

SCOR Annual Conference

3 & 4 October 2019

The acceleration of Hubs, Networks & Connectivity

How to ensure sustainability of insurability and its development?

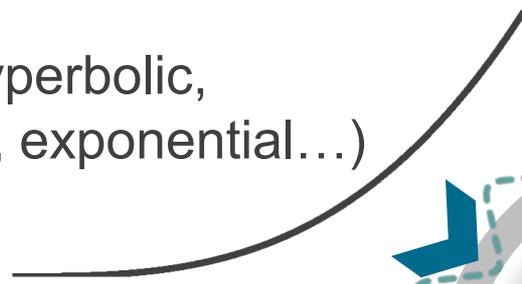
Reinsurance in an increasingly complex risk universe

Denis Kessler, Chairman and CEO

Every industry and every economic sector is subject to different kinds of positive, negative and disruptive forces

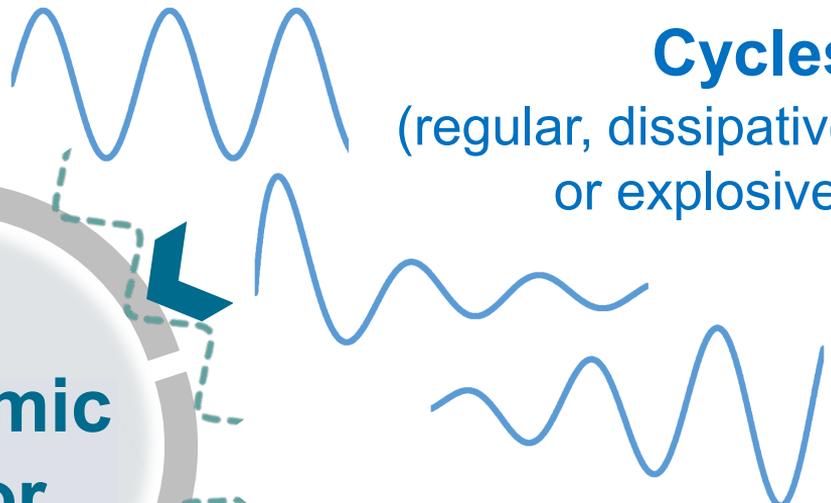
Trends

(linear, hyperbolic, parabolic, exponential...)



Cycles

(regular, dissipative or explosive)



Contestability

(rupture, discontinuity)



Economic sector

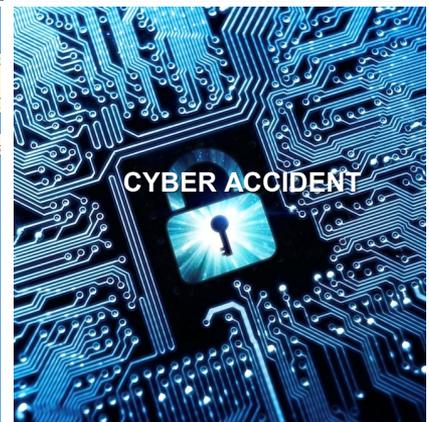
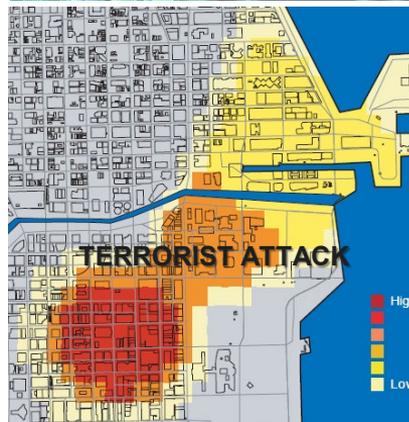
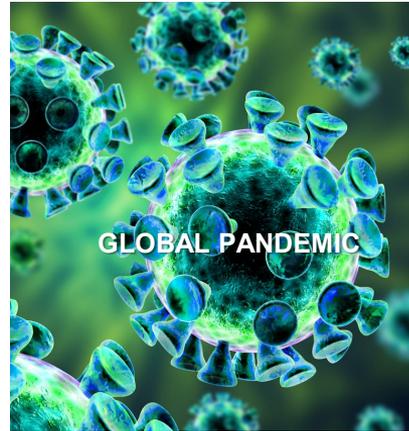


Shocks

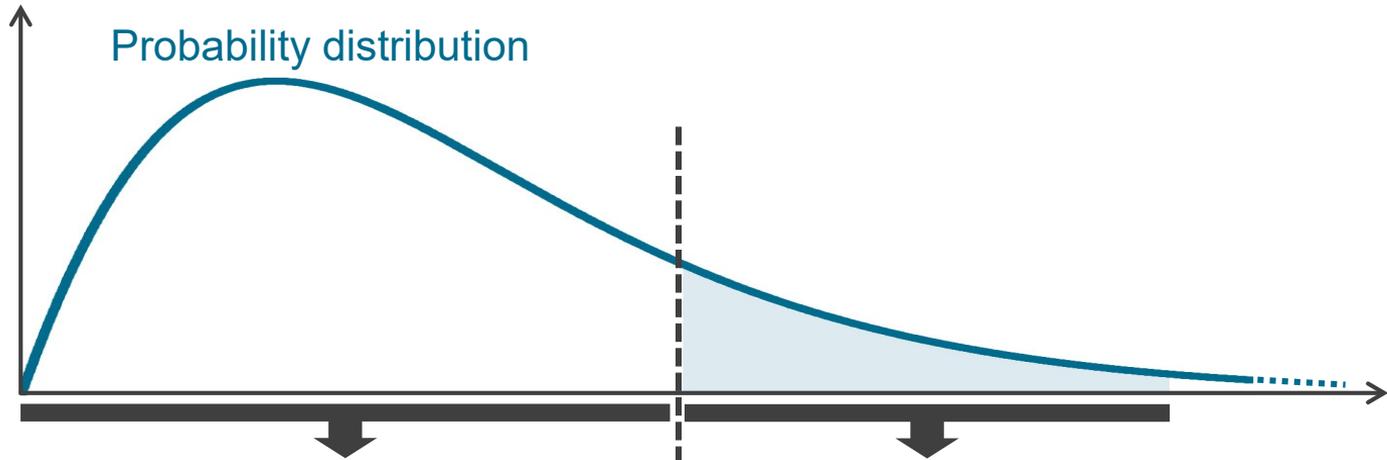
(single or multiple)

The reinsurance industry has one specific feature that it shares with no other sector: that of being structurally exposed to extreme events and shocks

- Large risks and catastrophes make up the raw material of reinsurance
- They result in shocks with varying origins, sizes and consequences
- The concept of *resilience*, which characterizes the reinsurance industry, is associated with that of shock
- In sectors marked by cycles and trends, shocks are exceptional. In reinsurance, shocks are a permanent feature
- Reinsurance is therefore a fully stochastic economic universe



Insurance and reinsurance operate in different “risk spaces”



The “insurance Gaussian world”

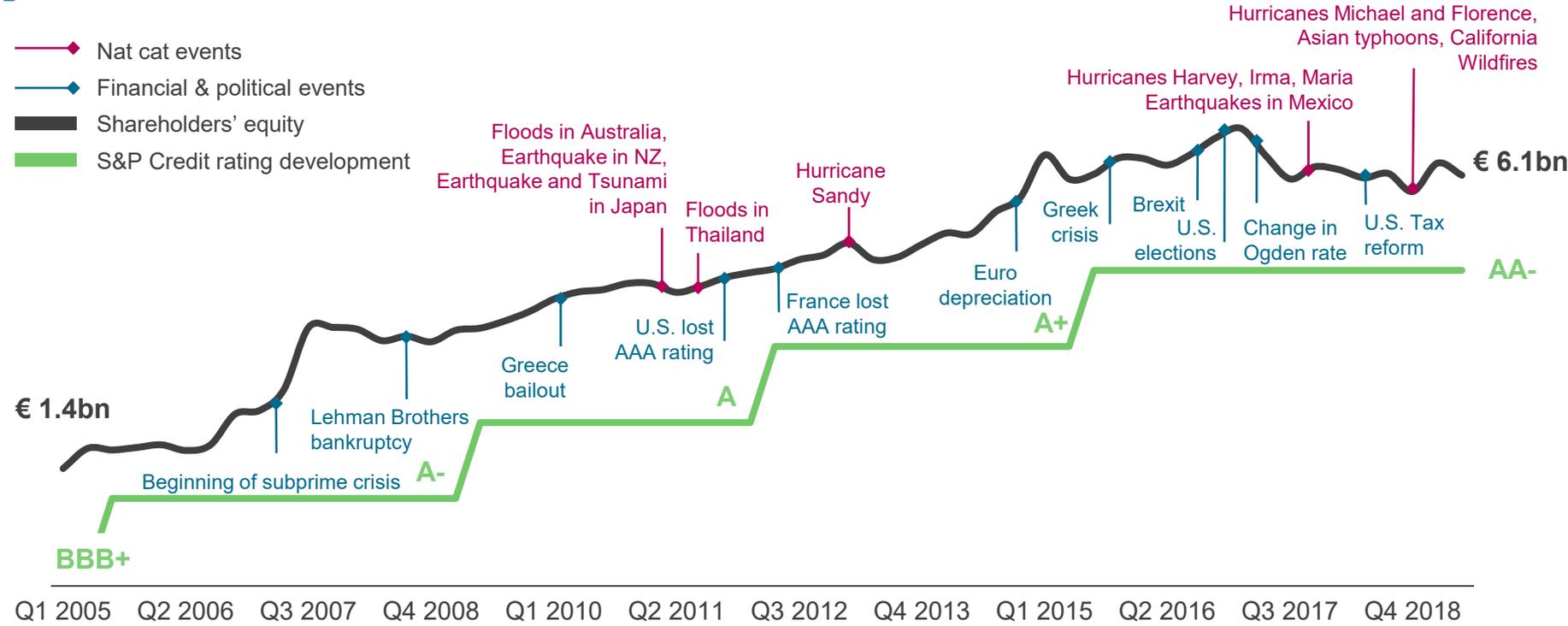
- Belly of the risk distribution
- Statistical nature
- Abundant and granular data
- High frequency / low severity
- Low variance

The “reinsurance world”

- Tail of the risk distribution
- Probabilistic nature
- Limited data
- Low frequency / high severity
- High variance per risk

SCOR has successfully created superior long-term value from such stochastic raw material over the years

Evolution of shareholders' equity (in EUR bn) and rating (S&P)



This performance can only be achieved by applying a very well-defined “recipe” through the strict respect of cornerstones



The Art & Science of Risk

Anticipating shocks



Constant risk management

Being very mindful of the risk universe and of its developments

Absorbing shocks



Controlled risk appetite

Strictly respecting a well-defined risk appetite with clear limits



High diversification

Building an optimally diversified portfolio of risks

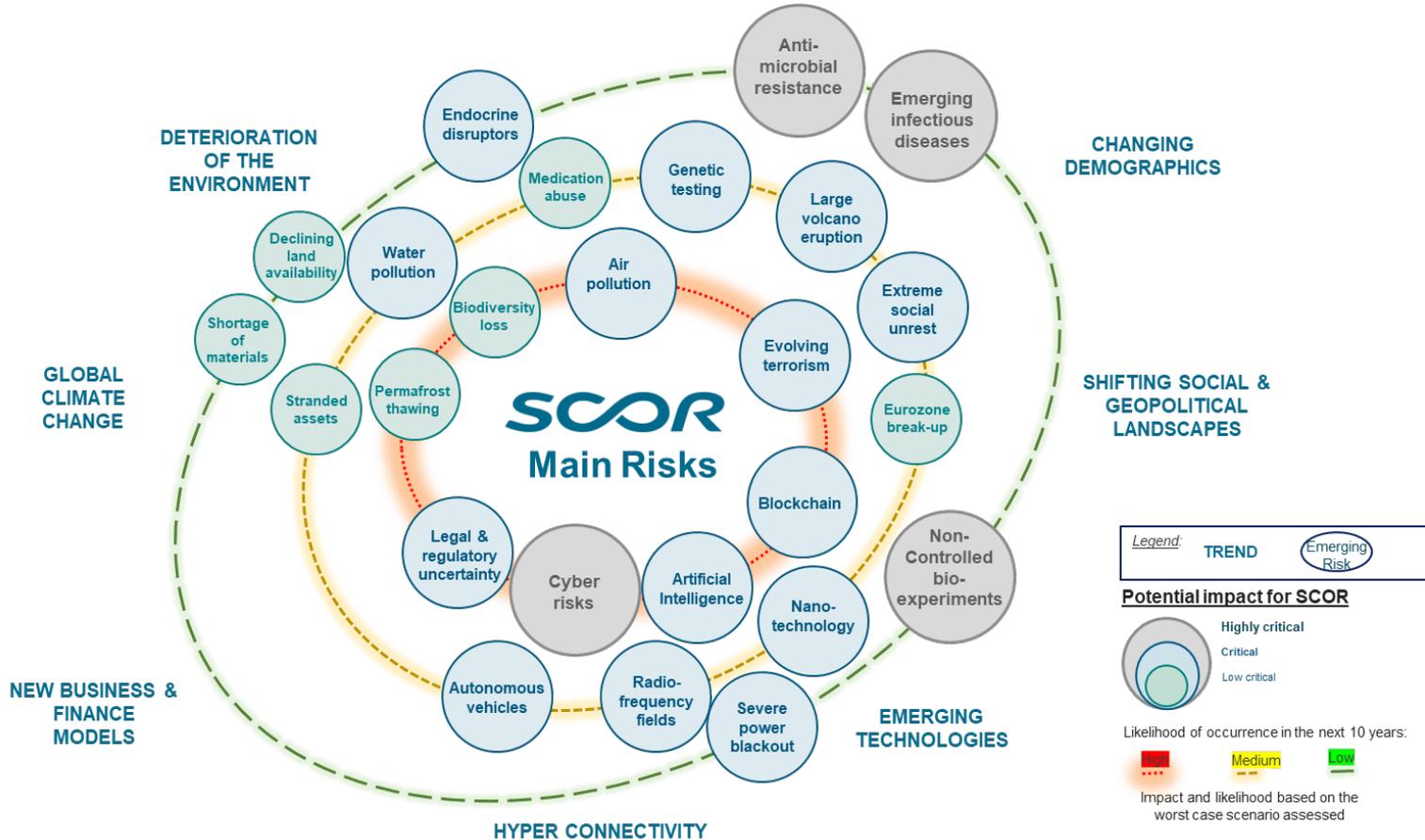


Robust capital shield

Transferring risks to protect the Group from the most extreme events

Constant risk management

Being very mindful of the risk universe and of its developments



Controlled risk appetite Strictly respecting a well-defined risk appetite with clear limits

Risk appetite



- SCOR is maintaining an upper mid-level risk appetite (after hedging) and a high level of risk diversification

**Disciplined underwriting
policy and prudent asset
management**

Risk preferences

- SCOR pursues an approach of thorough risk selection to optimize its profile and aims:
 - To actively seek risk related to reinsurance and selected primary insurance
 - To assume a moderate level of interest rate risk, credit risk, FX risk and market risk
 - To minimize its own operational and reputational risks, which are intrinsic to the conduct of business
 - To minimize the underwriting of cedant's asset-related risks

Risk tolerances

Solvency target

Capitalization level: Solvency target driving a process of gradual escalation and management responses

Exposure limits

Risk drivers: Maximum net 1:200 annual aggregate loss

Extreme scenarios: Maximum net 1:200 per-event loss

Investments: Maximum value-at-risk of aggregate portfolio, minimum and maximum exposure by investment category, minimum average rating, minimum duration of invested assets

Limits per risk in the underwriting and investment guidelines



Controlled risk appetite

Dynamically managing the Group's solvency towards the optimal range

Precise policy driving a process of gradual escalation

		Action	Possible management responses (examples)	Escalation level
300% SR ¹⁾	Over capitalized	Redeploy capital	<ul style="list-style-type: none"> • Consider special dividends • Consider acquisitions • Buyback shares / hybrid debt • Increase dividend growth rate • Reconsider risk profile, including capital shield strategy • Enlarge growth of profitable business 	Board/AGM
	Sub-Optimal			
220% SR ¹⁾	OPTIMAL RANGE	Fine-tune underwriting and investment strategy	No specific risk or capital management actions	Executive Committee
185% SR ¹⁾		Re-orient underwriting and investment strategy towards optimal area	<ul style="list-style-type: none"> • Improve selectiveness in underwriting and investment • Improve the composition of the risk portfolio • Optimize retrocession and risk-mitigation instruments (including ILS) • Consider securitizations 	Executive Committee
150% SR ¹⁾	Comfort	Improve efficiency of capital use	<ul style="list-style-type: none"> • Issue hybrid debt • Reduce dividend and / or dividends in other means (e.g. shares) • Reconsider risk profile, including more protective capital shield • Slow down growth of business • Consider securitizations 	Board/AGM
125% SR ¹⁾	Sub-Optimal			
100% SR ¹⁾	Alert	Restore capital position	<ul style="list-style-type: none"> • Consider private placement / large capital relief deal • Consider rights issue (as approved by the AGM) • Restructure activities 	Board/AGM
	GROUP SCR			
Below minimum range - submission of a recovery plan to the supervisor²⁾				Board/AGM

1) Solvency Ratio i.e. ratio of Own Funds over SCR

2) Article 138 of the Solvency II directive

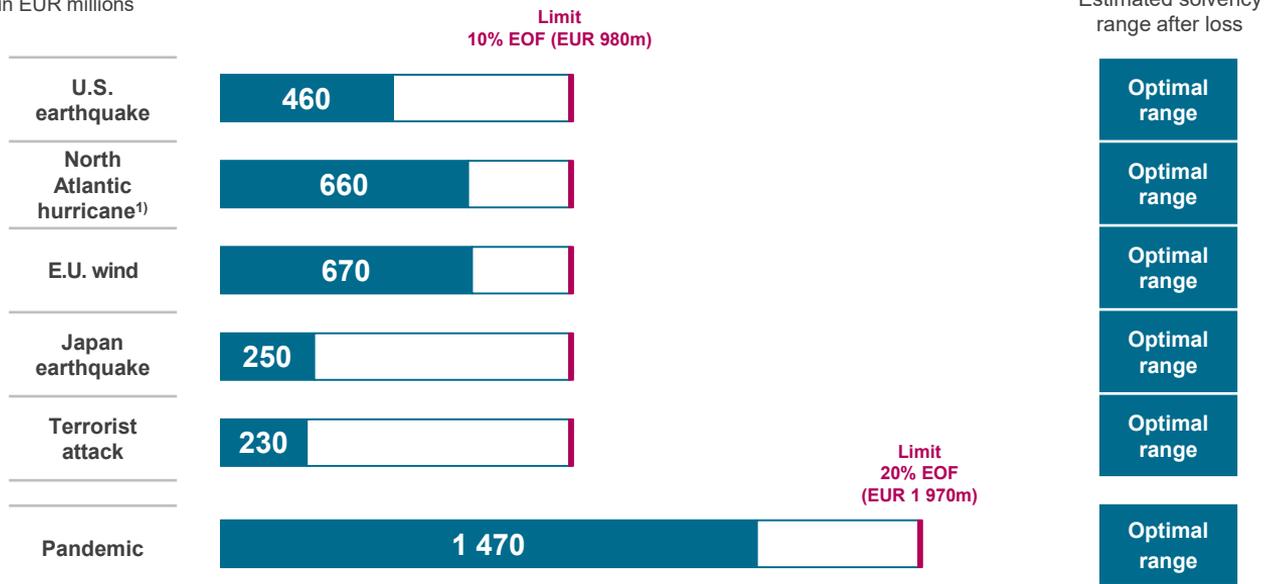


Controlled risk appetite

Monitoring risk exposures against strict risk tolerance limits

1-in-200 year loss

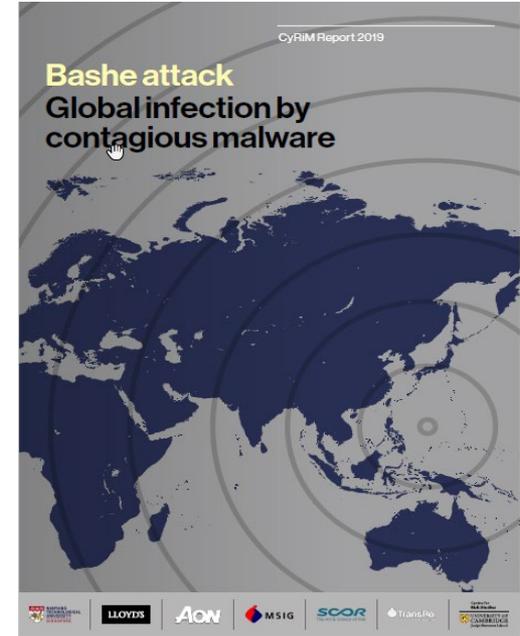
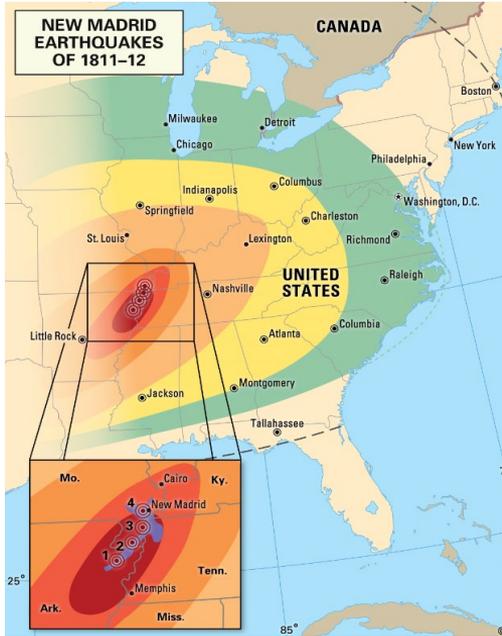
in EUR millions



Each extreme scenario is calibrated as a 1-in-200 year single-event. The corresponding loss includes expected new business for 2019, and is calculated net of all risk-transfer instruments (retro, ILS, contingent capital) and after tax.

Controlled risk appetite Monitoring risk exposures through scenario-based assessments

Complementing the probabilistic view by simulating “replicas” of key historical natural catastrophes or running specific scenarios based on the Group’s current exposures and capital shield instruments, assessing the impact of such scenarios on the Group’s solvency and liquidity





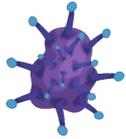
High diversification

Building an optimally diversified portfolio of risks

- Reinsurance fundamentally rests on the principle of mutualizing large risks that are – to a large extent – independent from each other



U.S. hurricane



Infectious livestock disease in Europe



Wildfire in Canada



Cyclone in Australia



Flood in Germany



Earthquake in Japan

and so on...

- All shocks will happen someday, but it is extremely unlikely that they will occur in the same year. Hence the reinsurer aims to build a risk correlation hypercube with a maximum of zeros (or even of negative numbers)
- Aggregating extremes that are not correlated allows the reinsurer to build a risk portfolio in which volatility is strongly reduced (in relative terms) and hence to “recreate regularity”
- A reinsurer must be global and present on all lines of business to fully leverage this diversification benefit



High diversification

A concrete example

Event 1	Event 2	Event 3	Event 4	Event 5
An earthquake in Japan as severe as or more severe than the Great Kantō earthquake of 1923	An earthquake in the U.S. as severe as or more severe than the San Francisco earthquake of 1906	A hurricane in the U.S. as severe as or more severe than the Great Miami Hurricane of 1926	A windstorm in Europe as severe as or more severe than Windstorm Daria in 1990	A typhoon in Japan as severe as or more severe than Typhoon Vera in 1959
Return period ~ 600 years	Return period ~ 150 years	Return period ~ 70 years	Return period ~ 35 years	Return period ~ 80 years

What is the probability p of these 5 events happening in the same year?

$$p = \frac{1}{600 \times 150 \times 70 \times 35 \times 80} = \frac{1}{17\,640\,000\,000}$$

Return period of 17.6 billion years (approximately the age of Earth multiplied by 4)

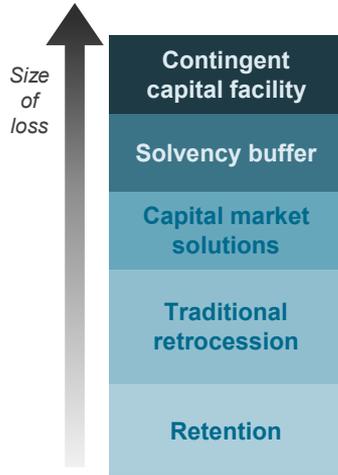
The 5 considered risks are independent from each other i.e. the occurrence of any of these events does not affect the probability of any of the other events occurring



Robust capital shield

Transferring risks to protect the Group from the most extreme events

Protection mechanisms



Illustrative

SCOR's capital shield policy seeks to avoid shareholders becoming retrocessionaires of last resort

Contingent capital facility

- The contingent capital is a pre-defined mechanism to raise new capital and replenish equity in case of extreme events
- SCOR's current innovative € 300m contingent capital facility protects the solvency of the Group from either extreme Nat Cat or Life events

Solvency buffer

- SCOR has defined a solvency scale with clear buffers

Capital market solutions

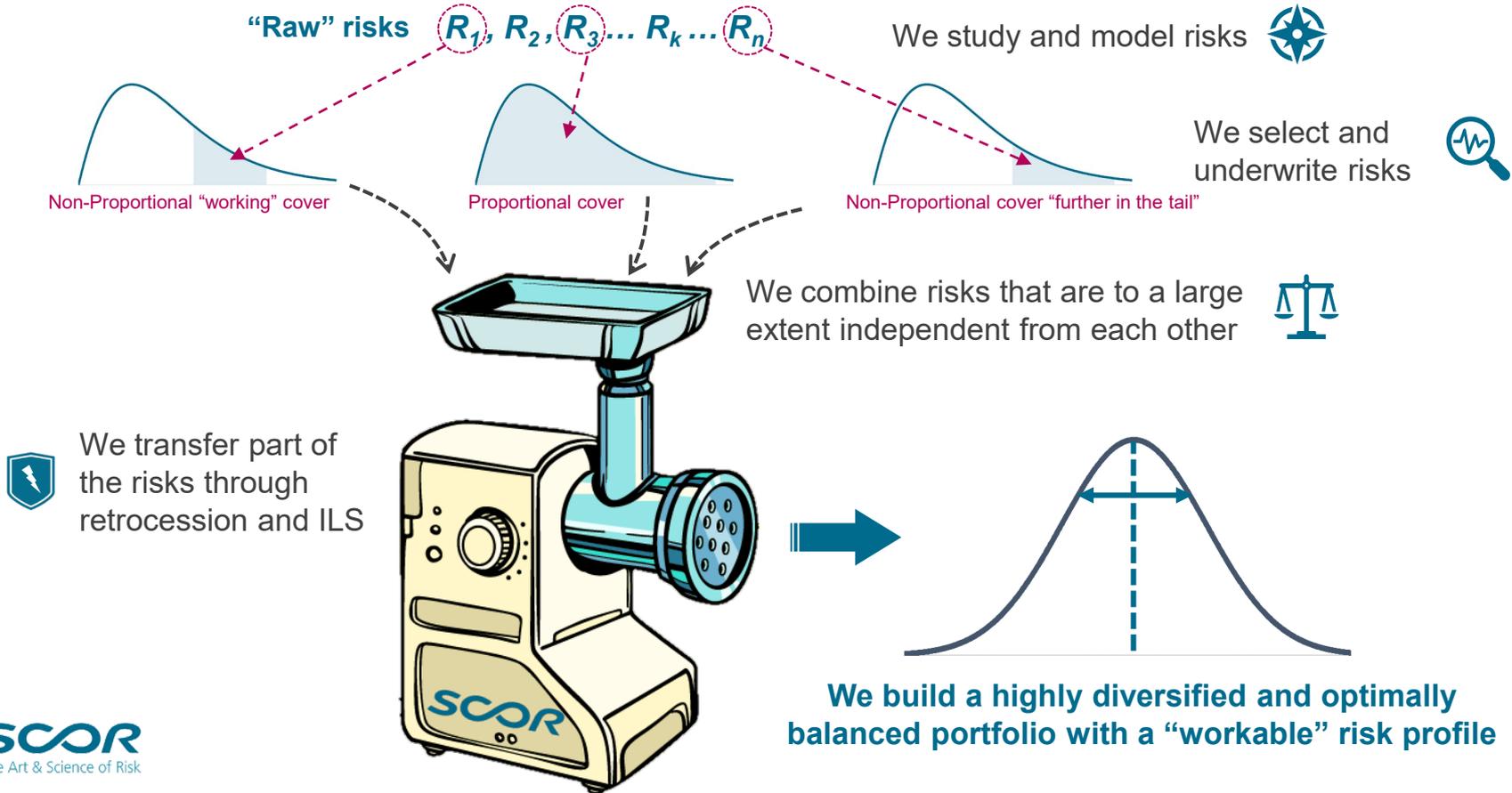
- SCOR has gained significant experience in Insurance-Linked Securities (ILS) over the last 20 years
- SCOR's outstanding ILS provide USD 850 million capacity protection

Traditional retrocession

- SCOR's wide range of protections includes Proportional and Non-Proportional covers (Per event / Aggregate) with long-term partners of high credit quality

The core Cat program is roughly 50/50 traditional vs. ILS capacity

In a nutshell... SCOR is a “risk processing plant”!



The relevance of this model has been demonstrated: SCOR has consistently delivered strong P&C technical profitability with low volatility over the years

Distribution¹⁾ of quarterly combined ratio since 2006²⁾ (in %)



- Q1 2011 (135.2%): Series of nat cat including the Australia floods + the New Zealand and Japan quakes
- Q3 2017 (136.7%): Series of nat cat including Hurricanes Harvey-Irma-Maria + Mexican quakes
- Q4 2018 (115.9%): Series of nat cat including Hurricanes Michael and Florence + Wildfires in California + Typhoons Jebi and Trami

Q1 2010 (108.6%): Chile Earthquake Xynthia Storm and Haiti Earthquake

Below 91%
9.3% occurrence

Between 91% and 100%
79.6% occurrence

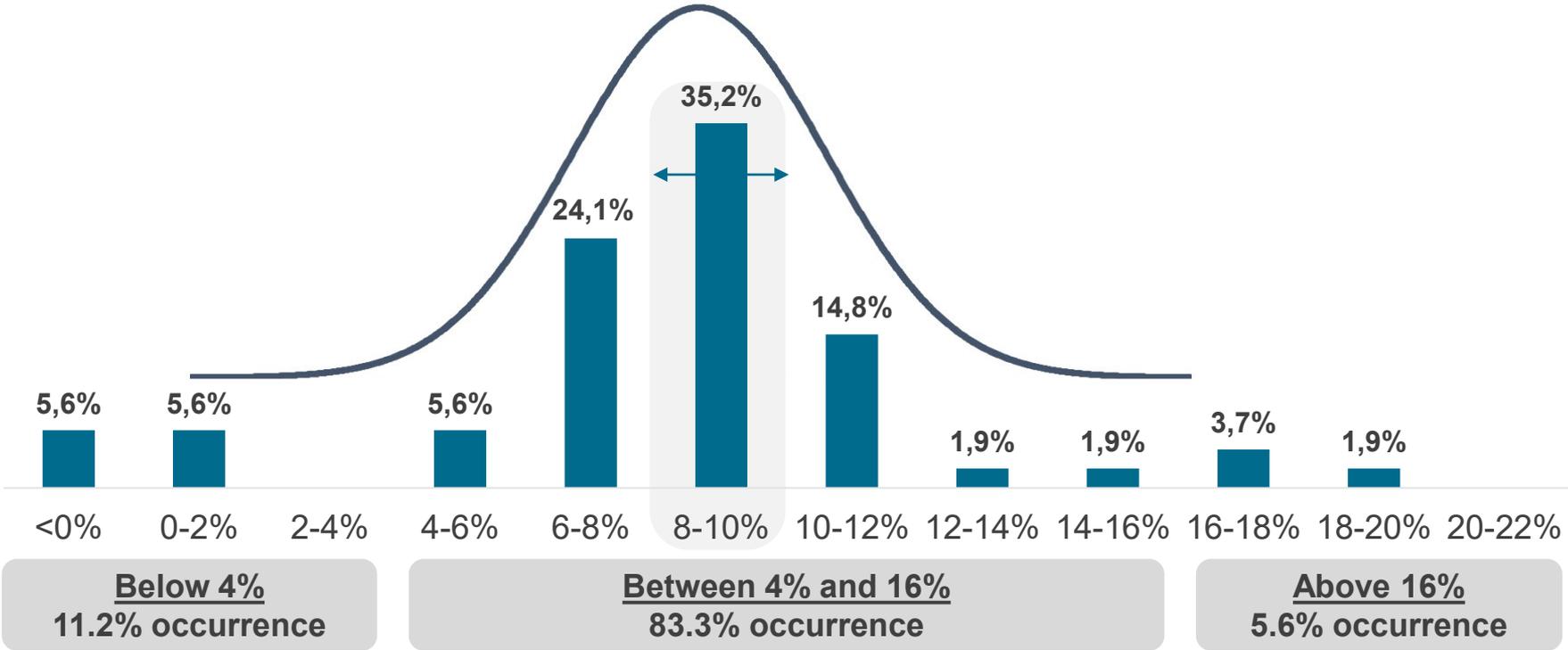
Above 100%
11.1% occurrence



1) How to read the graph: for instance, 14,8% of the quarters from Q1 2006 to Q2 2019 had a combined ratio between 92% and 93%
 2) 54 quarters in total, from Q1 2006 to Q2 2019 included. Q2, Q3 and Q4 2006 – 2007 quarterly COR estimated based on YTD disclosure

The volatility of SCOR's profitability at the Group level is even lower, due to the additional diversification with Life reinsurance and investment

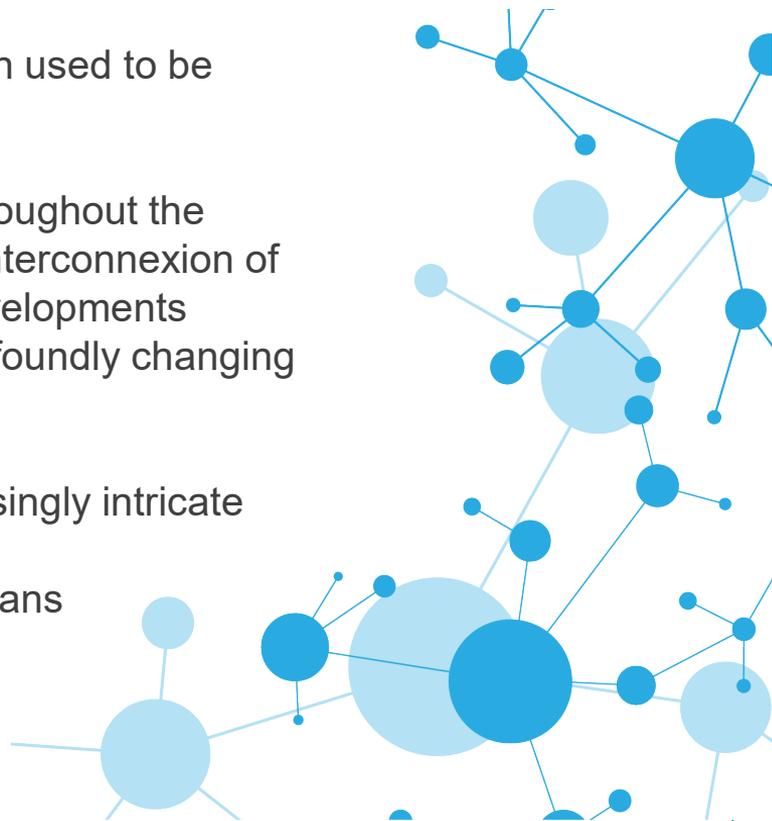
Distribution of quarterly adjusted ROE¹⁾ since 2006²⁾ (in %)



1) In excess of 5-year rolling average of 5-year USD rates and 5-year EUR rates
 2) 54 quarters in total, from Q1 2006 to Q2 2019 included

The development and the acceleration of the “network effect” in all dimensions stands for a challenge to the reinsurer’s diversification paradigm...

- Consequences of extreme events and shocks most often used to be largely “localized”. This is changing
- Growth, a higher concentration of people and assets throughout the World, globalization, the increasing fragmentation and interconnexion of production and supply chains globally, technological developments pertaining to digital networks and connectivity... are profoundly changing the risk universe
- The interactions between the risks are becoming increasingly intricate
- This acceleration of hubs, networks and connectivity means that risks are increasingly *serial* and *global*, i.e.
 - less and less circumscribed both in time and in space
 - increasingly interdependent with complex interactions



... because it affects the tail dependence between risks

- This “network effect” means that some risks that are most of the time – and to a large extent – independent from each other, may “re-correlate” in the most extreme events

A few examples

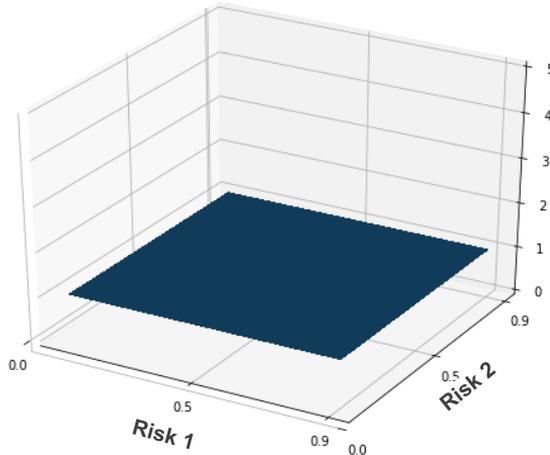
Risks that are most of the time independent from each other	... but that may “re-correlate” in the tail!
<ul style="list-style-type: none">• Mortality of individuals in different countries and of different ages	Global pandemic
<ul style="list-style-type: none">• Business Interruption (BI) risks from different corporates in various economic sectors and countries• Outage / disruption of some IT systems of the reinsurer himself	Global large-scale cyber attack
<ul style="list-style-type: none">• Property and BI risks from various US corporates• CBI risks from Japanese corporates• Individual Life insurance risks in California• Equity risk	Devastating earthquake hitting the San Francisco area

Copulas are the suitable mathematical objects in probability theory to describe and model this “network effect”

- Copulas comprehensively specify the dependence structures between risks, whatever their complexity
- There are many copula families, whose parameters control the strength of dependence between the risks

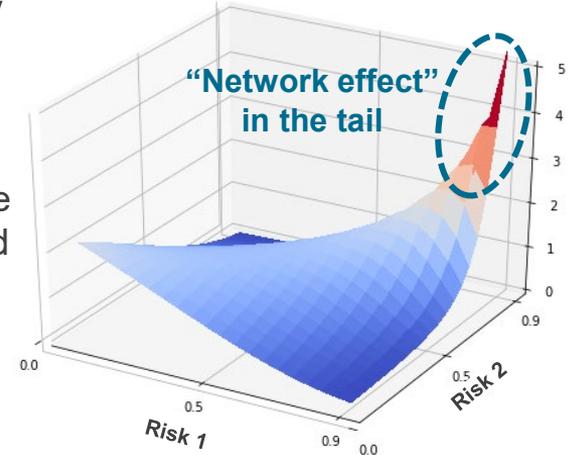
Risks that are fully independent from each other (both in the belly and in the tail)

- The copula density is constant (“flat”), both in the belly and in the tail
- Risks are fully independent, allowing efficient diversification throughout the risk distribution



Risks that are ~ independent from each other most of the time (i.e. in the belly) but “re-correlate” in the tail

- The copula density is relatively “flat” in the belly and peaks in the tail
- Risks are to a large extent decorrelated “most of the time” but re-correlate in the most extreme events
- Diversification in the tail is hampered



The tail dependence introduced by the “network effect” may strongly hamper diversification – A concrete example...

- We once again consider 5 events whose return periods are 600 years, 150 years, 70 years, 35 years and 80 years, respectively

Copula describing the dependence between the 5 risks	Probability of the 5 events occurring in the same year
Independence	$\frac{1}{17\,640\,000\,000}$
Gaussian (with Kendall's $\tau = 0.5$ i.e. $\rho = 0.707$)	$\frac{1}{3002}$
Flipped Clayton (with Kendall's $\tau = 0.5$ i.e. $\theta = 2$)	$\frac{1}{629}$
Comonotonic (i.e. fully dependent)	$\frac{1}{600}$

The tail dependence structure – which is strongly affected by the (non-)existence of a “network effect” – determines the probability of extreme events occurring simultaneously and drives the diversification benefit that the reinsurer may leverage

Technical expertise and strong risk management have always been – and are increasingly – a key competitive advantage in the (re)insurance industry



The Art & Science of Risk for the reinsurer consists in modelling, limiting, transferring and combining risk exposures to build an optimally diversified portfolio of risks



Leveraging and optimizing diversification globally, both across geographies and between business lines, is the key ingredient in the reinsurer's recipe for consistently creating value from a stochastic raw material made of extreme events and shocks



The acceleration of hubs, networks and connectivity means that risks are increasingly serial and global i.e. they increasingly tend to re-correlate in the most extreme events



This feature is a challenge for reinsurers, which explains why they take a more prudent approach with serial risks, notably through strict exposure limits. This translates into a (comparatively) lower available reinsurance capacity and a higher risk premium

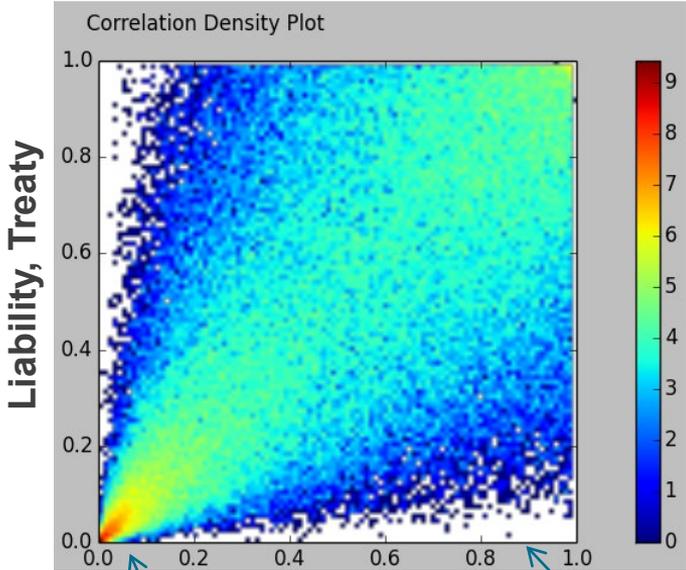


Going forward, reinsurers' shock-absorbing capacity and value-creation capability will depend, more than ever, on their ability to identify, measure and monitor their aggregations of exposures and to model risk interdependences throughout their portfolio on a global basis

APPENDIX – Copulas comprehensively specify the dependence structures between risks

- SCOR uses copulas in its internal model to specify the dependence between the risks carried onto its balance sheet. They determine the diversification benefit between the different segments of its risk portfolio

Example of strong dependence

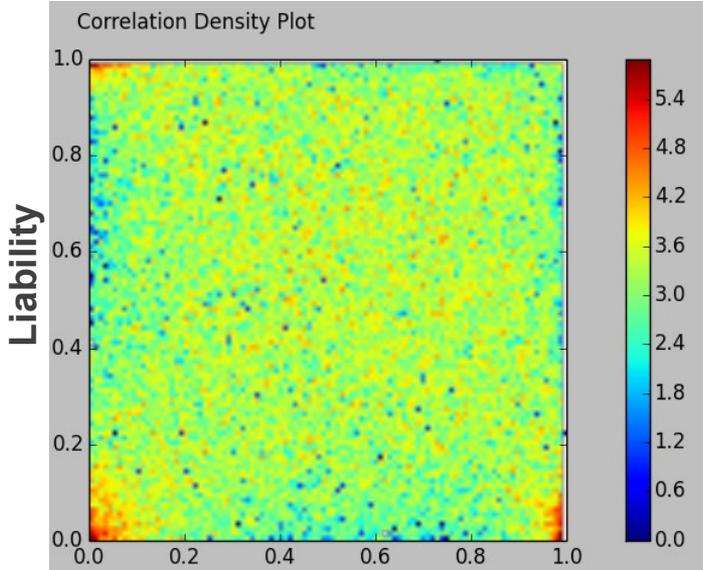


Liability, Facultative

Worst-case scenarios (largest losses)

Best-case scenarios

Example of very low dependence



Property