Policy making and climate risk insurability

How can (re)insurers contribute to economic resilience in climate risk events?

Georges Dionne
HEC Montréal

Seminar on Climate Risk
SCOR Foundation
Paris, 9-10 June, 2015

Introduction

- Natural hazards cause natural disasters.
- Natural disasters cause fatalities and casualties.
- More than 2 million fatalities since 1980 (only 5% of them from high-income countries).
- About 70 million people are affected each year; 12,700 deaths in 2014, less than the average of 80,000 since 1980 and 66,000 since 1999.
- To save lives, the most effective policy is via early warning systems with evacuation schemes. But many countries do not have access to this policy.
- Natural disasters also affect social welfare by causing economic consequences.

Introduction (continued)

- Economic consequences are often more severe than immediate losses related to property damages, business interruptions, and fatalities.
- Loss of production, lower productivity, higher unemployment, lower future consumption, lower taxes, …
- These losses often go beyond (re)insurance claims and are associated to the resilience of a country, a region or a city.
- One question here today is: How (re)insurance can contribute to economic resilience of such events?

Definitions

- **Natural disaster:** at least one of the following criteria:
  - Economic loss: ≥ 50 million USD (2013)
  - Insured loss: ≥ 25 million USD (2013)
  - Fatalities: ≥ 10
  - Injured people: ≥ 50
  - Homes/damaged structures: ≥ 2,000
- **Macroeconomic resilience**

  Ability to maintain aggregate future consumption losses (ΔC) as small as possible for a given amount of capital losses (ΔK) (Hallegate, World Bank).

Definitions (continued)

- **Microeconomic resilience**
  Ability to minimize population welfare losses (ΔW) for a given aggregate consumption loss (ΔC) (Hallegate, World Bank).
- **ΔK** can be reduced by reducing global warming. For example, investment in research, green technologies, less carbon emissions, …
- **ΔC** can be reduced by reducing hazard exposures and vulnerability or by reducing ΔK (loss of assets).
- **ΔW** can be reduced by increasing population protection or by reducing ΔK or ΔC.

Definitions (continued)

- **Resilience of the socioeconomic system**
  Reinsurance, Insurance-Linked Securities, Government support, public and private insurance, savings, prevention, risk management, ...
- **Prevention**
  Activities that reduce disaster risk (ex ante); individual prevention; collective prevention.
- **Moral hazard (ex ante)**
  Less incentives for prevention in presence of insurance coverage or Government support.
- **Moral hazard (ex post)**
  Less incentives to report the true losses (trade-off between basis risk and ex post moral hazard).

Simple framework for economic resilience (Starting point Hallegate, World Bank, 2014)

Consider ΔK, the reduction of assets following a given climate event.

Taking into account the reconstruction time, the average productivity of capital, and different externalities, we can write:

$$\Delta C = \Gamma \Delta K \text{ with } \Gamma > 1,$$

where ΔC is the reduction in future consumption associated to the event.

So we can define the macroeconomic resilience R^{ma} as:

$$\frac{1}{R^{ma}} = \frac{\Delta C}{\Delta K} = \Gamma.$$

R^{ma} is high when ΔC is low for a given ΔK or when Γ is small. In the limit with instantaneous reconstruction $(\Gamma = 1)$:

$$\Delta C = \Delta K.$$

One aspect not considered in Hallegate (2014) is the financing of reconstruction.

Here (re)insurance can be very useful to reduce Γ and increase R^{ma}.

Consumption loss is not welfare loss (ΔW).

We can define microeconomic resilience R^{mi} as:

$$\frac{1}{R^{mi}} = \frac{\Delta W}{\Delta C}.$$

R^{mi} is high when ΔW is low for a given ΔC.

Let us define $C = n_p C_p + n_r C_r$.

We can decompose ΔW as:

$$\Delta W = \frac{\Delta C}{C} \underbrace{\left(n_p\, U'\left(C_p\right) C_p + n_r\, U'(C_r) C_r\right)}_{\kappa} + (1 - \psi)\theta$$

where:

θ is the instantaneous impact of the climate event on welfare: deaths, injuries, health, property losses, …

ψ is insurance coverage and Government support

κ is the impact of $\frac{\Delta C}{C}$ on ΔW.

κ takes into account of net wealth $\left(U'(\cdot)\right)$ and the distribution of wealth between the poor households and the rich households.

Insurance coverage and the exposition of the two groups to the climate event also affect κ.

So:

$$\Delta W = \frac{1}{R^{mi}} \Delta C = \frac{1}{R^{mi}} \frac{1}{R^{ma}} \Delta \mathrm{K}$$

and the contribution of insurance to economic resilience following a climate event $\Delta \mathrm{K}$ is by increasing R^{mi} and R^{ma}.

More insurance coverage reduces the welfare cost of a climate event of value $\Delta \mathrm{K}$.

Where do we stand? Four major conclusions for the US insurance market from the following analysis:

- **Low insurance penetration in climate risks**
- **Low insurance demand** (Rand study, 2006)
- **Lack of preparedeness by the insurance industry** (CERES report, 2014, NAIC)
- **Potential capital overcapacity in the reinsurance industry**
  - Low demand by insurers
  - Larger concentration in the insurance industry
  - Strong regulation of capital

Major issues related to climate risks

- **Population concentrates in high risk areas**
  - Increases insurers' exposure to major catastrophes related to few natural hazards.
- **Frequency and conditional losses** related to climate risk have increased significantly around the world since 1970 and are very cyclical.
- **Low demand for insurance coverage (RAND)**
  - Underestimation of the risk by potential insured.
  - Bias in anticipated net loss estimation due to anticipated Government intervention.
  - Wealth inequality affects insurance demand.
- **Flood insurance is subsidized since 1968** in the United States by the Federal Government. However, the demand remains low.

Major issues related to climate risks (continued)

- **Natural hazard losses fluctuate radically**
  Insurers cannot use the recent loss history for the calculation of premiums. The sum of individual losses from a single event can be much higher than the sum of annual premiums for an insurer. Must compute Estimated Maximum Loss (EML)…
- **Problems also on the supply side**
  - Insurers not really prepared to cover climate risks (NAIC, 2014).
- **Investment in prevention is a long-run activity while insurance coverage is annual**
  - Problem of commitment from the insurance industry.
  - At individual level; at collective level.
  - May generate lower level of prevention.

Major issues related to climate risks (continued)

- **Insurance schemes vary significantly among countries:**
  - Voluntary vs compulsory
  - Indemnity-based vs index-based
  - Related or not to mortgage or other loan
  - Private vs public or mixed (private-public partnership)
- **Insurance-Linked Securities (ILS)** are becoming important in the reinsurance market for catastrophe losses related to climate risk.
  Not very important in the insurance market.
- Form of securitization of catastrophe risk to the financial markets. Caution must be made on the tradeoff between basis risk and ex post moral hazard.

Major issues related to climate risks (continued)

- **Advantages of ILS**:
  - Can lower the cost of risk transfer in hard (re)insurance market conditions
  - Help to maintain the (re)insurance capacity.
  - Offer multi-year protection
  - Are free of credit risk by offering full collateralization of losses
  - For investors, they are non-correlated with other market, liquidity, and credit risks
- **ILS do not solve the low demand for insurance problem, however.** But ILS penetration can reduce the price of insurance in the long run.

Major issues related to climate risks (continued)

- **Why do we need Government intervention in this market?**
  - Climate risks introduce externalities and public prevention is a public good: private market failure.
  - Government should be present when there is market failure or absence of sufficient insurance demand.
  - Government can reduce adverse selection and diversify CAT risk with compulsory insurance.
  - But compulsory insurance introduces moral hazard and less prevention.
  - Optimal partial compulsory insurance with incentive pricing can be a solution to moral hazard.

CERES insurance program report (NAIC, 2014)

- Survey to US insurance companies in 5 states on climate change risks by NAIC.
- 330 distinct insurers representing 87% of market.
- Most of the insurers reported profound lack of preparedness in addressing climate-related risks.
- P&C insurers more involved. Statistics below are related to them.
- Only about 10% have issued public climate risk management statements related to climate science and its implications for core underwriting and investment portfolios.

CERES insurance program report (2014) (continued)

- Many insurers did limit coverages or entirely withdraw from certain catastrophe-prone markets which reduced resiliency in communities and states.
- The vast majority of P&C insurers are not addressing climate risk comprehensively.
- 50% have, however, taken positive steps in Climate Change Modeling and Analytics.
- 31% use Climate Risk Governance practices.
- 28% use Enterprise-Wide Climate Risk Management.
- 12% have a Stakeholder Engagement with respect to climate risk.
- Life and Annuity insurance and Health insurers have taken little action with respect to climate risk management.

Worldwide statistics

88%

of all natural events worldwide were weather-related during the period 1980 to 2014.

40%

of the overall losses from 1980 to 2014 occurred in Asia.

64%

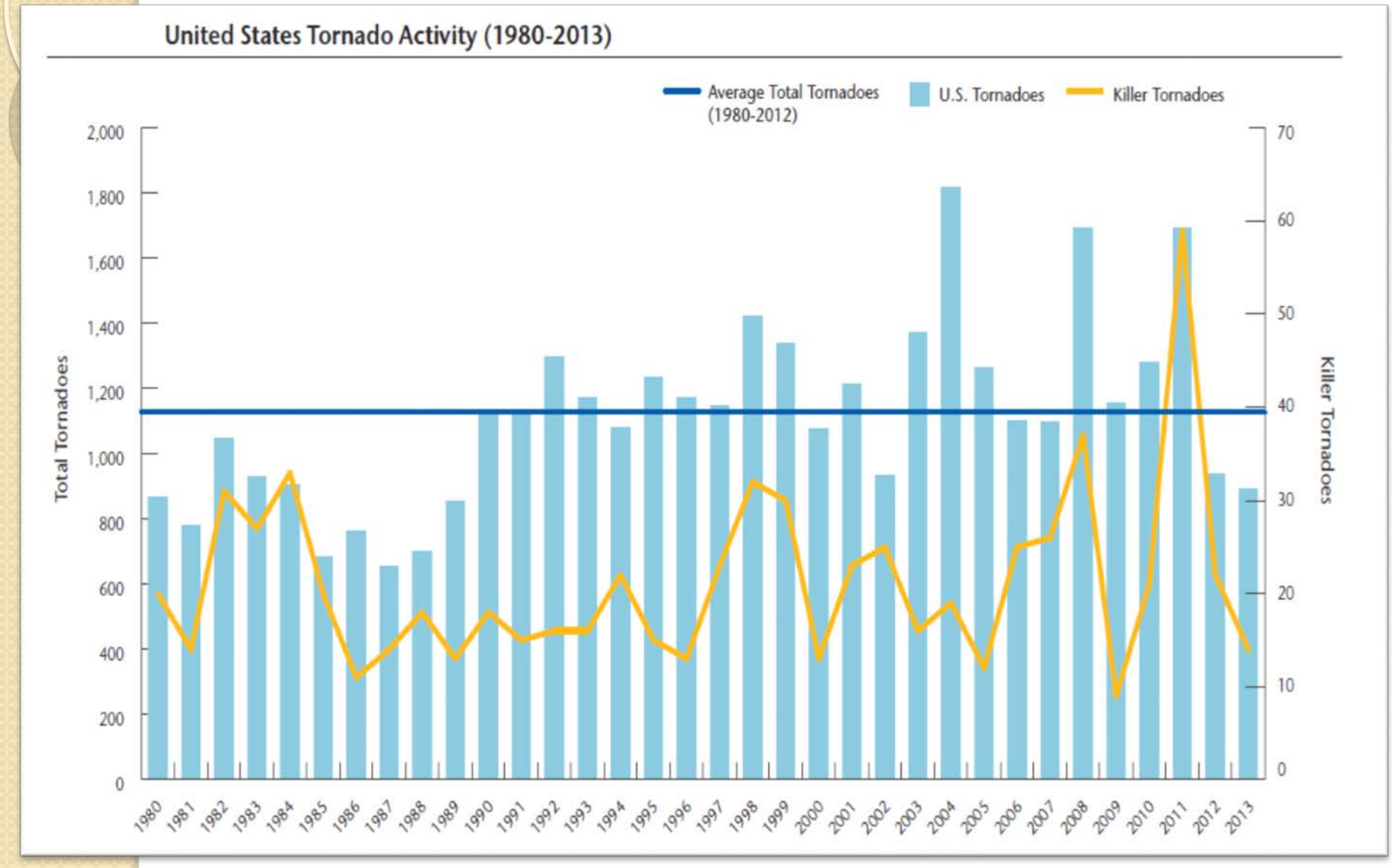
of the insured losses were incurred in North America (incl. Central America and the Caribbean) during this period.

Source: **Munich Re Topics Geo 2014**

Some statistics on economic loss and insurance coverage

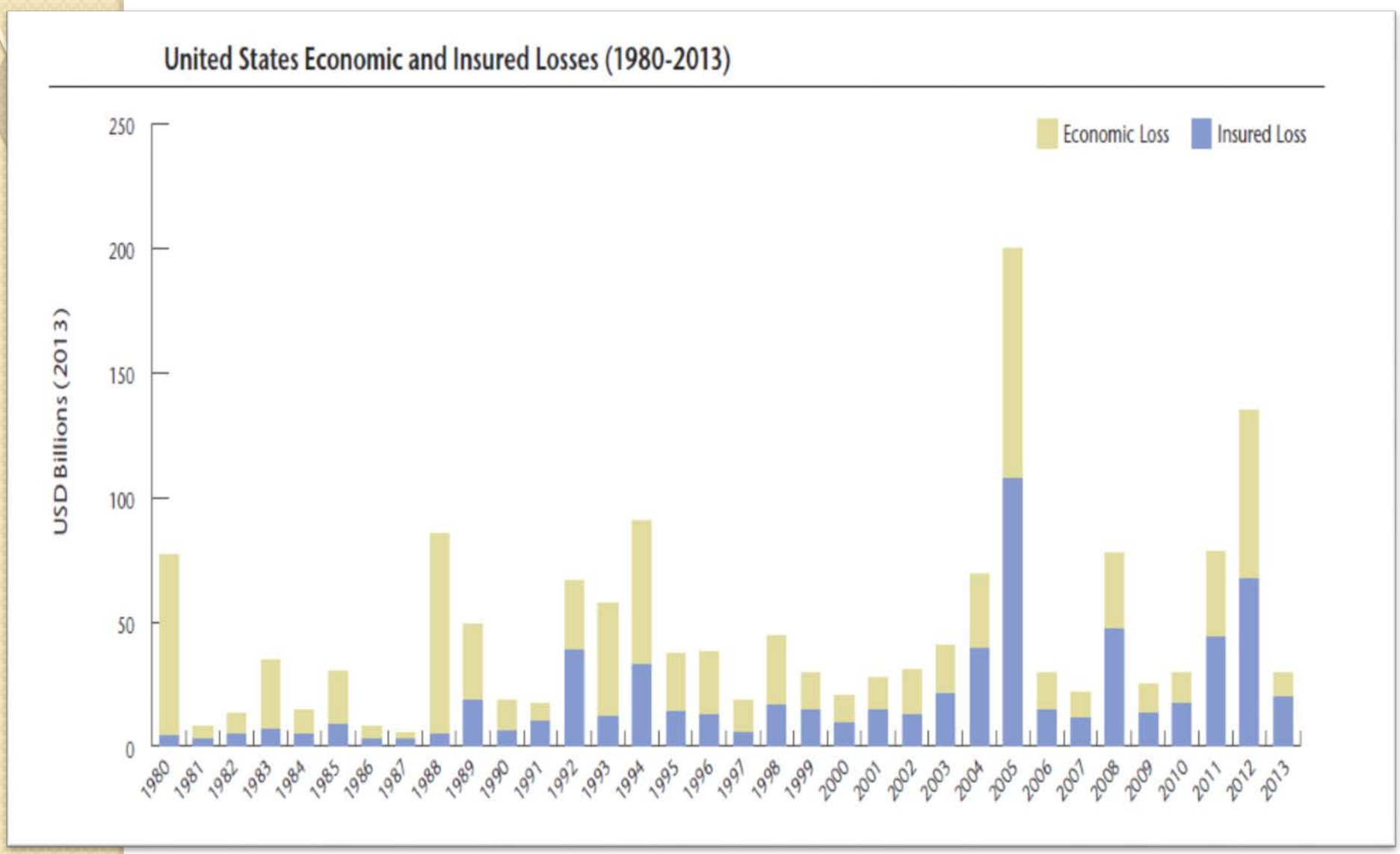
- U.S.A.

United States climate disaster events



Source: **AON Benfield - Impact Forecasting 2013**

United States natural disaster losses

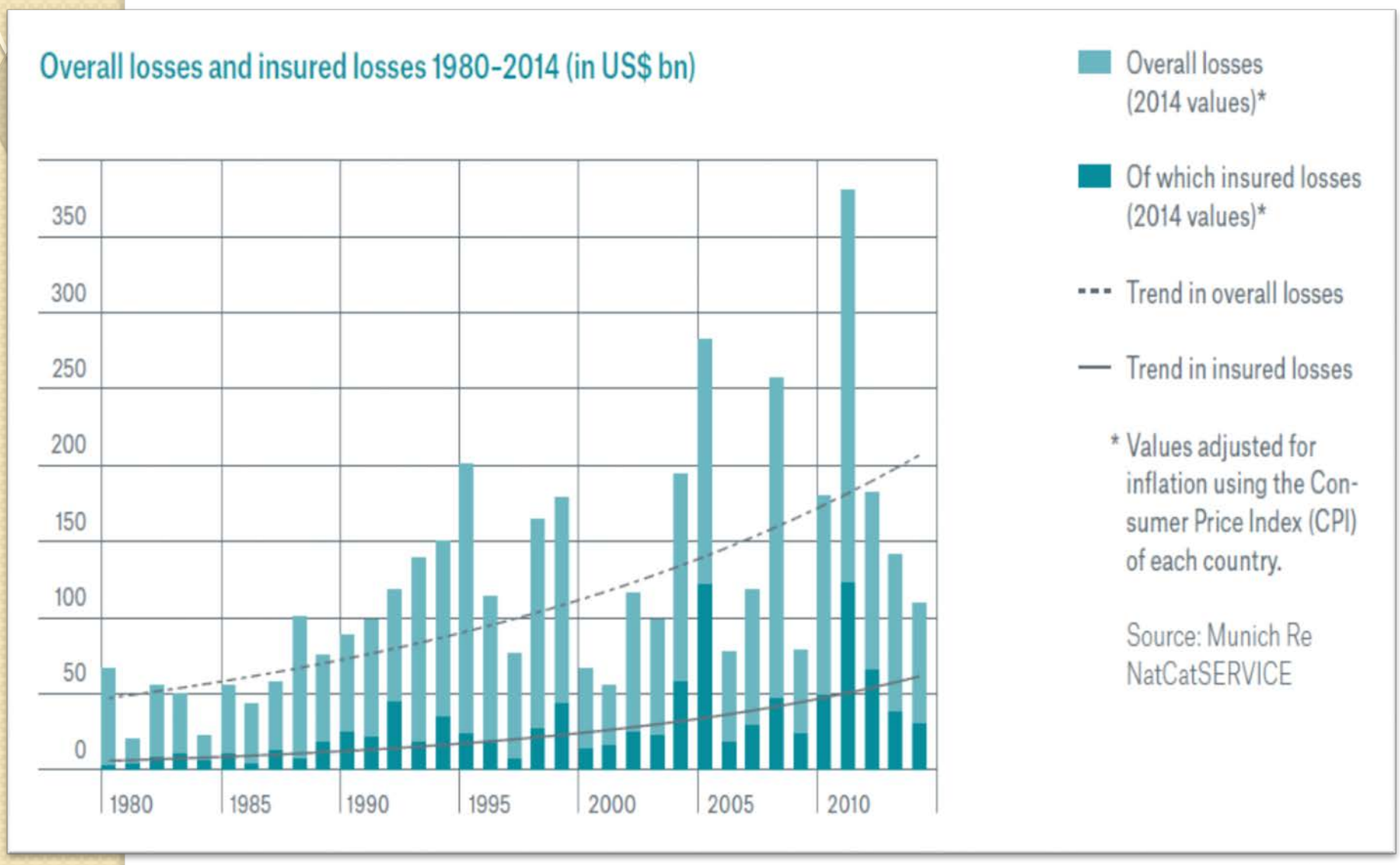


Source: **AON Benfield - Impact Forecasting 2013**

- Katrina killed 1,300 people and caused insured losses of about $48 billion in 2005. 41% of victims did not have any or sufficient insurance.
- Hurricane Ike caused estimated insured losses of $17.6 billion in 2008.
- Combined deficit of $30 billion for the National Flood Insurance Program (NFIP).
- Hurricane into NY city in 2012 caused total losses of $50 billion.
- Recent Texas-Oklaoma tornados event killed more than 30 people.
- Alberta flood in Canada in 2013 caused economic loss of $6 billion.

Natural catastrophes losses worldwide

Insured losses represent 32% of overall losses in 2014

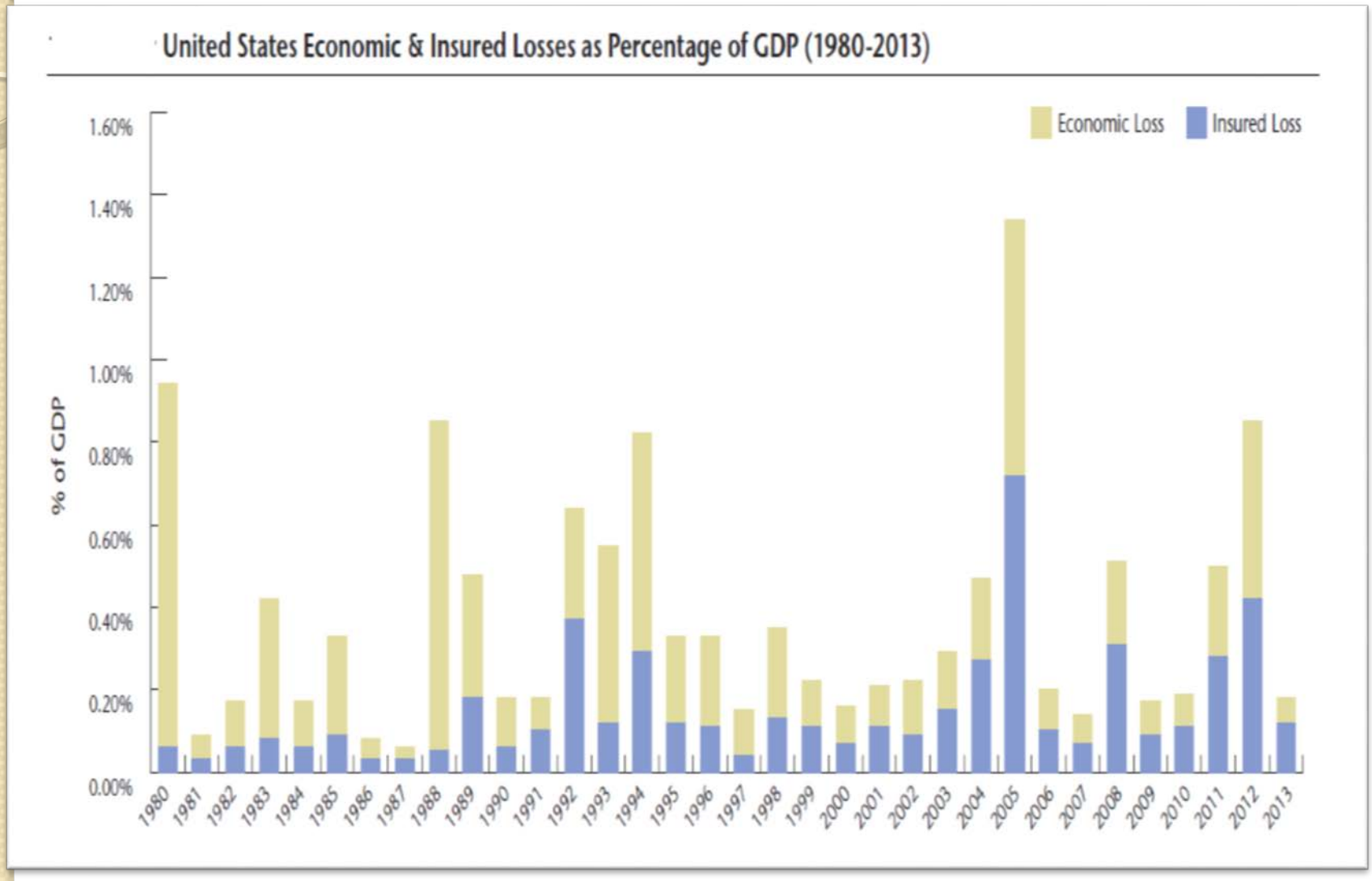


Source: Munich Re Topics Geo 2014

United States natural disaster losses

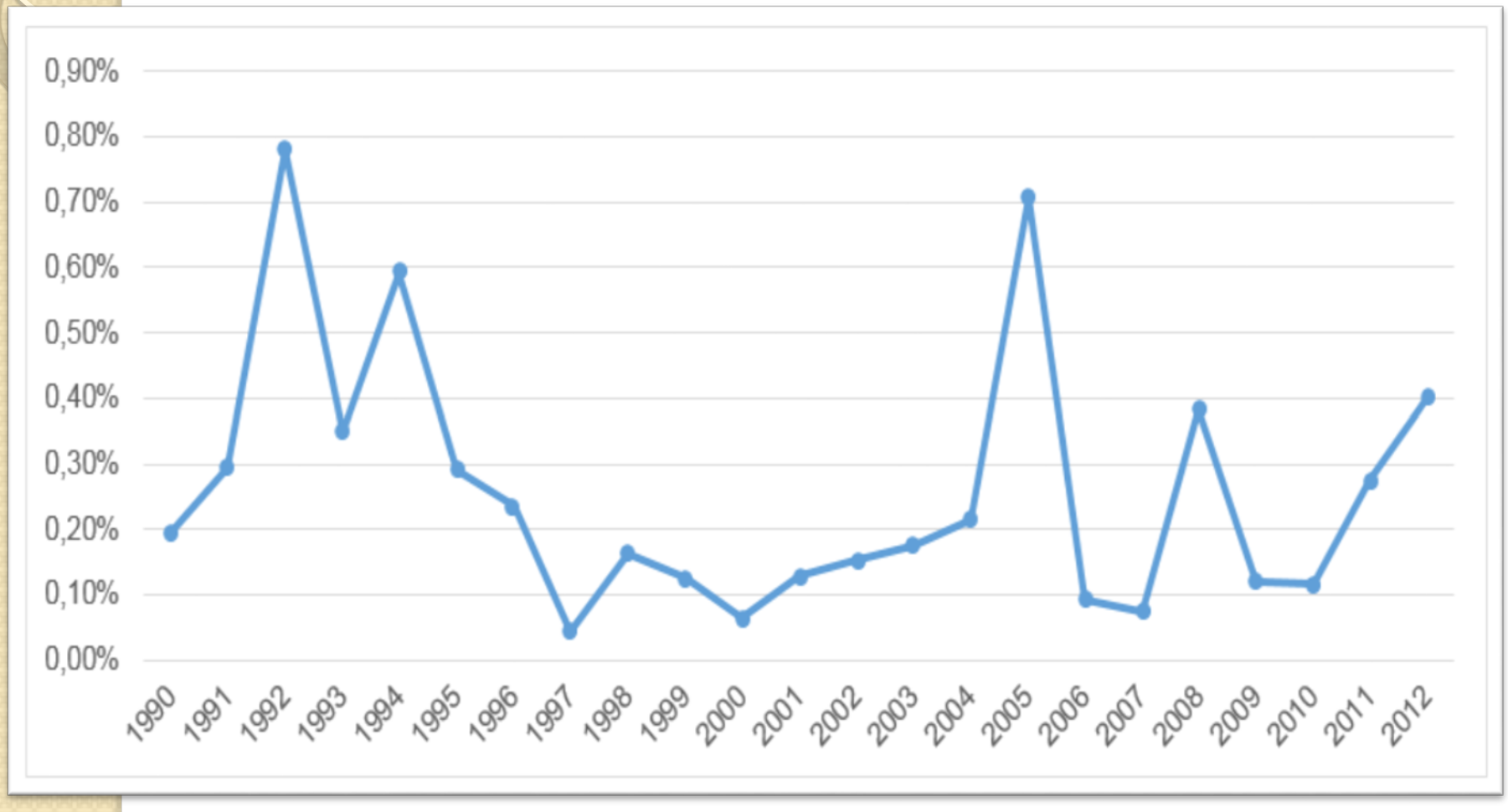
Over the total period: +0.8% (EL) and +4.3% (IL).

Over the last 10 years: -4.3% (EL) and -3.3% (IL).



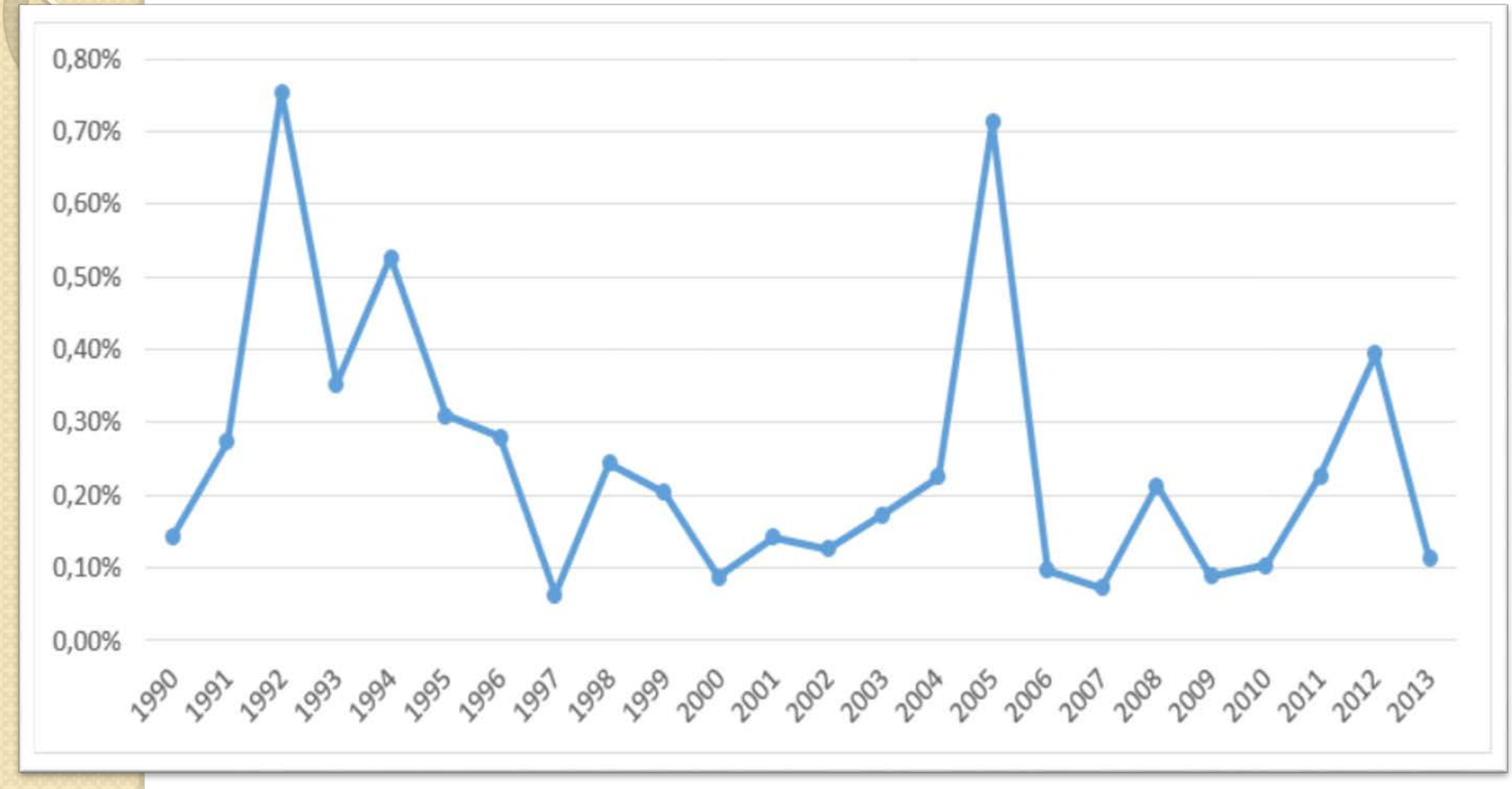
Source: **AON Benfield - Impact Forecasting 2013**

US climate insured losses as % of stock market capitalization



Source: **AON Benifield** and **World Bank**

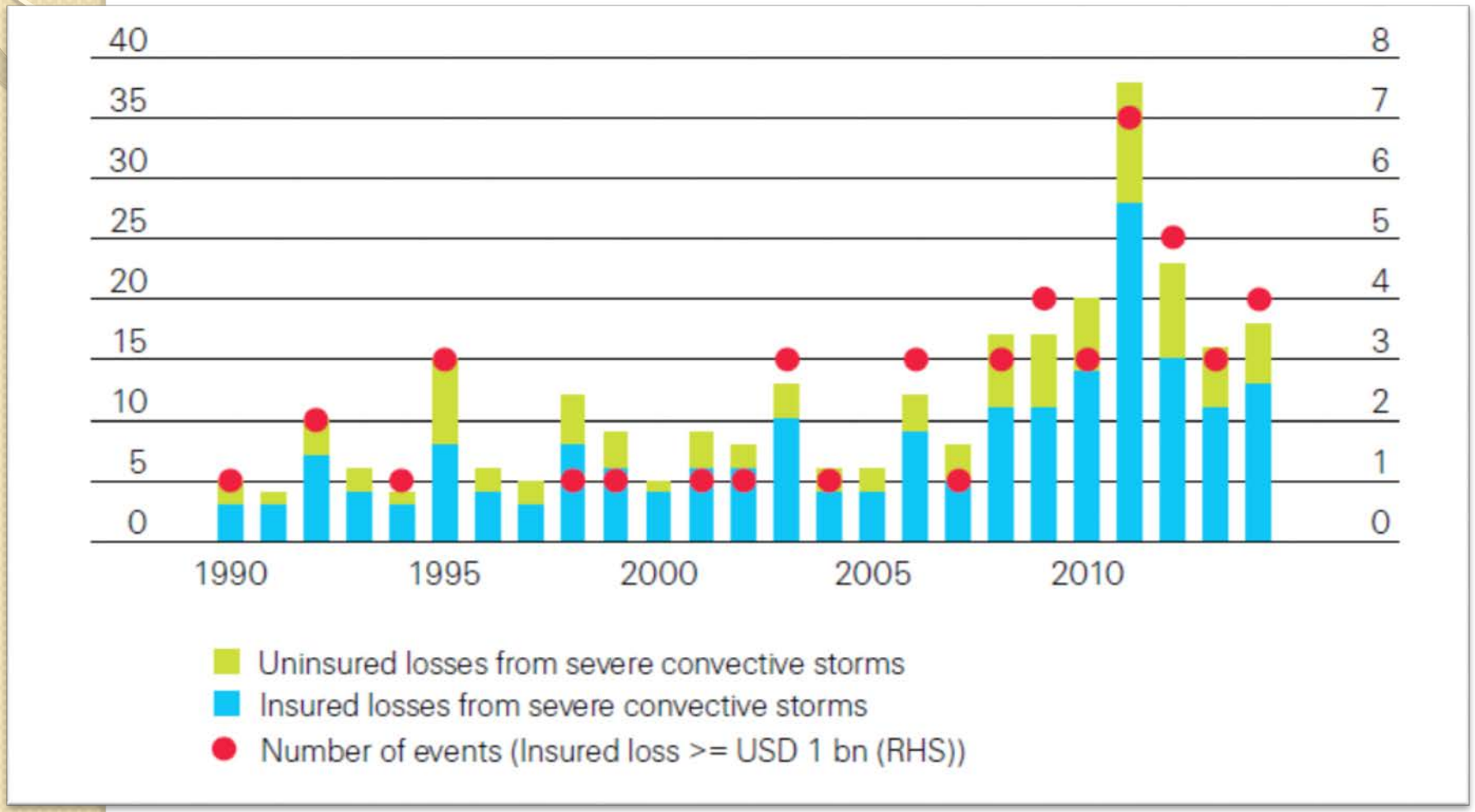
US climate insured losses as % of debt securities (Government excluded)



Source: **AON Benifield** and **BIS**

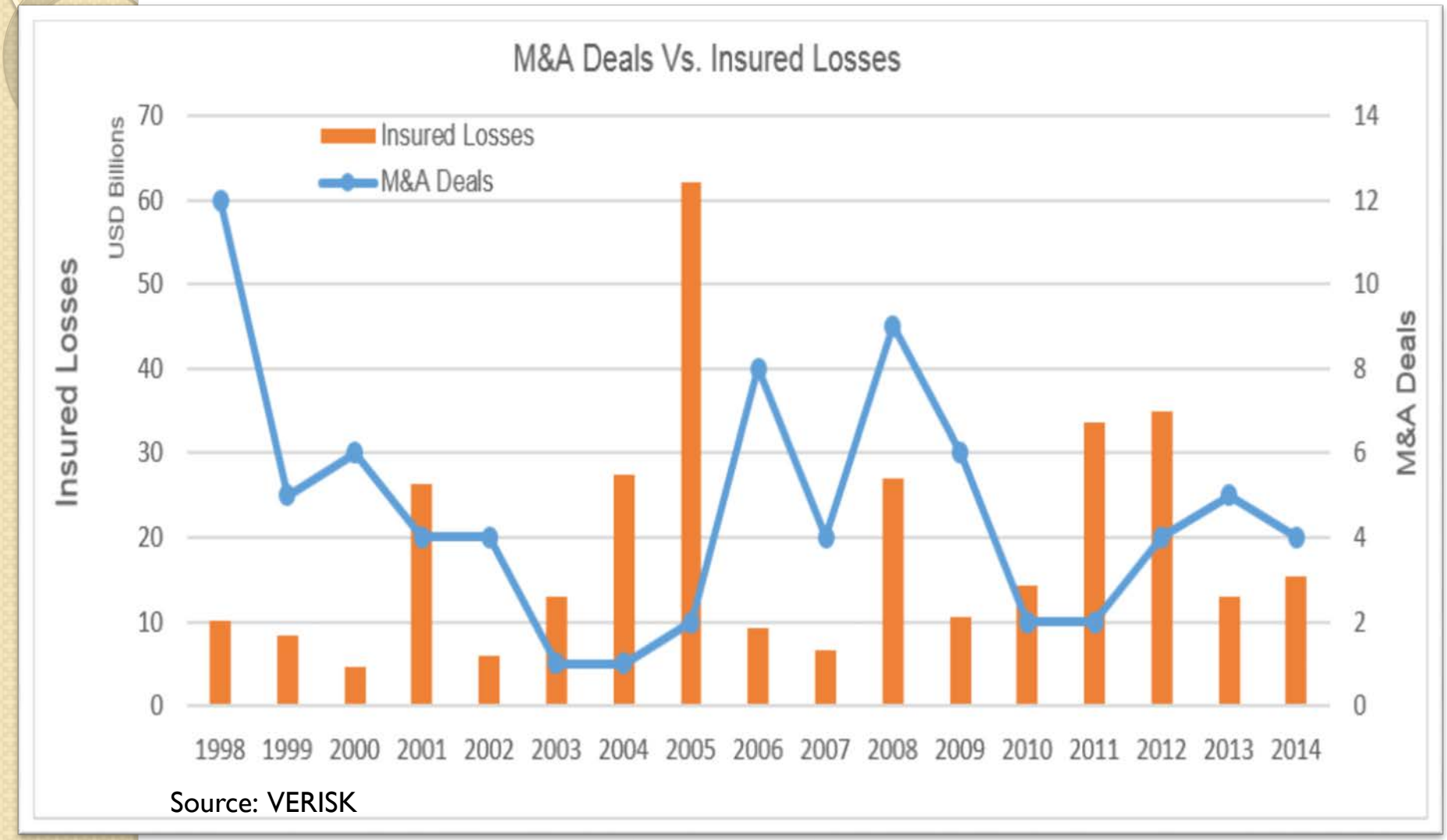
Severe convective storm impacts in the United States (billions)

Represent more than 45% of weather event insured losses in 2010-2014 and 30% in 1990-1999



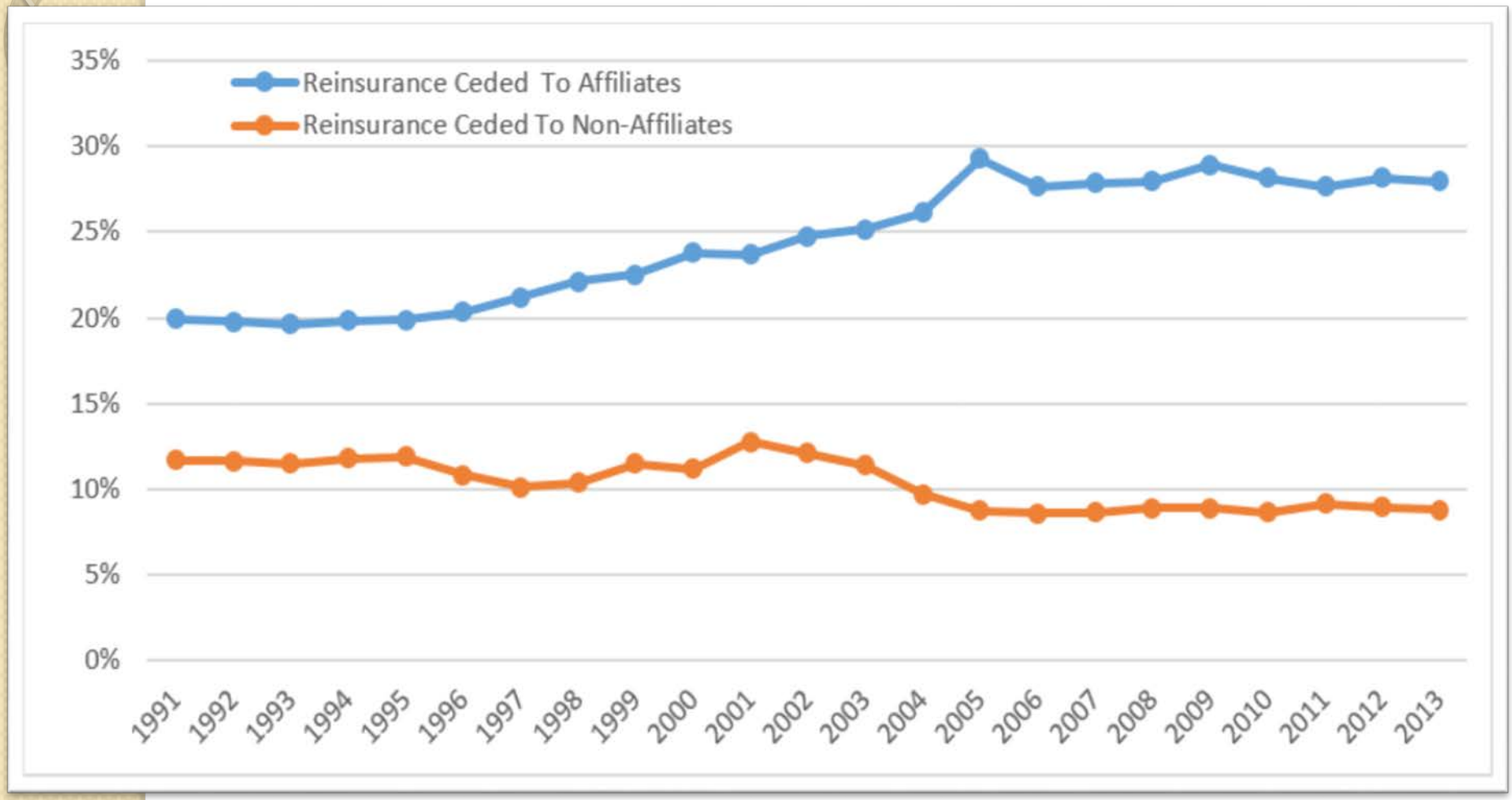
Source: **Swiss Re Sigma** No 2/2015

M&A in the U.S. P&C ins. industry Correlation of 33% (lag one year)



Source: VERISK

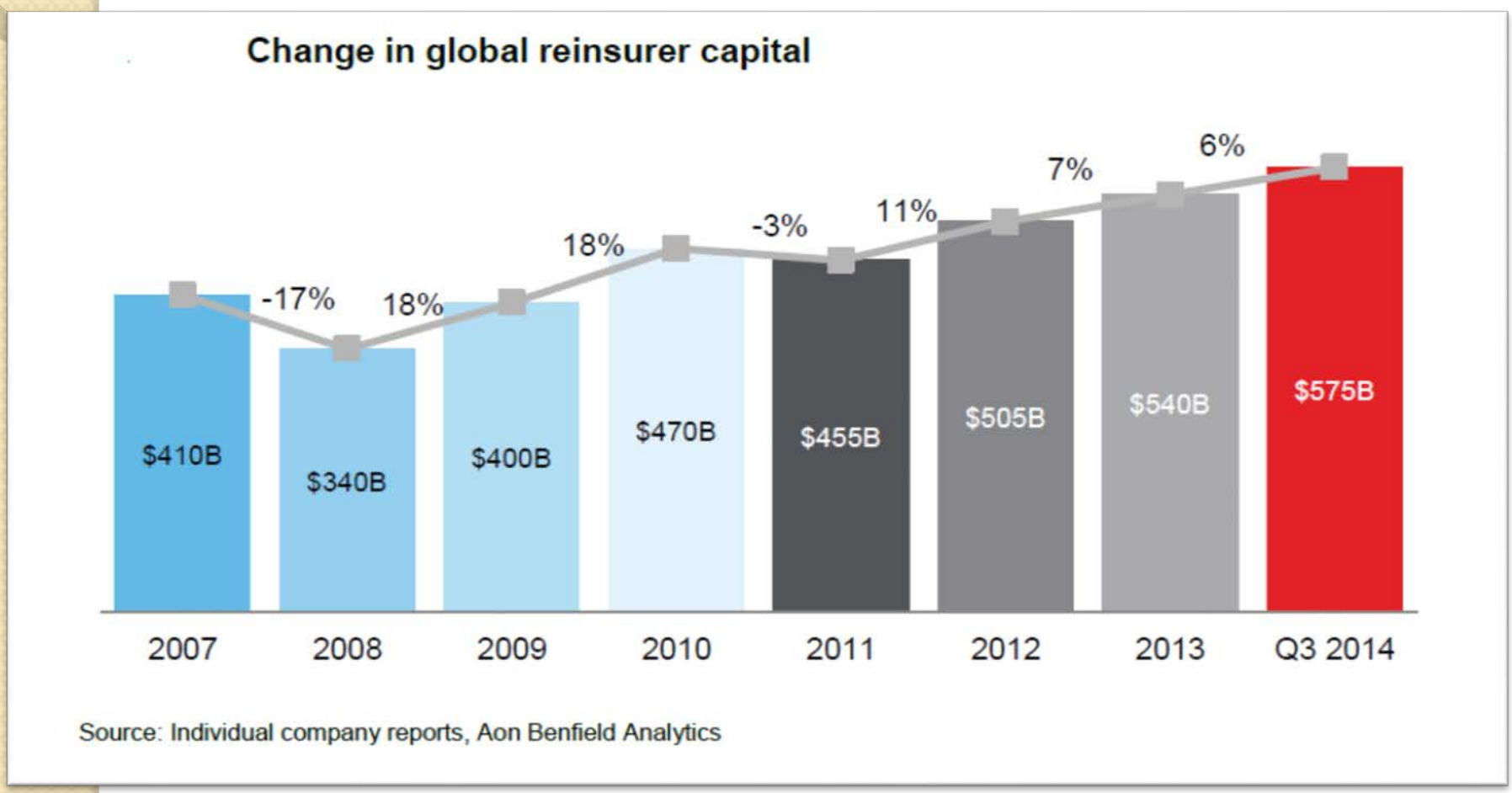
Reinsurance



Source: **National Association of Insurance Commissioners**

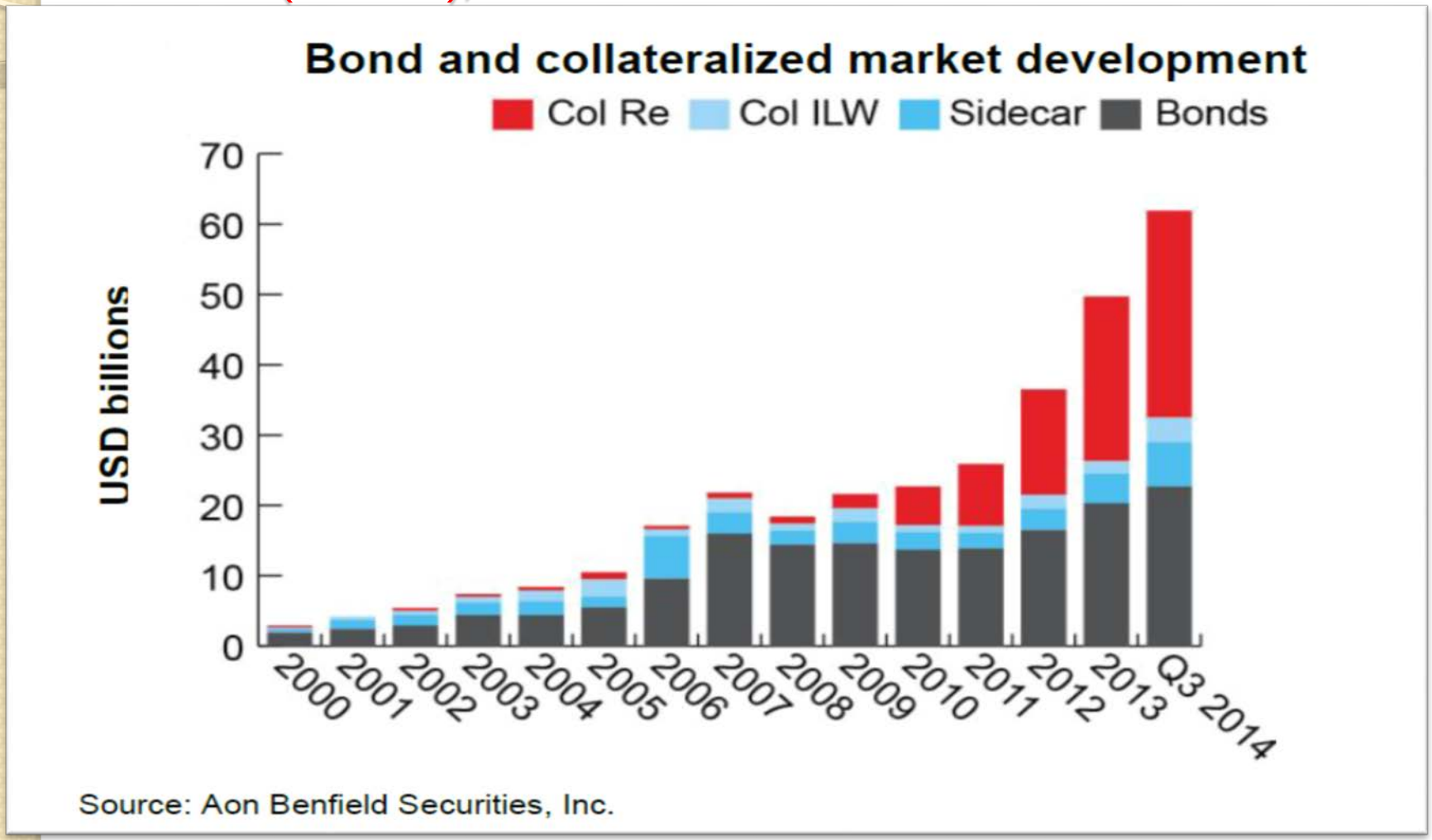
Reinsurance market outlook in the world

Supply growth continues to outpace reinsurance demand.
Total climate risk loss in 2008: 130 billion (44 insured)
Total climate risk loss in 2011: 375 billion (125 insured)

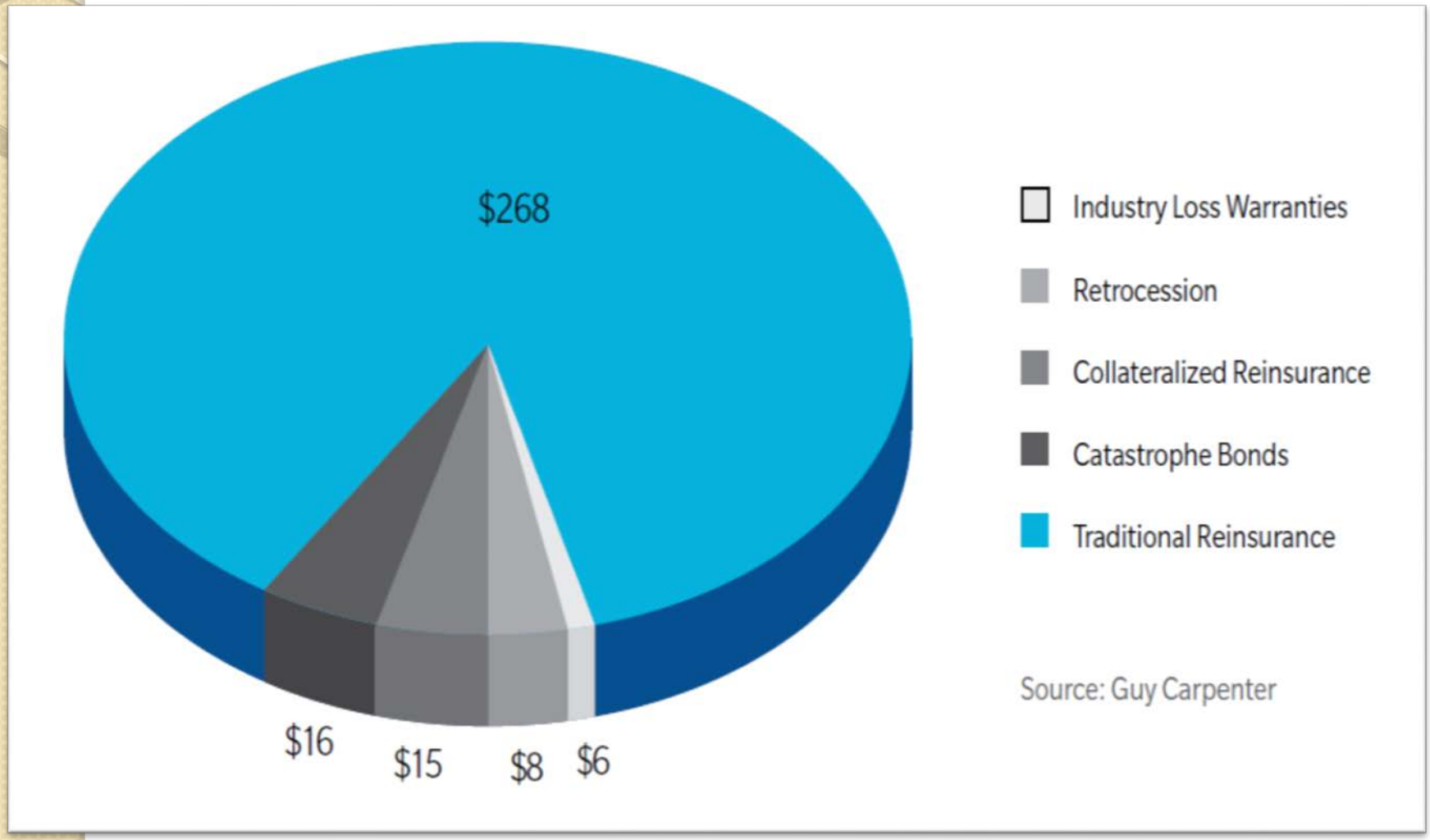


Reinsurance market outlook

Alternative capital (ILS) now represents 40 to 50 percent of global catastrophe reinsurance capital (250 years): collateralized reinsurance (ColRe), catastrophe bonds (Bonds), industry loss warranties (Col ILW), and sidecars.



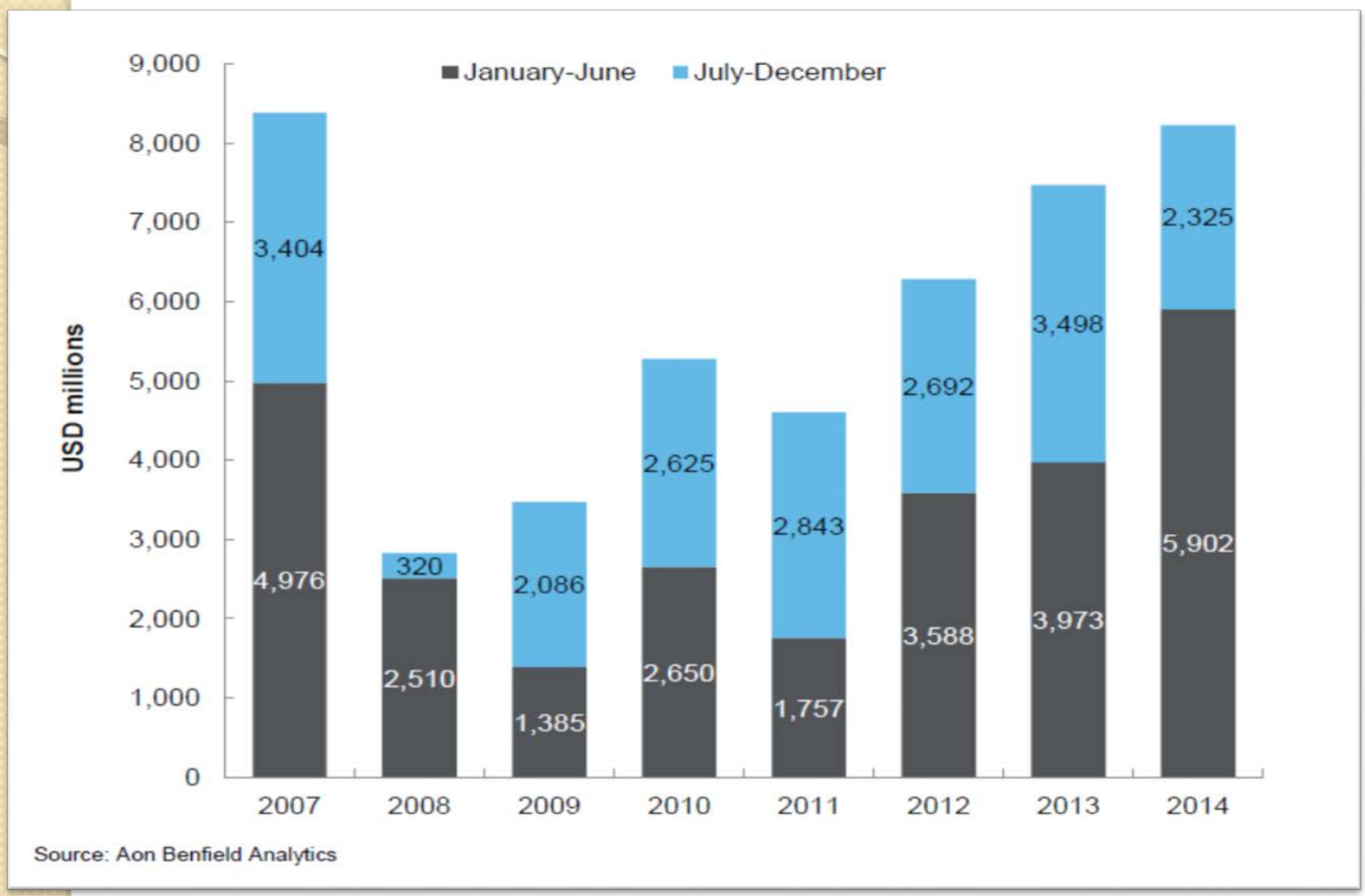
Global property catastrophe reinsurance capacity by source (USD billion): 2011 to 2013Q2



Source: Guy Carpenter. Mid-Year Market Overview September 2013

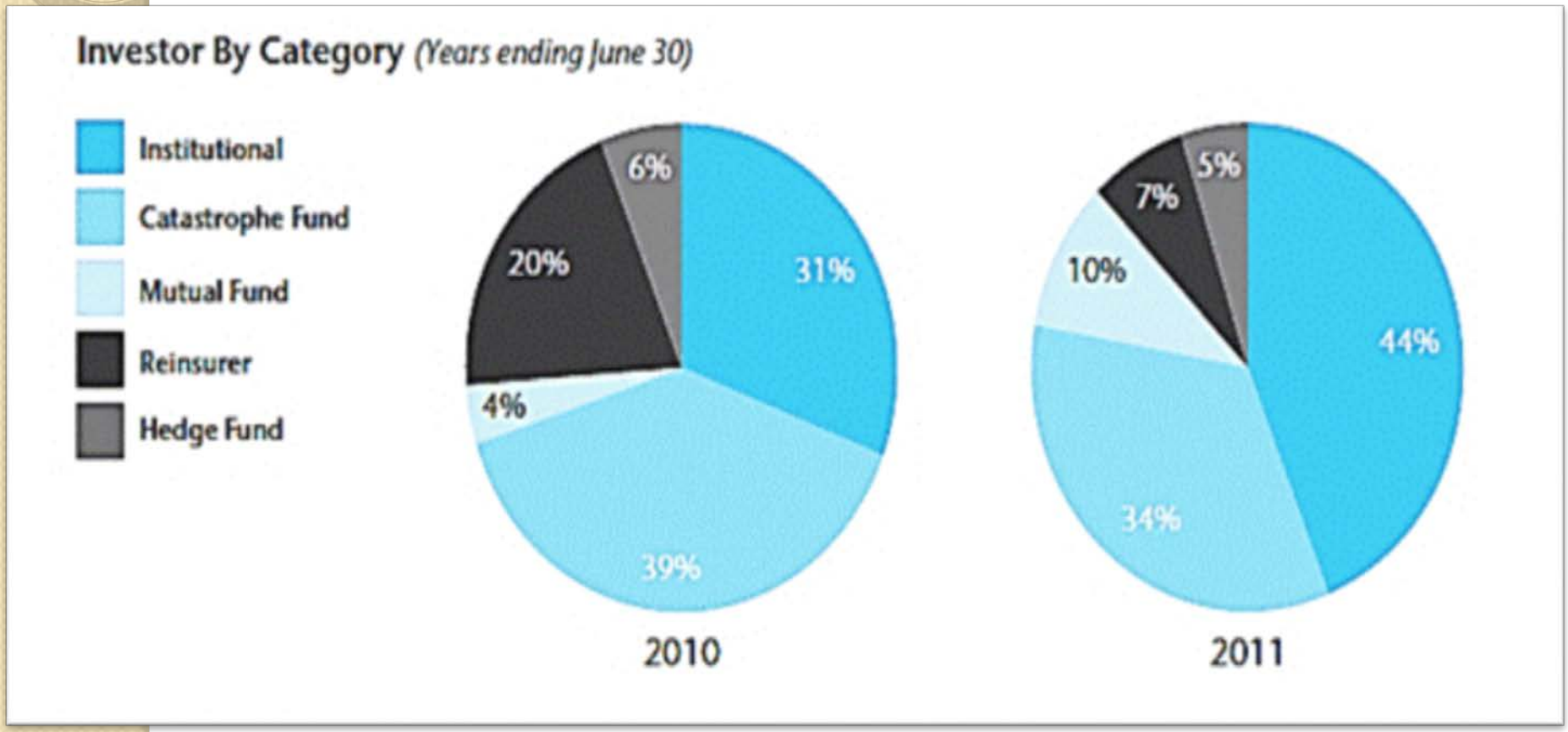
Reinsurance market outlook

Catastrophe bond issuance by half year



Catastrophe bond market shares by investor type

For years ending June 30, 2010, and June 30, 2011



Source: AON Benfield Securities, *Insurance Linked Securities*, 2011

Main conclusions from these statistics

- Reinsurance total capital is about $575B (2014)
  - Including $62B (2014) in alternative capacity than traditional reinsurance.
  - Alternative capacity (ILS) includes collateral. reinsurance, sidecar, ILW (Industry Loss Warranty), and CAT bonds. Complement to reinsurance.
  - They represent 40-50 percent of global **catastrophe** reinsurance capital (occurrence 250 years).

Main conclusions from these statistics (continued)

- There seems to be excess capacity (annual insured losses are below $100B since 2008, with one exception, 2011):
  - Low demand from insurers because low insurance coverage for climate risks.
  - Mergers and acquisitions in the insurance industry.
  - Insurers can also use alternative capacity (but still not important).
  - Strong capital regulation.
  - Rating agencies also affect the level of capital because risk management is important for the rating.

Conclusion: Role of (re)insurers in managing economic resilience

- Climate risk is related to global climate change (global warming).
- It is a major threat to global risk management and is among the major issues for the (re)insurance market.
- Where (re)insurers have a role to play?
- The role of the (re)insurer is to manage the risks:
  - Underwriting
  - Claims management
  - Asset management

Conclusion (continued)

- Their participation to the economic resilience of climate CAT risks should start by improving the (re)insurance efficiency market (itself) to obtain better insurance access and better insurance coverage.
- Better understanding of climate risk with multidisciplinary teams.
- Increase efficiency in insurance coverage to reduce premiums and increase demand with new climate-risk practices for underwriting, claims management, and asset management.

Conclusion (continued)

- Be more innovative in writing insurance contracts that may improve long-run investment in prevention (more commitment, longer coverage period).
- Insurance pricing must encourage private and public (infrastructure) investments to obtain better economic resilience to extreme events.
- (Re)insurers must disclose their climate risk strategy to regulators and all stakeholders.
- Develop models for climate risk scenarios and stress testing that integrate climate risk potential losses.
- Insurance regulators must also adapt existing rules and policies in relation to climate risk changes.

Conclusion (continued)

- Public good dimension in managing climate risk: coordination with public decision makers.
- Reduce insured risk perception bias from inappropriate public policies.
- Climate risk perception must be well documented by interdisciplinary teams and appropriate models and data.
- Appropriate pricing and coverage must separate efficiency goal from redistribution goal.

Conclusion (continued)

- Continue to improve the risk pooling efficiency through reinsurance and ILS instruments.
- Investments in green technology sector
- Investment choices should help to implement mitigation technologies (in the long run) against global warming.
- These policies and commitments must come from the Board because they are part of the enterprise risk management policy (ERM).
- It would be difficult to do more if the governments are not more involved in improving macroeconomic and international resilience against global warming!

THANK YOU FOR YOUR ATTENTION

Main references

- AON, 2015. Reinsurance Market Outlook. 66p.
- CERES, 2014. Insurer Climate Risk Disclosure Survey Report and Scorecard: 2014 Findings and Recommendations.
- Government Accountability Office (GAO), 2007. Natural Disasters: Public Policy Options for Changing the Federal Role in Natural Catastrophe Insurance, 84 p.
- Halegate, Stephane, 2014. Economic Resilience: Definition and Measurement. The World Bank, Climate Change Group, Office of the Chief Economist. 44 p.

Main references (continued)

- Mills, Evan, 2009. A Global Review of Insurance Industry Responses to Climate Change. The Geneva Papers 34, 323-359.
- Rand Corporation, 2006. The National Flood Insurance Program's Market Penetration Rate, 116 p.
- Sigma, 2015. Natural Catastrophes and Man-made Disasters in 2014: Convective and winter storms generate most losses. Swiss Re, N2, 46 p.
- Surminski, Swenja, 2013. The Role of Insurance in Reducing Direct Risk – The Case of Flood Insurance. International Review of Environmental and Resource Economics 7, 241-278.

Factors that determine insurance demand for flood insurance

(Rand study in USA)

- Price of insurance, not a strong factor.
- Market penetration is very low for homes not subject to the mandatory purchase requirement.
- Low penetration of insurance in small communities (500 or fewer homes).
- Mandatory requirement of NFIP less enforced in these communities.
- The probability of purchasing insurance is higher in communities subject to coastal flooding.

Factors that determine insurance demand for flood insurance (continued)

- Market penetration higher in the South.
- Regions with higher insurance penetration are associated with lower public assistance but the effect is not large.
- Higher market presentation rates are associated with more favorable Building Code but the statistical relationship is weak.

Rating agency and regulatory update

- **Impact on reinsurance demand = slight increase**

Key rating agency and regulatory topics impact on reinsurance demand

Topic	Impact	Commentary
Capital management	Neutral	As industry capital continues to grow towards record levels, some companies are choosing to reduce their reinsurance purchases.
Evolving criteria	Neutral	Rating agencies continue to apply new criteria that influence capital requirements.
Regulatory developments	Slight increase	Regulators are strengthening capital requirements. Changes include updated RBC models and new stress testing requirements, while others indirectly impact capital needs by requiring companies to obtain a rating.
Catastrophe risk tolerance	Neutral	Rating agency surveys, stress testing and public disclosures are leading to a focus establishing a clear risk tolerance (especially on peak exposures).

Source: **AON Benfield Analytics**

Rating agency and regulatory update

- **Key rating agency topics for 2015**
- Impact of stochastic BCAR and related catastrophe risk charge on capital adequacy.
- Renewal of TRIA program and managing terrorism exposures.
- Emphasis on ERM with specific focus on risk tolerance, stress testing capital and emerging risk management (such as managing TRIA expiring and cyber exposures).
- Maintaining profitability and reserve adequacy. Ability to continue profitability despite competitive market conditions, reduced reserve releases, and low investment yields.
- Increasing merger and acquisition activity.

Source: **AON Benfield – Reinsurance Market Outlook,** January 2015.

Definitions

Disaster

- A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts.

Disaster risk

- The potential disaster losses, in lives, health status, livelihoods, assets and services.

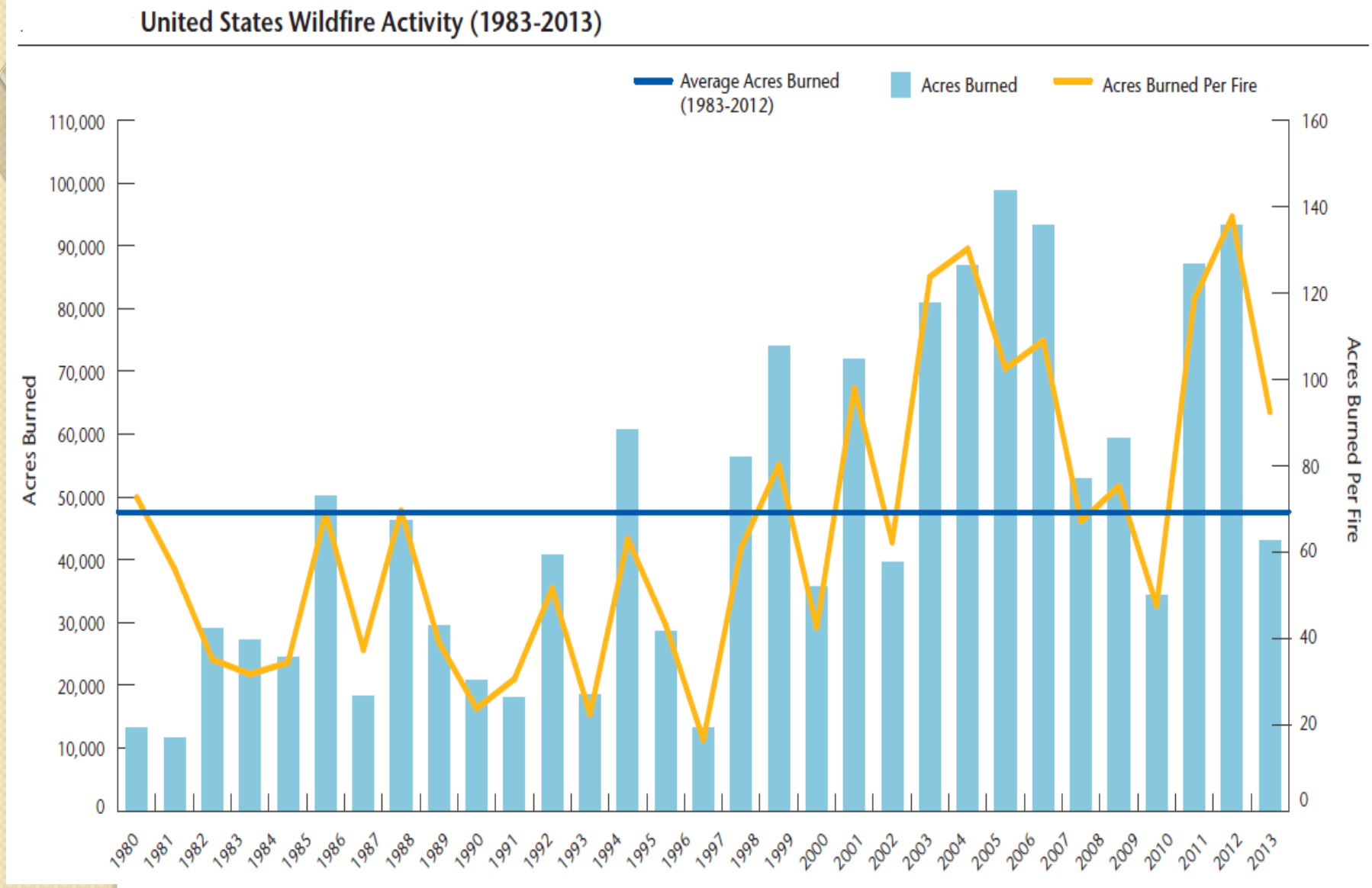
Disaster risk management

- The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

- **Insurance can reduce the impacts of hazards**

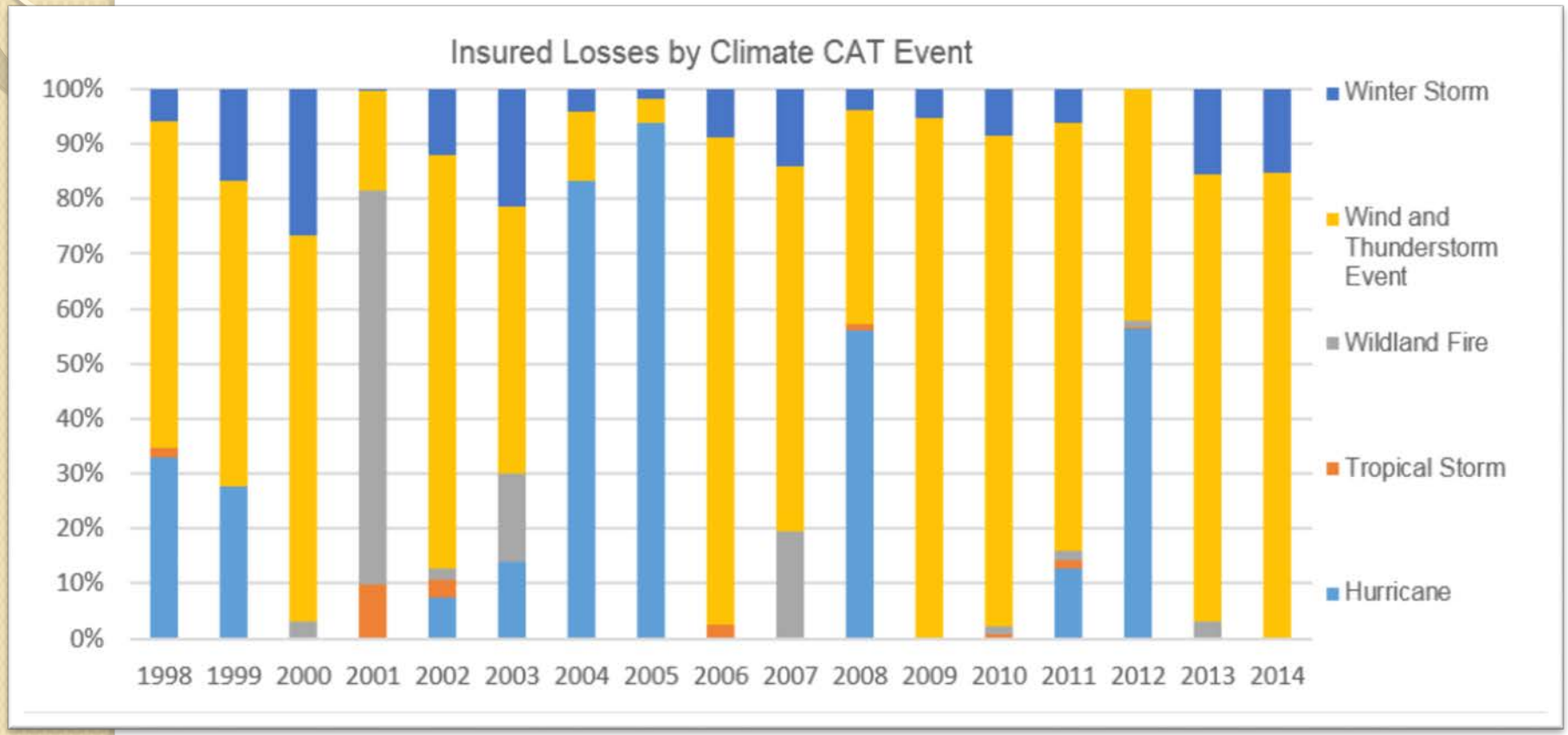
Definitions from the *United Nations Office for Disaster Risk Reduction*

United States climate disaster events

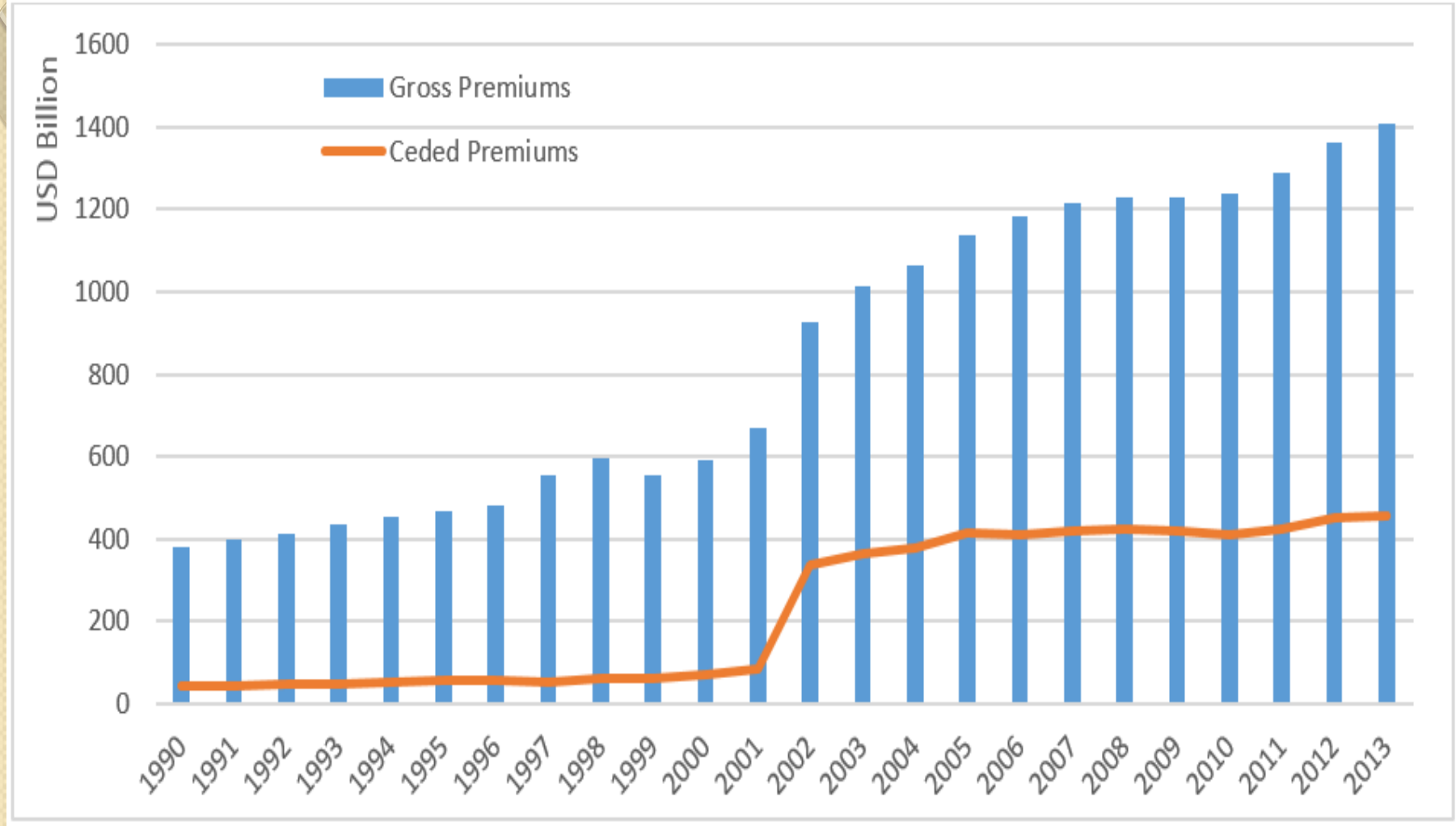


Source: **AON Benfield - Impact Forecasting 2013**

% by climate CAT event



Non-life insurance USA



Source: **OCDE ILibrary**