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Climate risks in the own risk and solvency assessment

A sensible approach to integration into strategic management

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How can the risk horizon of climate developments, which span several decades, be harmonised with the management horizon of insurance and reinsurance undertakings? We provide possible answers to this central question in this white paper. We focus on its meaningful integration into the strategic management of insurance and reinsurance undertakings, so that this risk observation can result in benefit for the undertaking and sustainability becomes reality. We consider the following aspects:

- The long-term path of possible climate development as a starting point
- Classifying climate risks as a possible material risk on the reference date
- The forward-looking perspective in the own risk and solvency assessment with a mid-term time horizon
- Stress tests and scenario or sensitivity analyses over different time horizons

To demonstrate that climate risks can be integrated into the strategic management of insurance and reinsurance undertakings, this discussion is concluded with two practical examples.

Requirements for the consideration of climate risks

In recent years, climate change and its consequences have received growing attention from the public, political actors and companies. The German Federal Financial Supervisory Authority (BaFin) has declared “sustainable finance” as one of the four supervisory priority topics for 2020 and announced that ESG risks are to be systematically identified and addressed by existing supervisory instruments as early as next year.

At European level, based on the recommendations of a High-Level Expert Group (HLEG), the European Commission launched an extensive work program in March 2018. In addition to refocusing capital flows on sustainable investment and promoting transparency and the long-term nature of economic activities, the action plan for financing sustainable growth also aims to integrate sustainability risks into risk management. In this context, the European Insurance and Occupational Pensions Authority (EIOPA) received several mandates from the European Commission in 2018 to include sustainability risks in the European Insurance Supervisory Framework (Solvency II and the Insurance Distribution Directive IDD). Corresponding EIOPA recommendations were published in 2019 in a Technical Advice [1]. According to the Technical Advice, sustainability risks must be included, particularly in the risk management areas of (a) underwriting and reserving and (b) investment risk management. Furthermore, measures must be taken by the insurance and reinsurance undertakings to ensure appropriate identification, assessment and management of these risks. In addition, EIOPA recommends that the Delegate Regulation explicitly refers to accounting of sustainability risks, including climate change, when assessing the undertaking’s overall solvency needs.

The own risk and solvency assessment (ORSA) is highlighted by EIOPA as a central process for assessing climate risks. This is justified by the key role of the ORSA process in risk management. Due to the characteristic features of climate and environmental risks, including

- extended time horizons,
- far-reaching effects, and
- strong dependence on political measures,

long-term scenario analyses are recommended as an effective tool for strategic planning and risk assessment [2].

It is precisely in the context of these requirements that a novel form of climate stress testing is needed in order to harmonise the time horizons of climate developments with the management horizons of strategic management. The frequent lack of implementation of these climate stress tests is criticised by BaFin in its horizontal analysis of the ORSA reports[1]. Therefore, we would like to illustrate in the following that climate risks can also be seamlessly and sensibly integrated into existing tools for strategic management.

Integration of climate risks into the strategic management process

The value contribution of integrating climate risks into the strategic management process depends on whether meaningful management measures can be generated within the established steering committee of an insurance or reinsurance undertaking. Even if climate risks only manifest themselves beyond the conventional three to five year planning or management horizons of an insurance or reinsurance undertaking, they certainly have an impact on business strategy via modelling and planning assumptions, e.g.

- Long-term effects over several decades are already taken into account today in the underwriting of an insurance or reinsurance undertaking, e.g. in the area of premium calculation.
- In the case of long-term investments, projected developments over the next 20-30 years are included in the current valuation. For example, in the discounted cash flow (DCF) method, changes in expected payments over

1 See https://www.bafin.de/SharedDocs/Veroeffentlichungen/DE/Fachartikel/2020/fa_bj_2007_Ergebnisse_ORSA_VA

the next 20-30 years or changes in long-term discount factors already affect the present value today. However, this effect depends strongly on the underlying interest rate: the lower the long-term interest rate, the higher the materiality of this effect.

A closer look shows that it is essentially a question of the compatibility of different time horizons:

- The planning horizon on which the asset and liability sides can be sensibly planned. This horizon is usually three to five years[2].
- The strategic horizon, which may well extend beyond several decades, but over which there is no detailed planning of assets and liabilities that is sufficient for quantification.
- The time horizon involved in the valuation of (long-term) assets and underwriting risks, which can easily extend over several decades.
- The horizon of the modelled climate scenarios, which can extend far into the future until 2050 or beyond.

In the own risk and solvency assessment process, established tools for strategic management are available, which should be used as a basis for a meaningful mapping of climate risks to the various horizons outlined in ORSA (see Figure 1).

A central requirement for measuring the overall solvency needs in ORSA and for determining the Solvency Capital Requirement using internal models is that all material risks, to which the insurance and reinsurance undertakings are exposed, must be included. A frequently used instrument for quantifying risks and classifying them as a material risk is instantaneous stress testing, which allows a long-term accumulated effect to take effect immediately (see line "Identification of material risks" in Figure 1). Similarly, other instantaneous shocks could also be taken into account, such as the regulatory stress tests "technology shock" and "policy shock" of the Dutch central bank De Nederlandsche Bank NV (DNB) [4], which include as scenario narratives, a sudden and disorderly transition to a low-carbon economy. In these instanta-

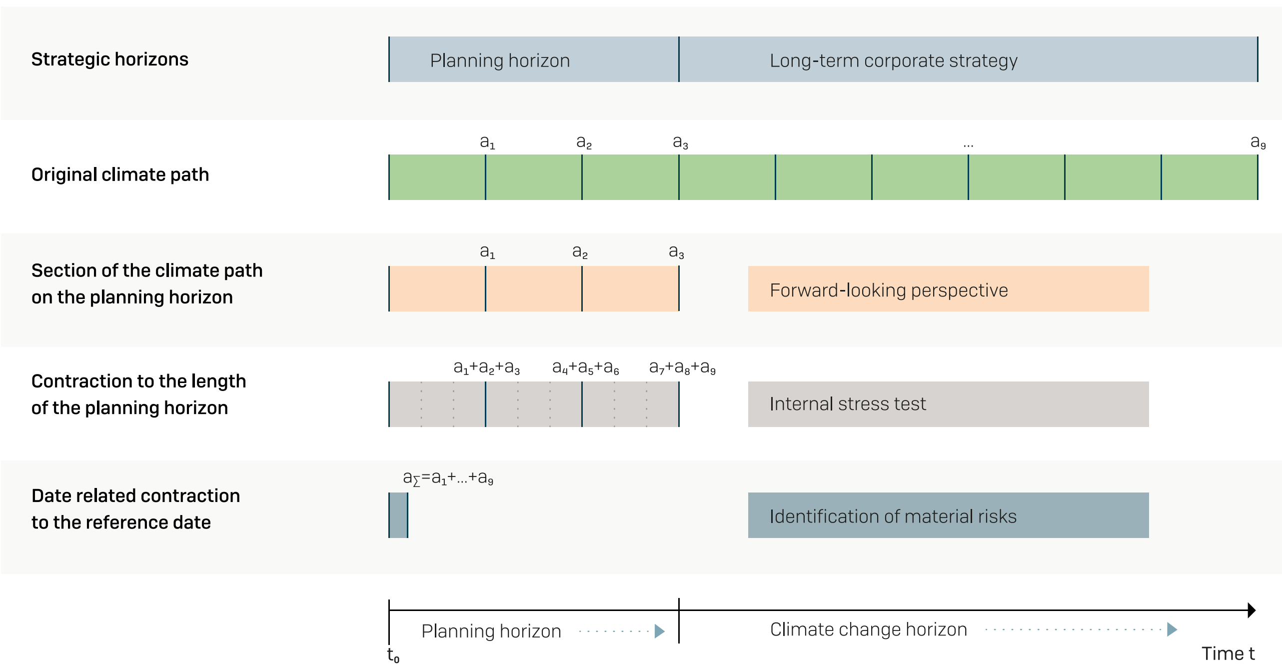

Figure 1: Projection of the long-term climate path and the associated shifts (a_i) on the planning horizon in ORSA's forward-looking perspective, for the identification of material risk, and in internal stress tests.

2 According to the interpretation decision of BaFin [3], the planning horizon of an insurance or reinsurance undertaking is generally three to five years.

neous stress tests, the risk factors are deflected in leaps and bounds. The effects are calculated on the assumption of a constant portfolio. It is important to note that, despite this short-term view, long-term climate effects may well play a role in the valuation models of assets and underwriting risks: on the assets side, the cash flow profile of long-term assets can be affected by climate effects, which in turn has an impact on the current value of the assets. On the liabilities side, in life insurance, for example, mortality changed by long-term climate effects is taken into account through adjusted mortality tables.

The overall solvency needs are assessed in ORSA beyond the valuation date over the entire planning horizon in a base scenario and under adverse scenarios. From this forward-looking perspective, insurance and reinsurance undertakings assess not only their risks at the reference date, but also the risks to which it is or might be exposed in the longer term. The forward-looking assessment also includes the measures taken by management under the respective assumptions of the scenarios in accordance with the company's business strategy. Therefore, estimates of changes in the portfolio and risk structure due to climate risks would be included in this analysis. The climate scenario is effectively cut off at the end of the planning horizon.

An extension of the forward-looking perspective to a horizon beyond five or even ten years seems implausible with regard to dynamic balance sheet modelling, because the usual planning uncertainty would then outweigh the informative value of quantitative projections[3]. However, certain climate effects (physical and/or transitory) can be taken into account in an adverse scenario, if their effects on the planning horizon can be reasonably and consistently quantified. If climate risks are explicitly included in the calculation of the Solvency Capital Requirement, this procedure can also be used in the context of continuous compliance with regulatory capital requirements in ORSA.

Climate scenarios can be reflected not only in the assessment of an undertaking's overall solvency needs but also in internal stress tests as a supplementary management component. Here, the challenge also lies in the question of whether and how dynamic balance modelling over a reasonable period of time can be reconciled methodologically and consistently with long-term climate scenarios. According to the explanations above, modelling the climate stress test horizon beyond five or even ten years appears implausible with regard to dynamic balance sheet modelling. Therefore, for a suitable integration of the long-term climate paths into the horizon of the risk assessment, it makes sense to compress the effects of the long-term climate paths for consideration in the stress test. For example, if the contraction is uniform, the sum of the shifts is distributed over the planning horizon (see line "Internal stress test" in Figure 1). Management measures and portfolio reallocations are considered up to the planning horizon in order to avoid the usual artifacts of a purely static balance sheet view. In this (conservative) assumption, long-term effects and realistic balance sheet assumptions can thus be agreed. The assumption of a "snapshot of risks" and "forward looking" [5] approach, which essentially amounts to a static balance sheet and a roll-out of losses to a 30-year horizon, is quantitatively less meaningful than the compression approach described above.

Another approach for integrating climate risks into the risk management process of companies is management through sensitivity analyses. In this approach, the main risk drivers of climate stress tests are first identified, e.g. using the NGFS Climate Scenario toolkit[4]. Examples of the main drivers of transitory risks include, amongst others, the price of CO2 and energy as well as the energy mix, and for physical risks the average surface temperature and the sea level height. The sensitivity of the portfolio to the main risk drivers identified along the planning horizon is determined using dynamic balance sheet modelling, e.g. the change in value of the portfolio if the price of CO2 increases by one dollar per ton, or the change in mortality if the average surface temperature increases by one degree Celsius. For this purpose, the portfolio can be broken down by country, region or industrial sector and the robustness of the countries, regions or industrial sectors to changes in the main risk driver under consideration can be analysed. A measure of robustness can be, for example, the so-called TVF (transition vulnerability factor). The calculation of the TVF based on the carbon footprint of the individual industrial sectors is described in [4].

In both approaches, it should be noted that depending on the assumptions or compression of the effects, the absolute results are not necessarily meaningful. The management must rather focus on relative changes over time. Such analyses enable statements to be made on the risk structure of the portfolio and its development over time, from which helpful impulses for business management can be derived.

In summary, the consideration of climate risks is entirely compatible with the current methodology of strategic management, ideally as a complementary triad of the methods described above:

- A time-consistent modelling of climate effects and management measures as well as portfolio allocations on the planning horizon. The method, particularly suitable

3 See also „but it is not feasible for participants to project cumulative losses (and management actions) over a 30-year scenario." in [5], p. 18

4 https://www.ngfs.net/en/publications/ngfs-climate-scenarios

for the forward-looking perspective in ORSA, includes the best possible portfolio modelling. However, climate risks are only partially modeled because of their longer time horizons.

- The compression of climate risks on the planning horizon or to instantaneous shocks. In addition to the best possible portfolio modelling, all climate risks of the scenario are covered by this method, but the time axes of the scenario and the long-term climate path are inconsistent.
- The determination of the portfolio's sensitivity structure to climate risk factors.

The assessment of the time course of absolute and relative effects of these three complementary methods results in an adequate reporting for strategic management.

Practical example: Investment portfolio corporate bonds

The complementary triad of methods is first outlined by using an investment portfolio of corporate bonds with high exposure in the energy supply sector and a planning horizon of five years as an example. As described in the previous sections, management measures and portfolio allocations up to the planning horizon are included.

Since the energy supply sector has a unfavorable relationship between gross value added and CO2 emissions as shown in Figure 2, the price of CO2 could be classified as an important risk driver for the investment portfolio. The next step is to examine whether a change in the price of CO2 represents a material risk for the investment portfolio. To achieve this, the investment portfolio is subjected to an instant stress test, in which the price of CO2 rises by 100 dollars per ton as part of a sudden and disorderly transition to a low-carbon economy. This scenario is subject to exceptional but plausible macroeconomic assumptions as described in [4].

In addition, the scenario narrative is based on a steady increase in the price of CO2 by 180 dollars per ton over 30 years, i.e. an annual increase of 6 dollars per ton per year. The steady increase of 180 dollars per ton is contracted to the company's planning horizon, i.e. an increase of 36 dollars per ton is assumed for each year in the planning horizon (see line "Internal stress test" in Figure 1). Taking into account management measures and portfolio allocations up to the planning horizon, the stress test result is determined. The relative change in this stress test result over time is then used as a management parameter in internal stress testing. Accompanying this, the relative change in sensitivity to the price of CO2 can be regarded as a management parameter.

In the forward-looking perspective of overall solvency needs, only the first 5 years of the steady increase in the price of CO2 by 180 dollars per ton over 30 years are considered, i.e. the scenario is truncated at the end of the planning horizon (see line "Forward-looking perspective" in Figure 1). Thus, the existing adverse scenarios are extended by a uniform increase in the price of CO2 by 5*6=30 dollars per ton over the planning horizon and the overall solvency needs are calculated along the extended adverse scenarios.

CO_2 emissions (Mt)	Economic activities NACE Rev. 2	Gross value (EUR billions)
95	Agriculture, forestry and fishing	219
26	Mining and quarrying	44
744	Manufacturing	2.058
926	Electricity, gas, steam and air conditioning supply	212
36	Water supply, sewerage and waste management	112
64	Construction	647
66	Wholesale and retail trade	1.372
14	Accommodation and food service activities	351
452	Transportation and storage	599
11	Financial and insurance activities	541
5	Real estate activities	1.301
15	Professional, scientific and technical activities	796
18	Administrative and support service activities	559
24	Public administration and defence; compulsory social security	778
15	Education	588
25	Human health and social work activities	889
7	Arts, entertainment and recreation	159
8	Other service activities	199

Figure 2: CO_2 emissions and gross value added in the EU in 2018, **Source:** Eurostat

Practical example: Life insurance

Considering a life insurer as an example, the following illustrates a possible first step towards implementing the method triad described above: many scientific studies show that mortality increases with the average surface temperature. In a study [6] Gasparri et. al have quantified this effect along the Representative Concentration Paths (RCP) of the IPCC [7] for different regions (see Figure 3).

Based on these study results, an instantaneous stress test can be defined for each Representative Concentration Path: first, the mortality tables are adjusted according to the excess mortality along the Representative Concentration Path. The underwriting risk is then recalculated based on the new mortality tables. The effects of the instantaneous stress tests on the Solvency Capital Requirement, the overall solvency needs or the premium calculation can serve as management parameters. By restricting possible climate impacts to mortality probabilities in the example, climate risks can be integrated into the ORSA process in a timely manner. In this way, a first step towards the comprehensive mapping of climate risks can be implemented with low effort.

We support you

Our methodological teams are available for exchange at any time and will be happy to develop a customised approach that allows you to realistically consider climate risks.

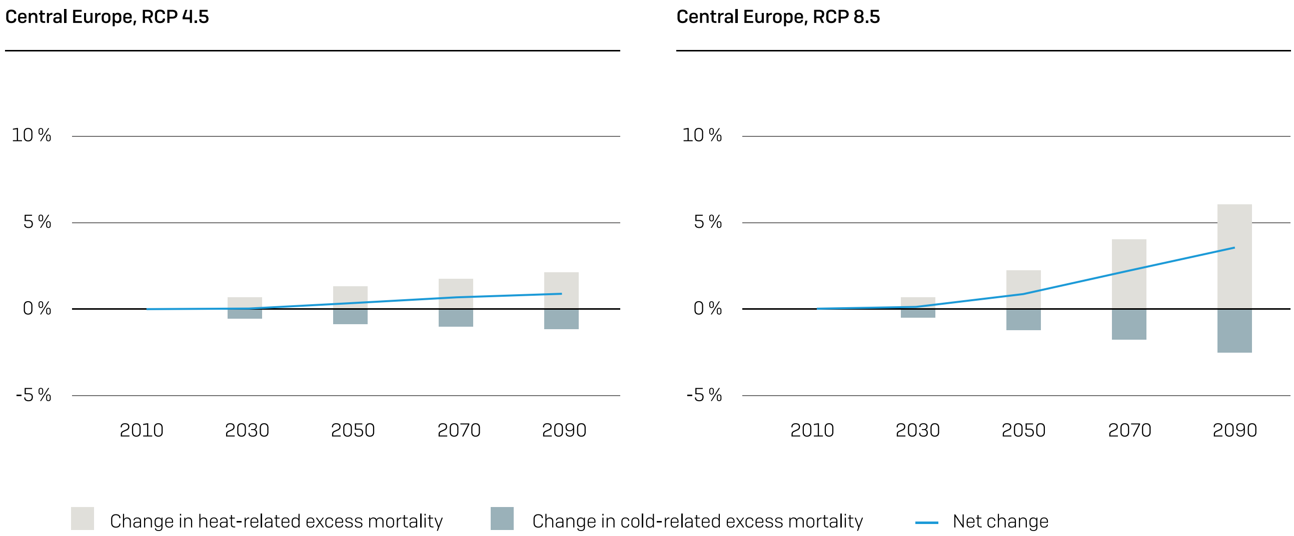

Figure 3: Change in mortality due to temperature changes, compared with 2010-2019 [6]. The change is shown along the Representative Concentration Paths 4.5 and 8.5 of the IPCC [7].

Appendix

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