

# Surviving the next crisis

## A risk management perspective

Presented by

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**SCOR**

- 1 → The 2008/09 financial crisis – an analysis from the risk management point of view
- 2 → Preparing for the next negative surprise to come
- 3 → Consequences of financial crises on insurance capital requirements
- 4 → Giving the regulatory system enough flexibility to respond to the next crisis to come
- 5 → Conclusion

# The current developments in the financial industry line up amongst the worst economic crises in history

S&P index annual returns from 1800 to 2011<sup>1)</sup>



What is next  
???

We are here!

2008 was the 3<sup>rd</sup> worst year after 1937 and 1931 with -38.5%

After two years of recovery, 2011 showed -0.11% return for a year

2009 showed a  
+23.5% return

1965	9.1%	1885	19.8%
2004	9.0%	1852	19.6%
1959	8.5%	1999	19.5%
1886	8.5%	1943	19.4%
1800	8.1%	1976	19.1%
1845	8.1%	1898	18.9%
1968	7.7%	1963	18.9%
1830	7.4%	1924	18.8%
1921	7.4%	1850	18.7%
1871	7.3%	1880	18.7%
1993	7.1%	1891	17.6%
1802	6.8%	1983	17.3%
1872	6.8%	1951	16.5%
1899	6.5%	1918	16.4%
1864	6.4%	1901	15.7%
1878	6.1%	1905	15.6%
1821	6.1%	1972	15.6%
1926	5.7%	1844	15.5%
1870	5.6%	1882	14.8%
1840	5.5%	1986	14.6%
1824	5.1%	1858	14.3%
1832	4.8%	1900	14.1%
1820	4.7%	1936	27.8%
1806	4.6%	1885	19.8%
1992	4.5%	1955	26.4%
1807	4.4%	1985	26.3%
1856	4.4%	1991	26.3%
1866	3.6%	1980	25.8%
2007	3.5%	1958	38.1%
1889	3.5%	1961	38.0%
1812	3.5%	2009	23.5%
1916	3.4%	1928	37.9%
1906	3.1%	1908	37.4%
1835	3.1%	1817	11.9%
2005	3.0%	1952	11.8%
1881	3.0%	1971	10.8%
1831	3.0%	1868	10.8%
1912	3.0%	1949	10.3%
1874	2.8%	1904	25.6%
1815	2.7%	1938	25.3%
1956	2.6%	1988	12.4%
1897	2.0%	1979	12.3%
1892	1.8%	1951	11.9%
1869	1.7%	1925	23.3%
1838	1.6%	1961	23.1%
1867	1.6%	1975	31.5%
1855	1.5%	1997	31.0%
1984	1.4%	1950	21.8%
1902	1.3%	1922	20.9%
1847	1.2%	1996	20.3%
1813	1.1%	1967	20.1%
1978	1.1%	1945	30.7%
1809	1.1%	1935	41.5%
2010	12.8%	1862	55.4%
1897	12.6%	1911	0.7%
1942	12.4%	1895	0.5%
1988	12.4%	1970	0.1%
1979	12.3%	1808	0.0%
1817	11.9%	1823	0.0%
1952	11.8%	1826	0.0%
1971	10.8%	1828	0.0%
1868	10.8%	1849	0.0%
1949	10.3%	1947	0.0%
1884	-18.8%	1953	-6.6%
1903	-18.4%	1887	-6.6%
1842	-18.1%	1990	-6.6%
1876	-17.9%	1934	-6.0%
1941	-17.9%	1825	-5.8%
1973	-17.4%	1939	-5.4%
1814	-16.7%	1822	-4.8%
1940	-15.3%	1805	-4.4%
1932	-15.2%	1804	-4.3%
1846	-14.5%	1875	-4.1%
1957	-14.3%	1816	-3.8%
1913	-14.3%	1848	-3.6%
1890	-13.5%	1818	-3.2%
1841	-13.3%	1851	-3.2%
1966	-13.1%	1827	-3.1%
2001	-13.0%	1960	-3.0%
1874	-12.7%	1882	-2.9%
1853	-12.7%	1894	-2.5%
1835	-12.3%	1888	-2.5%
1910	-12.1%	1896	-2.3%
1929	-11.9%	1810	-2.1%
1946	-11.9%	1861	-1.8%
1962	-11.8%	1994	-1.5%
1836	-11.7%	1923	-1.5%
1977	-11.5%	1829	-1.1%
1831	-11.5%	1833	-0.9%
1969	-11.4%	1948	-0.7%
1859	-10.7%	1801	-0.1%
2000	-10.1%	2011	-0.1%
1937	-38.6%	1974	29.7%
2008	-38.5%	1930	28.5%
1907	-33.2%	1920	24.5%
1857	-31.0%	1969	-11.4%
1917	-30.6%	2002	-23.4%
1854	-30.2%	1893	-20.0%
1931	-47.0%	2000	-10.1%
1931	-47.0%	2011	-0.1%
to -50%		to -40%	
		to -30%	
		to -20%	
		to -10%	
		0-10%	
		10-20%	
		20-30%	
		30-40%	
		40-50%	
		50-60%	

## The effects are eye-striking – but where is the cause?

→ The 2008/09 financial crisis and its consequences has caused previously unimaginable wealth losses:

The 100 largest banks of the world lost 384 billion USD by May 2008  
(Citigroup: 43 billion, UBS: 39 billion, Merrill Lynch 37 billion)

AIG lost 100 billion USD in the last quarter of 2008  
(300k USD per minute!)

The current program to help Greece to cope with its debts is already above 450 billion EUR

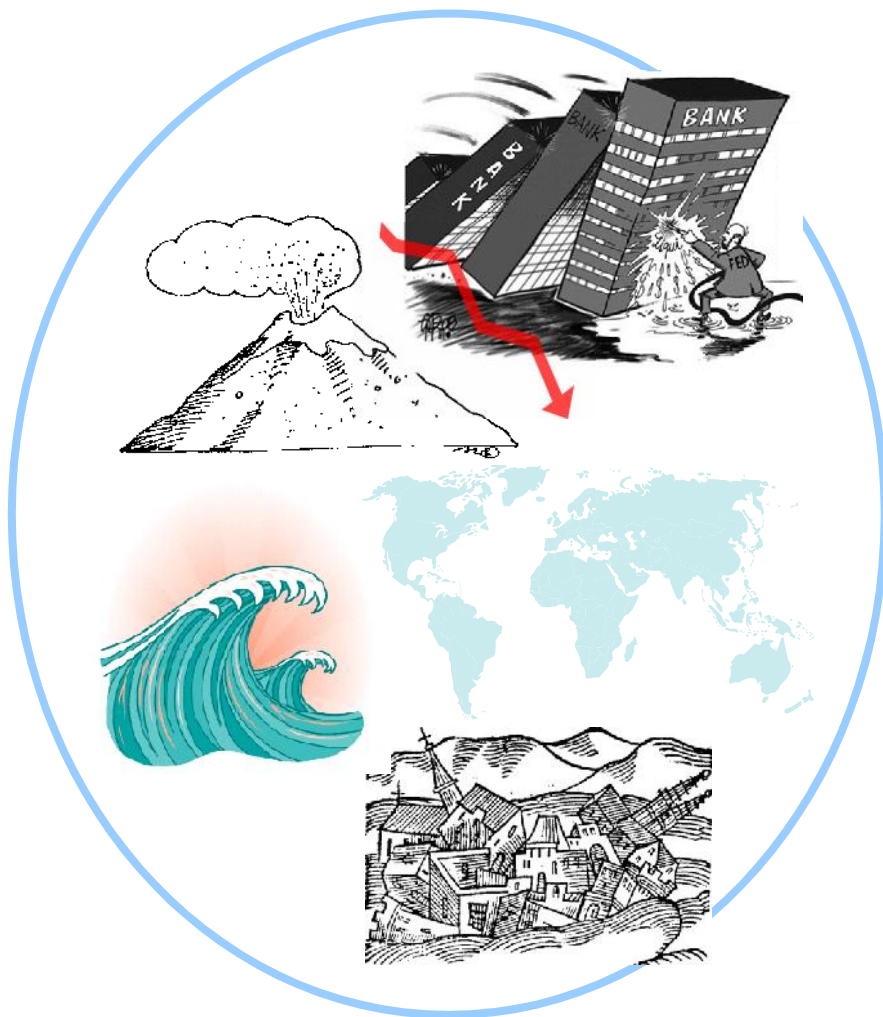
The GDP of OECD countries dropped by 2% in last quarter of 2008 and by 2.1% in the first quarter of 2009...

→ This crisis has also caused the demise of elite financial institutions, and a global recession

→ What are the causes of financial crises...

→ ...despite the traditional post-crises themes of insufficient regulations, real-estate bubbles, excessive leverage and capital flows, lax monetary policies and so on...?

# Financial crisis: naturally natural?



- since 1825 the volcano Mount Vesuvius had 9 periods of eruption<sup>-1)</sup>...
- ...while 6 volcanic eruptions causing more than 5'000 death occurred worldwide<sup>-2)</sup>...
- ...and 10 earthquakes worldwide with more than 50'000 fatalities<sup>-3)</sup> happened,...
- ...7 tsunamis with more than 25'000 people killed<sup>-4)</sup>,...
- ...while in the meantime there are 10 years of more than -20% loss in the S&P 500 index on record

History shows: there were many crises before and likely there will be more coming up in the future

- To be prepared for a future financial crisis the companies' general mindset has to change

## What is behind the 2008/09 severe financial crisis?

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- The common measures have proven grossly insufficient to prevent severe crisis from recurring and risk asphyxiating the development of the financial system through excessive capital requirements and deleveraging
- That is why it is important to focus the analysis on factors that are not part of the core of the conventional wisdom
- We highlight here the importance of three key ingredients for severe financial crises:

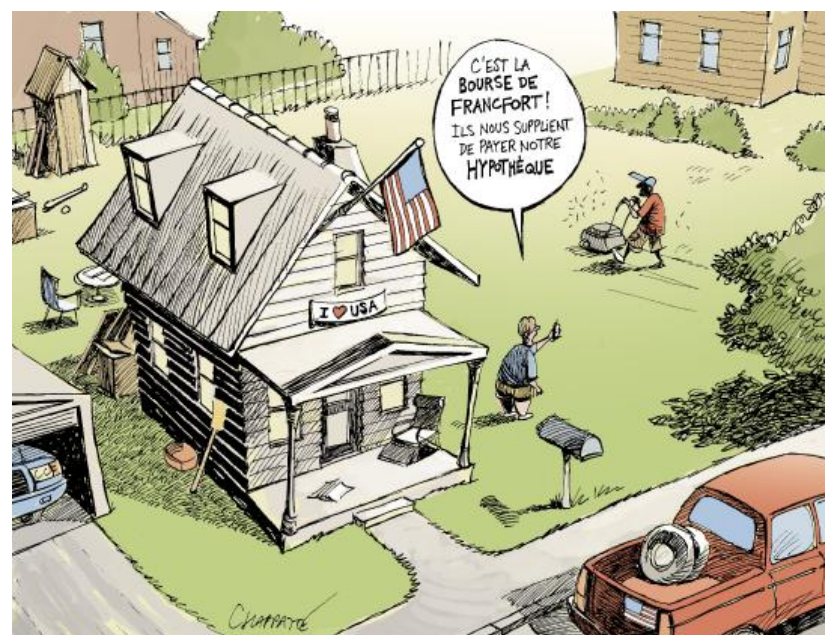
1. A significant negative surprise
2. Irresponsibly high risk appetite, advantaged by high financial leverage
3. The excessive concentration of aggregate risk in highly leveraged financial institutions

# The surprise in the present financial crisis was the weak links in an immensely complex system

1. A significant negative surprise

- The surprise was *not* the decline of real estate prices and the fact that subprime were the first affected by this
- The surprise was the *related distress of many parts* of the financial system, even those very distant from the subprime market itself
- The data was available to recognize the problem, but reality is immensely complex with millions of potential weak links
- “*Ex-post*”, it is easy to point out the one that blew up, “*ex-ante*” it is a different matter
- This change in paradigm from irrelevant to critical linkages, triggers massive uncertainty and unleashes destructive flights to quality

Unexpected dependences:



## Surprises are changes in the environment itself

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- Surprises that have the potential to trigger a severe financial crisis are not simply *bad realizations* within a *known probabilistic* environment...
- ...rather, they are *changes in the environment* itself

### Example:

- In 2008, the first under-par redemption from a Money Market fund since their creation in 1968 (Reserve Primary fund after Lehman bankruptcy) caused investors to question the safety of the entire industry
- Money market funds had been *considered extremely safe*, and had indeed benefited from the flight to quality the previous year, growing by about USD 850 billion (34%) since mid-2007
- The week following Lehman's default, there were USD 169 billion redemptions from total invested USD 3.4 trillion (5%), as well as large shift from prime funds towards fund investing exclusively in government debt



# In time of crisis small effects can generate huge impacts – mainly driven by human behaviour

1. A significant negative surprise

Management failures in times of crisis	Effects (based on Lehman bankruptcy example)
<b>Missing leadership:</b> failing systematic landscape monitoring	→ In retrospect, the consequences of Lehman's demise on the Primary Fund could have been predicted: Public filings showed large investments in Lehman as early as November 2007
<b>Missing analysis:</b> Generally missing systematic interpretation of actual developments	→ Anyone who took the trouble of connecting the dots could, in principle, have foreseen what might happen
<b>Missing initiative:</b> Sitting on cash cows instead of proactively evaluating future risks	→ However, money market funds had a track record of stability that had always made it unnecessary to inspect their holdings
<b>Missing coolness:</b> Harsh and disproportional reaction of market participants	→ The realization that there might be further losses in previously unexamined places led investors to intensify their flight to quality

- The main failure was not to understand that relatively “small effects” could generate huge impacts and create a confusion on the entire system
- Surprises *quickly trigger a chain of unexpected events* from the panic they engender

# What is the „right“ leverage for the „right“ risk appetite?

→ On capital, there is very strong consensus that financial companies should in future run with more capital and lower leverage than in the past – but how much more?

**Business Model A:  
Low financial leverage**



Total Available Capital

- Preferred business model by the regulatory boards
- Relatively low expected ROE, but with low volatility in the results

**Business Model B:  
Medium financial leverage**



Total Available Capital

- Uncertain volatility
- Relatively speaking higher cost of capital

**Business Model C:  
High financial leverage**



Total Available Capital

- High volatility in results due to irresponsibly high risk appetite
- Generally higher risk appetite since cost of capital is higher

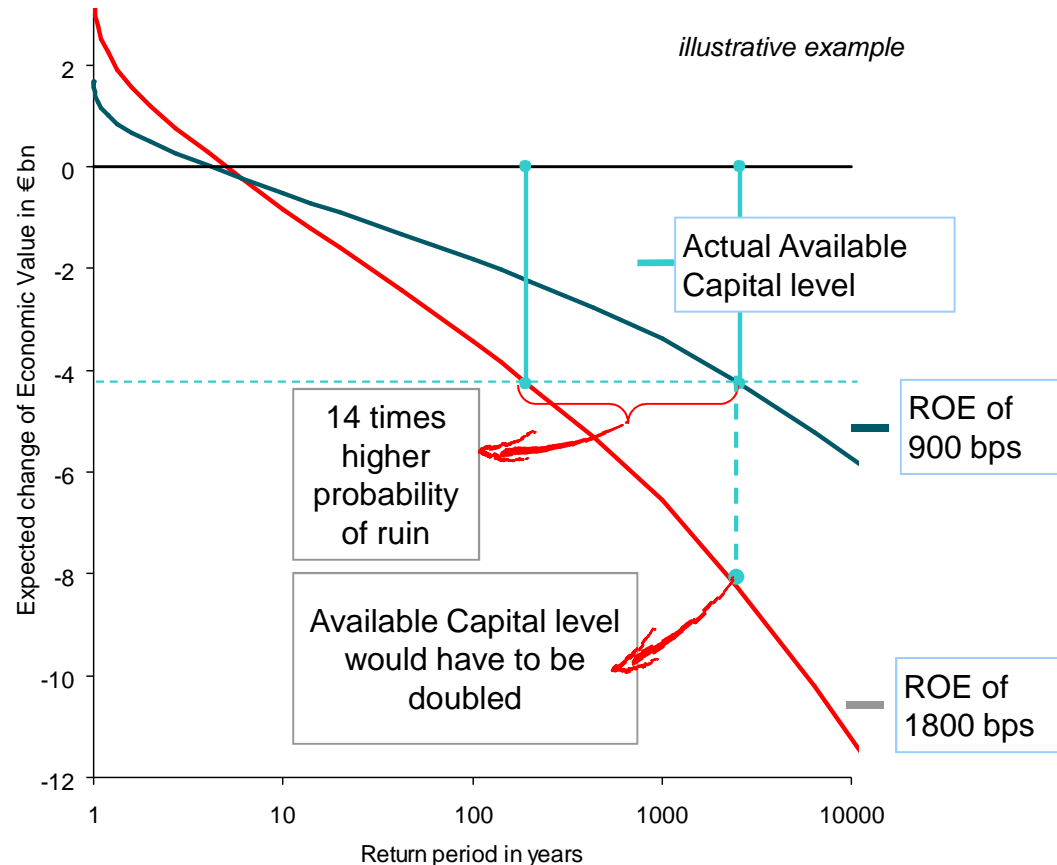
■ Debt (Hybrid issuances, bonds, etc...)  
■ Equity Capital

*illustrative*

The relevant risk measure for the regulators is the ratio between the own capital and the companies' total risk exposure

# A controlled risk appetite reduces the probability of ruin

Theoretical example: increasing the risk appetite has a highly multiplicative effect on a companies' probability of ruin if crisis scenario is integrated in the model



- ➔ Keeping the same business risk and doubling the expected profit without increasing the Available Capital reduces the probability of ruin from an extreme scenario by a factor of 14
- ➔ Doubling the profitability target to 1 800 bps would require the Available Capital to be doubled accordingly in order to cover the probability of ruin equally compared to the lower risk profile

## Aggregate risks are a major cause for crisis

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- The third important cause for a severe crisis to develop is to what extent the highly leveraged and interconnected sector of the economy, generally the financial sector, is being exposed (directly or indirectly) to a surprise of the kind discussed earlier
- Aggregate risks are those exposed to aggregate shocks to the entire economy
- Investment in structured products exposed financial institutions to more aggregate risk and surprises than in the past
- In the 2008/09 crisis, banks were holding mostly AAA-tranches of a large variety of new ABS (Asset Backed Securities) (85% of assets hold in securitized form)
- Those tranches rely on the protection by the junior tranches and by the *law of large numbers* in order to *reduce the risk* of default enough to achieve AAA-rating

## The law of large numbers does not hold under major aggregate shocks

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- The law of large numbers implies that the loss on a pool with sufficient number of underlying assets, as was the case with most ABS, can only occur when an aggregate shock takes place
- Furthermore, the *higher up* a given structure is situated, the *larger the aggregated* shock must be for it to pierce the protection offered by the junior tranches
- Losses large enough to affect the AAA-tranche only occur in states of severe aggregate shocks, but this is exactly what large surprises do!
- Therefore holdings of AAA-tranches of structured products *exposed* financial institutions to more *systemic risks* than their rating, when misinterpreted, would suggest and certainly more than similarly rated “single name” corporate bonds

## Major financial institutions were bearing more aggregate risks than anticipated

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- Corporate bonds are still affected by macroeconomic conditions but idiosyncratic factors play a larger role
- Downgraded structured financial securities lost on average between 5 and 6 notches in the period 2007/2008
- By comparison, during the great corporate bond downgrade of 2001/2002 (30% of corporate bonds were downgraded) the average notch-loss was 1.8
- The systemic consequence of this risk was that highly leveraged institutions were *bearing more aggregate risks* than would have been thought from simply observing the average ratings of their assets
- Having the financial sector of the economy holding such risk with respect to aggregate surprise proved to be a recipe for disaster

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## Surprise and aggregate risks are not going to disappear soon

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- Surprise and aggregate risks are major causes for financial crises
- Both elements are not going to disappear soon. We can thus expect that our economy despite all attempts will be again subject to shocks
- The right risk management policy is to *prepare the organization* to the *occurrence of such shocks* and to make sure that the company can survive them
- Rather than trying to predict the next crisis or to avoid it, we should concentrate on making sure that our risk management model integrate the occurrence of crisis with a reasonable probability
- Only this way, our organizations will be prepared to face major disruptions of the financial markets

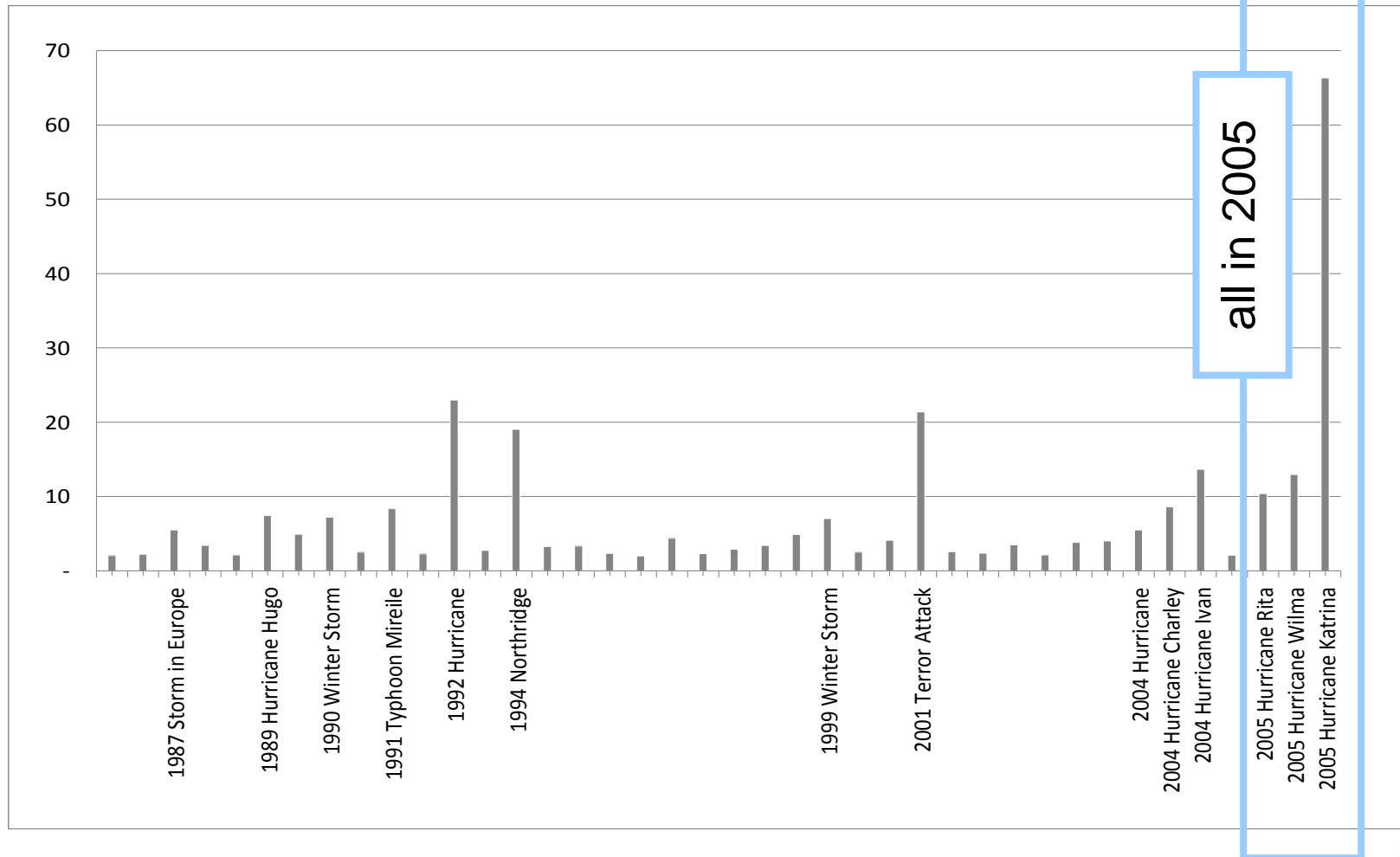


## Reinsurers and banks as risk bearers

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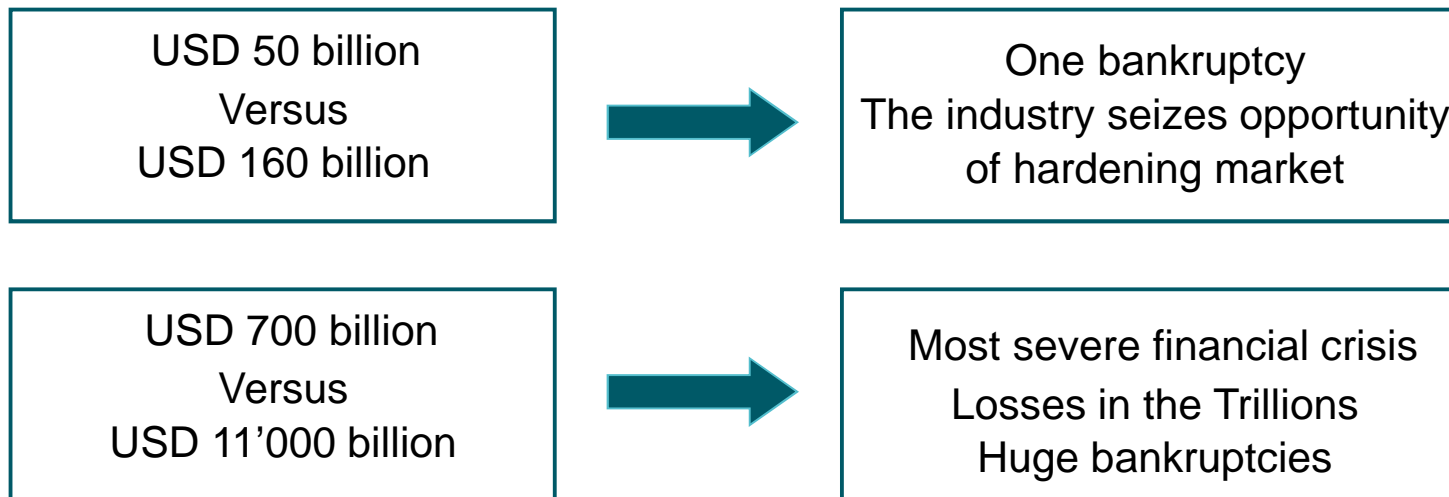
- Banks have traditionally been taking *credit risks* on their books in their wholesale lending operations, but also *market risks* through their securities trading operations
- Insurers and reinsurers have been taking *most other kinds of risks*: mortality and interest rate risks for life insurers, natural disasters, liability and accident risks for non-life insurers
- Reinsurers are *confronted to extreme risks* in their daily business and have integrated them in their internal models
- The last dramatic event for reinsurance was the series of US hurricanes Kathrina, Rita and Wilma, which cost the industry USD 50 billion for a total of reinsurance premium around USD 160 billion covering all the reinsured risks
- Such large event caused only one reinsurer to fail. All the others survived and profited from the hardening of the market

# Worldwide Insured Natural Catastrophe Losses: By List of Events



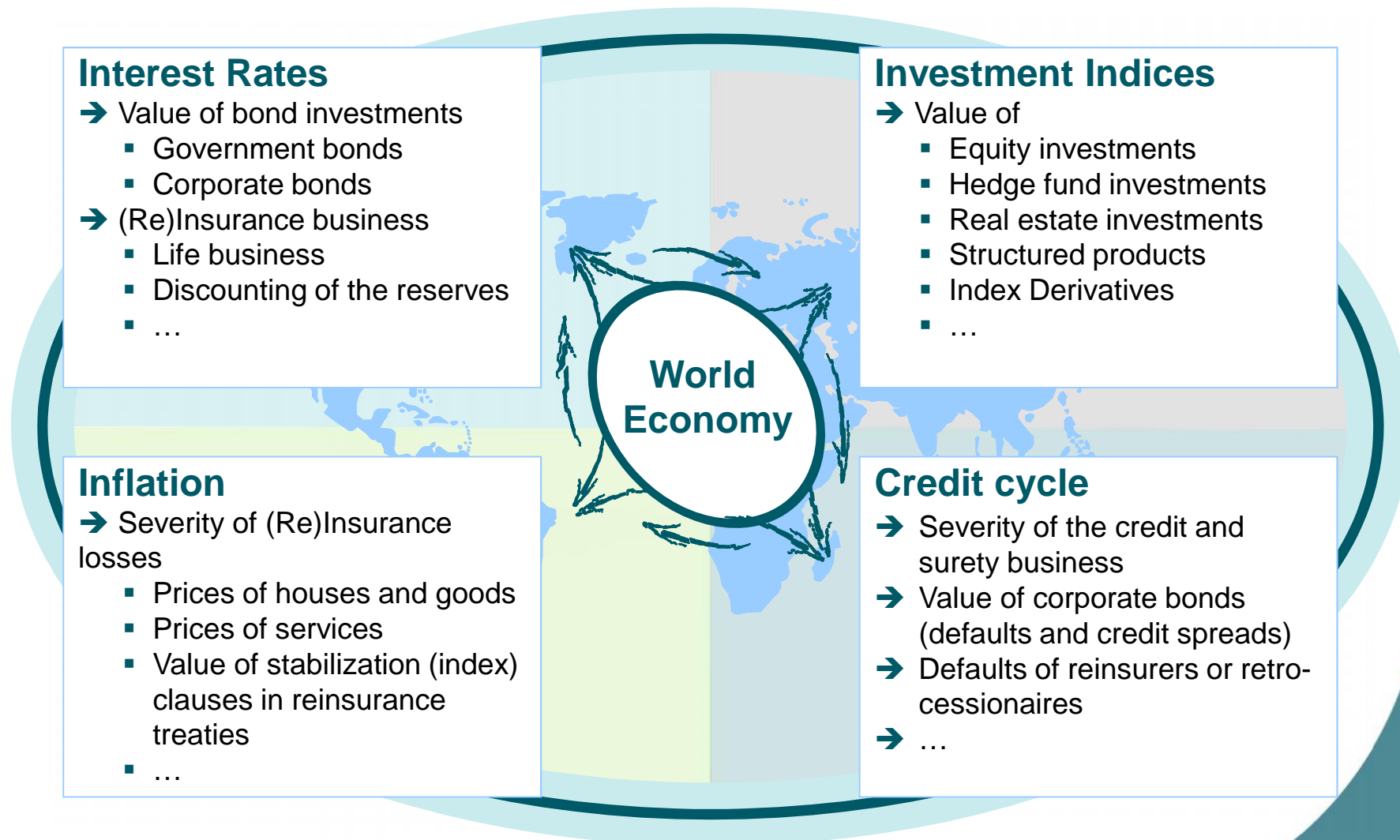
## Resilience comes from readiness to tackle extreme risks

- Before the crisis the sub-prime market was estimated at a value of between USD 500 to 700 billion. This is to be compared to the total value of US real estate market of around USD 11'000 billion

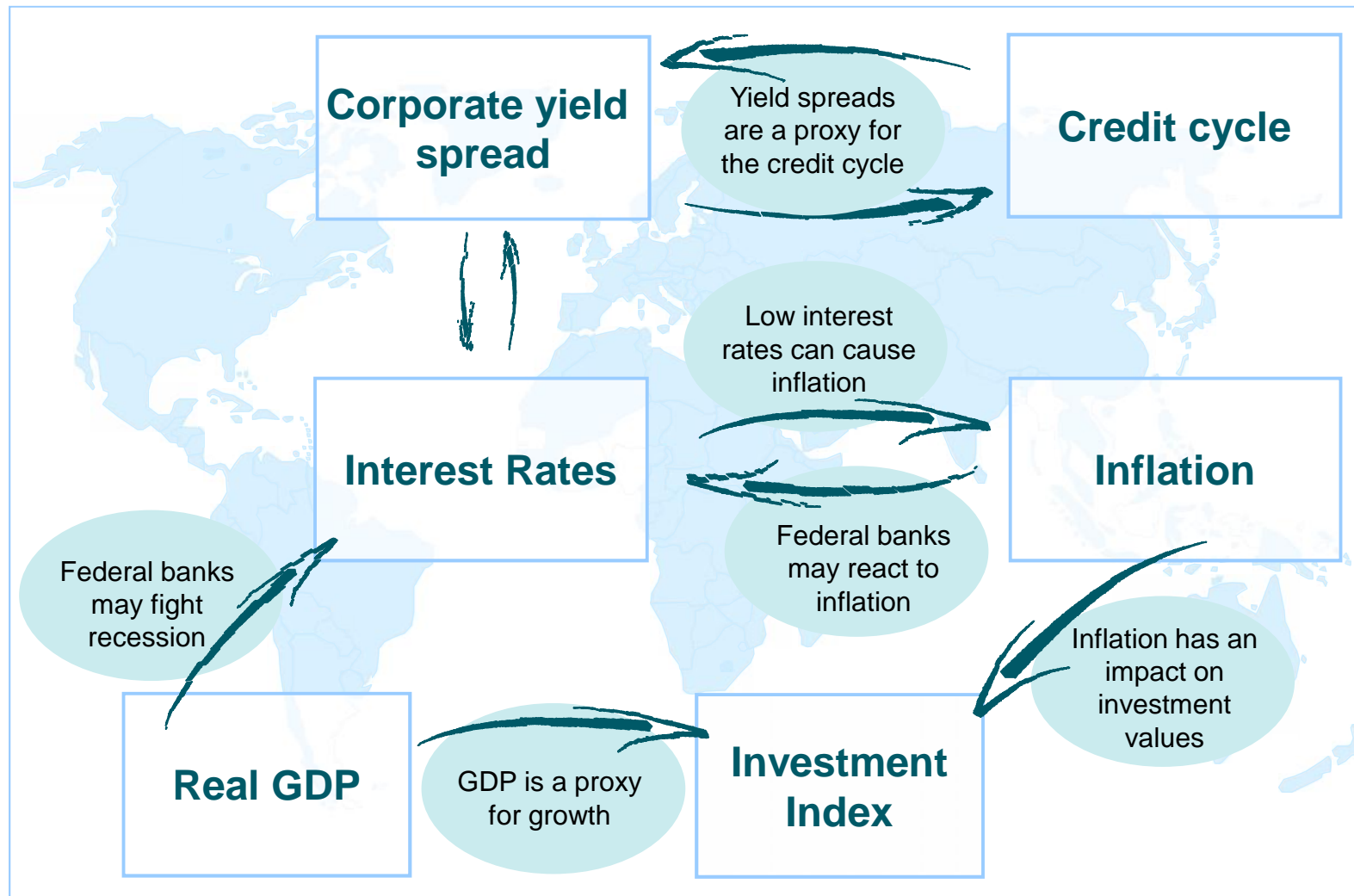


- Extreme events are part of the daily life of reinsurers. The financial system must admit that extreme events can happen. It is the only way to make it more resilient

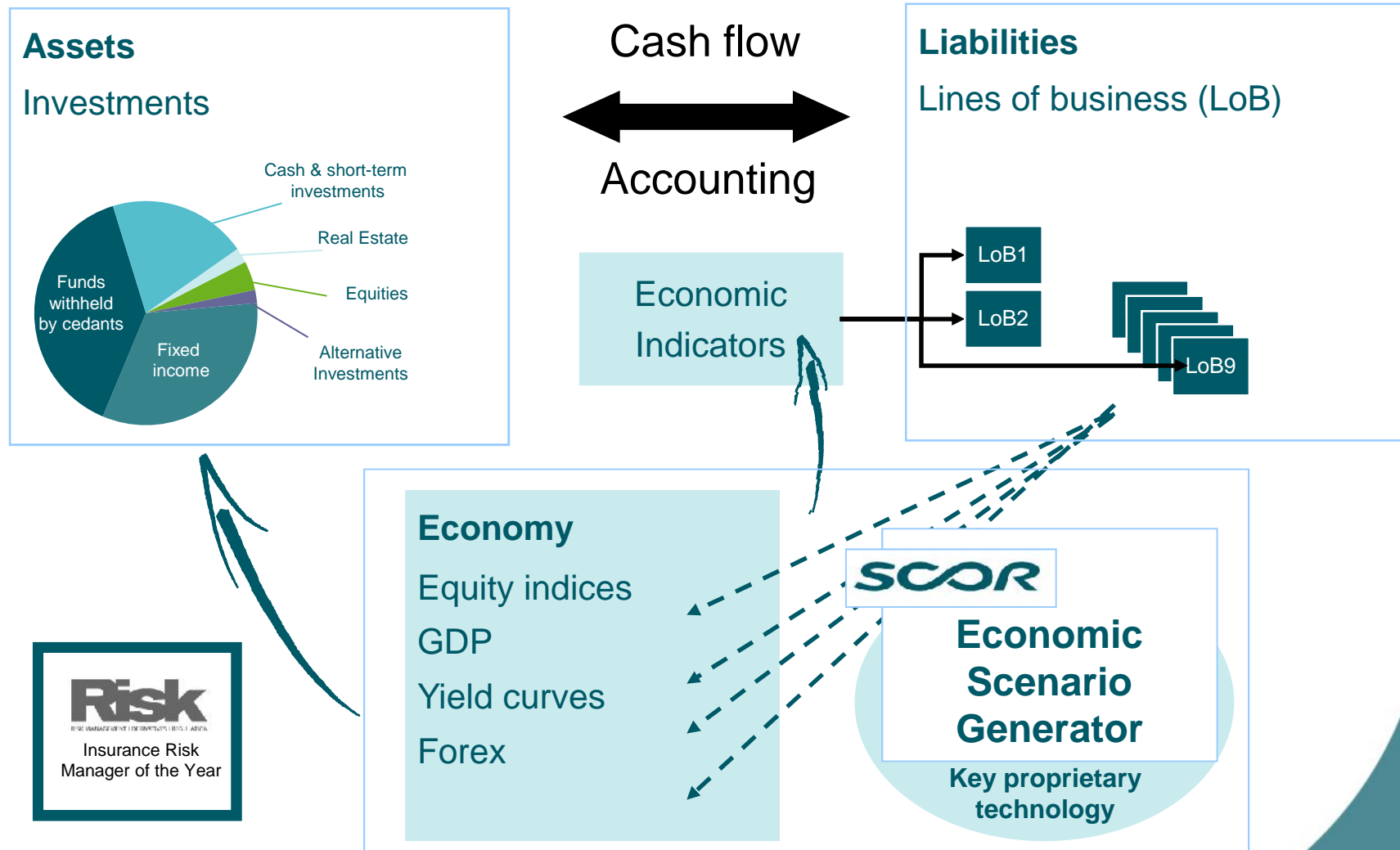
# Influence of the economy on a Reinsurance Company like SCOR



# Some Dependencies of Economic Variables



# SCOR's models capture full circle of dependencies between assets, liabilities and the economy



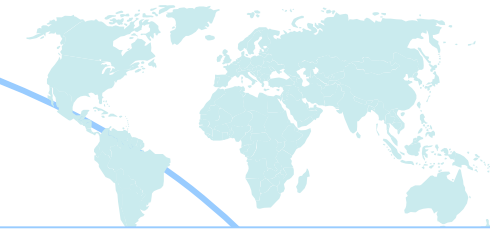
## Realistic Economic Scenario Generators (ESG)

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- Since many years, SCOR has built internal models to evaluate all its risks: underwriting, market, credit risks
- Those models integrate a high probability of extreme events and of *changing dependence* in times of crisis
- At the heart of it there is an ESG that will explore many possible paths including severe financial and economic crises
- This ESG is based on bootstrap methods making use of a large number of time series of financial and economic indicators
- This ESG allows us to *estimate the risk of a crisis* and to analyze how our balance sheet would react to it

# SCOR ESG withstands extreme scenarios

**Extreme scenarios are an integral part of our ESG**



## Extreme rates of 0% or below

- The ESG calculates scenarios with interest rates of 0% or slightly below (not below -1%)
- Historic data shows examples of such occasions
- Yen – rates fell slightly below Zero in the early 1990's
- Swiss national bank in the 1980's used negative interest rates as a tool to make investments in Swiss Francs unattractive to fight the strength of the currency

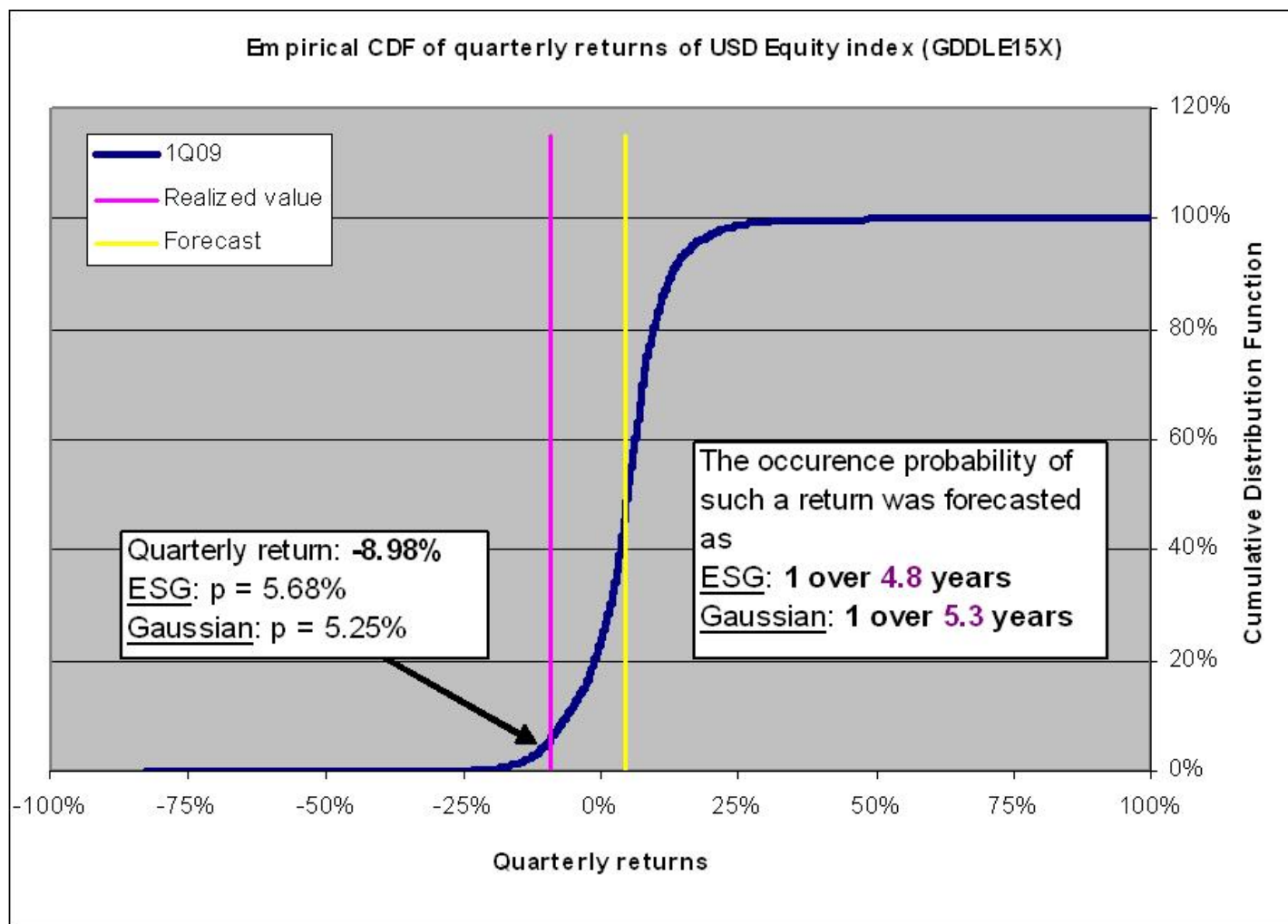



## Extreme rates of around 40%

- The national banking institutions have raised the amount of money in circulation on levels not seen for decades
- Expected inflation can only be fought by high interest rates
- Historic examples show that extreme rates can become reality: Mexico, Argentine, Turkey or other EMEA-countries, 26% US Fed rate in the 1980's, hyperinflation of the 1920's in Germany



# Backtesting the ESG distributions of USD Equity index during the crisis



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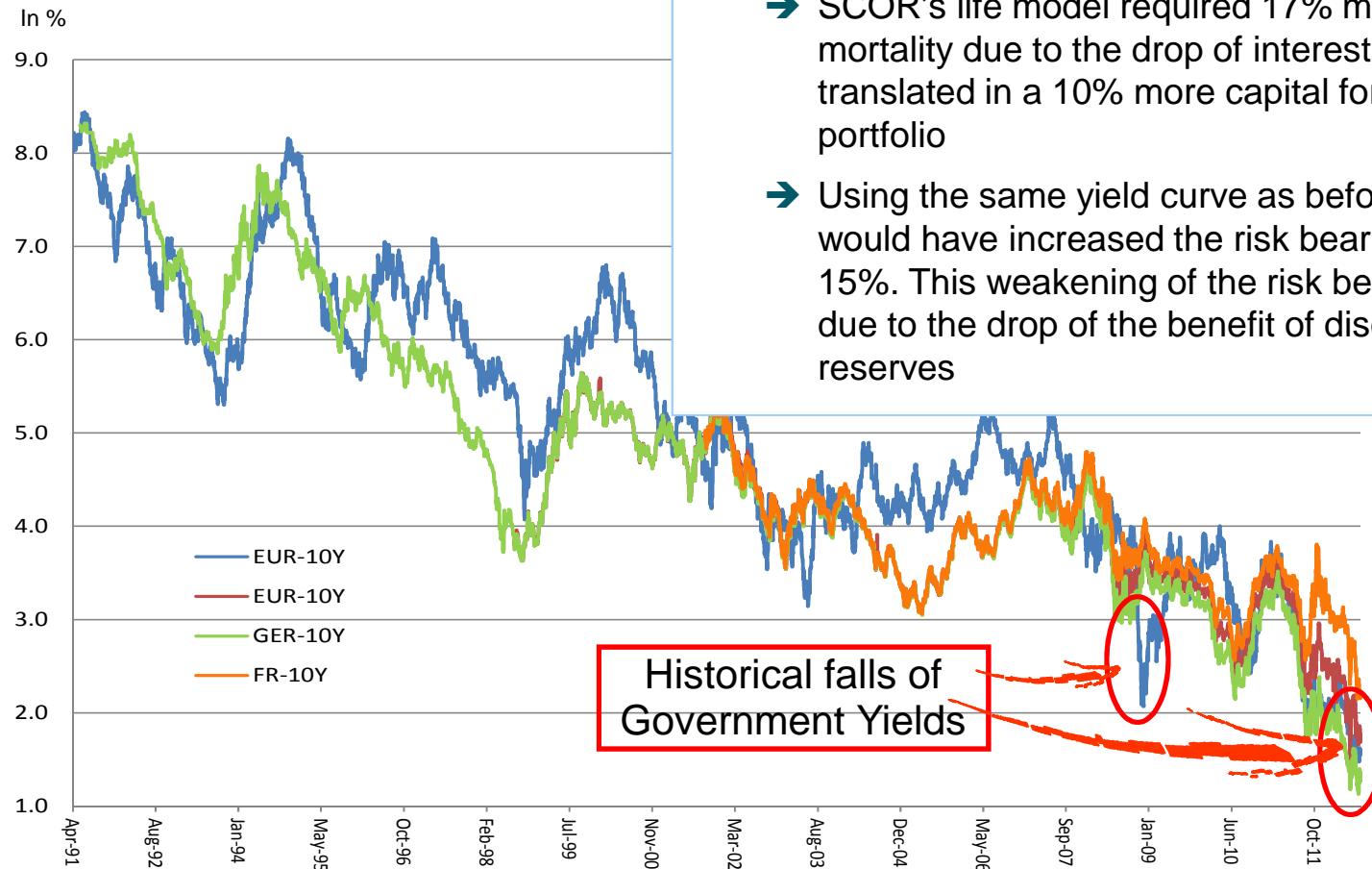
## An efficient regulation in time of crisis

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- In time of crisis, it is *too late to correct* the errors of the system. One should analyse them in order to learn from them
- It is important to adapt the solvency rules to the new situation and restore confidence in the system
- Good risk models would show an increased risk of the situation and thus come up with higher risk adjusted capital than in quieter times
- Requiring companies to keep the same level of security than before the crisis would require a *significant increase in capital*
- Such an increase will in turn *accentuate the lack of liquidity*, which is the main characteristic of financial crisis

# Examples of increased risk: Government yield developments

Historical 10Y Government Yields



Some risks are directly linked to the fall of interest rate:

- ➔ SCOR's life model required 17% more capital for mortality due to the drop of interest rate. This translated in a 10% more capital for the whole portfolio
- ➔ Using the same yield curve as before the crisis would have increased the risk bearing capital by 15%. This weakening of the risk bearing capital is due to the drop of the benefit of discounting P&C reserves

Source: Bloomberg as of 06 Aug 12



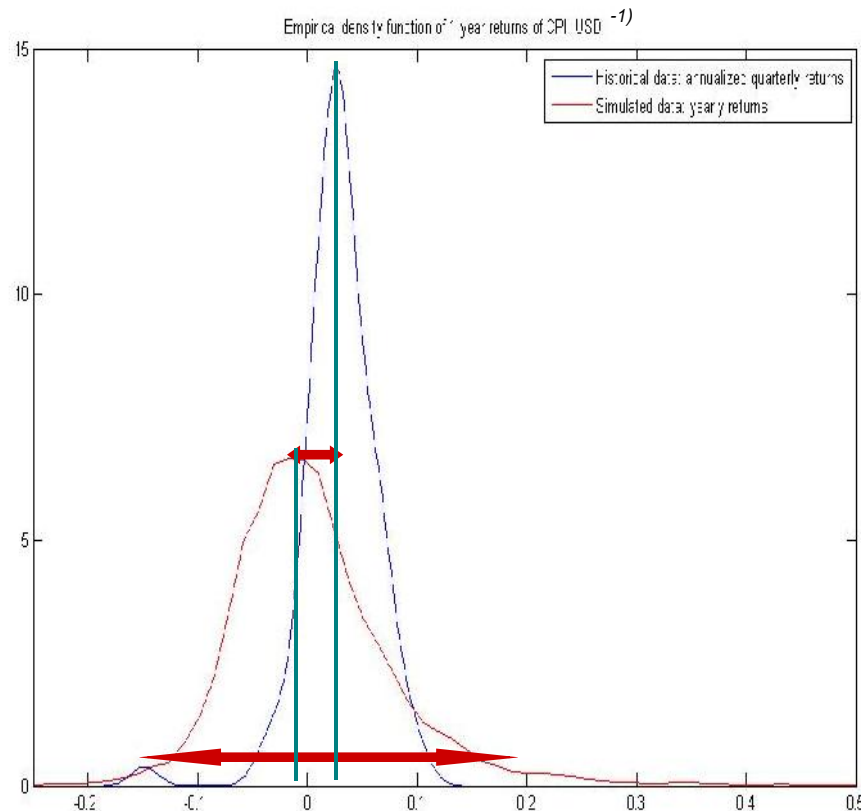
Financial Crises from a Risk Management Perspective  
SAA, Martigny, August 31<sup>st</sup>, 2012  
Michel M Dacorogna

## Examples of increased risks: Volatility of financial markets

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- Some risks are linked to the *increased volatility of financial markets* and increased credit risk:
  - During the crisis the volatility of stock return more than doubled
  - Credit spread sky rocketed for reinsurance to 2000 basis points
- Those cumulated effects *reduce significantly the solvency ratio* of companies. In the Swiss Solvency Test (SST), we experienced in 2009 a significant drop of more than 20% in our solvency ratio even though there was no significant changes in our portfolio of liabilities and our asset portfolio was significantly de-risked

# Examples of increased risks: Inflation



The empirical distribution of the simulated inflation is:

- **Out of phase**
  - because the current interest rates are lower,
- **Wider**
  - because the current volatility is bigger (GARCH effect)

SCOR's Economic Scenario Generator (ESG) reflected the uncertainty on inflation at the onset of the crisis

- In an economic situation as we experienced, with credit markets deteriorating rapidly and liquidity being dried up and countered by massive liquidity injections by government bodies, the *risk of inflation is much higher* than in times of certainty
- A *good model reflects this* and implicitly should ask for more capital to keep the solvency level, as SCOR's ESG does
- If both the risk bearing capital goes down and the risk increases → this combination influences strongly the solvency margin

## Consequences of not changing the rules

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- Insisting on the same level of security even if the economic situation is rapidly deteriorating could force companies to declare insolvency for claims they would have to pay far in the future
- It would also require uniformly higher capital from insurances and reinsurances forcing them to de-leverage their balance sheet and thus fueling the crisis
- At the same time this would immobilize huge amount of supplementary capital, which in turn would pointlessly increase the cost of protections provided by insurers and reinsurers
- Moreover, it would dry out the capital available for the rest of the economy weakening further non-financial companies, which would, in turn, reduce the quality of the asset portfolio of insurers and reinsurers, reinforcing the vicious circle

## Regulators and companies come up with ad hoc changes in the rules

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- Several proposals are put forward to come out of the dilemma of pro-cyclicality
- Use of the swap rate for discounting instead of the risk free rate. The argument being that this allows to account for liquidity risks
- How liquid are 30 years swap rates ? Why would swap rates be more liquid than government bonds ? We have seen the interbank money market collapse
- Some propose to give companies negative capital add-ons, but nobody knows how such add-ons would work in practice other than arbitrarily
- Some propose to suspend all together the solvency rules based on risk models and leave it up to the regulators to let company surviving, thus defeating the very purpose of risk-based solvency regulation



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## Recognizing the riskiness of the situation

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- The EIOPA (European Insurance and Occupational Pensions Authority) answer to the crisis is to put forward an indiscriminate increase of the target capital for insurance companies
- Such requirements, if they go through, would have severe social consequences by drying even more up the liquidity of the markets and increasing the price of insurances
- What is required in such situations is simply the recognition of its riskiness and that company have to adapt to survive it
- One cannot ask a ship not to pitch when sailing through rough sea due to a storm
- Contrary to EIOPA, we think regulators should *relax the rules* in *time of crisis* and make them *more stringent* during *good times*

# Efficient regulation should be contingent to the economic situation

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- Capital requirements should be *adaptive* and change according to the economic situation
- Studies<sup>(1)</sup> have shown that value-at-risk (VaR) are actually reduced during the crisis because the probability of rebounds increases
- Currently, the risk measure adopted by Solvency II is the VaR at a threshold of 99.5%
- This threshold is arbitrarily chosen in the tail of the distribution. There is no convincing argument why it should be 99.5% instead of 99.4% or 99%
- Why not then changing it according to the economic situation?

## Changing the risk measure threshold

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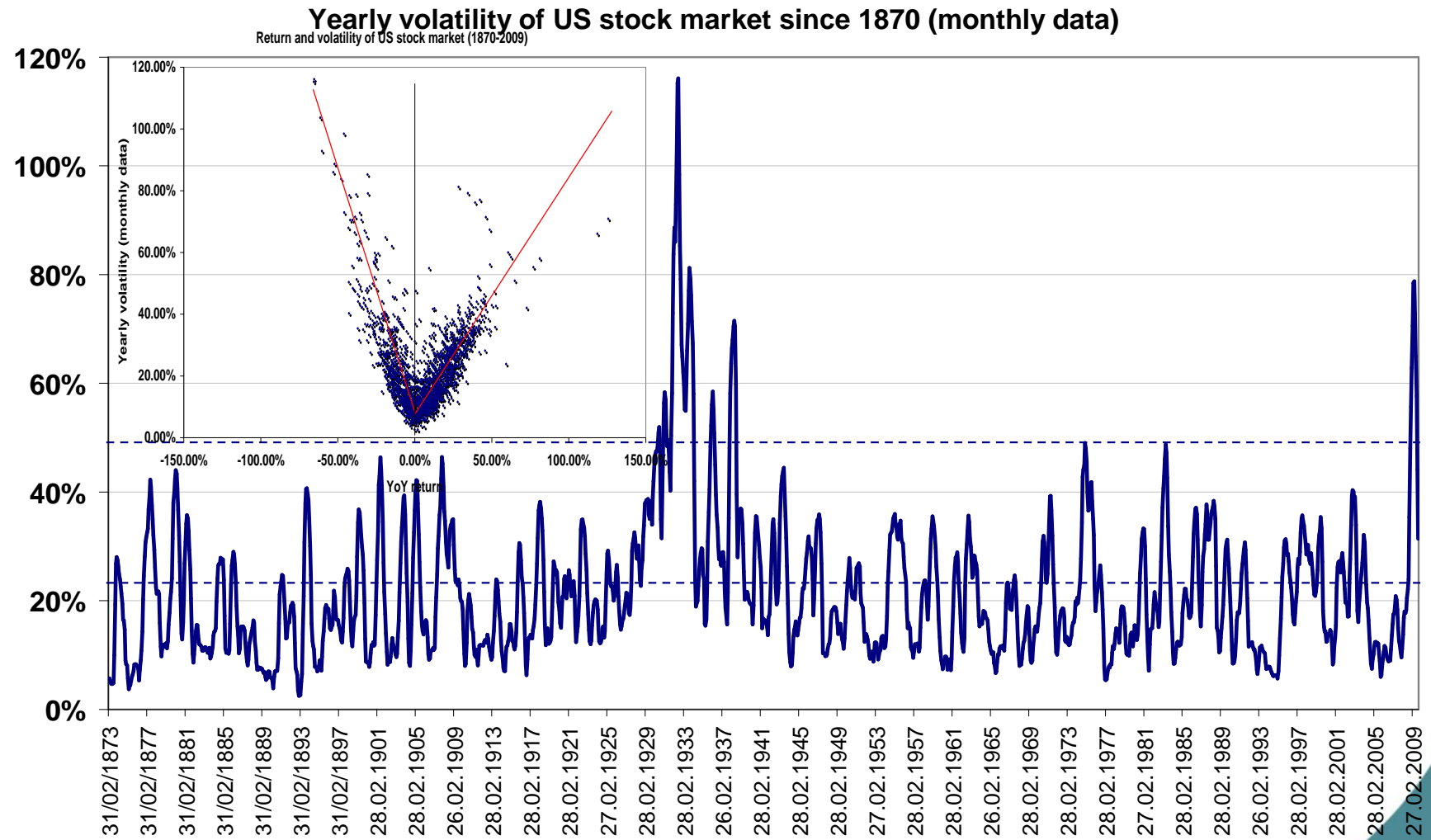
- Moving from 99.5% to 99% is a simple and transparent way to recognize the reality of the economic situation: nobody can be so safe anymore when the whole world is in turmoil
- Moreover, this change of threshold will mainly compensate in terms of capital the increase due to the recognition by the model of the increase of the risks due to the crisis
- In SCOR's model, it would represent a decrease of roughly 10% of the required capital compensating the increase due to the higher market volatility and lower interest rates
- It is important that the law sets a threshold sufficiently remote to inspire confidence in the system by all stakeholders
- But, it would be logical to allow the supervisory authorities to change this, within predefined range, when times are difficult

## A clear and transparent trigger

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- A rule allowing the regulators to change the threshold of the risk measure should be simple and based on an objective assessment of the crisis situation
- It is always hard to set a trigger for a rule when a mere financial turmoil turns into a crisis
- We suggest to use one of the elements in the internal model that produces higher risks: market volatility
- Market volatility will affect the risks generated by the economic scenario generator (ESG) and thus end up requiring higher capital from the model
- It is a measurable quantity that is highly affected by the state of financial markets
- We propose to use *twice the average yearly volatility* of a chosen stock market index

# Market volatility has reached such values only twice in the past 140 years



## A simple rule

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- Regulators will declare that companies would be allowed to use a VaR at 99% for measuring their solvency for the next year if the stock index yearly volatility reaches twice its historical average measured on a very long period
- A year later, if the volatility is below this index, the regulators would then reestablish the 99.5% threshold and ask companies to refurbish their capital to comply with it
- Such a rule would allow insurance and reinsurance to use part of their capital to face up the bad economic situation without risking to become insolvent for liabilities they would have to pay in a distant future
- Given this flexibility to the system combines three advantages:
  1. It works against the famous pro-cyclicality
  2. It reduces the need to lock up useless extra capital
  3. It is transparent by recognizing an objective situation

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- 2 → Preparing for the next negative surprise to come
- 3 → Consequences of financial crises on insurance capital requirements
- 4 → Giving the regulatory system enough flexibility to respond to the next crisis to come
- 5 → Conclusion



## Prepare for the next crisis to come

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- There will always be crisis and we will be always surprised by them, because they reveal links that were underestimated
- We undoubtedly need to learn the lessons of this one to reduce the risk of the same causes producing the same effects
- As risk manager, we need to integrate in our models a reasonable probability for crisis to happen and prepare for it
- The Romans used to say: “si vis pacem para bellum” (if you want peace prepare for war)
- I’ll paraphrase them: “if you want to survive a crisis you have to be prepared for it”

## Adapt the solvency regulation to it

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- It is essential to adapt the solvency regulation to the occurrence of crises and to make them dynamic
- For the system to remain credible, it is important to put forward simple adaptive rules that everybody understands and not compromising with principles
- Recognizing the situation and adapting the threshold of the risk measure to it, is a simple way of fighting against the rigidity of rules that could destabilize the industry even further without any real justification
- Using an independent indicator like the *extreme volatility* of financial markets, avoids the blaming of any stakeholders for the decision and puts forward the objective situation