

*somewhat
different*



Capital generation and risk profile

Including an update on our reserving level

Dr. Andreas Märkert, Chief Risk Officer and Managing Director Group Risk Management
22nd International Investors' Day
Frankfurt, 23 October 2019

hannover **re**[®]

Agenda

- 1 Capital generation, Solvency II outlook and sensitivities
 - 2 Natural catastrophes and climate change risk
 - 3 Cyber risk management
 - 4 Annual update of the P&C claim reserving level
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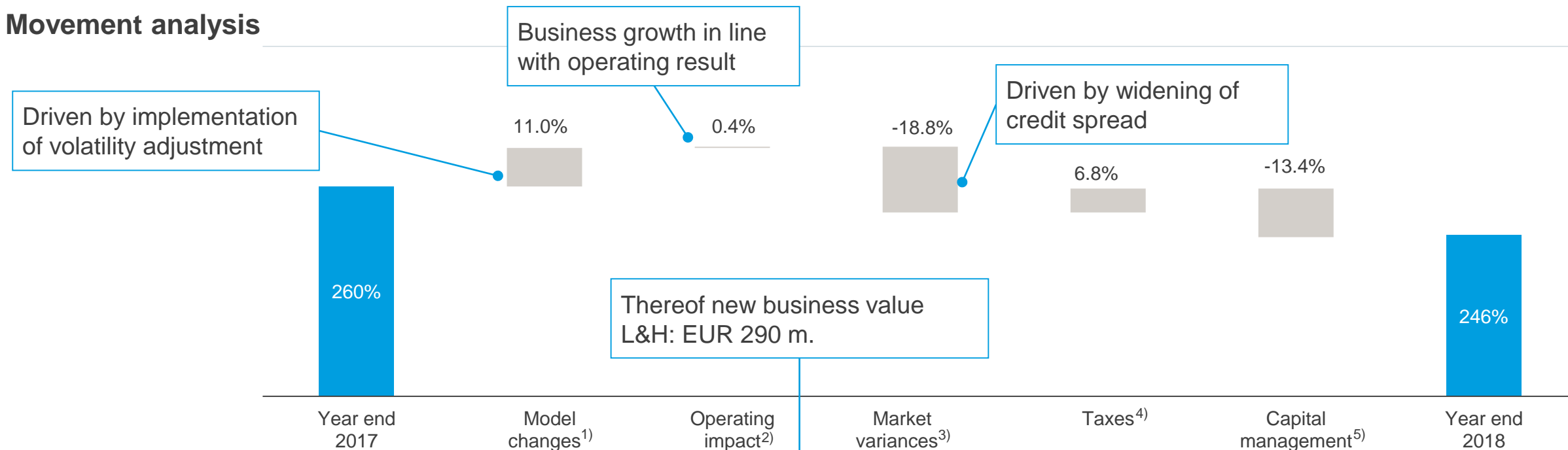
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Capital generation: review 2018

Solvency II eligible own funds and SCR movement analysis

Movement analysis



Category	Year end 2017	Model changes ¹⁾	Operating impact ²⁾	Market variances ³⁾	Taxes ⁴⁾	Capital management ⁵⁾	Year end 2018
Eligible own funds	12,296	393	1,037	-282	-123	-686	12,635
SCR	4,729	-46	376	264	-188	0	5,135

Figures in m. EUR. SCR – Solvency Capital Requirements according to Solvency II internal model

1) Model changes, main effect from first-time application of static volatility adjustment; pre-tax

2) Operating earnings and assumption changes; pre-tax

3) Changes due to changes in foreign exchange rates, interest rates, credit spreads and other financial market indicators; pre-tax

4) Tax payments and changes in deferred taxes

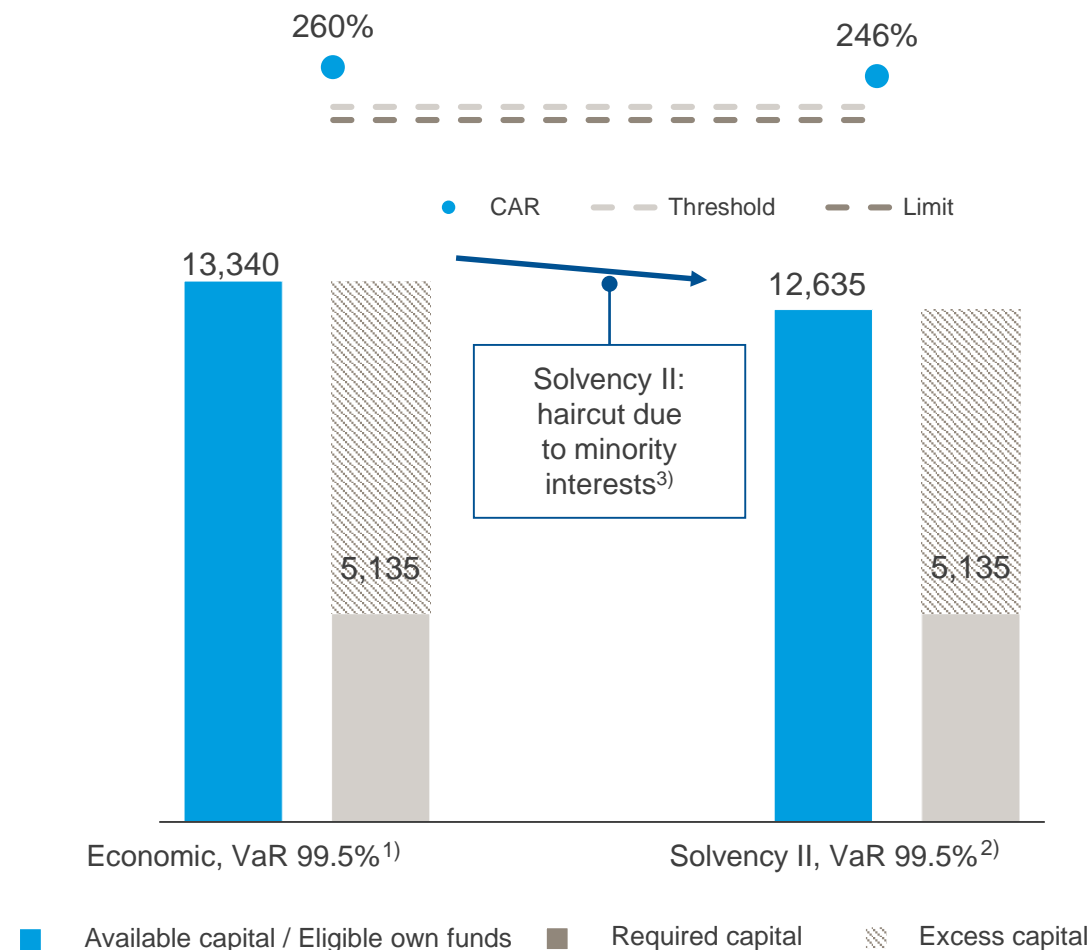
5) Dividend payments and changes in foreseeable dividends

Continuous and consistent monitoring of economic performance

Comfortable capital position above targets

- Monitoring of internal and Solvency II targets
 - on a regular, quarterly basis,
 - upon significant transactions and
 - as a component of our planning process
- Further side constraints
 - Solvency II ratio of Hannover Rück SE: 251%
 - Rating targets
 - Standard & Poor’s rating AA-
 - A.M. Best rating A+
 - include adherence to rating agencies’ capital requirements
 - Ruin probability: currently significantly below target level 0.03%
 - Legal entities solvency requirements

Capital adequacy ratios, internal and Solvency II metrics



All figures as at 31 December 2018 and in m. EUR

1) Available capital vs. Value-at-Risk at confidence level 99.5%

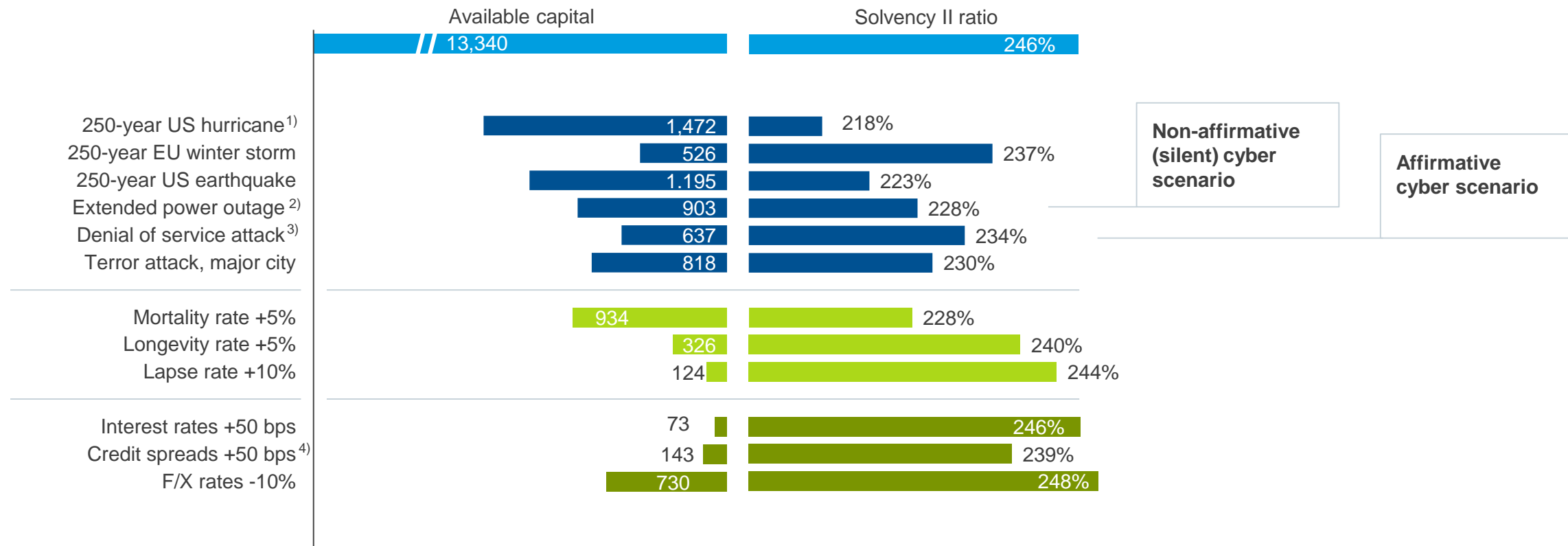
2) Solvency II eligible own funds vs. Solvency Capital Requirements SCR (VaR at confidence level 99.5%)

3) Non-available minority interests mainly consist of non-controlling interests in E+S Rückversicherung AG

Individual risks with limited impact on own funds

Substantial excess capital to withstand stress events

Sensitivities and stress tests



As at 31 December 2018, in m. EUR; post-tax

1) A return period of 250 years is equivalent to an occurrence probability of 0.4%; based on the aggregate annual loss. Car – Caribbean

2) Approx. 3 weeks of power outage in a larger area of a developed country

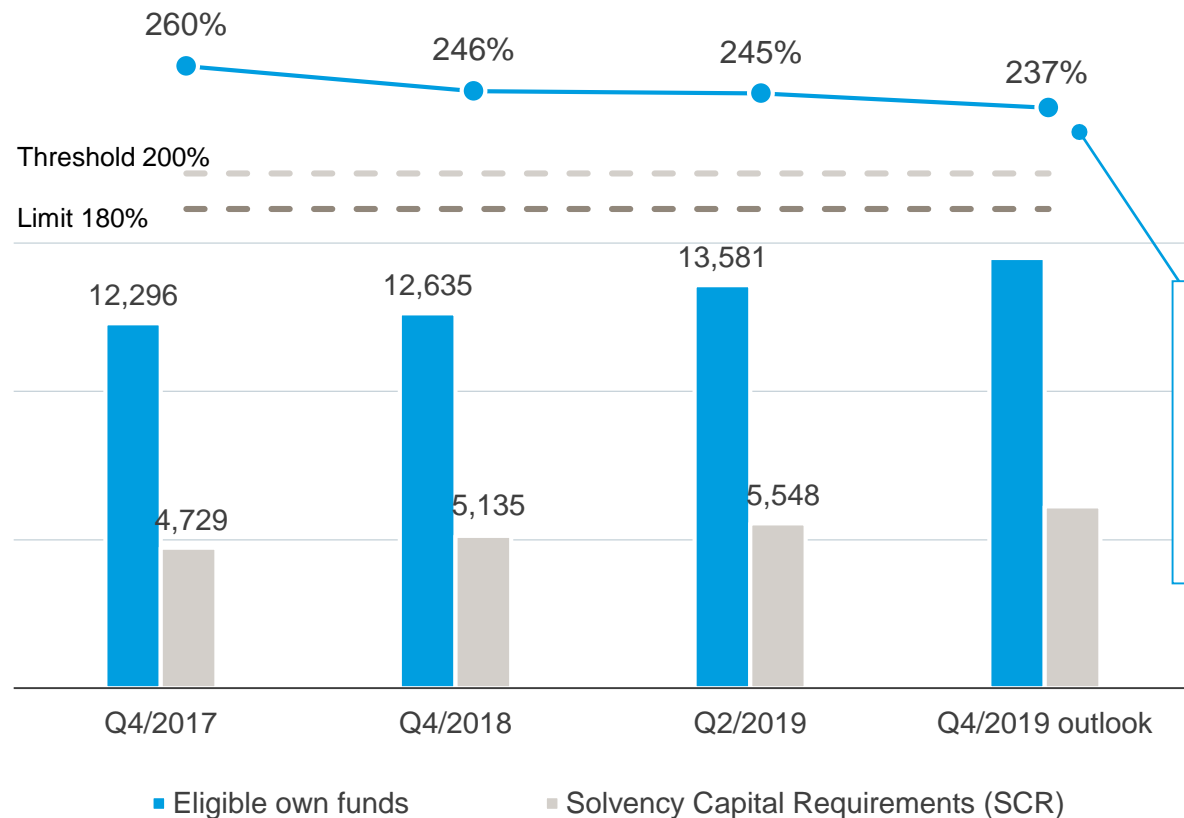
3) Distributed denial-of-service-attack on main DNS provider

4) +50bps for Hannover Re average portfolio bucket. Stress level differs by rating and duration. Includes impact of changes in static volatility adjustment.

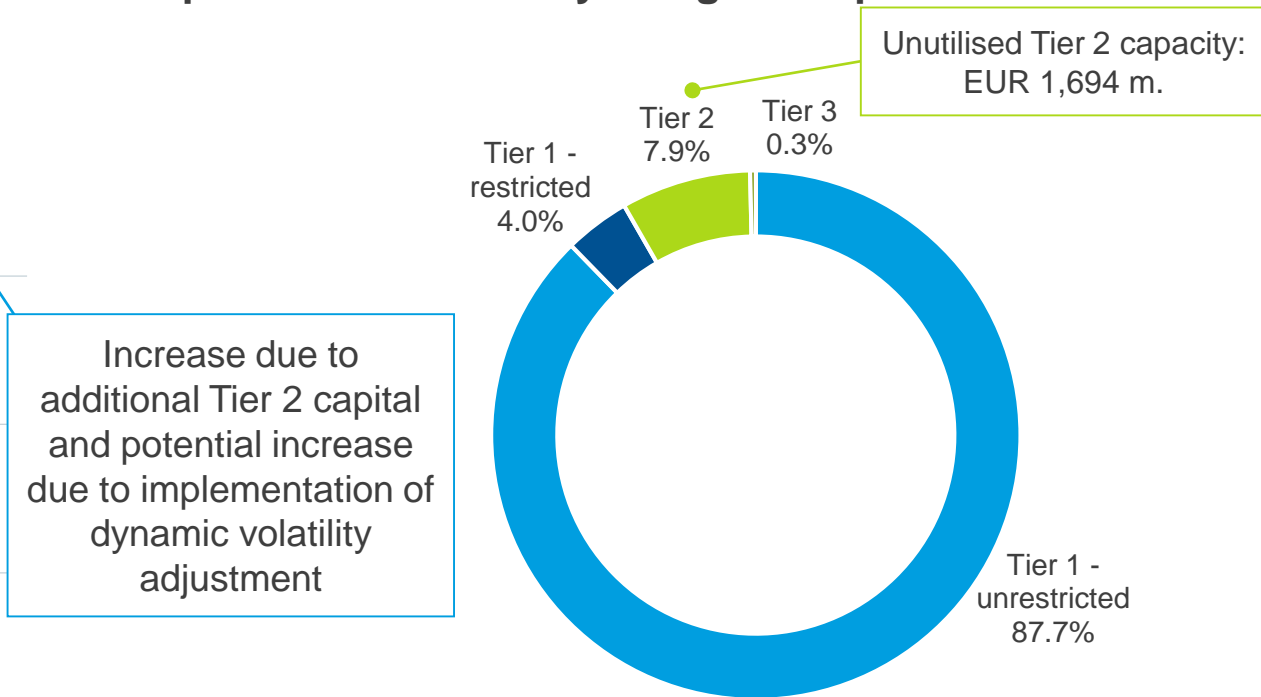
Stable buffer above capital targets

Increasing SCR reflects strong and diversified business volume growth

Development of Solvency II capital adequacy ratio



Composition of Solvency II eligible capital¹⁾



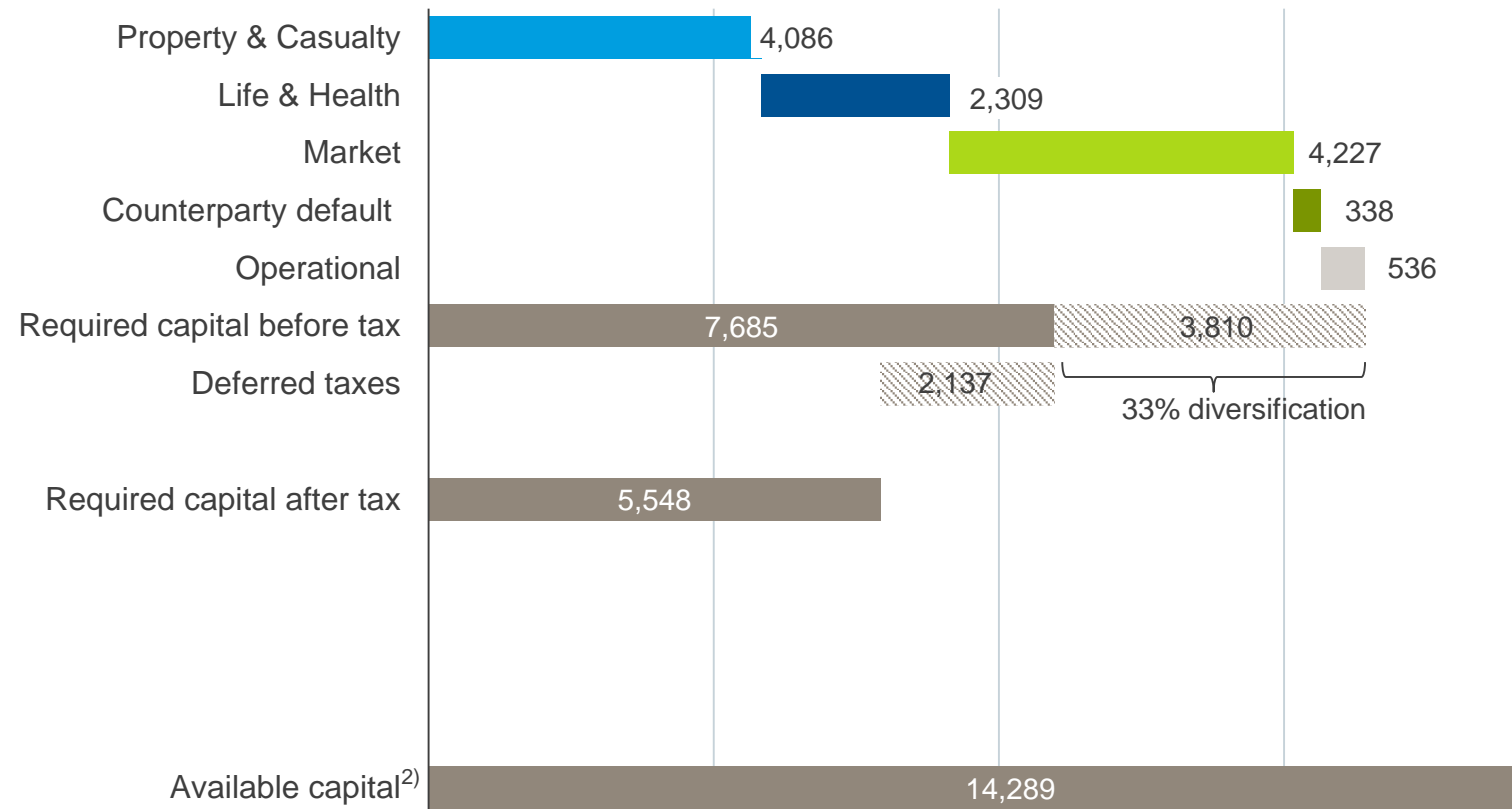
Figures in m. EUR
1) As at Q2/2019

Consistent high degree of diversification

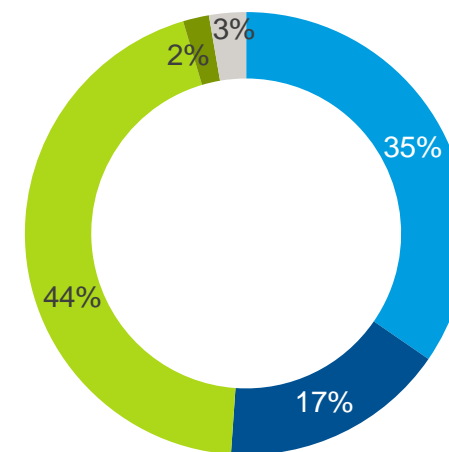
Breakdown of capital requirements and contribution analysis

Required capital at confidence level 99.5% (SCR¹)

in m. EUR



Capital allocation to risk categories³⁾



- Property & Casualty
- Life & Health
- Market
- Counterparty default
- Operational

As at 30 June 2019

1) SCR - Solvency Capital Requirements according to Solvency II internal model

2) Including minority interest

3) Allocation based on Euler principle and Tail-Value-at-Risk at confidence level 99%

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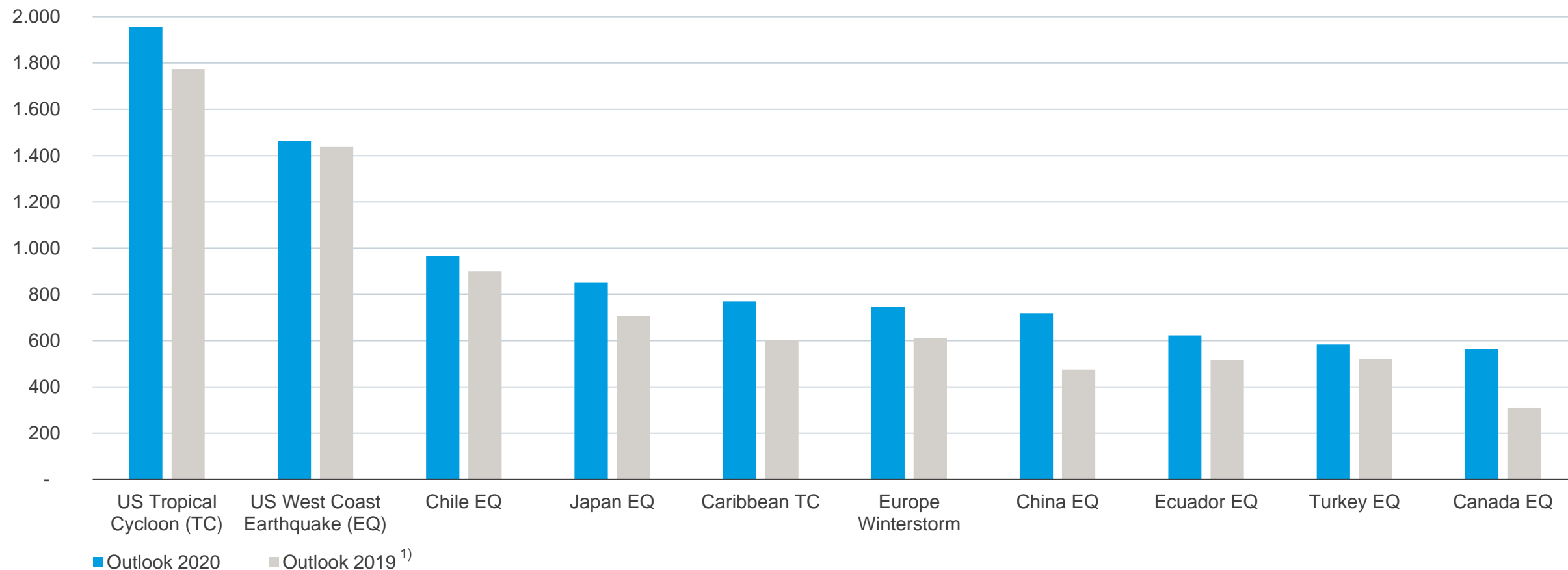
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Natural catastrophe exposure – peaks and diversification

Selective growth based on return-on-capital considerations

Required capital at confidence level 99.5% per peril/region (pre-tax)

in m. EUR

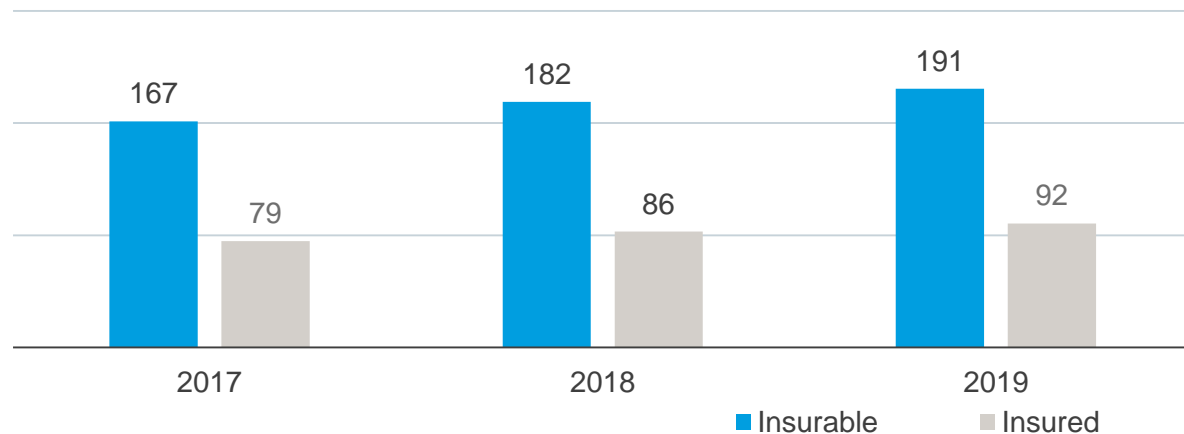


1) Outlook 2019 as of end 2018

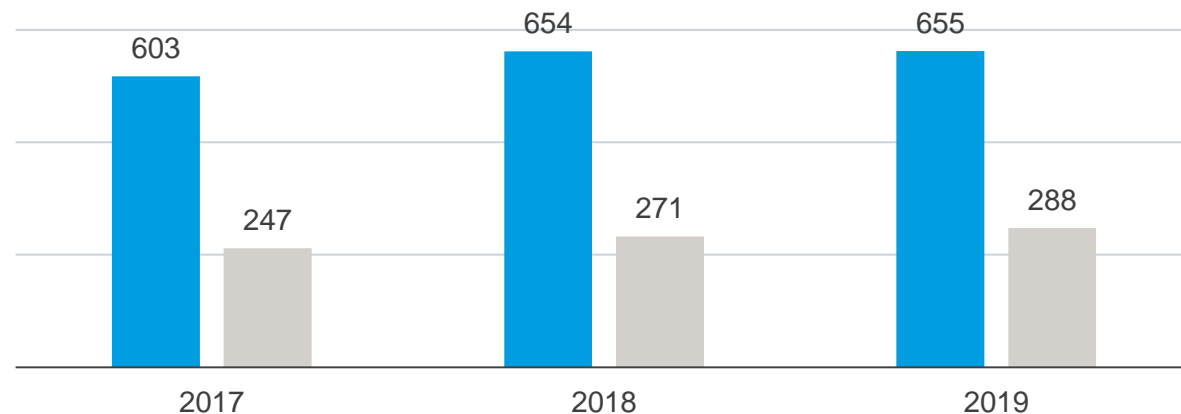
NatCat protection gap remains significant in all regions

Insurable vs. insured losses from natural catastrophes (models)

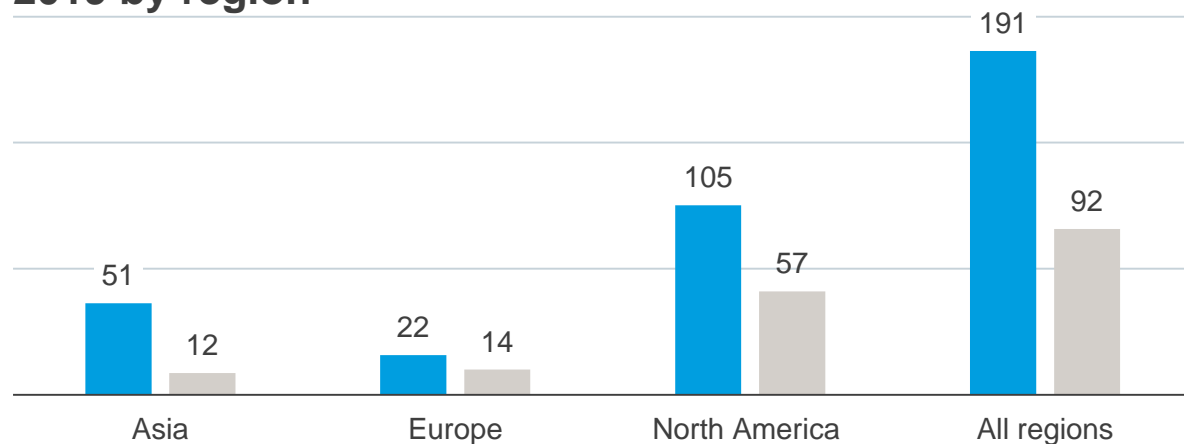
Average annual losses in bn. USD



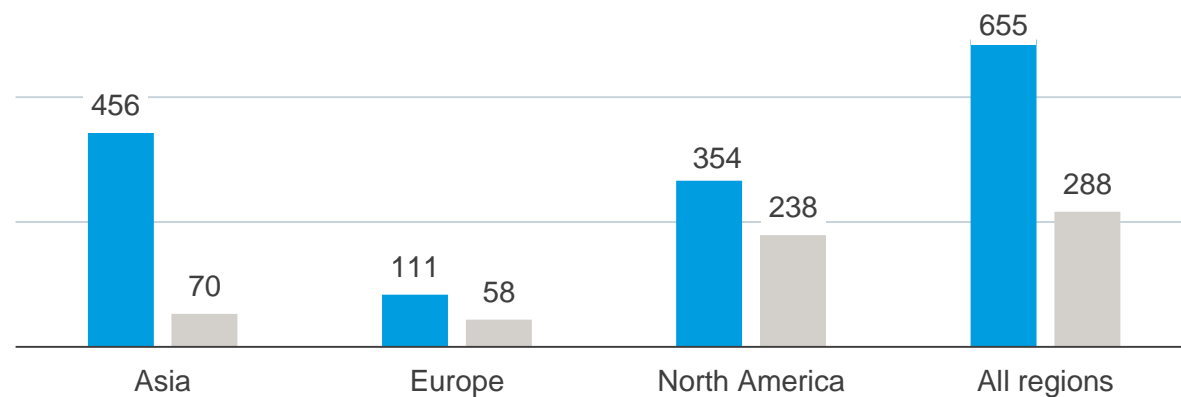
Losses in 100-year event in bn. USD



2019 by region



2019 by region

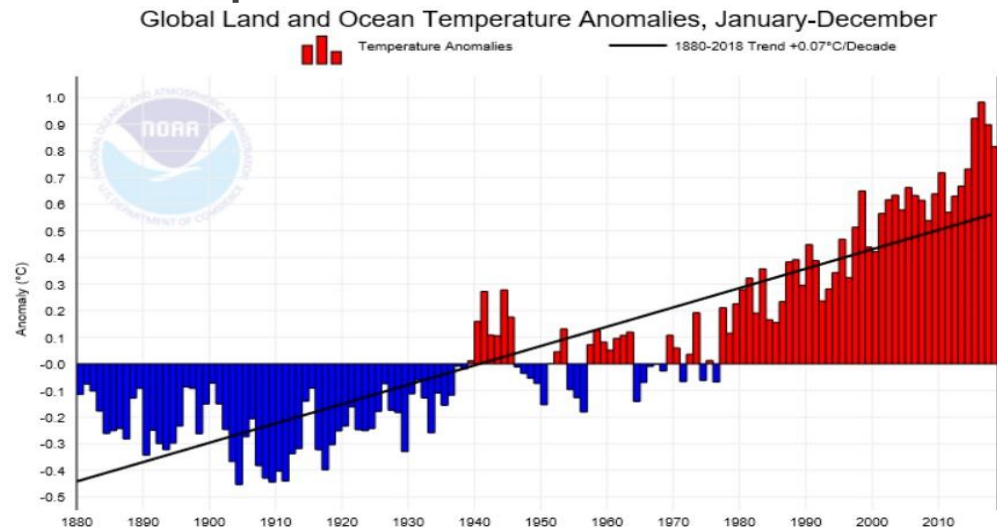


Source: 2019 AIR Worldwide "Global Modeled Catastrophe Losses"

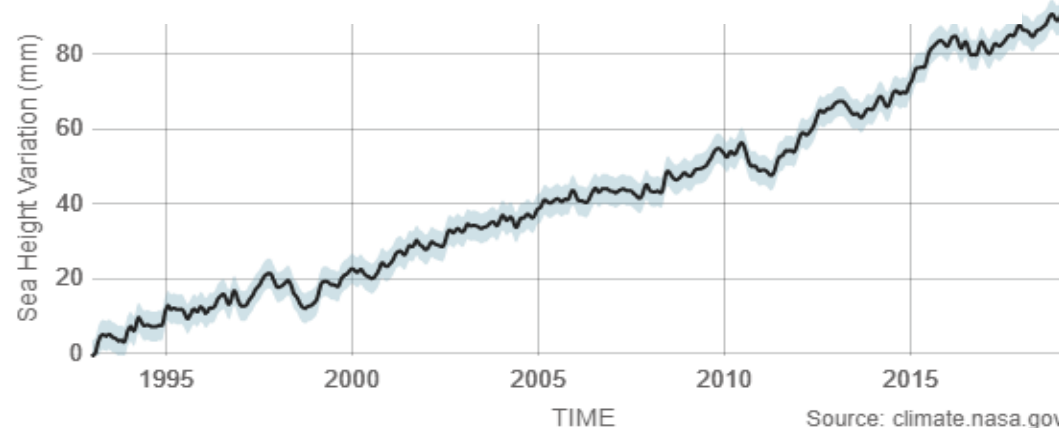
Climate change risk – selected observations

Change in progress

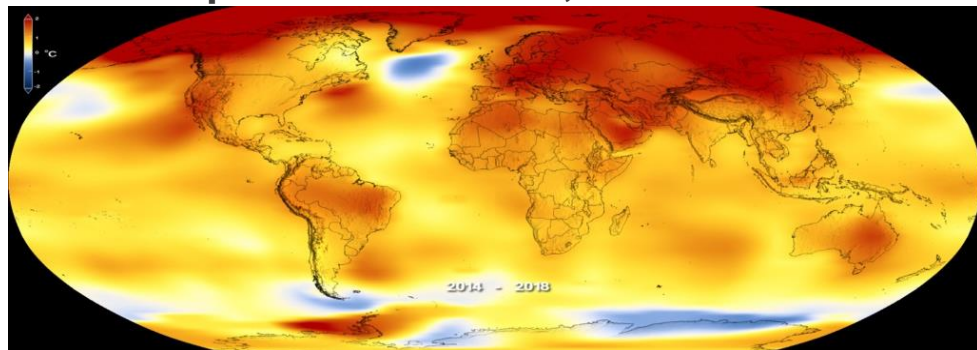
Global temperature increase since 1880



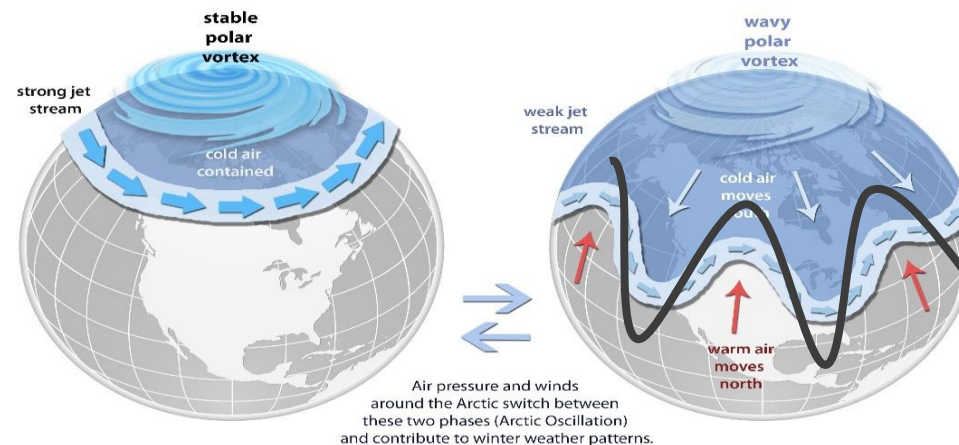
Sea level rise since 1995



Local temperature increase, 1951-1981 vs. 2013-2018



Jet stream variation

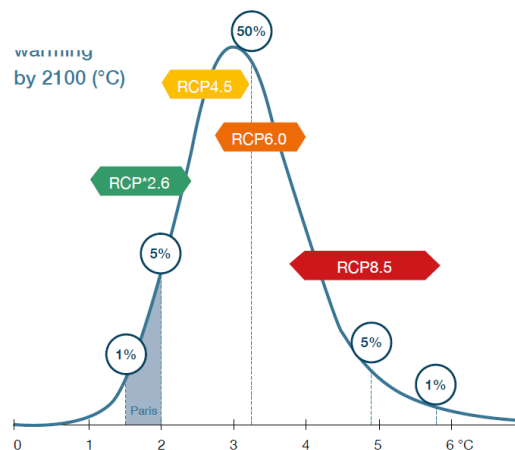


Source: <https://www.ncdc.noaa.gov/cag/global/time-series>; <https://www.noaa.gov/multimedia/infographic/science-behind-polar-vortex>; <https://svs.gsfc.nasa.gov/13142>; <https://climate.nasa.gov/vital-signs/sea-level/>

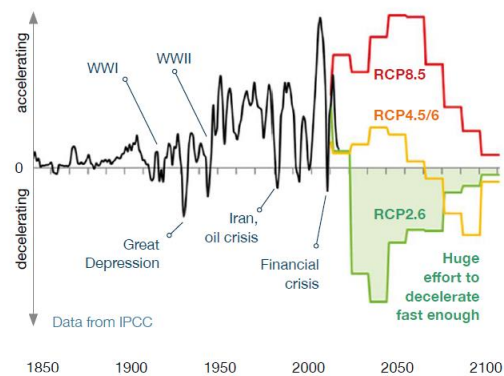
Significant challenges on any path to 2100

The scenarios

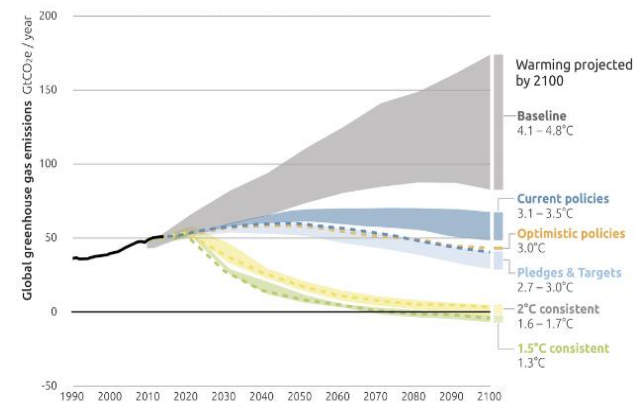
Probability of warming by 2100(°C)



Rate of acceleration of CO2 emissions over time



Emissions and expected warming pledged to policies



Fundamental scenarios

- **Road to Paris:** Fast and orderly transition to a low-carbon economy
- **Bumpy transition:** Disruptive and disorderly transition to a low-carbon economy
- **“End of civilisation”:** No transition to a low-carbon economy. Global temperature increases by 5°C or more









Sources: (1) CRO-Forum, The heat is on (2019),; (2) Intergovernmental Panel on Climate Change IPCC: AR5 Synthesis Report (2014); (3) Climate Action Tracker <https://climateactiontracker.org/> (2019)

The risk landscape

Natural catastrophes and beyond

Warming by 2100

Physical impacts

		<2 °C		3 °C	5 °C
		1.5 °C	2 °C		
	Sea-Level Rise (cm)	0.3-0.6 m	0.4-0.8 m	0.4-0.9 m	0.5-1.7 m
	Coastal assets to defend (\$tn)	\$10.2tn	\$11.7tn	\$14.6tn	\$27.5tn
	Chance of ice-free Arctic summer	1 in 30	1 in 6	4 in 6 (63%)	6 in 6 (100%)
	Tropical cyclones: Fewer (#cat 1-5)	-1%	-6%	-16%	Unknown
	Stronger (# cat 4-5)	+24%*	+16%	+28%	+55%
	Wetter (total rain)	+6%	+12%	+18%	+35%
	Frequency of extreme rainfall	+17%	+36%	+70%	+150%
	Increase in wildfire extent	x1.4	x1.6	x2.0	x2.6
	People facing extreme heatwaves	x22	x27	x80	x300
	Land area hospitable to malaria	+12%	+18%	+29%	+46%

The risk landscape

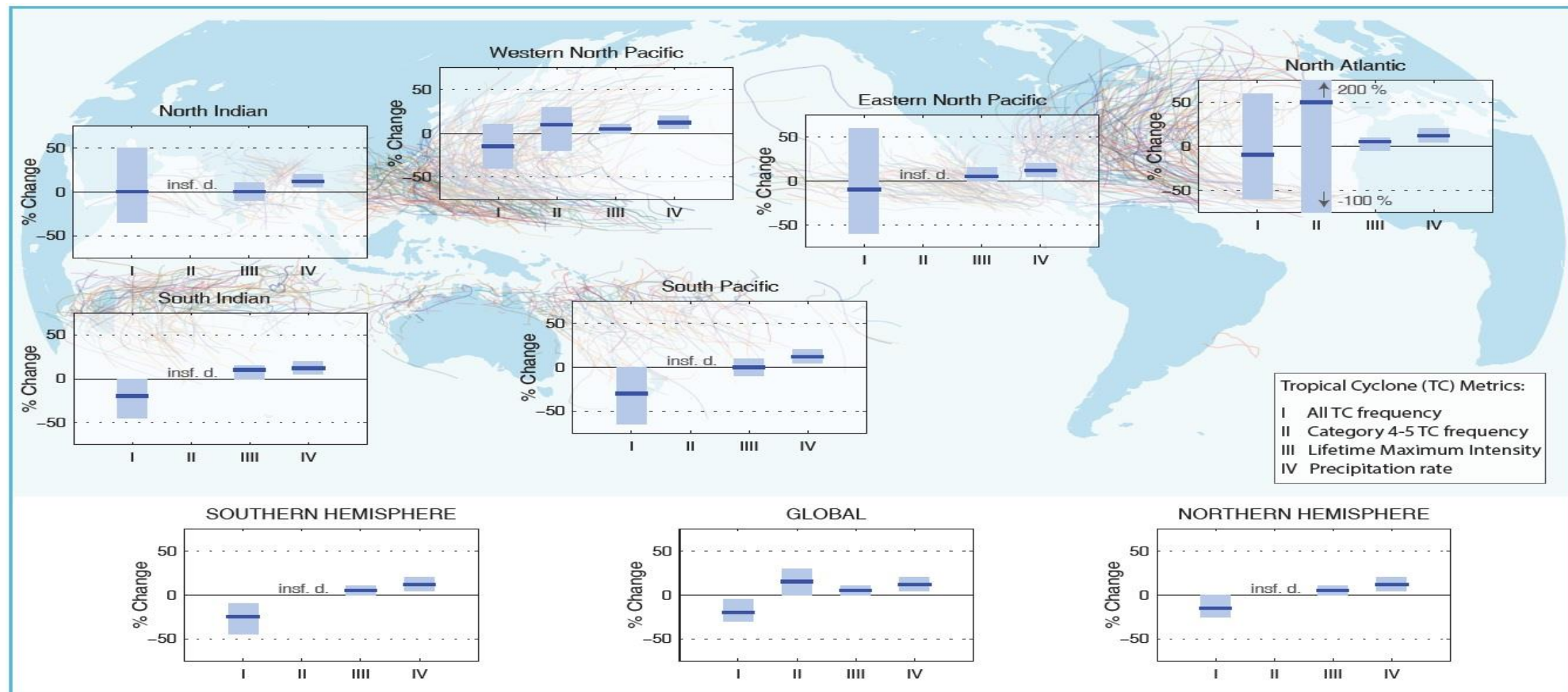
- Natural catastrophes
- Eroding biodiversity
- Liability arising
- GDP decline / economic risk
- Stranded assets / transition risk
- Pandemics / changing mortality rates
- Migration / political risk
- Food / water uncertainty
- Agricultural risks
- Reputational and conduct risk
- ... aspects beyond current research

... and the list of opportunities is at least as long as the list of risks

Source: CRO-Forum, The heat is on – insurability and resilience in a changing climate, 2019, based on IPCC data

Impact on tropical cyclones

No clear direction, yet, due to projection complexity and uncertainty



Source: IPCC report 2013

Climate change risk – conclusions

- Climate change is in progress and any path to 2100 – whether focusing on climate change prevention or adoption - bears significant risks (and opportunities). The speed of change is difficult to estimate, e.g. due to a number of self-inflating processes.
- Natural catastrophe protection remains a core element of re/insurance and a core element of Hannover Re's business model. Increasing uncertainties about the impact of climate change and the impact as it materializes may call for (technical) price increases (for selected exposure).
- Current natural catastrophe models incorporate the past impacts from climate change but no strong trends. The one-year time horizon of natural catastrophe protection helps to limit the impact of currently unknown effects.
- Closing the protection gap remains a challenge for both, the re/insurance industry and policy makers. More so in scenarios with larger temperature increases. Hannover Re contributes to a significant number of projects to address the current and future protection gap.

Agenda

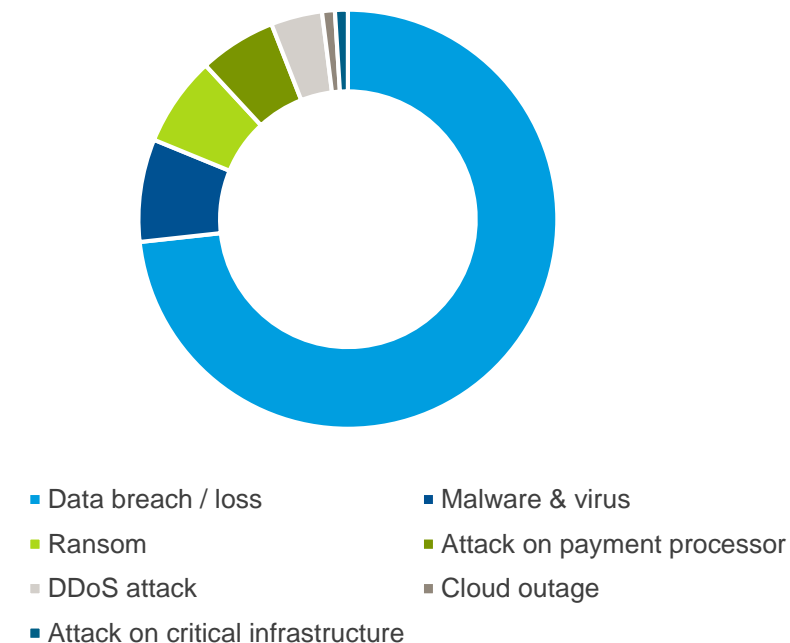
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The cyber risk landscape – threats and events

Name / Target	Year	Event Type	Attack outline	Economic loss ¹⁾	Insured loss ¹⁾
Yahoo	2013/4	Data Breach	3 billion email accounts compromised	\$120m	unknown
Dyn (DNS provider)	2016	DDoS	several websites temporarily unavailable	unknown	unknown
WannaCry	2017	Ransomware	over 200,000 machines in 150 countries affected	\$4bn	unknown
Equifax	2017	Data Breach	theft of social security numbers, credit card information, drivers license numbers...	\$1.4bn	\$125m
NotPetya	2017	Ransomware	several large manufacturers and service providers affected	\$10bn	\$3bn
Marriott	2018	Data Breach	383m sensitive records affected	\$1bn	\$500m
Norsk Hydro	2019	Ransomware	business interruption, switch to manual controls	\$75m	unknown

1) All figures are estimates, partially based on public sources

Hannover Re claim frequency dominated by data breaches



Cyber insurance and models

Insurance cover

First Party:

- Data / System Recovery
- Cyber Extortion
- Cyber Breach Remediation
- Network Interruption

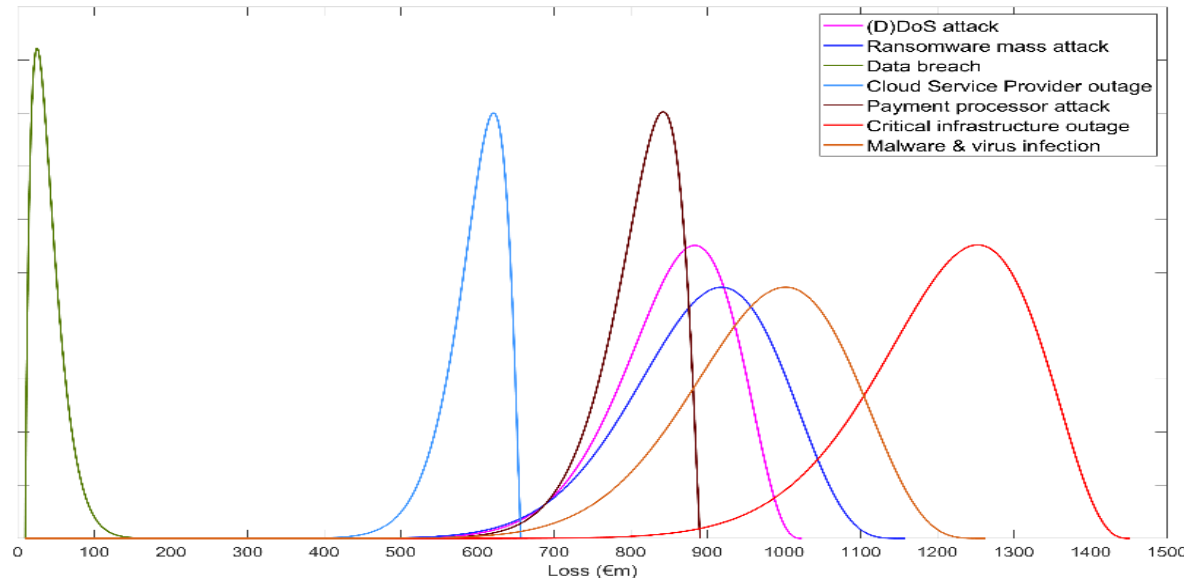
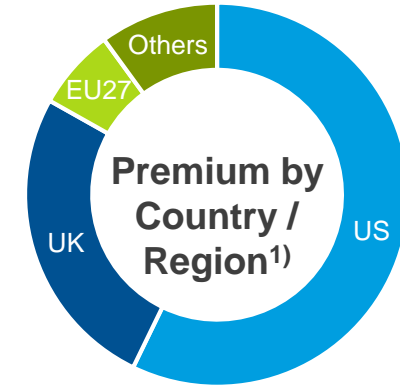
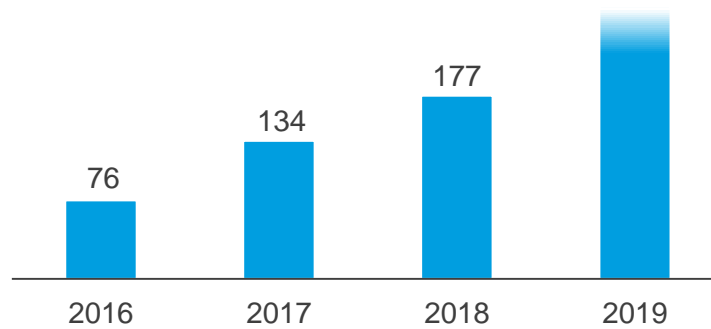
Third Party:

- Network Security Liability
- Privacy Protection Liability
- Media Liability

Features / challenges:

- Modular concept
- Wording differs by policy

Cyber GWP (U/Y) as of Jul 2019 in m. EUR



1) Cedant home country

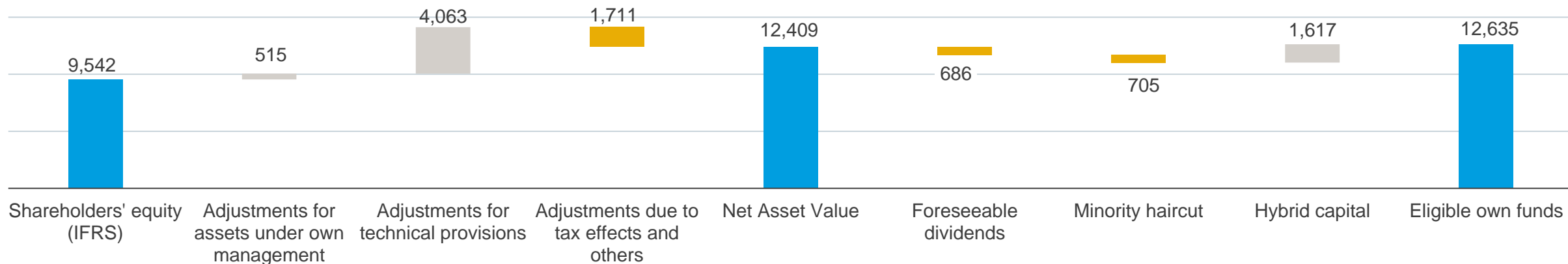
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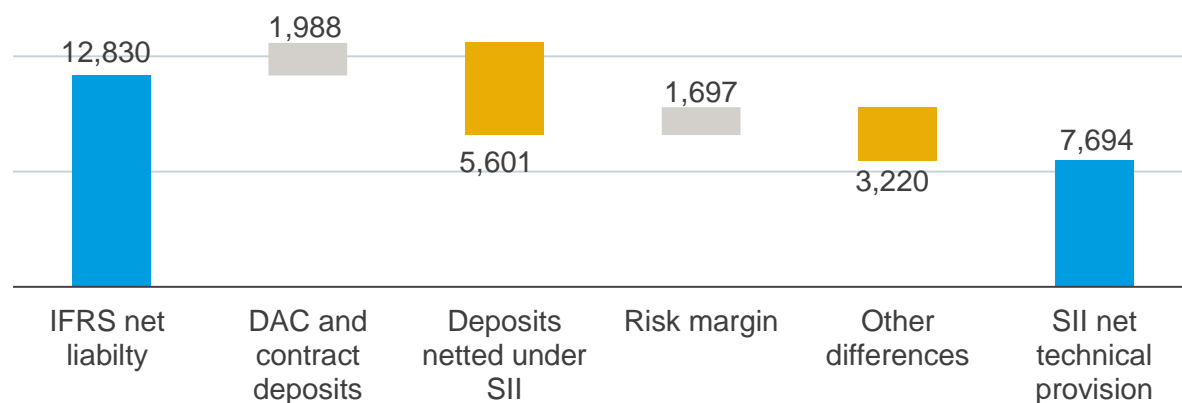
Reconciliation IFRS vs. Solvency II

Solvency II valuation based on current assumptions

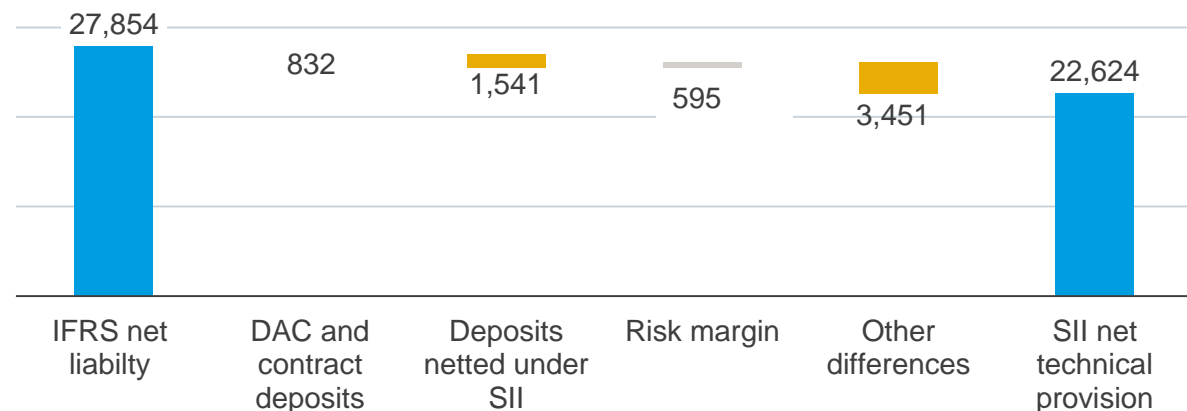
IFRS shareholders' equity vs. Solvency II eligible own funds



L&H technical provision: IFRS vs. Solvency II



P&C technical provision: IFRS vs. Solvency II



As at 31 December 2018; according to Solvency II year-end reporting, incl. minority interests, in m. EUR

Reserve redundancy reduced but remains at high level

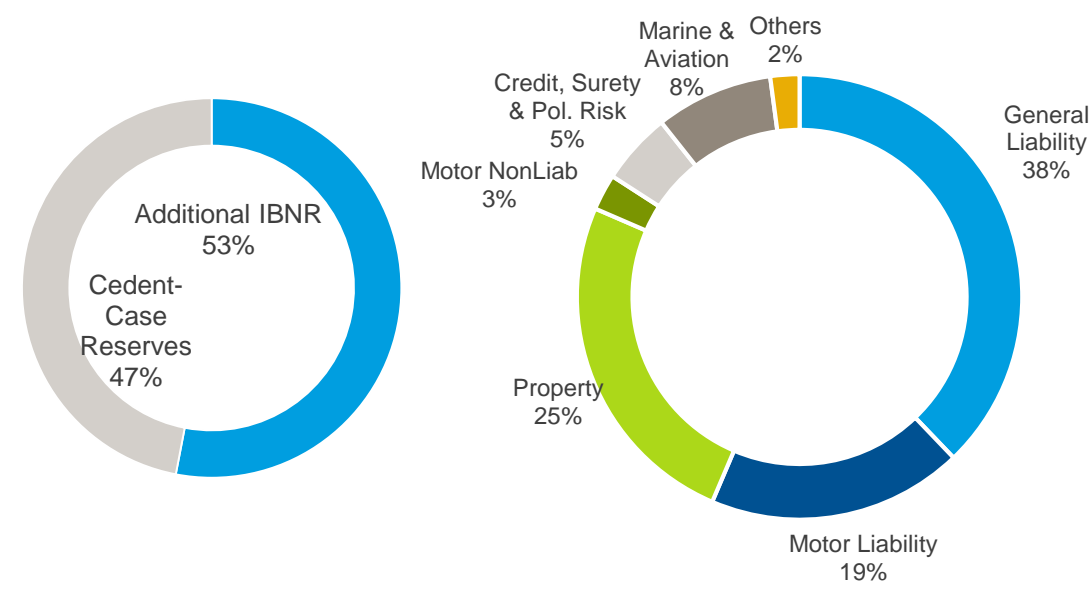
Level of additional IBNR remains above 50%

in m. EUR

Year end ¹⁾	Third-party estimate vs. booked ²⁾	Change	Impact on loss ratio	P&C premium (net earned)
2009	867	276	5.3%	5,230
2010	956	89	1.6%	5,394
2011	1,117	162	2.7%	5,961
2012	1,308	190	2.8%	6,854
2013	1,517	209	3.1%	6,866
2014	1,546	29	0.4%	7,011
2015	1,887	341	4.2%	8,100
2016	1,865	-22	-0.3%	7,985
2017	1,813	-52	-0.6%	9,159
2018	1,694	-118	-1.1%	10,804

Property & Casualty gross loss reserves³⁾

EUR 26,185 m.



1) Figures unadjusted for changes in foreign exchange rate, i.e. based on actual exchange rates at respective year end.

2) Redundancy of loss and loss adjustment expense reserve net of reinsurance for its non-life insurance business against held IFRS reserves, before tax and minority participations. Willis Towers Watson reviewed these estimates - see appendix

3) As at 31 December 2018, consolidated, IFRS, IBNR – Incurred but not reported

Details on reserve review by Willis Towers Watson

- The scope of Willis Towers Watson's work was to review certain parts of the held loss and loss adjustment expense reserve, net of outwards reinsurance, from Hannover Rück SE's consolidated financial statements in accordance with IFRS as at each 31 December from 2009 to 2018, and the implicit redundancy margin, for the non-life business of Hannover Rück SE. Willis Towers Watson concludes that the reviewed loss and loss adjustment expense reserve, net of reinsurance, less the redundancy margin is reasonable in that it falls within Willis Towers Watson's range of reasonable estimates.
 - Life reinsurance and health reinsurance business are excluded from the scope of this review.
 - Towers Watson's review of non-life reserves as at 31 December 2018 covered 96.9% / 98.6 of the gross and net held non-life reserves of €26.2 billion and € 24.2 billion respectively. Together with life reserves of gross €4.2 billion and net €4.0 billion, the total balance sheet reserves amount to €30.4 billion gross and €28.2 billion net.
 - The results shown in this presentation are based on a series of assumptions as to the future. It should be recognised that actual future claim experience is likely to deviate, perhaps materially, from Willis Towers Watson's estimates. This is because the ultimate liability for claims will be affected by future external events; for example, the likelihood of claimants bringing suit, the size of judicial awards, changes in standards of liability, and the attitudes of claimants towards the settlement of their claims.
 - The results shown in Willis Towers Watson's reports are not intended to represent an opinion of market value and should not be interpreted in that manner. The reports do not purport to encompass all of the many factors that may bear upon a market value.
 - Willis Towers Watson's analysis was carried out based on data as at evaluation dates for each 31 December from 2009 to 2018. Willis Towers Watson's analysis may not reflect development or information that became available after the valuation dates and Willis Towers Watson's results, opinions and conclusions presented herein may be rendered inaccurate by developments after the valuation dates.
 - As is typical for reinsurance companies, claims reporting can be delayed due to late notifications by some cedents. This increases the uncertainty in the estimates.
 - Hannover Rück SE has asbestos, environmental and other health hazard (APH) exposures which are subject to greater uncertainty than other general liability exposures. Willis Towers Watson's analysis of the APH exposures assumes that the reporting and handling of APH claims is consistent with industry benchmarks. However, there is wide variation in estimates based on these benchmarks. Thus, although Hannover Rück SE's held reserves show some redundancy compared to the indications, the actual losses could prove to be significantly different to both the held and indicated amounts.
 - Willis Towers Watson has not anticipated any extraordinary changes to the legal, social, inflationary or economic environment, or to the interpretation of policy language, that might affect the cost, frequency, or future reporting of claims. In addition, Towers Watson's estimates make no provision for potential future claims arising from causes not substantially recognised in the historical data (such as new types of mass torts or latent injuries, terrorist acts), except in so far as claims of these types are included incidentally in the reported claims and are implicitly developed.
 - In accordance with its scope Willis Towers Watson's estimates are on the basis that all of Hannover Rück SE's reinsurance protection will be valid and collectable. Further liability may exist for any reinsurance that proves to be irrecoverable.
 - Willis Towers Watson's estimates are in Euros based on the exchange rates provided by Hannover Rück SE as at each 31 December evaluation date. However, a substantial proportion of the liabilities is denominated in foreign currencies. To the extent that the assets backing the reserves are not held in matching currencies, future changes in exchange rates may lead to significant exchange gains or losses.
 - Willis Towers Watson has not attempted to determine the quality of Hannover Rück SE's current asset portfolio, nor has Willis Towers Watson reviewed the adequacy of the balance sheet provisions except as otherwise disclosed herein.
- In its review, Willis Towers Watson has relied on audited and unaudited data and financial information supplied by Hannover Rück SE and its subsidiaries, including information provided orally . Willis Towers Watson relied on the accuracy and completeness of this information without independent verification.
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