoring climate change

**Shareholder Demand for Action**

**Shifting Regulatory Environment**
- Energy prices
- Carbon caps, etc.
- Compliance cost of "penstroke regulation"

*Note: non-business entities also have liability insurance, e.g., local governments*
Availability & Affordability

• Exodus from coastal areas
  – 600,000 cancellations/non-renewals, and counting
• Dramatic price increases
• “Hollowing out” of coverage
  – deductibles; exclusions
  – limits (aggregate versus per-event)
• Mandated “Residual Markets” growing rapidly
  – ~3 million policyholders in US
• Example of Pharmaceuticals:
  – (a) total capacity of $1.3B reduced to 0.5B; (b) deductibles once $25-$35 million have ballooned to $400 million, (c) premiums have tripled or quadrupled (d) more exclusions, (e) mutuals formed.
The insurance sector has a key role to play in helping to mitigate the effects of climate change ... and by developing new products and solutions that can support emerging greenhouse-gas and renewable energy markets.

- Marsh & McLennan

Ceres Report: 25 strategies; ~220 examples; ~120 insurers
Cutting U.S. Emissions in Half with Climate-Stabilization “Wedges”

After Pacala and Socolow (Science)
More Business!

The strength, dependability and flexibility to protect business against risk.

The fundamental strength to deliver customized insurance solutions.
Promoting Loss Prevention

• Meets *Institute for Business and Home Safety’s* “Fortified... for safer living” stds.
  - Wind-resistant rigid foam panel walls and multi-glazed windows
  - Ice-dam resistant
  - Mold resistant
  - Water-resistant insulation

BASF Home - Patterson

NJ

Some insurers are giving premium credits....
Crafting Innovative Insurance Products

- **Fireman’s Fund**: first-ever “Green-Buildings Insurance”
  - Premium credits for green features
  - Rebuild green after loss

- **Lloyds**: Energy Savings Insurance; **Munich Re**: geothermal performance insurance

- **Munich Re**: Climate insurance Initiative (MCII) for developing countries
Providing New Customer Services

- **Insurance Australia Group** offering on-line automobile carbon-offset service for customers

Participating in Carbon Markets

- **AIG, Marsh**, others offering carbon project risk-management consulting services; insurance

Rewarding Customers’ Good Behavior

- **Travelers** offers 10% premium discount to drivers of hybrids

- **GMAC** offers “pay-as-you-drive” insurance discounts of up to 40%
Financing Solutions

- **Tokio Marine & Nichido** has reforested 7,500 acres of mangroves in Indonesia, Thailand, Philippines, Myanmar and Vietnam. 5,000 more acres in progress.

Source: http://www.tokiomarine-nichido.co.jp/english/index.html
Sustainable Asset Management

- **Munich Re**: membership in sustainable investment indices; screens its own investments
- **Allianz**: endorsed the Ceres/INCR "Call to Action"
- **Gerling**: Select 21 Fund includes energy and environmental criteria in the selection of securities.
Conducting Research

Expected increase in annual windstorm loss in Europe

*Swiss Re*

*Increase in annual expected loss for Europe (EUR), Denmark (DNK), Germany (DEU), Sweden (SWE), Belgium (BEL), France (FRA) and the UK (GBR) over the period 1975 to 2085 (in %). The broad bars represent the mean value of the climatic models, and the error bars show the spread of the results from all models.*
Participating in Public Policy Discussions

- **American Insurance Association** - Endorsing public transportation; reduced speed limits; telecommuting based on win-win benefits

- **Association of British Insurers** advising City of London on land-use planning and flood defenses
Leading by Example

Carbon Disclosure Project
Insurers’ responses: AIG, Aon, Marsh & McLennan, MBIA, Safeco, St. Paul Travelers, Unum Provident

Swiss Re’s “Gherkin” building (London)
- Energy efficiency
- Daylighting
- Natural ventilation

Source: http://www.cdproject.net/
Educating Fellow Insurers

- **Swiss Re** has run *regular* full-page adds on climate change in major insurance trade journals for several years.
Risks are also associated with responses to climate change

• **Emissions reduction** – supply- and demand-side energy choices
  – Green Buildings
  – Nuclear power
  – Hydrogen energy
  – Renewable energy
  – Carbon capture & storage
Carbon Capture and Storage (CCS)

- Lake Nyos - 1986 (Cameroon): Natural CO$_2$ leak suffocated 1800 people, 3500 farm animals
Bottom Lines....

- The insurance sector - a powerhouse
- Risks from climate change - material
- Risks from responses - under-appreciated
- Opportunities - very significant; off to good start
- Emission vs. impact reduction: strong synergisms
http://insurance.lbl.gov

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