

There will be a next crisis surprising us someday – let us be prepared to survive it!

Presented by

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- 1 → The current financial crisis – an analysis from the risk management point of view
- 2 → Preparing for the next negative surprise to come
- 3 → Conclusion

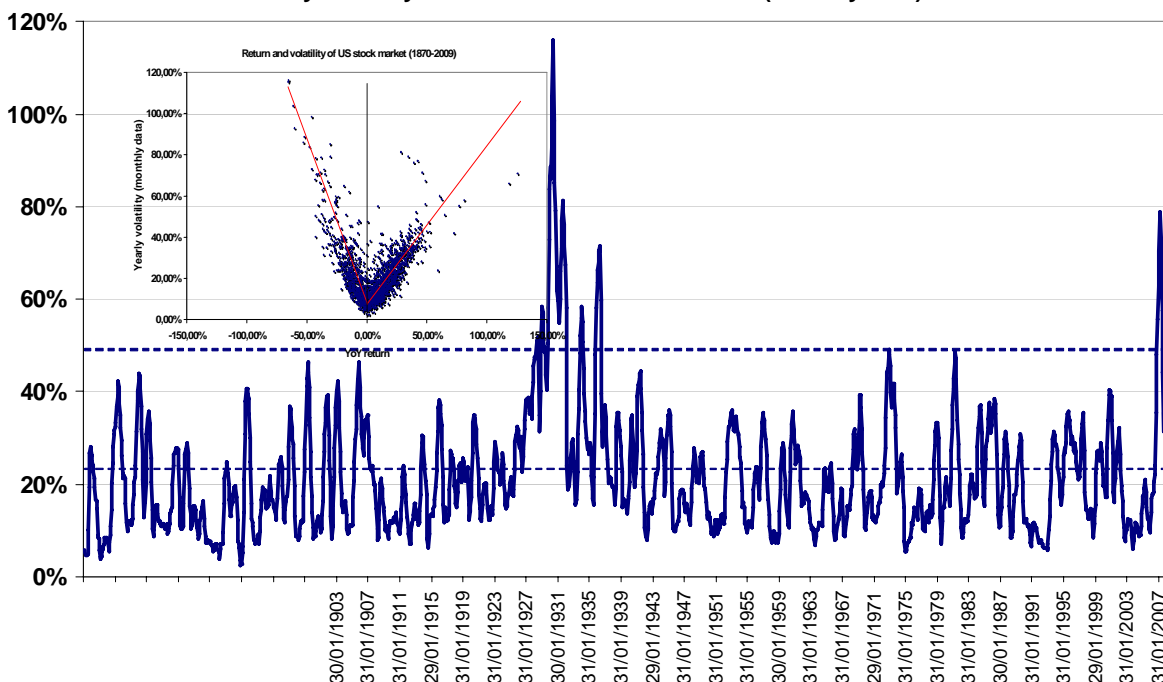
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We live through one of the most severe financial crises of the modern times

- The present financial crisis 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 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
- We are all seeking answers to the causes of financial crises, but we should not rush too quickly into conclusions and converge to the traditional post-crisis themes of insufficient regulations, real-estate bubbles, excessive leverage and capital flows, lax monetary policies and so on...

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

Yearly volatility of US stock market since 1870 (monthly data)



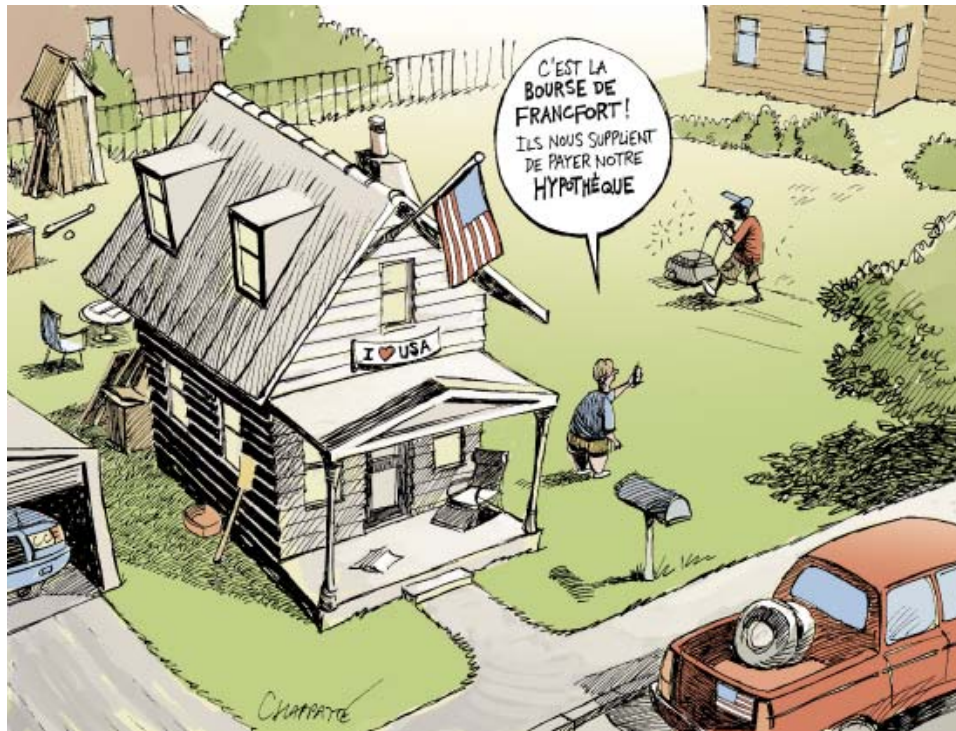
What is behind the current severe financial crisis?

- 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 two key ingredients for severe financial crises:
 1. A significant negative surprise
 2. The excessive concentration of aggregate risk in highly leveraged financial institutions

The surprise was the weak links in an immensely complex system

- The surprise was *not* the decline of real estate prices and the fact that subprime were the first affected by this
- Rather, 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



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Surprises are changes in the environment itself

- The 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. It is this “*rare event*” feature that holds the key as it has the potential to trigger sharp rise in the *perceived uncertainty* and flight to quality
- An example of such a surprise took place when the Reserve Primary fund, a leading money market fund, did not reimburse at par after Lehman declared bankruptcy (breaking the buck)
- The authority thought that because Lehman had not such a high exposure in CDS and that their own CDS was so high, its failure would not catch the market by surprise
- Unfortunately, the primary fund had invested in Lehman’s debt 1.2% of its assets

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From extremely safe to massive run

- Immediately after Lehman filed for bankruptcy, the fund *suffered a massive run*, with over USD 30 billion of redemption requests (about half of its total assets), before it stopped accepting redemption requests at USD 1 by 11am the following day (breaking the buck)
- 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 drop in the Reserve Primary Fund's NAV caused investors to question the safety of the entire industry and the first under-par redemption from a Money Market fund since their creation in 1968
- That week, 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

- 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
- Anyone who took the trouble of connecting the dots could, in principle, have foreseen what might happen. However, money market funds had a track record of stability that had always made it unnecessary to inspect their holdings
- 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

Aggregate risks a major cause for crisis

- The second 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 current 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

- 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 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

- 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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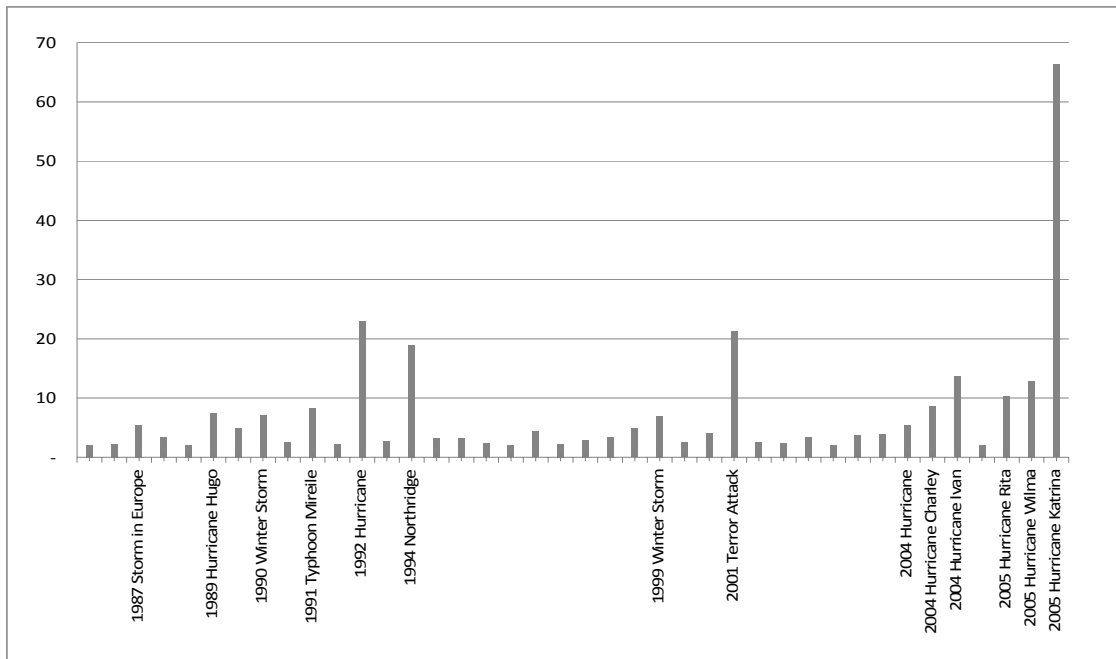
Surprise and aggregate risks are not going to disappear soon

- 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

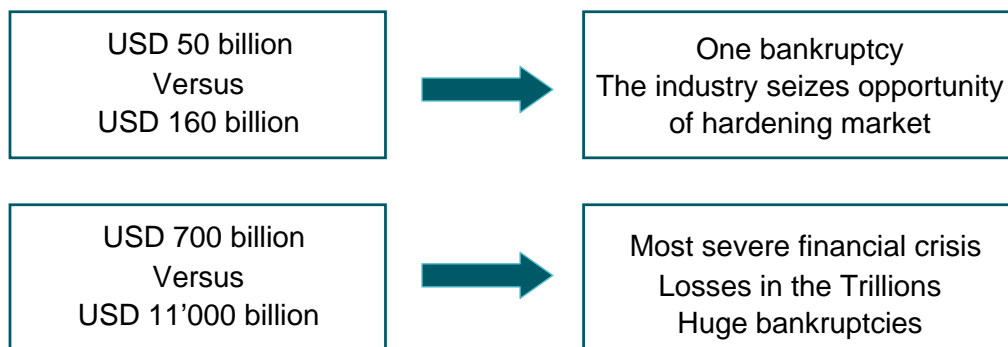
- Banks have traditionally been taking *credit risks* on their books in their wholesale lending operations, but also *market risks* through their securities trading operations
- Insurers and reinsurers have been taking *most other kinds of risks*: mortality and interest rate risks for life insurers, 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



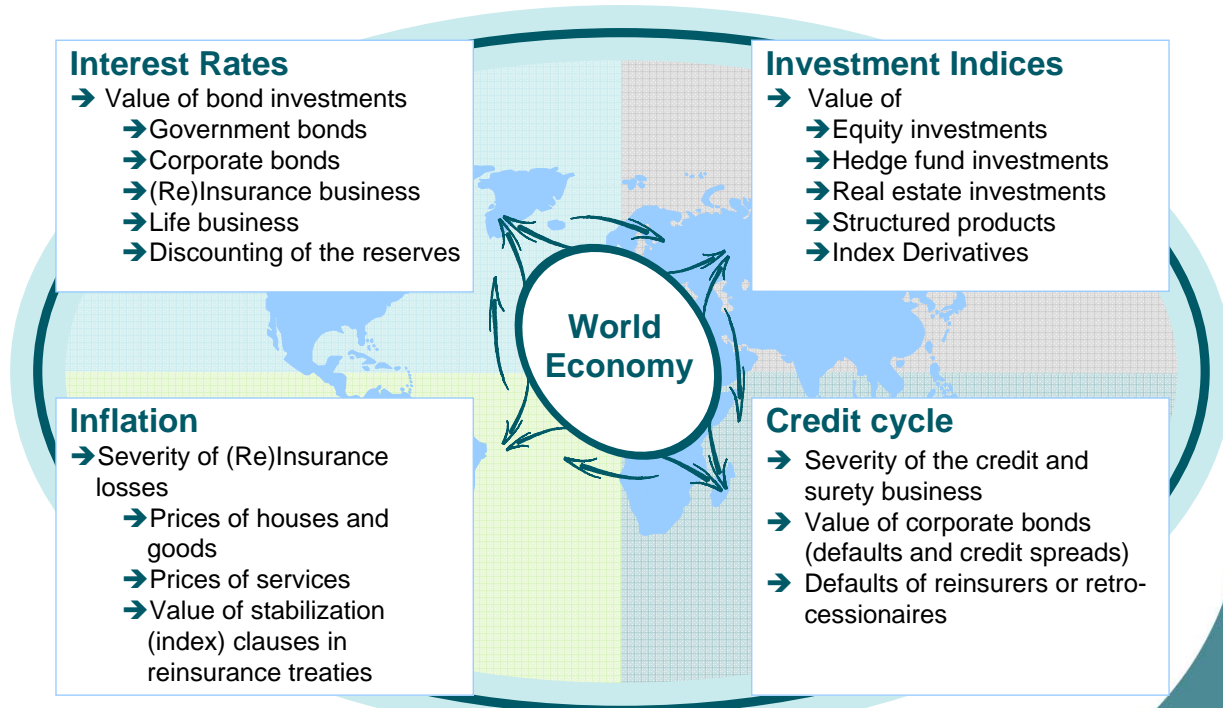
Resilience comes from readiness to tackle extreme risks

- ➔ 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

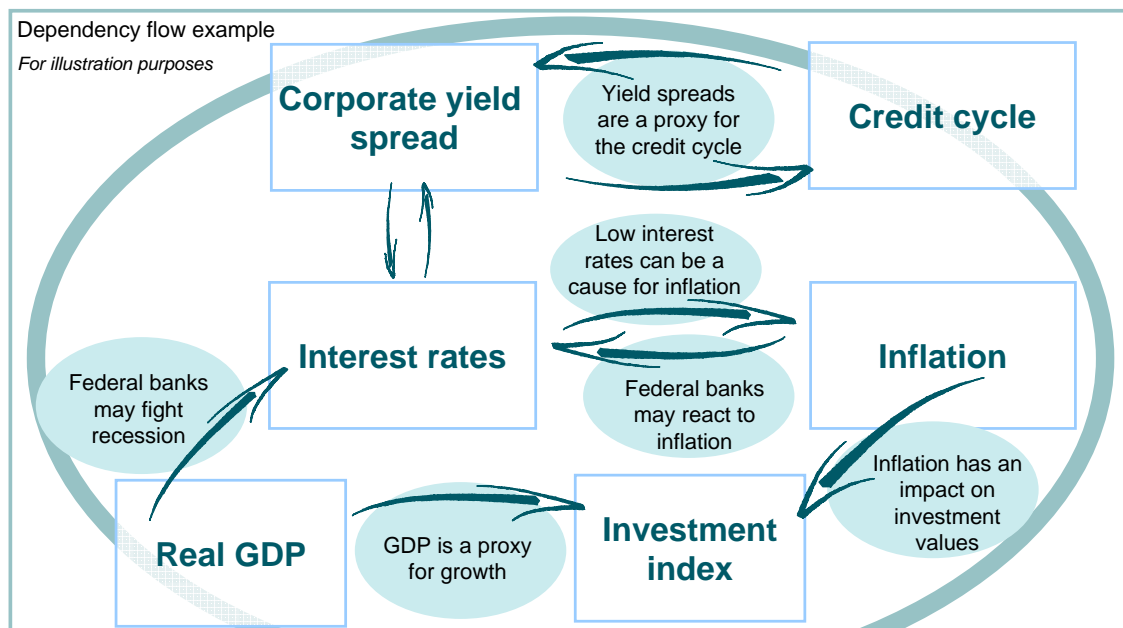


- ➔ Extreme events are part of the daily life of reinsurers. The financial system must admit that extreme events can happen. It is the only way to make it more resilient

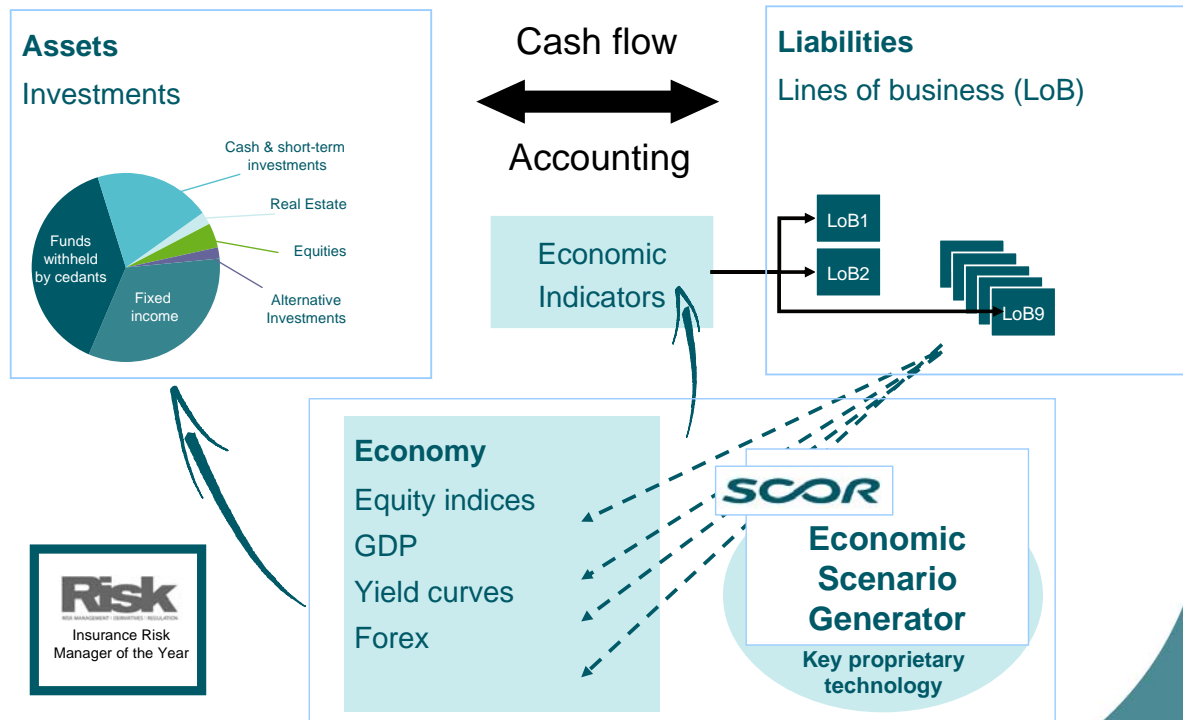
Influence of the economy on a reinsurance company like SCOR



Dependencies of economic variables are very complex to model



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



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Realistic Economic Scenario Generators

- 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 economic scenario generator (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

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SCOR ESG withstands extreme scenarios

Extreme scenarios are an integral part of our ESG

Extreme rates of 0% or below

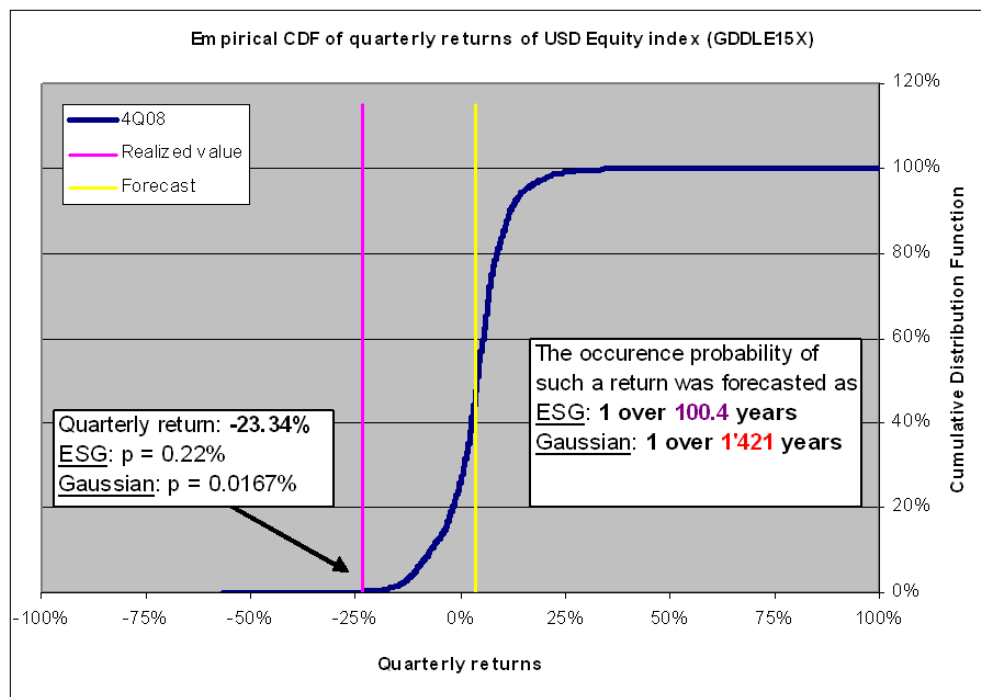
- The ESG calculates scenarios with interest rates of 0% or slightly below (not below -1%)
- Historic data shows examples of such occasions
- Yen – rates fell slightly below Zero in the early 1990's
- Swiss national bank in the 1980's used negative interest rates as a tool to make investments in Swiss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



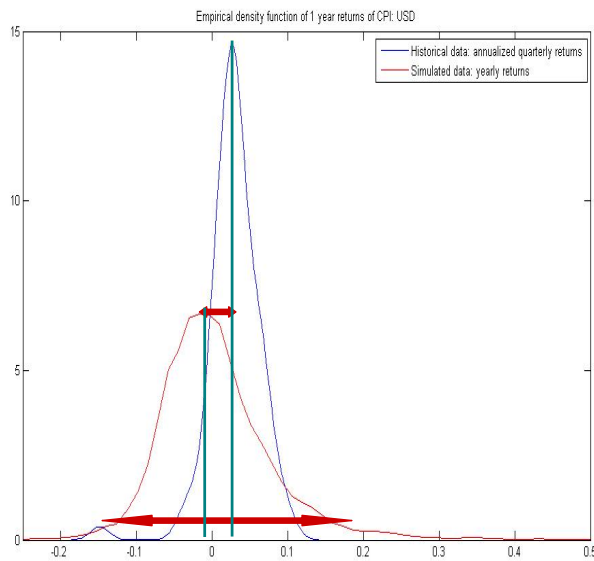
Extreme rates of around 40%

- 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, Argentina, 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



The ESG reflects the current uncertainty on inflation



Data:

- ▶ Number of historical data: 83 (relatively small),
- ▶ Number of simulations : 60'000.

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).

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Conclusion

- 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
- But overall, 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”