
Climate risks in ICAAP and stress tests?

A sensible approach to integration
into bank management.

How can the risk horizon of climate developments, which span several decades, be harmonised with the management horizon of banks? We try to answer this central question in this white paper. We focus on its meaningful integration into bank management, so that this risk management topic adds value to the institution overall and sustainability becomes reality. We consider the following aspects:

- The long-term path of possible climate developments as a starting point
- The normative perspective based on capital planning with a mid-term horizon
- The economic perspective with its rather reference date-based approach
- Stress tests and scenario or sensitivity analyses over different horizons

To demonstrate that climate risks can be integrated into the management of a bank, 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. Within the framework of the revised capital requirements of the EBA, the European legislators have issued several mandates in connection with the inclusion of ESG risks in the three pillars of the Basel III supervisory framework, placing climate risks in particular as a supervisory focus. 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. The ECB is also building upon the work of the Network for Greening the Financial System (NGFS) [2] in its joint consultation with NCAs on a guide [1] on risk management and disclosure of climate and environmental risks, which sets out 13 supervisory expectations in total. The ECB considers this guide complementary to the ECB Guide on the internal capital adequacy assessment process [3]. Institutions are asked to assess the potential impact of these risks on their capital adequacy from both a normative and an economic perspective. 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. Accordingly, the guide expresses the expectation that the resilience of current business models to climate and environmental risks requires a longer-term assessment with a number of future scenarios beyond the typical business-planning horizon (> five years).

Within the framework of the ICAAP, the supervisory authorities expect two perspectives, a normative as well as an economic, to be implemented. While the normative perspective attempts to answer the question of whether an institution meets the regulatory requirements over a multi-year horizon even under adverse conditions, the economic perspective poses the question of covering all economic risks over a one year horizon. The economic perspective does not necessarily employ scenario analyses, but frequently uses methods of daily risk management, such as the value-at-risk, to determine internal capital requirements.

In contrast, the normative perspective essentially corresponds to a scenario calculation in which at least two scenarios must be considered. These scenarios should be consistent with other internal processes, especially the business and capital planning process, in their design and the multi-year horizon considered. In the normative perspective, the typical multi-year horizon considered is three to five years. Quantifying risks in the form of stress scenarios in internal stress tests also presents the possibility for specifically mapping wide-ranging adverse developments and including them in bank management.

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 those of bank management. In the following, we would like to illustrate that climate risks can also be seamlessly and sensibly integrated into existing tools for bank management.

Sensible approaches to integration into bank management

The value contribution of integrating climate risks into bank management depends on whether meaningful management measures can be generated within the established management processes of a bank. Even if climate risks only manifest themselves beyond the conventional three to five year planning or management horizons of a bank, they can also have a short-term impact on bank management:

- Long-term effects over several decades are taken into account in the bank's strategy today and lead to a reallocation in the bank's balance sheet before the obvious effects can even be measured in the classic risk parameters.
- In a present-value consideration, such as in the economic perspective of the ICAAP, changes in cash flow forecast for long-term investments in 20 to 30 years or changes in long-term discount factors already affect the present value today. However, this effect strongly depends on the underlying discount rate: the lower the long-term interest rate and therefore the discount rate, the higher the materiality of this effect.

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

- The planning horizon over which the portfolio composition can be planned reasonably, and thus the question of the balance sheet assumption (static or dynamic). This horizon is usually three to five years.

- The strategic horizon, which may well extend beyond several decades, but over which there is no detailed portfolio planning that is sufficient for quantification.
- The cash flow horizon resulting from the valuation of (long-term) assets, 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 overall bank management and especially in the ICAAP, established tools are available, which should be used as a basis for a meaningful mapping of climate risks to these various horizons in accordance with the requirements of, for example, the different perspectives in the ICAAP (see Figure 1):

In the normative perspective, capital ratios in the scenarios are rolled out. Moreover, the RWA and the balance sheet figures change and subsequently the regulatory capital in accordance with the business and capital planning and in accordance with the scenarios. In order to check compliance with regulatory ratios in a meaningful way, there should be as much consistency as possible between all portfolio and ratio changes and planning and scenario effects. Therefore, estimates of changes in the portfolio and risk structure due to climate risks should be included in this analysis. The climate scenario is hereby effectively cut off at the end of the planning horizon. An extension of the normative perspective to a horizon beyond 5 or even 10 years seems implausible because the unavoidable planning uncertainty would then outweigh the informative value of quantitative projections and capital considerations. However, certain climate effects (physical and/or transitory) can be taken into account in

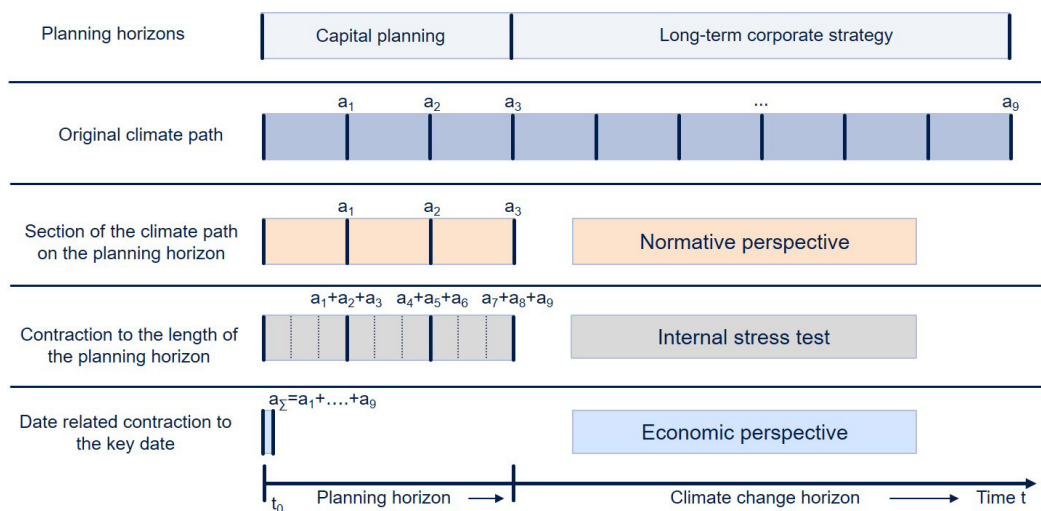


Figure 1: Projection of the long-term climate path and the associated shifts (ai) on the planning horizon in the normative and economic perspective, and in internal stress tests.

an adverse scenario, if their effects on the planning horizon can be reasonably and consistently quantified. In the economic perspective, it is essentially a question of observing the risk on a reference date or on a risk horizon of one year in which the portfolio composition does not change or changes only insignificantly. Typically, the economic perspective does not consider individual scenarios, but a value-at-risk determined from many implicit scenarios. Thus, thousands of scenarios are simulated in credit risk as part of a credit portfolio model and an overall loss distribution is calculated from the scenario losses. Similar value-at-risk methods are also applied to market risk, and when all major risk types are combined, they produce the overall risk value in the economic perspective. It is important to note that despite this short-term view, long-term effects may well play a role: for long-term assets, the cash flow profile may be affected by climate effects such as flooding, which in turn may affect the current value of the assets or lead to haircuts in the simulation parameters. The economic perspective is equivalent to instantaneous shocks, which, when accumulated, have an immediate long-term effect. 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.

Climate scenarios can be reflected not only in the mentioned perspectives of the ICAAP but also in internal stress tests as a supplementary management component. Here, the challenge is whether and how a dynamic balance assumption over a reasonable period of time can be reconciled in a methodologically consistent manner with the long-term climate scenarios.

In the following, we consider two possible approaches for a suitable integration of the long-term climate paths into the horizon of the risk assessment: The idea of the first approach is 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. 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 aligned. An 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.

A second 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. Examples of the main drivers of transition risks include, amongst others, the price of CO₂ and energy as well as the energy mix, and for physical risks the surface temperature and the sea level height. The sensitivity of the portfolio to the main risk drivers identified is determined, e.g. the change in value of the portfolio if the price of CO₂ rises by one dollar per ton, or the decrease in value of real estate at or below sea level if the frequency of flooding increases. 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. However even relative statements allow prioritisation in the context of business management and thus generate meaningful management effects.

In summary, the consideration of climate risks is entirely compatible with the current methodology of strategic management:

- In the economic perspective of the ICAAP, long-term effects can be taken into account by instantaneous shocks, provided that suitable models are available for the effect of climate risks on the underlying cash flows.
- Due to its consistency with business and capital planning, the normative perspective can take climate effects on the corresponding planning horizon into account.
- Due to their flexible methodological design, internal stress tests allow a direct handling of long-term climate risks, e.g. the compression of effects.
- However, it will not be possible to develop a meaningful methodology without combining plausible, dynamic balance sheet assumptions with long-term climate effects.

Practical example: Investment portfolio corporate bonds

The approaches described are first outlined by using a portfolio of corporate bonds with high exposure in the energy supply sector and a planning horizon of five years as an example. 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 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 portfolio is subjected to an instantaneous stress test in the economic perspective, 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. The steady increase of 180 dollars per ton is contracted to the planning horizon of the institution, i.e. an increase of 36 dollars per ton for each year in the planning horizon is assumed. 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 normative perspective, only the first 5 years of the steady increase in the price of CO2 by 180 dollars per ton over 30 years are considered. Thus, the existing adverse scenarios are extended by a uniform increase in the price of CO2 by 30 dollars per ton over the planning horizon.

Practical example: Real Estate Financing

The loan portfolio of a real estate financier usually contains long-term real estate and project finance loans for residential and commercial real estate. In addition, there are often direct investments in real estate or real estate funds on the company's own book. This portfolio structure and the maturities of these assets give rise to the following possible effects of climate change on the risk situation of a bank within the framework of the economic ICAAP perspective:

- The property-related performance may be affected, e.g. by a location close to sea level or changed weather conditions and the associated migration movements.
- The general performance of real estate can be affected, e.g. by economic crises caused by climate change.
- The volatility of real estate values may increase due to increasing uncertainty in the market.

All these influences lead to higher default rates and lower collateral values, thus increasing the credit risk in the economic perspective. In a present value or near present value view, these effects can be considered as follows:

- In real estate finance, rating models based on cash flow simulations are well established. These rating models can be complemented in such a way that, with the help of climate scenarios, they can also simulate these effects in the region of long-term cash flows. For example, the cash flow of a property near the sea can be stochastically modified to include the probability of flooding or loss of insurance cover. From such a simulation, both the present value and the credit risk parameters probability of default and loss given default can be determined for each exposure under certain climate scenarios. These parameters can then be used in a credit portfolio model. This procedure enables management at individual object/commitment level.



Figure 2: CO2 emissions and gross value added in the EU in 2018, Source: Eurostat.

- To map systematic economic effects, an adapted parameterisation of the credit portfolio model is suitable, e.g. through increased systematic correlations. With appropriate segmentation, this results in management impulses on an aggregated level, such as regions.
- The volatility of real estate values can also be taken into account in the parameterisation of the credit portfolio model, in which the idiosyncratic fluctuation range is suitably taken into account on the basis of climate scenarios.

At a very advanced stage of development, these effects could also be taken into account in a portfolio model or a climate CVaR (climate credit value-at-risk).

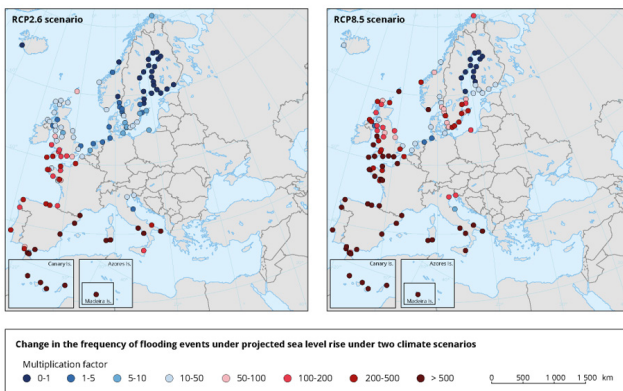


Figure 3: Rise in flood frequency in two climate scenarios with a significant accumulation of flood events, e.g. in France, Great Britain and southern Sweden. Source: European Environmental Agency (EEA), 2020, <https://www.eea.europa.eu/data-and-maps/figures/change-in-the-frequency-of>

1 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

2 See <https://www.ngfs.net/en/publications/ngfs-climate-scenarios>

3 See <https://www.eea.europa.eu/data-and-maps/indicators/sea-level-rise-6/assessment>

4 See <https://www.eea.europa.eu/data-and-maps/indicators/river-flow-drought-3/assessment>

5 In the normative view, the parameter volatility does not play an explicit role, since only the effects of a few, unambiguous scenarios are considered without stochastics.

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.

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