Platform voor Duurzame Financiering

Climate risk and the financial sector: sharing of good practices

The Sustainable Finance Platform

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This report is a reflection of the deliberations of the DNB Climate Risk Working Group. The Climate Risk Working Group was set up in 2017 under the flag of **the Sustainable Finance Platform**, chaired by De Nederlandsche Bank (Dutch Central Bank, DNB). The working group is currently sponsored by MN and consists of APG, MN, Robeco, Kempen, ABN AMRO, De Volksbank, Rabobank and the ING.

The Sustainable Finance Platform is a cooperative venture of De Nederlandsche Bank (chair), the Dutch Banking Association, the Dutch Association of Insurers, the Federation of the Dutch Pension Funds, the Dutch Fund and Asset Management Association, Invest-NL, the Netherlands Authority for the Financial Markets, the Ministry of Finance, the Ministry of Economic Affairs and Climate, and the Sustainable Finance Lab.

The aim of the Platform is to encourage dialogue on sustainable finance in the financial sector. Platform members meet twice a year to forge cross sectoral links, to find ways to prevent or overcome obstacles to sustainable funding and to encourage sustainability by working together on specific topics.

The Sustainable Finance Platform fully supports this paper. However, the practices and advice described herein are in no way binding for the individual financial institutions comprising the industry organizations which are members of the Platform, nor are they committed to take any specific follow-up actions. Furthermore, this paper outlines private sector initiatives and as such does not contain any supervisory requirements.

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Foreword DNB

I am honored that the working group has asked me to provide their publication with a foreword.[1] Over the past decade, sustainability and the risks stemming from climate change have moved to the heart of our work at DNB. As a supervisor, we have realized that environmental and social challenges can expose the financial sector to risks. We therefore expect Dutch financial institutions to also take such risks into account.

Among the many environmental and social challenges we face, tackling the climate crisis is one of the most pressing. The coronavirus currently shows how an external shock can impact our economy and financial sector. But while the coronavirus hit us unexpectedly, the climate crisis we have long seen coming. Next to the far-reaching impact that the drastically changing global climate will have, and already has on the livability of our planet, it will also impact our economy and financial sector. Financial institutions exposures are vulnerable to the physical consequences of changing weather, as collateral such as real estate could for example be damaged. At the same time, the transition to a carbon-neutral society can impact the market value and creditworthiness of companies that our financial sector finances. For example, a carbon tax will impact companies with CO2-intensive production processes.

The measurement, monitoring and management of such climate-related risks is a big challenge. This anthology, in which a group of banks and institutional asset managers share their experiences, gives a clear account of this challenge. It shows, for example, that only a few parties actually mitigate climate risks in their portfolios because there is a lack of usable climate data and widely accepted methods for accurate risk weighting. At the same time, I think we cannot delay mitigating these risks until we have completely captured them. The urgency of the climate crisis forces us to navigate through the fog to some extent. An importing condition to this all is that the prudential risks of climate change are adequately reflected in financial legislation and regulation. This is a priority for us in our international efforts.

Major challenges like these cannot be solved in splendid isolation. Cooperation and exchange, both nationally and internationally, and between different actors is needed to build up the required knowledge. This is exactly why we at DNB, together with sectoral organizations, ministries and supervisors set up the Sustainable Finance Platform in 2016. Platform members meet twice a year to forge cross-sectoral links, to find ways to prevent or overcome obstacles to sustainable funding and to encourage sustainability by working together on specific topics. This publication is an excellent example of this. I want to applaud the working group members particularly for sharing their challenges. Because it requires some level of vulnerability to share the less positive aspects, while these are precisely the most useful aspects for other institutions on the same journey.

Frank Elderson
Executive Director of Supervision De Nederlandsche Bank

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1 Readers will understand that the content of this paper does not necessarily represent the views of DNB nor does it contain any supervisory expectations.

Foreword MN

Europe faced one of its driest springs in history resulting in wildfires, extremely dry forests and farmlands and river depths that are half of what they should be at the time of the year. The consequences directly affect our socio-economic environment and the financial industry.

The recommendations from the Task Force on Climate-Related Disclosures have provided guidance for both investors and companies in structuring and developing thoughts and insights about climate related risks and opportunities. This significant step forward has not been without result. Companies are increasingly taking into account the long term effects of climate related risks and opportunities in their strategies. In dialogue with large shareholders many European oil and gas companies for example have raised, ahead of the AGM season 2020, their long term carbon emission reduction ambitions. *Despite this progress, there is no time to sit back and relax*.

MN, who participates in different working groups under the umbrella of the Sustainable Finance Platform, is proud to be the sponsor of the Climate Risk Working Group. Within this group, issues around climate related risks and opportunities in the investment and lending portfolios are discussed on a regular basis. This is done in an informal and open manner with the aim to learn from the insights of each other. The underlying anthology is a product of this collaboration.

Financial institutions are increasingly able to identify and measure climate related risks and opportunities in their investment- and lending portfolios. As long term shareholders it is in our best interest that companies prepare for the energy transition and benefit from the opportunities. Together with this, we are committed to contribute to a sustainable society for our beneficiaries, the pensioners of today and the future.

In this Anthology, The DNB climate risk working group shares knowledge and provides insight into how leading Dutch financial institutions deal in practical terms with the challenges and opportunities of the transition to a low-carbon economy. It concludes with a number of next steps and recommendations. Despite challenges, such as the lack of data or standardization of indicators, this Anthology shows that Dutch Financial institutions made significant progress in their climate risk analyses. I invite policy makers, regulators, companies and other financial institutions to enter into dialogue and to collectively bring the management of climate related risks and opportunities to the next level.

I hope that this Anthology will stimulate further discussion, consultation and foremost cooperation directly contributing to the next steps in jointly controlling climate risks and taking advantage of the opportunities that arise from it. Together we can make a difference.

Martijn Scholten
Director Asset Management MN

Introduction

What we see happening

The world is in a crisis, a health, a social and an economic crisis as a result of the COVID-19 pandemic. The shocks to our economies are in a way similar to the shocks that are described in the various climate change scenarios from and based on IPCC, IEA and other renowned institutions. Rising temperatures (physical risks), but also the efforts to limit global warming (transition risks) are at the root of such shocks.

Climate change is here to stay. At the same time, international climate ambitions stand firm. The timelines for the Paris Climate Agreement implementation have not changed. The UN Climate COP26 in Glasgow has been postponed, but countries are still due to submit their enhanced NDCs (Nationally Determined Contributions) by the end of 2020 and the EU net-zero ambition for 2050 has been underlined by recent calls for a resilient, Green Recovery by EC leaders.

As financial institutions, we need to understand the risk climate change poses for our clients and our portfolios. This is why we consider the implications of climate change in our risk processes to safeguard our business. In addition to risk mitigation, the financial sector also has a role to play in financing the transition to a low-carbon, climate-resilient economy. This is where climate impact management comes in, including individual as well as joint climate ambitions with the aim to contribute to the goals of the Paris Agreement.

In our view, the FSB TCFD Recommendations provide a solid starting point for managing both climate risks and opportunities. The wider adoption of these recommendations paves the way to making it a standard and guide the development of climate risk management and consequentially climate strategies. This development goes hand in hand with the maturing of sustainable finance: the focus on this field over the past few years has increased rapidly.

How climate risk and climate impact management are complementary

The focus of this anthology is on insights by representatives of Dutch financial institutions regarding climate risk: how do rising temperature (physical risk) and the transition to a low-carbon economy (transition risk) impact the portfolios of financial institutions? But we should not completely separate this perspective from the other side of the coin: how can a financial sector player measure and manage the impact of its portfolio on climate change? Rather, the two perspectives should be seen as complementary, feeding into the overall climate strategy of a financial institution.

Climate impact management provides climate risk identification, in particular related to transition risk, pinpointing under or over-exposure to low-carbon or high-carbon technologies, which could be useful as a first step towards understanding financial risk as part of TCFD.

Climate impact management can therefore inform sector strategies, for instance capital allocation choices on portfolio level. Besides this being a strategic choice, financial institutions are able to reduce and monitor the amount of risk being carried over time. Reducing exposure to high-emitting sectors can support this de-risking process.

Conversely, climate risk management can but does not necessarily contribute to better climate outcomes and the transition to a low-carbon economy. This also poses a risk: we must achieve net zero emissions by mid-century to deliver Paris and thus steer on climate impact, while physical climate-related risks are already starting to have a material impact. This is how climate risk and climate impact management complement each other.

Anthology

Climate risk and the financial sector: sharing of good practices

Following the FSB-TCFD Recommendations, the Climate Risk Working Group published its first report [1] in March 2018. This publication summarises the outcome of almost a year of peer learning with the aim to 'share ideas with peers and experts as well as to provide insights into how Dutch financials are thinking about climate-related financial risks.' Several investors and banks contributed to the report, providing an overview of current practices at that time, structured along the four pillars of the TCFD. The report concludes with several recommendations for 1) investee companies and clients, 2) regulators and policy makers and 3) service providers.

After this publication, the working group agreed to continue sharing good practices on how to measure, manage and report on climate-related risks, while also discussing climate strategies for financial institutions, including capturing opportunities and managing the impact of portfolios on climate change. Again, the FSB-TCFD Recommendations served as guidance. This report captures insights and learnings of the work that has been done in the working group and by the individual organisations on the topic of climate risk. To allow for a more detailed knowledge sharing at practitioner level, several case studies have been bundled as an anthology.

By publishing these insights and by exploring challenges and opportunities, the DNB working group on Climate Risk aims to contribute to global practices on this topic. We invite peers, experts and other stakeholders to respond to this paper and be part of the dialogue.

1 APG Asset Management

APG Asset Management is a fiduciary asset manager for pension funds, including ABP, bpfBOUW, SPW and PPF, managing a total of EUR 488 billion (March2020). As a leading long-term responsible investor, we regard robust management of climate risks and opportunities as essential to our mission of providing good pensions in a sustainable world.

1.1 Approach to climate risk and opportunities

Governance

The Investment Committee of APG Asset Management has adopted a formal climate risk policy, and the APG AM Risk Committee has added climate risk to the risk taxonomy as an investment risk. The climate risk policy determines the governance and describes the instruments for monitoring and managing climate-related risks and opportunities. The scope of the policy covers the investment beliefs, the ALM/SAA, mandating process, portfolio management and monitoring & reporting.

Considering that methods for climate-related risk management are still in development, we have established a climate steering group within APG. This steering group is tasked with keeping oversight of various initiatives to monitor and manage climate-related risks and opportunities within APG, including the prioritisation of research. The steering group contains members from various parts of the organisation: portfolio management, risk management and fiduciary management.

1.1.1 Methodology and instruments

Approach

We have included climate factors in the analysis that was used to determine the strategic investment plan of ABP. The starting point was the central path scenario, which is based on stochastic modelling. To stress-test the central path scenario, four additional deterministic scenarios were constructed. Climate change was one of the key factors in constructing these scenarios, along with other elements such as the role of central banks and the strength of international collaboration. In fact, one scenario (the "climate pit") is comparable with a 4-degree scenario, and another one ("good globalisation") is comparable with a below-2-degree scenario. The deterministic scenarios have been used to map potential effects of climate change for economic growth, inflation, and impact on various asset classes. Also, for each asset class ESG scores were developed based on a methodology that ranks asset classes primarily for their upside potential for responsible investing. Underlying factors include involvement by asset owners, market transparency within that asset class on ESG-related topics and percentage Sustainable Development Investments. The analysis was integrated into the 2019-2021 strategic investment plan.

For the mapping of climate-related risks and opportunities in portfolio construction, APG conducted a scenario analysis in collaboration with an external consultant (ERM). The scenario analysis was conducted at the level of economic sectors (26 in total). To analyse transition risks and opportunities, we used a business-as-usual scenario (IEA Current Policies Scenario, 3.7°C) and a 2-degree scenario (IEA Sustainable Development Scenario, 2°C), supplemented with specific information from the IEA Energy Technology Perspectives (ETP). As the IEA scenarios do not cover physical risks and opportunities, we used the RCP 4.5 and RCP 8.5 scenarios for analysing the physical dimension. For both transition and physical analysis, we looked ahead to 2022, 2030,

and 2040. The year 2022 has been chosen as the short-term horizon, due to the fact that it is far enough into the future to observe climate impact and also falls within a relevant investment horizon for investments in liquid capital markets (~5 years). The years 2030 and 2040 are often used as intermediate and longer-term horizons in climate analysis.

The results of our climate scenario analysis have been captured in a traffic light model, which creates insights into the most prominent climate-related risks and opportunities in 2022, 2030, and 2040. For each of the economic sectors, in each of the time horizons, the traffic light model depicts both the transition as well as the physical aspect as 'high', 'moderate' or 'low'. This score is determined by the difference in the value of the key climate factor (selected for the specific sector) between the business-as-usual and the 2-degree scenario in the specific time horizon: The larger the difference between those values, the larger the risk or opportunity. The climate factors are defined as key drivers of global climate-related risk and opportunity that may impact the economic sectors that we invest in. The taxonomy of climate factors (44 in total) has been determined, amongst others, by the climate factors suggested by the TCFD. Examples are carbon pricing, oil demand, litigation risk and flooding risk. For every sector, a key climate factor has been proposed by the external consultant and validated by APG.

Next to the traffic light model, we have developed a climate dashboard. This dashboard is a supplementary analysis to the traffic light model with the aim to track the speed of the transition to a low-carbon economy. The dashboard consists of 20 indicators and is updated on an annual basis (compared with bi-annual for the traffic light model). The most prominent changes in indicators and the overall score are analysed. Therefore, this dashboard supports the assessment and management of climate-related risks and opportunities on a shorter time frame.

A similar analysis has been performed for sovereign bonds at country level. For each country, we looked at physical risk (based on the Notre Dame GAIN database) and at transition risks (based on HSBC indicators). This resulted in a low-medium-high risk profiling of the sovereign bonds portfolios.

Together, the traffic light models for sectors and countries, and the climate dashboard are the primary instruments to monitor climate-related risks and opportunities at a high-level across the portfolio. For all investments in areas that are denoted 'high risk' within the investment horizon, explicit attention should be paid to climate risk in the investment case, including a rationale why we are prepared to take the risk, and the impact of the specific investment on the climate goals of APG and its clients. The tools are available to portfolio managers of the various asset classes.

1.1.2 Most prominent risks on short and longer-term

Insight

The scenario analysis shows that the effects of climate change are large and comprehensive in 2040. In the run-up to 2040, the transition is gradual for a global and diversified portfolio such as APG's portfolio. However, the transition can be accompanied by disruptive changes and unexpected inflection points that we will have to monitor closely.
Before 2030, we see major transitions already taking place in the 2-degree scenarios, with corresponding risks and opportunities, in particular for the following sectors: utilities, real estate, cement, oil & gas, aerospace, food and consumer goods, automotive, semi-conductors and electrical equipment, agriculture, chemicals and the construction sector.

Sectors that are especially vulnerable, but also show opportunities, for the physical impact of climate change are in particular: agriculture, forestry, real estate, oil & gas, food processing, road and rail transport, mining, utilities, health care, construction and water utilities.

From the analysis on climate risks in sovereign debt, we have concluded that our exposure to countries with a high climate risk (physical and transition) is limited. Countries with lower ratings (emerging economies) are more exposed to climate risks than higher rated countries, and there is evidence that this is already being priced in.

1.1.3 Reporting

Clients of APG have insight into the results of the scenario analysis and the climate dashboard through a digital client reporting tool. This report is updated on a semi-annual basis. Furthermore, clients are briefed on the monitoring and management of climate-related risks and opportunities by APG via specific deep-dive sessions. Finally, the various asset classes are reviewed (at least annually) by the Fiduciary Management department as part of granting and evaluation of mandates. Climate risk is part of this analysis and the results are fed back to clients.

1.1.4 New insights

Learning

Based on the work thus far, we gained the following insights:

- The scenario analysis provides insights on a generic level where the impacts of climate change are most prominent in the portfolio. However, a true understanding of climate-related risk and opportunity for individual investments (including financial impact) requires more granular analysis. This is the reason that within the APG governance model, the investment teams are primarily responsible for managing climate- related risks and opportunities, while overall exposures are monitored and reported across the portfolio. In addition, on a portfolio-wide level, attention needs to be paid to second order and network effects of climate change as these impact on the entire portfolio.

Next Step

- The scenario analysis that was conducted in 2018 highlighted the importance of having insight into the macro-economic spill over effects of climate change. The basis for the analysis were IEA scenarios which are linear by nature, whereas in reality the changes are most probably dynamic and non-linear. Climate change can be seen as not a risk by itself, but rather a risk multiplier with impacts on conflicts, migration and scarcity that might materialise via economic variables such as economic growth, interest rates and inflation. Therefore, for the next iteration of the scenario

analysis, we are considering including more disruptive scenarios (akin to the Inevitable Policy Response (IPR) scenario developed by the PRI). To inform scenario analysis, we are collecting insights on the underlying patterns of impacts on economies and financial markets and their speed of recovery, through analogies with historical cases where physical destruction and major government interventions took place (e.g. natural disasters and wars).

- For the asset class real estate, we conducted a pilot on the measurement of physical risks. As part of this pilot, six different methods for measuring physical risks have been tested on a single asset. The results showed large differences between the six methods, where no single model successfully accounted for all physical risks. We concluded from this analysis that careful interpretation is required for evaluation of results from off-the-shelf products. A combination of insights and analysis is required.

1.2 Limitation of the approach and next steps

Dilemma

Measurement, monitoring and management of climate-related risks and opportunities is in an incipient phase. Therefore, there are a number of critical limitations.

Firstly, robust quantitative metrics to measure climate risks in portfolios and to integrate this into regular risk management are missing. Many quantitative and semi-quantitative metrics and methodologies are becoming available. In practice, however, we observe that these metrics are strongly dependent on models and assumptions, and therefore we do not yet consider these suitable for setting explicit limits on the portfolio in relation to climate risk. Thus far, we have opted to work with a semi-quantitative approach via the traffic light model. We are closely monitoring developments in this field and we are looking to strengthen our approach in the future using more quantitative risk management metrics.

Secondly, for asset classes such as sovereign debt and sectors such as financials, we observe that climate risks are not direct but rather indirect on the basis of the underlying economy and financial relationships. Our analysis for the asset class sovereign debt has proxied climate risk for countries on basis of their underlying economies. The next step will be to make this methodology applicable to financials and proxy climate for companies operating in this sector.

Next Step

Thirdly, we have developed a dashboard to track the speed of the transition to a low-carbon economy. Currently, this dashboard has been filled with relatively conventional indicators where data is available at a global level, such as oil demand and capacity of renewable energy versus fossil fuels. These indicators are all backward looking by nature and have a limited forward-looking character. We therefore aim to supplement the dashboard with forward-looking indicators that also exhibit a more disruptive character to get a better understanding of strong changes in the speed of the transition to a low-carbon economy (e.g. policy developments and social sentiment). We are looking into the possibility whether innovative technology and data sources such as unstructured data can help us to enhance the dashboard.

Next Step

Finally, we have concluded that the physical risks of climate change have not been sufficiently accounted for in our scenario analysis. Our scenario analysis has merely touched upon physical vulnerabilities rather than physical risks. Due to the fact that our scenario analysis was performed on a global level, the information is not specific enough to map physical risks of individual investments. We would need more detailed information on the physical risks of climate change at a local level for the specific locations where the investment has a footprint. Therefore, as a follow-up analysis, we aim to map physical risks at a local level for specific sectors, staring with the asset class real estate.

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2 MN

Governance

MN is the fiduciary manager of several large Dutch pension funds, including PMT, PME and Bpf Koopvaardij (Dutch Merchant Navy's Company Pension Fund) with over 150 EUR billion assets under management. For more than five years, MN has been working on the development of the climate policy for its clients. In 2019, all the work and knowledge developed over the past years was brought together in a comprehensive PMT and PME climate strategy.

2.1 Climate strategy (Part I)

The climate strategy is an integrated policy document applicable to the entire investment process including two building blocks. The first part (Part I) defines climate risks, provides an overview of different scenarios and concludes with a broad assessment of the most exposed asset classes. In the second part (Part II), all possible measures that touch on climate-related risks and opportunities are addressed.

This chapter follows the structure of the climate strategy. First, the most important insights regarding climate risks, climate scenarios and an assessment of the exposed asset classes are provided. Subsequently, the findings of a research project on measures for climate-related risks and opportunities in the passively managed listed equity portfolios are explained.

2.1.1 Climate risks & scenarios

Approach

In the climate strategy, a distinction is made between transition risks and physical risks. Four different transition risks are recognised: regulatory risks, technological risks, market risks and reputational risks. For physical risks, a distinction is made between acute and chronical physical risks. To be able to understand how climate risks could potentially affect the portfolios of MN and its clients, the different climate risks have been plotted in different scenarios including different time horizons. The scale of the potential impact in the different scenarios has been based on available research on this topic.

Three different scenarios are distinguished: a well-below 2°C pathway, a 3°C pathway in line with the Nationally Determined Contributions (NDCs) and a Business As Usual (BAU) pathway, which is considered a 4°C pathway. For each of the scenarios, a distinction is made between a short-term (0-15 year) and a long-term (>15 years) horizon. Figure 2 provides an overview.

Figure 2 Overview of potential impact of the different climate risks in the various climate scenarios on both the portfolio and in society.

Insight

Figure 2 shows that for the long-term horizons in the 3°C and 4°C scenario, both the physical climate risks and the negative impact on society are very high. The transition risks in these scenarios are low. For the short time horizon in the well-below 2°C scenario, the climate transition risks are high while the impact on society in both the short- and long-term horizon in the well-below 2°C scenario is low. Considering the risks in different scenarios as depicted above and the ambition of MN's clients PMT and PME to positively contribute to society, the 'orderly well-below 2°C scenario' is the most favourable scenario from both the perspective of climate risks and the impact on society.

2.1.2 Assessment of climate risks at the level of asset classes

Approach

Over the past years, multiple regulatory bodies, research providers, investors and other types of institutions[2] have published research in which the potential impact of climate risks on portfolios or specific asset classes are estimated. The extent to which portfolios or asset classes are vulnerable to climate risks depends not only on the underlying sector or regions, but also on the risk profile of the particular asset class. Suppose, for example, that a government imposes a tax on carbon dioxide in certain high-carbon sectors. A listed equity portfolio with 50% exposure to these sectors will probably be more affected than a corporate bond portfolio with the same sector exposure. For an equity investor, the tax has a potential impact on future cash flows, which generally speaking will decline once the costs increase. The main issue for bond investors is whether the probability of defaults increases during the remaining life of the bond. These will increase significantly only if the extra expected costs are so great that the survival of a company is endangered.

Insight

Based on the available research, a broad assessment has been made of estimates of which asset classes of the managed portfolios are most vulnerable to climate risks. This assessment shows that both the private equity and listed equity portfolios are vulnerable to climate risks, due to their risk profile and exposure to vulnerable sectors. The infrastructure equity portfolio has also been found to be vulnerable due to exposure of the underlying assets to physical climate risks. Compared with other asset classes, The euro governmental bonds with the highest credit ratings, such as Germany and the Netherlands, have been found to be least exposed to climate risks. The high credit ratings

2 DNB, Mercer, Ortec Finance, MSCI, Carbon Delta, Seventwentyfour

ensure that the probability of default as a result of climate risks is relatively low. The vulnerability of the listed equity portfolio, combined with the large allocation of capital in this asset class, make this asset class a top priority for the mitigation of climate risks.

2.2 Climate strategy (Part II)

Approach

The insights from the first part of the climate strategy are used as input for the second part. This part of the chapter elaborates on two examples of measures that are taken to research and integrate climate-related risks in the investment portfolio, starting at the level of Strategic Asset Allocation (SAA) followed by the passively managed listed equity portfolios.

2.2.1 Integration of climate risks at Strategic Asset Allocation level

Insight

At strategic asset allocation level, PME has contributed to a pilot study of Ortec Finance in which climate-related risks and opportunities are taken into account as separate components in an ALM study. This trajectory provided insights into the possible impact of the three scenarios on future risk-return expectations of the PME asset mix. Based on the results of this pilot, it was concluded at the time that it was not opportune to make strategic adjustments as a result of climate-related opportunities and risks.

2.2.2 Climate risks in passively managed listed equity portfolios

Approach

Almost all listed equity portfolios that MN manages for its clients are passively managed. This means that certain benchmarks are followed for a pre-set time period and no active investments decisions about individual companies are made. MN constructs its own benchmarks based on a set of criteria that are formulated in investment strategies. The investment strategy includes all financial- and ESG-related criteria that apply for the construction of the benchmark. The investment strategies apply on average for a period of about three years, after which the strategy is evaluated and renewed. Climate risks and opportunities are therefore taken into account only when developing the investment strategy. This is an important difference compared with active investors, where climate risks are also taken into account in the investment decision.

PMT and PME both have customised benchmarks taking into account specific financial- and ESG-criteria using a set of rule-based indicators. The framework of rule-based indicators is called the *conscious selection framework*.[3] Climate risks and opportunities are researched as a separate component of the broader conscious selection framework (CSF). This has been carried out for seven high-risk sectors: airlines, marine shipping, precious metals and mining, oil & gas, utilities and steel producers. The relatively high carbon emissions of these sectors, and the classification of being 'highly exposed to climate risks' accordingto MN's external data provider, are the main reasons for the selection of these particular sectors.

3 www.unpri.org/passive-investment/developing-a-conscious-selection-framework-for-responsible-investment-in-passive-allocations/5502.article

2.2.3 Research: climate risks in passively managed listed equity portfolio

Several climate risk methodologies of existing external data providers, with datapoints available on company level, have been researched. Several aspects have been researched such as the extent to which the different methodologies measure the climate risks as defined in our climate strategy, the underlying assumptions that have been made in the different methodologies and the extent to which outcomes on the same indicator are correlated. The most important findings are as follows:

Insight

1. *Limited availability of climate transition risk indicators*
   Only the regulatory risk has been translated into measurable indicators. Data providers did not provide any useful forward-looking indicators for technology, market and reputational risk.
2. *Lack of information on physical climate risks indicators*
   Methodologies that measure physical climate risks are challenging, as the largest impact of physical risk is expected around 30 years from now. This makes these risks incredibly difficult to quantify and sensitive to small changes in assumptions. A lot of company-specific information, such as the location of the production facilities is required to measure the physical climate risks. No data provider was found that measures physical risks in a manner robust enough for MN to include the indicators in the portfolio construction process.
3. *Different methodologies on the same climate risk often contradict each other*
   The alignment between the different methodologies to measure climate risks is low, because of different underlying assumptions and methodologies used by the various data providers. For example, regulatory risk can be calculated on the basis of the assumption that companies located in countries with large commitments to reduce their carbon footprint are affected relatively hard. Another methodology to measure regulatory risk is to compare the production process and the CO2 intensity of two companies in the same sector, and assume that the company that is least efficient is most exposed to regulatory risk. These two methodologies that measure the same indicator can lead to completely different outcomes. For investors, it is essential that the methodologies and assumptions are being researched in detail to be able to decide on a methodology that matches the beliefs of the investors.
4. *Sectors exposed to transition and physical risks are different*
   Although the estimates of the exposure to regulatory risks vary between different methodologies, consensus is found on the sectors most exposed to regulatory risk. These are the sectors with the largest emissions of carbon dioxide. For physical risks, the range of sectors appears to be much broader as these are mostly dependent on the location of the production facilities or their supply chain, and not at the level of carbon dioxide emissions.
5. *Not all indicators are material for all sectors*
   Not every indicator is material for every sector. The 'Water Stress' indicator is very relevant for precious metals mining, and not for the oil and gas sector. A sector-specific approach should be taken in selecting indicators for a rule-based framework.
6. *Overlap between 'Alignment' indicators and 'Risk' indicators*
   There is a large overlap between 'Alignment' and 'Risk' when it comes to some of the indicators. For example, the carbon footprint of a company can be considered an 'alignment indicator' as well as it can be a proxy for 'regulatory risks'. A company that is not taking sufficient action to

contribute to the goals of the Paris Agreement will be impacted relatively hard by further regulation that is focused on a reduction of carbon emissions.

The analysis of the different data providers provided valuable insights into the possibilities or impossibilities to measure climate-related risks and opportunities in the passively managed listed equity portfolios. The next part of this chapter elaborates measures that are taken based on the results.

2.2.4 Integration: climate risks in the passively managed listed equity portfolio

Next Step

Although it is possible to measure some of the climate risks, open fields remain that require follow-up research and development in the market, such as the development of forward-looking indicators and a better consensus of how similar climate risks are measured. Therefore, follow-up research will be conducted in the future, which will be started in the second half of 2020. PMT decided to await the follow-up research and the developments of the market. PME decided to use the available insights of the research to integrate climate-related risks factors in the customised benchmark.

Approach

MN has developed a rule-based methodology and integrated this in the broader conscious selection framework. Starting point was the selection of a data provider with the best available methodology for measuring climate risks. For each of the seven sectors, several indicators have been selected that, together, provide an indication of the amount of exposure to climate related risks in that sector. The available indicators do not cover all climate-related risks. Primarily regulatory risks, and a small selection of physical risks, are covered. The number of indicators used differ per sector, varying from two to ten indicators, as not every indicator is material for every sector. For every sector, indicators that capture the extent to which the management of a company deals with climate risk has been included. Based on the acquired data, the 50% worst performing companies on climate-related risks in each of the sectors are excluded from the portfolio of our client PME.

Insight

The datapoints are updated by the selected data provider at least once a year. The updates are automatically used in the re-balancing of the portfolio. If the updated data result in a company performing better or worse, this could result in inclusion or exclusion. The set of indicators to measure climate-related risks will be evaluated and renewed every three years as part of the regular evaluation cycle of the investment strategy. The developments around methodologies to measure climate-related risks and opportunities are being monitored during that same time period.

2.3 Challenges

Challenge

The knowledge about climate-related risks and opportunities in the portfolio has grown significantly over the past few years but is still incomplete and therefore considered work in progress. MN aims to obtain a better insight into the climate-related risks and opportunities in the portfolio and to integrate this information into the investment strategies and investment decisions. The most important challenges that are being found by MN, and which are also applicable for the rest of the sector, are the following:

1. *Available methodologies and indicators do not reflect all known climate risks*
   Only a few of the climate risks are being translated at present into measurable indicators by the data providers. MN closely monitors the developments in this field and will take new developments into account in the follow-up study that is planned for the second half of 2020.
2. *Lack of standardisation between the methodologies*
   There is a lack of standardisation among data providers when it comes to measuring climate risks. The same climate risks can be measured differently by different methodologies, resulting in different outcomes. MN has enabled itself to select a methodology that is considered best suitable by testing it on MN's owns climate strategy. MN contributes to standardisation by providing input to the work of the EU taxonomy and standardisation organisations such as the ISO.
3. *Complexity of execution*
   Data that has been acquired via multiple sources, or sources other than commercial data providers, often do not serve the purpose of building a customised benchmark. MN therefore uses data only from one single external data provider to limit complexity in the execution.

2.4 Next steps

Next Step

ESG factors – including climate-related risks and opportunities – are being taken into account in every new investment strategy that is being developed by MN for its clients. On top of climate risks and opportunities, a new concept has emerged in the industry that is about the degree of contribution of investors to the Paris Agreement: the degree of Paris Alignment. For the first half of 2020, MN has planned research into the extent of Paris Alignment of the passively managed listed equity portfolios of PMT and PME. Later in 2020, MN will conduct the follow-up study on climate-related risks and opportunities of the passively managed listed equity portfolios.

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3 Robeco

Robeco is a pure-play international asset manager using a unique combination of fundamental, sustainable and quantitative research. We offer our clients an extensive selection of active investment strategies covering a broad range of asset classes built around our key strengths of quantitative and sustainable investing, credits, emerging markets and trends and thematic investments.

3.1 Introduction

Robeco acknowledges the responsibility of the asset management industry towards climate change risks through the investment decisions that we make and the contact we have with investee companies and other institutions. As signatories to the Paris Agreement, we aim to contribute to its ambition: to keep temperature rise well below 2 degrees Celsius above pre-industrial levels. Robeco also wants to meet the commitment we made to the Task Force on Climate-related Financial Disclosures, our climate change strategy is playing a significant role in helping us to do so.

In 2018, the Financial Risk Management department (FRM) started investigating and monitoring environmental risks, and climate risks in particular. This approach focuses on transition risk by visualising carbon emissions and designing climate change scenarios in order to monitor the impact on client portfolios.

3.2 Climate risk buckets

Approach

The CO2 exposure of a company is captured by the climate risk buckets. Financial Risk Management is proposing that the CO2 exposure be proxied with the CO2 emission normalised by the revenues of a company. The rationale behind this is that when a company has a high CO2/revenue, the company's revenues are relatively CO2-intensive and therefore assumed to be more sensitive to transition risk. The climate risk buckets range from 1 to 10 and companies are assigned a bucket based on their CO2 exposure. As companies in some industries are more polluting by nature, Robeco includes an industry correction. This means that companies who are heavily polluting compared with their industry peers are allocated to a higher bucket and companies who are relatively less polluting are assigned a lower bucket. The climate risk bucket is used as input for the climate risk stress test scenarios and the climate risk sensitivity analysis.

3.3 Stress testing and sensitivity analysis

Robeco developed three scenarios where different shocks are applied to companies based on their CO2 exposure. In the process of developing scenarios, the Financial Risk Management department performed an extensive literature review and had several meetings with sustainability experts, this resulted in the following scenarios:

3.3.1 Carbon bubble

As several leading economies are highly dependent on fossil fuel production and export, the transition to a low-carbon economy can significantly impact these economies. The valuations of fossil-fuel-dependent companies are based on the assumption that their fossil fuel reserves will be consumed. Under the carbon bubble scenarios, these reserves will become wholly or partially

unusable, which will have a significant effect on the valuation of the companies. The burst of the carbon bubble will therefore have a significant negative impact on carbon-intensive companies.

3.3.2 Stranded assets

The stranded assets scenario reflects the situation where companies have to write off on their equipment because of the transition to a low-carbon economy. Companies in several sectors (i.e. oil/gas, chemicals and related) will experience steep declines in their market values. This scenario is based on a 'hard landing', where markets will abruptly re-evaluate the value of firms that are sensitive to a reduced demand for fossil fuels and stranded assets.

3.3.3 Fossil fuel price increase

As a result of the growing scarcity of fossil fuels, the price of oil is likely to increase. According to the National Energy Board, the oil price will increase to approximately 134 USD in 2040 assuming a hard transition.

As not all companies and industries will be impacted in the same way by these scenarios, Robeco uses the climate risk buckets and the industry of the companies to apply different shocks. In the carbon bubble scenarios, for example, companies with a high carbon exposure (and high climate risk bucket) are impacted more than companies with a lower carbon exposure.

In addition to the stress testing, the Financial Risk Management department also performs a sensitivity analysis based on the climate risk buckets. This provides insight into a portfolio's sensitivity towards climate-related risk without making additional assumptions, which is the case when performing scenario analysis.

As our portfolios are exposed to climate-related risk, this also means that the profitability of Robeco will be impacted through climate risk. In order to assess the impact of transition risk on Robeco's profitability, Robeco ran the four transition risk scenarios defined by the DNB on our gross margin. The results of these scenarios are included in the yearly Internal Capital Adequacy Assessment Process (ICAAP).

3.4 Climate risk governance

Governance

Currently, all climate stress tests and the sensitivity analysis are performed on Robeco's equity and credits products, the sovereigns bond products are not yet in scope. The outcomes of these climate risk scenarios and the sensitivity analysis are an essential part of the regular risk deep dives with portfolio management. During these deep dives, Financial Risk Management discusses the financial risks within the portfolio after conducting a more thorough analysis of the portfolio. Climate risk is one aspect that gained more importance. As setting limits or restrictions on climate-related metrics is currently undesirable, it is important to discuss the results with portfolio management to increase awareness. In addition to the deep dives, Financial Risk Management reports that the potential impact across all our portfolios is being reported and discussed in Robeco's Risk Management Committee.

3.5 Physical risk

Challenge

The current framework focuses only on transition risk, and physical risk is not considered. However, physical risk in an important component in the analysis of financial risks within the portfolio. For example, companies below sea level are significantly exposed to flood risk. And flooding of the area would impose risk on the profitability of the company. At present, we do not have data to capture and asses the physical risks to which a company is exposed. This is one of the challenges we will work on in the year ahead.

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4 Kempen

Kempen is an asset manager that believes in stewardship and long-term investment for the benefit of all stakeholders. We have measured the carbon intensity of our own funds for five years and, since 2017, we have also assessed the carbon footprint of our assets under management and reported in line with TCFD recommendations (via Van Lanschot Kempen).

4.1 Carbon footprint

Approach

Insight into climate risks starts with measurement. Kempen measures its carbon emissions[4] using three metrics to calculate the carbon footprint for its portfolios (also mentioned in the TCFD recommendations):

- **Financed carbon emissions:** measures a portfolio's absolute carbon footprint (in tonnes of CO2) based on its shareholdings in the underlying companies. The shareholding in each company is taken as part of the enterprise value and multiplied by the carbon footprint of that company.
- **Carbon emissions per €1 million invested** (CO2 / EUR mln invested): relative footprint shows how many tonnes of CO2 an investor is financing in relation to its ownership in a certain company or portfolio. This metric captures the carbon exposure of an investment amount and is measured by dividing the absolute footprint of the portfolio by the total amount invested in the portfolio.
- **Weighted Average Carbon Intensity (WACI)**: calculates a portfolio's exposure to the carbon intensity of companies (expressed in tonnes of CO2/€ million revenues) multiplied by the percentage of the company in the portfolio.

As a participant of the Partnership for Carbon Accounting Financials (PCAF), Kempen strives to align its carbon footprint methodology with this standard where possible. More information about the three carbon metrics can be found in our annual Responsible Investment report (see www.kempen.com/en/asset-management/responsible-investment).

Challenge

The current carbon footprint gives an indication of the past carbon emission characteristics of companies in the portfolios as, in line with financial accounting, these figures are based on past emission data and can be seen as more backward looking. Nevertheless the carbon intensity can be seen as an indication of the exposure in portfolios towards carbon intensive companies, when compared with the portfolios benchmark. Note that data quality can be a challenge and this is an area for further development. Companies need to improve their CO2-emission reporting so that the resulting data can enhance such analysis. Kempen's risk department has started to use carbon intensity to assess Kempen's own equity funds compared with the benchmark. The team evaluates if there are statistically significant deviations between the portfolios and benchmarks.

[4] In fact, the carbon emissions are carbon emission equivalents, as other greenhouse gas emissions are converted into carbon emissions.

4.2 Transition risks

Climate risks can be broadly divided into transition risks and physical risks. Transition risks include policy responses to the low-carbon transition, such as the introduction of a carbon tax, or changes in demand, such as for renewable energy over fossil fuels. Some sectors are more exposed to these risks than others; think of the utilities and oil and gas sectors or suppliers to these sectors. Without Carbon Capture and Storage deployment at scale, fossil fuel reserves and fossil-fuel generated power are exposed to stranded asset risks. We can assess the extent of these risks by looking at energy reserves and power generation mixes of companies in these sectors and comparing them with the benchmark. Kempen has started to use these indicators in its transitional risks assessments for some of its portfolios (covering most investment strategies) and clients. These measurements and assessments will continue in 2020.

4.3 Physical risks

Challenge

Physical climate risks relate to the long-term weather changes due to global warming, such as higher temperatures and droughts, more frequent and intense storms, cyclones and flooding. Kempen has started to look at high-level physical risks for a few of its own portfolios (covering most investment strategies), but we acknowledge that more detailed physical risk data is needed to improve this analysis. In 2019, Kempen investigated physical climate risk data providers and will continue with this in 2020.

4.4 Climate scenarios

The global temperature is already rising, leading more and more countries, policy makers, regulators, companies and civilians to take climate action. International climate goals also require companies to transition towards a low carbon economy. To see if investment portfolios will move in line with these climate goals, climate scenario analysis can be undertaken. There is a broad range of climate scenarios with different climate outcomes (e.g. IPCC, IEA, 1.5 degrees, 2 degrees, 4 degrees, etc.). In 2018 and 2019, Kempen undertook climate scenario analysis of some of its own funds, based on IEA scenarios.[5]

In 2020, Kempen will continue this analysis for more of its own portfolios and for some of its clients.

4.5 Stress testing

In 2019, we started to use climate stress test scenarios from the DNB study on climate risks at a high level for portfolio analysis and investment plans for our institutional clients. We also used a policy scenario (a sharp carbon price increase) as a short-term shock scenario. This allowed us to gain valuable experience with climate scenarios in our top-down investment approach (in contrast to the bottom-up approach described above). In 2020, we will continue with more extensive use of climate scenarios in our top-down investment approach.

5 IEA scenarios from the Energy Technologies Perspectives report.

4.6 Climate policies

We expect that the probability of physical climate risks will increase. To mitigate these risks, we formulated a specific climate change policy that aims to measure the carbon intensity of all investments in the most carbon-intensive sectors (oil & gas, mining, utilities industries). Lagging investees (compared with peers) can be selected for engagement. Furthermore, we have a separate engagement policy with regard to coal for the mining sector and utilities, where we can engage with companies when they derive certain revenues from their coal activities or coal-fuelled power. As well as engaging directly with companies, we also participate in collaborative engagements through the Climate Action 100+. In 2020, we will update our climate change policy.

4.7 Asset classes and data

The carbon footprint and climate risks described above relate to listed equities, listed bonds and government bonds. For the carbon data, Kempen uses ISS Ethix.

4.8 Development

Recommendation

Climate data quality remains the largest challenge. Companies need to improve the measurement and reporting of their emissions. All relevant parties (e.g. policy makers, companies, investors, data providers) need to use their influence to enhance climate data quality. Nevertheless, we expect that, in general, climate data (including the coverage of companies that report on climate) will improve in the coming period. Currently, it is primarily larger companies that report climate data, while a large part of the universe is estimated. As more companies report in a standardised manner, the quality of climate data will improve. Furthermore, investors are and will be asking companies to report on climate (e.g. via the TCFD recommendations). On climate scenarios and climate risks, there is no silver bullet as yet and all methodologies have their advantages and disadvantages. Also in this area we expect that the quality of climate scenarios and climate risks will be enhanced, driven by climate data providers, investors (like us), policy makers, companies and other stakeholders (e.g. regulators).

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5 ABN AMRO

5.1 Introduction

The financial world is becoming more and more aware that climate change is a process to reckon with. Both climate change itself and the efforts to prevent it will have an effect on people's lives, on business activities and on the stability of economies as a whole. In line with the recommendations[6] of the Financial Stability Board Taskforce on Climate-related Financial Disclosures (TCFD), we performed a first climate risk scenario analysis in 2019 to assess the impact on ABN AMRO. We focused on the Dutch residential mortgage portfolio, which is the largest lending portfolio in the bank. We assume that this portfolio faces flooding and drought risks as a result of global warming.

Risk Management & Governance

This scenario analysis is part of the broader steps we have taken to implement the recommendations of the TCFD. Climate-related risks have been integrated in our risk management process and are managed in line with our risk governance. For example, in our sustainability risk policy framework, we have imposed several sector-specific requirements relating to managing climate risks, including zero-deforestation commitments for agricultural clients, GHG reduction plans for clients in carbon-intensive sectors, and phase-out strategies for coal-fired power generation for energy clients. Furthermore, we are monitoring the carbon intensity of our lending portfolio, using the PCAF methodology, and alignment of portfolios with the Paris Agreement goals, using the 2Dii Banking Tool. In 2020, we will use this tool to set Science-Based Targets.

The Annual Report 2019 contains our first full TCFD disclosure. This paper, however, focuses on our scenario analysis of the Dutch residential mortgage portfolio, as we wish to share our methodology and lessons learned with our peers and a wider audience. We do not suggest that our approach is perfect or complete. It is a first step in providing transparency on our climate-related risks and, moreover, we hope that sharing and discussing it will advance the sector in the assessment of climate-related risks.

5.2 Physical climate risk scenario analysis

An average global temperature rise has different implications in different regions. National average annual temperatures may be higher or lower than the global average, depending on other variables such as geography. Also, the resulting weather may be different per location. In almost all areas, extreme weather events will increase in frequency and severity as a consequence of global average temperatures rising.[7] TCFD therefore distinguishes between acute event-driven risks such as extreme weather events and chronic risks resulting from long- term shifts in climate patterns such as annual average temperatures.

6 Financial Stability Board (June, 2017). Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures.
7 KNMI (May, 2014). KNMI'14: Climate Change scenarios for the 21st Century – A Netherlands perspective.

The Dutch Meteorological Institute KNMI develops climate scenarios for the Netherlands in line with the assumptions of the Intergovernmental Panel on Climate Change (IPCC). These scenarios show the expected weather in the Netherlands in 2030 and 2050 in the event that global average temperature rise follows a path towards 2ºC or 4ºC global warming in 2100. For each path, a scenario has been developed including high and low wind variables. Wind variables were included because the weather in the Netherlands is heavily influenced by wind given its geographical location (KNMI, 2014).

In all KNMI scenarios, but predominantly in the 4ºC scenarios, extreme weather events will increase in frequency and in severity, most notably flooding and drought.[8] Although 195 countries signed the Paris Agreement in 2015, committing to limit global warming to well below 2ºC above pre-industrial levels, current policies by these countries are not in line with achieving this objective. If no additional measures are taken, it is more likely that global warming will be between 3ºC and 4ºC by 2100.[9] A 4ºC scenario can thus be considered a plausible stress scenario and forms the starting point in our analysis.

Approach

In our scenario analysis, we distinguished three different types of impact resulting from extreme weather events:

- Occurrence effects
- Perception effects
- Macro-economic effects

5.3 Occurrence effects

The occurrence effect is the impact resulting from a flood or drought actually taking place. It is not difficult to imagine that flooding causes damage to properties. Depending on the depth of the flood (we examined 50cm and 200cm flooding), the duration of the flood and the characteristics of the property (ground or upper floor), damage may vary.

Drought, however, causes more indirect damage. Drought will lead to decreasing groundwater levels, causing foundation piles to go dry. The exposure of foundation piles to oxygen will cause rotting, resulting in subsidence.[10] While flooding is a sudden event, rotting is a more gradual process. It is, however, irreversible and will inevitably require property owners to replace foundation piles entirely.

Foundation piles are commonly used in peat soil, which also subsides. The piles rest on deeper layers of soil, which do not subside. The above problem of rotting foundation piles is applicable only to wooden piles. Concrete piles are also used and are not impacted by decreasing groundwater levels. On other soil types, such as clay and sand, foundation piles are not used. More frequent and severe (prolonged) periods of drought will, however, also affect property built on these soil types. When the soil dries and settles unequally, unequal subsidence may damage properties.

8 KNMI (2014). KNMI'14-klimaatscenario's.
9 IPCC (2013). Climate Change 2013: The Physical Science Basis.
10 Deltares (March, 2012). Schades door watertekorten en -overschotten in stedelijk gebied.

In our analysis, we examined only the effects of drought on houses with wooden foundation piles.

5.3.1 Flooding

For flooding we used the probability maps provided by Climate Adaptation Services (CAS) presented in the klimaateffectatlas.nl. These maps show the probability of a ≥50cm and ≥200cm flooding in 2050 for each geographical coordinate in the Netherlands. Probability ranges from very low to very high. Although the KNMI scenario shows that the frequency and severity of flooding risk will increase, the 2017 Dutch Water Act committed to approx. EUR 30 billion investment in water protection measures to reduce the risk. We therefore assume in this analysis that the current risk (without the protection measures) is the same as in 2050 (with the protection measures), allowing us to calculate the probability until 2050 using the Bernoulli trial method.[11]

This data on probability was then combined with the (geographical) data of each property in our mortgage portfolio using Python and incorporated into the Geospatial Information Software QGIS. This resulted in portfolio-specific probability maps as shown in Figure 1. Potential damage was then calculated based on the Standaardmethode 2017 Schade en Slachtoffers by Deltares, which includes a formula taking into account flood height and ground floor surface area.

Figure 1 Probability flooding ≥50 cm.

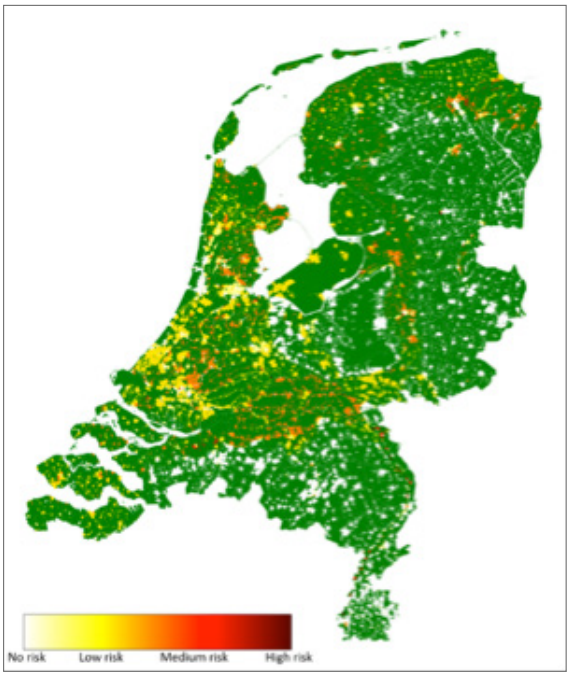
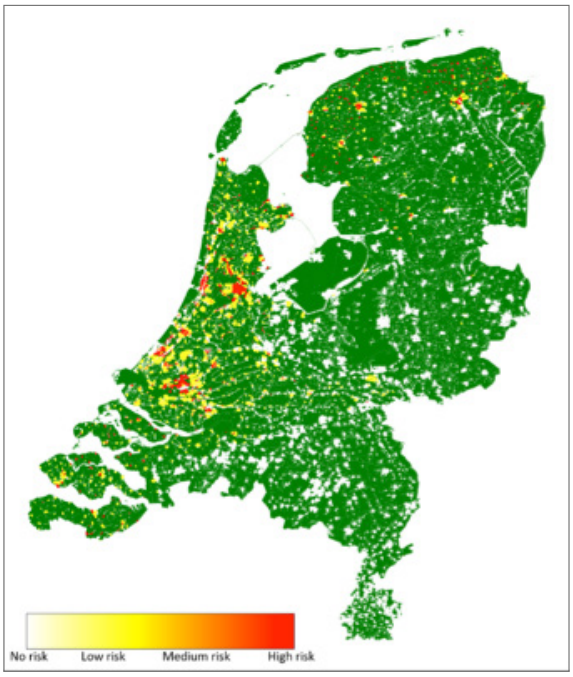


Figure 2 Probability pile rot.



[11] In the theory of probability and statistics, a Bernoulli trial (or binomial trial) is a random experiment with two possible outcomes, "success" and "failure", in which the probability of success is the same every time the experiment is conducted.

5.3.2 Drought

For drought and pile rot, we used data provided by Kenniscentrum Aanpak Funderinsproblematiek (KCAF), which is also partially included in the klimaateffectatlas.nl. KCAF provides the expected percentage of houses in a specific area that will encounter pile rot until 2050. This is either 0, 1, 5 or 30%. For some areas this data is very granular: the areas are very small and probabilities are based not only on weather, soil and structures, but also on actual data from foundation research performed on/in the ground.

This data was again combined with the (geographical) data of our mortgage portfolio and incorporated in QGIS, resulting in a probability map as shown in Figure 2. As stated, once pile rot starts it is irreversible. Although we cannot predict precisely when rotting foundation piles need to be replaced, they will have to be replaced at some stage. Potential damage is therefore assumed to equal foundation replacement, which in turn is estimated based on invoices of foundation replacement projects in the past.

5.4 Perception effects

In addition to a flood actually occurring, the risks that people perceive (of encountering a flood or other extreme weather event) can drive down demand and hence market value. Literature provides some indications of the magnitude of this effect for flooding. Dutch empirical data[12] showed a 1% price fall for properties in areas perceived to be at risk of flooding. This study was conducted in 2012 and although the flooding exposure in the event of dykes being breached was already high at the time, we believe the fall would be greater today. This is because there is a significant growth in public awareness of climate change and in the awareness of flooding probabilities growing as a result.

More recent data from the US shows a fall of approx. 5% for (owner occupied) property at a location that would be flooded if sea levels rise by 6 foot (1.80 m) in 2100, compared with the same property that would not be flooded if sea levels rise.[13] The importance of public awareness is also clear in this study, as the price fall was greater in the year that IPCC published a new report about climate change and resulting sea level rise. Similarly, a fall of over 30% occurred in house prices after a flood shown in another US study.[14] This effect, however, declines rapidly: 5% per year after the flood. Notwithstanding some level of irrationality, we feel that the perception effect should be considered. We therefore included a 5% fall on market value of all properties at risk of flooding.

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12 Bosker, M. et al. (2018). Nether Lands: Evidence on the Price and Perception of Rare Natural Disasters, 17 (2), pp. 413-453.
13 Federal Reserve Bank San Francisco (2019): Strategies to Address Climate Change Risk in Low- and Moderate-income Communities, 14 (1).
14 Atreya, A., Ferreira, S. and Kriesel, W. (2013). Forgetting the Flood? An Analysis of the Flood Risk Discount over Time, 89(4), pp. 577-596.

5.5 Macro-economic effects

Empirical studies show that extreme weather events such as a severe flooding cause a macro-economic shock through a depreciation of the capital stock of the economy (buildings and infrastructure) and a temporary standstill of economic activity that affects production capacity. Literature suggests the following: the floods cause a first order effect. Economic activity falters due to production disruptions as people can't get to work, imports increase and exports decrease. These disruptions cause an initial GDP shock.

As housing values fall due to the damage, a second order effect occurs: people lower their consumption to pay back their mortgage so as to level their loan with the value of their houses. This triggers a drop in demand causing unemployment. All the more so when negative equity problems occur. Meanwhile, the government and businesses will step up spending on repair investments, crowding out more innovative investments that would have otherwise generated productivity growth. Eventually, repair will boost demand, promoting economic activity until the economy is on its initial growth path. While most studies show that economic growth returns to trend after an extreme weather shock, the level effect (on average -0.6 percent GDP) remains.

To assess the macro-economic effects of flooding, we ran the following scenarios in our stress test model:
A 50cm flood scenario: occurrence of a ≥50 cm flood in areas that have been identified as at risk (based on CAS maps in klimaateffectatlas.nl). The scenario includes changes in initial House Price Index (HPI) of -16% due to both direct damage and market reactions in response to risk perception changes, an initial GDP effect (based on the literature[14] Koks, 2019) of -1.3% and a DNB Delfi tool adjustment for the second order effects. The probability of this scenario is estimated between 1% and 15% over 40 years.
A 200cm flood scenario without second order effects: occurrence of a ≥200cm flood in areas that have been identified as at risk (based on CAS maps in klimaateffectatlas.nl) including HPI change of -32% and an initial GDP effect (-2%). The probability of this scenario is estimated between 0.1% and just over 1% over 40 years.
A 200cm flood scenario with second order effects: occurrence of a 200cm flood in the areas that have been identified as at risk (based on CAS maps in klimaateffectatlas.nl) including HPI change of -32%, initial GDP effect of -2% and a Delfi adjustment for the second order effects.

5.6 Effects on individual households

Potential damage from extreme weather occurring varies per property (see above). The occurrence effect can be undone by repair. Some houses however are not worth repairing, for example when the damage/repair costs are too high compared with the value of the property, when the property is too old or when it is poorly maintained. An energy label below D may be an indicator in this respect. Furthermore, the property owner may not have the financial means to repair. Ideally, the property owner has freely available wealth or sufficient mortgage headroom to finance repair. Payment record

[15] Koks, E. et al. (2019). The macroeconomic impacts of future river flooding in Europe, 14 (8), pp. 1-9.

or maximum Loan to Income (LTI) ratio may be indicators in this respect. From the properties at risk, the initial focus should be on those with the highest probabilities to encounter flooding or pile rot, in combination with high vulnerability of the property and/or high vulnerability of the clients in terms of repair capacity.

Flooding and pile rot are in general not covered by insurance in the Netherlands. Government support is available in some cases: collectively in the case of flooding (for example the damage from the flood in Limburg in 1993 was largely covered by public funds) or individually for vulnerable households via public funds at municipality level (e.g. Fonds Duurzaam Funderingsherstel). This latter fund is not available in all municipalities. For vulnerable clients that do not have access to public support, damage may ultimately result in financial difficulties.

It is important to note that the relative number of vulnerable households in high-risk areas could potentially grow as the perception effect becomes stronger. The vulnerable households will be drawn to the cheaper, but higher-risk properties in areas prone to flood or pile rot. Having said that, the current number of clients in high-risk areas is low and/or time horizons are long. The expected damage does not therefore have significant impact at portfolio or bank level.

5.7 Reflection

Insight

We note that it is unlikely that all areas identified as at risk will experience a flood at the same time. It is more likely that flood protection (dykes) in specific areas breach, causing flooding. The Landelijk Informatie Systeem Overstromingen (LIWO), developed by Deltares on behalf of Rijkswaterstaat provides maps of such specific scenarios. It is worth analysing the occurrence and macro-economic effect of such scenarios, including the most extreme. This is also important because the areas on the CAS maps with the highest probability of flooding are often in areas unprotected by dykes (the Buitendijkse areas). Properties in these areas are generally built on higher ground, reducing the expected damage if a flood occurs. Focussing on flooding in areas assumed to be protected may be more informative.

Recommendation

Having said that, being able to identify individual properties with a high risk of flooding and pile rot (notwithstanding the exact causal chain of the scenario), in combination with the repair capacity of the property and the owner, allows us to identify clients that require most urgent attention. The solution for these clients may not come from ABN AMRO alone or directly. It may be necessary to work together with municipalities and other banks that finance properties in the same area (or even street) that are exposed to the same risks. In Rotterdam, for example, the Funderingsloket supports residents with guidance and subsidies to undertake foundation and soil investigation, and to finance foundation repair when the investigation indicates a need to do so.

Challenge

A lot of public data are available on flooding and pile rot risk, but it remains uncertain whether a property will actually encounter damage. Data quality can still be improved to reduce uncertainty. Information is required at individual property level too. For existing owners, programmes like the

Recommendation

Rotterdam Funderings-loket[16] are helpful. But also for new owners and in the mortgage provision process, data are needed. Banks usually depend on valuations and structural inspections. In this respect, service providers will need to devote more attention to climate-related risks. Currently, there is very little attention, if any.

Next Step

The focus in our analysis has been on the effects of flooding and drought on the mortgage portfolio, but impact is also to be expected from other extreme weather events such as heat. These have been disregarded in this first analysis, as the direct damage from these events (occurrence effect) seemed less prominent. It does, however, influence the value of a property. Measures taken to combat heat stress, for example, may increase the value of property.

Next Step

Based on the above, the focus for 2020 will be on improving the current analysis of flooding and drought, but also to widen the scope to heat and extreme events. Emphasis will be placed on the risk of damage and the opportunity to generate positive impact. We also aim to continue the (public) debate with peers, municipalities and other stakeholders about how to assess these and other climate risks and – for the mortgages sector in particular – how to address the risks faced by vulnerable properties and households in particular.

In 2020, we will undertake further analysis in other sectors too. A scenario analysis on transition risks in the energy sector that was started in 2019 will be continued in 2020. A heatmapping exercise will also inform us regarding additional sectors on which to perform scenario analysis. We aim to build on the lessons learned in the analysis of physical risk in the mortgage portfolio and on discussions with peers.

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16 www.rotterdam.nl/bestuur-organisatie/funderingsloket/

6 De Volksbank

De Volksbank is a multi-brand bank with a focus on the Dutch market, offering clear and transparent mortgages, savings and payment products to private individuals and SMEs.

To live up to our mission – Banking with a human touch – de Volksbank has formulated the following ambition: optimising shared value. This means that de Volksbank serves the joint interests of customers, society, employees and shareholders.

Our goal is to achieve a positive contribution to a sustainable society. De Volksbank, in particular the ASN Bank brand, aims to be at the forefront of stimulating positive changes in society. One of its strategic objectives is to achieve a climate-neutral balance sheet in 2030. In 2016, de Volksbank decided to adopt ASN Bank's sustainability policy within the entire organisation. We began implementation of this policy in other organisation departments, brands and processes in 2017.

6.1 Management of climate risks

6.1.1 Sustainability identified as a material risk type

In addition to our role as a catalyst for sustainable changes in society, we are investigating how internal and external developments can have an impact on the assets of the bank. The risks inherent to our business model and strategy are reviewed annually in a strategic risk analysis. Climate change and the Paris Agreement are important external developments, which are identified as one of the key risk drivers for sustainability risk. In 2019, sustainability risk was assessed as a material risk for de Volksbank and as such added to the risk taxonomy. In addition, sustainability risk has been cascaded down into the sub-risk types environmental risk and social risk. Climate risk is an environmental risk. The risk appetite of sustainability risk is based on the bank's qualitative overall risk appetite and the defined and allocated risk-taking capacity. The following elaboration focuses only on climate risk.

6.1.2 Governance

Governance

In line with the EBA guidelines on Internal Governance (EBA/GL/2017/11), the risk management framework for sustainability is based on the risk management cycle. It encompasses a limit system, policies, processes and internal controls, including regular independent reviews and evaluations of the effectiveness of the framework.

In order to manage climate risks, it is important to elaborate the responsibilities for the business and independent control functions based on the 'Three Lines of Defence' model. Because sustainability risk is a diffused risk type, the first and second line responsibilities are spread throughout the organisation. Setting up a risk management policy on sustainability risk is important to further integrate sustainability into the bank's risk management.

The Board of Directors is ultimately responsible for the risk management of de Volksbank. To increase efficiency and allow deeper focus in specific areas, risk committees and related 'thematic' organisational bodies are in place. Adding sustainability as a new risk type to our risk taxonomy has resulted in an adjustment in the risk committee structure. We are investigating whether the

mandate of the Climate Neutral Committee is sufficient to set, monitor and manage our climate-related objectives taking into account the risk appetite. Because climate-related events can be a driver of conventional risk types, such as credit risk and operational risk, climate risks could also be discussed in other risk committees.

6.1.3 Sustainability Policy Framework

The Sustainability Expertise Center (ECD) is a department of ASN Bank and part of the first line of defence as a supporting team for the core business. ECD is responsible for the set-up of the Sustainability Policy Framework that contains the first-line policies. This framework is based on the three pillars within sustainability: human rights, biodiversity and climate change. The general climate policy has been cascaded down to business line and portfolio level by setting sector-specific requirements for managing climate-related risks. As de Volksbank has adopted this first-line policy of ASN Bank regarding climate change and sustainability criteria, it applies to the entire organisation. Biodiversity and human rights may be included at a later stage.

Approach

6.1.4 Risk appetite

Climate-related risks can have an impact on the bank. We have determined a risk appetite, risk drivers and risk indicators for monitoring and adjusting the development of climate risk. This is elaborated in the Risk Appetite Statement (RAS) on sustainability risk. The identified risk drivers are: the conversion process towards climate neutrality (transition risk), acute and chronic climate events (physical risk) and the expectations of society (reputation risk). We have opted for risk indicators aligned with our current strategic objectives. The limit system of these risk indicators is based on the strategic objective to obtain a climate-neutral balance sheet in 2030. The planned growth in climate neutrality in the years ahead is translated into an average growth per quarter.

Climate change can also be a driver for other conventional risk types. We have investigated the effect of climate change on other risk types. If the impact of climate change is material, it will be included in the RAS of that specific risk type.

6.1.5 Risk assessment

The risk management function (RMF) assesses the plans of the business, including business plans, the Operational Plan (OP), strategic plans, first-line risk reports and first-line policies (this list is not exhaustive). Every year, the bank sets up an OP in which we describe how we plan to reach our strategic goals in the next few years. The RMF reviews this OP annually to provide a comprehensive risk view including all risk types of the risk taxonomy to facilitate effective and balanced decision-making. In 2019, the RMF for sustainability risk also performed a review on the OP to assess whether the targets in the area of sustainability are sufficiently integrated in the OP for the next three years.

In 2019, climate risk was included in the reverse stress test for the first time. The focus of the analysis was the negative impact that lower groundwater levels (due to heavy droughts as a result of climate change) can have on the mainly wooden foundations of homes, and therefore

on collateral values. It was a high-level estimation of the potential impact of this type of physical climate risk on our mortgage portfolio, negatively affecting the House Price Index and potentially increasing the default rates for this segment.

6.1.6 Methodology to measure climate risks

To calculate the progress towards our goal of a climate-neutral balance sheet, we use the methodology of the Partnership Carbon Accounting Financials (PCAF)[17], another working group of the Sustainable Finance Platform. In 2015, ASN Bank initiated PCAF as a collaborative venture of eleven Dutch financial institutions. In 2019, PCAF developed into a global partnership comprising over 50 financial institutions that works towards a transparent, uniform and widely accepted methodology for carbon accounting.

De Volksbank's carbon-neutral goal comes down to equalising all financed emissions to all avoided emissions. The PCAF methodology to calculate the CO2 emissions for mortgages is based on an average energy consumption per energy label.

The actual CO2 emissions are not only influenced by the energy label, but also by behaviour. Together with PCAF-NL members, we are looking into Statistics Netherlands (CBS) data that reflect real carbon emissions as well. This is one way to set climate goals.

Insight

The other way is alignment with Science Based Targets.[18] A reduction in carbon emissions is one of the initiatives to achieve the goals of the Paris Agreement and the Dutch Climate Agreement. Alignment with Science Based Targets implies aligning the total mortgage portfolio with 2 degrees Celsius scenarios. We have participated in a test case, which means we incorporate the goals in question into our own targets and ensure that our activities are aligned with these agreements.

We are transparent about the status of de Volksbank' level of climate neutrality and report on it in our Annual Report, press releases and on our website. The methodology we use to calculate climate neutrality is published on ASN Bank's website.

6.1.7 Measures to mitigate or reduce climate-related risks

When it comes to investment decisions, de Volksbank takes into account the ESG factors covering all Sustainable Development Goals (SDGs). To increase our avoided emissions we are investing in renewable energy projects and specific green bonds. In order to decrease our carbon footprint, we rule out investments in companies involved in fossil fuels. De Volksbank also continuously assesses whether investments still meet our sustainability criteria. We update these criteria on a regular basis, which can lead to the termination of specific loans or investments in our investment universe or portfolio.

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[17] For more information about the PCAF methodology see: https://carbonaccountingfinancials.com/files/downloads/1911-pcaf-report-nl.pdf?6253ce57ac

[18] For more information about Science Based Targets see: https://sciencebasedtargets.org/

Challenge

Three-quarters of de Volksbank's assets comprise residential mortgages. Most of the carbon emissions on the balance sheet are, therefore, caused by these mortgages. The biggest challenge is to lower these emissions. The first step is to determine the CO2 loss in accordance with de PCAF methodology. We lack information about the actual or real carbon emissions of our mortgage customers. However, we do know the energy label of each home and the average emission of every energy label, so we are able to calculate an average carbon emission on total mortgage portfolio level based on the average energy consumption per energy label.

Insight

As a bank, you can decide not to provide mortgages to people with an energy label E, F or G to mitigate sustainability risk. Because of our mission 'Banking with a human touch', we do not exclude customers with less energy-efficient homes. This may, however, make it more complicated to improve the total average energy label of our mortgage portfolio. Our goal is to stimulate customers to achieve more sustainable housing. We are committed to reducing emissions by encouraging our customers to make their houses more energy efficient and offer products to boost energy saving or renewable energy production. We train our advisers to advise and stimulate customers to take these measures. Furthermore, we offer customers an interest discount on an ASN mortgage or a higher mortgage when taking measures in order to make their home more sustainable.

6.1.8 Monitoring and reporting

The RMF regularly monitors the actual risk profile and assesses the bank's strategic goals and risk appetite in order to enable decision-making by the management body in its management function and to challenge by the management body in its supervisory function. Each quarter, the Board of Directors is informed of the key risk indicators (KRIs) and the early warning indicators (EWIs) as reported in the risk report of the RMF. The short-term perspective of this report focuses on the review and monitoring of the risk types in the past and coming months with a maximum of three years (stress-testing horizon). Climate change, and the policies to mitigate it, will occur over a much longer timeframe than the normal horizon for stress testing. The long-term perspective is reported in the Climate Neutral Committee.

6.2 Challenges in managing climate risks

Challenge

One of the challenges in managing climate risks is achieving a more sustainable mortgage portfolio. A bank has limited influence on the home owners to make their homes more sustainable. A bank may decide to oblige customers to have a final energy label instead of a preliminary energy label, or may decide not to accept new mortgages with energy labels E, F and G. However, excluding people from obtaining a mortgage is not in line with our mission.

Challenge & Recommendation

Another concern is the lack of accurate, complete and historical data. For example, it is not obliged by law for home owners to have a definite energy label. The energy label of a home is not the only element that determines the actual energy consumption. When the energy label was introduced, it was assumed that theoretical consumption, in particular gas consumption, would increase more or less linearly as the energy label deteriorated. In practice, there is no such difference because of customers' behaviour and different types of home. The conclusion is that the behaviour of people

is a very important variable in the actual energy consumption. For a bank to know the real CO2 emission of the mortgage portfolio it needs the data from energy suppliers.

Challenge

Finally the long-term horizon of the impact of climate change is a challenge. It is not expected that climate risks would materialise in the three-year stress-testing horizon. However, it does not seem very realistic to use a static balance sheet and business model for a long term of 30 years to calculate the impact of climate change.

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7 Rabobank

Climate change risk is a complex issue, an aggregation of the adverse impacts that climate change may have on the private and public sector and hence the bank's portfolio. In this document we examine the impact of the two main types of climate risk - transition and physical - and their potential impact on the quality of the bank's credit portfolio in the Netherlands and around the world. Climate risk can vary over time and across regions. As a result, some sectors, companies and regions could be subject to both high physical and transition risk.

Insight

While changes associated with a transition to a lower-carbon economy can present significant risks, they can also create huge opportunities for banks and organizations providing climate-compatible approaches. Leading organizations can have better chances to capture these opportunities, which may come in terms of new businesses, products and services. In particular, embedding climate risk and opportunities into corporate strategic thinking can have the potential to increase innovation, anticipate and stay ahead of policy changes, and improve operational efficiency and resources management. In some way, successfully aligning over time with a "2°C strategy" can become an indicator of a company's governance. Our strategic ambition is to be a leading bank in the Energy transition & Climate Smart Agriculture.

7.1 Four analyses of climate risk for Rabobank

Approach

In this document, we present four preliminary analyses that estimate a part of Rabobank's exposure to climate change risk. For these preliminary analyses, the regions and sectors selected are Food and Agriculture (F&A) in the Netherlands and global, and the Dutch Residential mortgage portfolio. These reflect Rabobank's largest exposures. By analysing the impact of climate risk on mortgage and F&A portfolios, we also cover two of the four categories classed by the UNEP FI TCFD[19] ('TCFD') working group as most exposed to climate change risks (Energy, Transportation, Materials & building, Agriculture, food & forestry products). The fact that Rabobank's current overall exposure to these four TCFD industry sectors is roughly 60% of the Group exposure at default (EAD) only serves to underline the importance and urgency to account for the systemic risk climate change. We carried out four analyses using different methodologies:

- Worldwide stress test on transition risk (an enhanced version of the DNB stress test 2018: An energy transition risk stress test for the financial system of the Netherlands).
- Portfolio analysis on transition risk for F&A sector in the Netherlands (an analysis of the expected loss based on methodologies developed by the UNEP FI TCFD working group).
- Portfolio analyses on water stress as physical risk for Europe, US, AU/NZ.
- Portfolio analysis on physical risk for the mortgage portfolio on flooding risk in the Netherlands.

The analyses were carried out between 1 September and 1 November 2019. We applied different approaches to reflect methodologies currently in use by De Nederlandsche Bank (DNB), TCFD and our own modelling teams. The methodologies, results and recommendations from each analysis are presented below.

[19] The Task Force on Climate-Related Financial Disclosures (TCFD) was set up in 2015 by the Financial Stability Board (FSB) to develop voluntary, consistent climate-related financial risk disclosures for use by companies, banks, and investors in providing information to stakeholders.

7.1.1 Two approaches on transition Risk

Transition Risk Stress Test: The impact of Carbon Tax

For transition risk we took two approaches. Firstly, we performed two macro-economic stress tests on Rabobank's worldwide credit portfolio (ex. De Lage Landen). The first stress test scenario considers the introduction of a new policy with respect to carbon pricing tax of USD 100 per tonne globally (based on a DNB macro-economic stress test)[20] and enhances the analysis performed by the DNB. We extended the scope and used Rabobank's internal framework and input. The cumulative impact on Impairment Charges (IC) of this macro-economic stress test for energy transition risk policy shock is not very severe over five years. This internal stress test does not explicitly differentiate between the impact of the climate scenario on the different sectors. Rabobank is currently developing a methodology to facilitate this using sector-specific input. When these are added in the next climate change stress test, it is expected that the total impact will increase.

Next Step

Rabobank has also taken climate risk into account in the Mid-Year (MY) 2019 adverse stress test, where the introduction of a carbon emission tax in Europe leads to an extreme trade war scenario with big losses as a result. In this MY adverse scenario, a natural disaster happens near Europe due to global warming. This extreme event triggers governments' sense of urgency to abruptly introduce a carbon emission tax to curb greenhouse gas emissions. As a result, carbon prices rise by USD 100 per ton, similar to the policy shock climate stress test scenario. This tax, however, is only introduced in the EU and not globally. To compensate EU companies for the carbon price difference between EU and non-EU countries, governments in European countries will impose import tariffs. This will intensify the trade tensions between EU and other countries and in turn many non-EU countries will also impose import tariffs on EU products, causing a global trade war. The trade war scenario materializes, in addition to higher energy prices, by a decline in equity prices, lower trade due to higher export prices, a sharp increase in risk premiums plus additional shocks on growth, labor and house prices. In terms of historical precedent, the scenario shares similarities with the Global Financial Crisis of 2008/2009. The impact of this extreme trade war is significantly bigger than the policy shock scenario and shows increased impairment charges.

Transition Risk Portfolio Analysis: The impact on Rabobank's Dutch Livestock and Crops sectors

The second transition risk approach was a portfolio analysis of the impact on Rabobank's Dutch Livestock and Crops sectors. This methodology is developed by the UNEP FI TCFD working group led by Oliver Wyman. The analyses show that the impact of transition risk differs significantly between sectors. Sectors will react differently to transition risk: covered crops was deemed most sensitive to transition risk in terms of future revenues and costs. This was followed by annual crops. Perennial crops showed little to no sensitivity over the horizon up to 2040. Similarly, pork meat was deemed more sensitive to transition risk than dairy cattle based on the sample set and scenario used.

Insight

The highest impact was for covered crops with up to a three-notch downgrade for specific clients. However, the total impact for the Dutch Livestock and Crops sectors results in an mild increase in expected loss in 2030.

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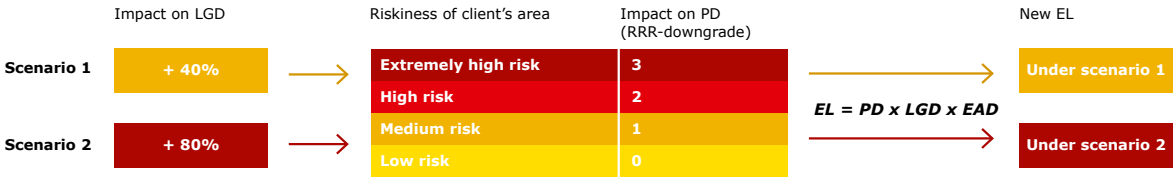
20 De Nederlandsche Bank, "An energy transition risk stress test for the financial system of the Netherlands," 2018.

7.1.2 Two approaches on physical risk

Physical risk portfolio analysis: The impact of global water stress on Rabobank

We also conducted two assessments for physical risk. First, we expanded on an assessment Rabobank carried out in 2018 with respect to water stress around the world, based on a DNB approach.[21] To quantify the impact on water stress in terms of Expected Loss (EL) we assumed two possible scenarios, i.e. a mild and a severe impact. In the mild impact scenario the loss given default (LGD) increases by 40%, while in the severe impact scenario the LGD rises by 80%. Each of these scenarios is combined with a change in the probability of default (PD). This PD change is estimated based on the riskiness of the area where our clients' exposure resides. The combined changes in LGD and PD are then used to estimate the new EL for the two different scenarios.

Figure 1 Approach used to estimate the EL Schematic Representation of the approach used to estimate the EL in the Non-NL Portfolio Due to Water Stress



Insight

Water stress (flooding and drought) seems one of the most relevant physical climate risks for Rabobank. The analysis reveals that water stress can have important implications for Rabobank's F&A portfolio especially in the USA and Australia. The sectors most impacted are Animal protein, Grains & Oil seeds, Dairy, Fruit and Vegetables. For Brazil the most vulnerable sectors are Grains & Oil seeds and Sugar for which the EL almost triples when the worst-case scenario is applied. Our calculations for our non-domestic credit portfolio yielded a considerable amount if the worst-case scenario is realized.

Physical risk portfolio analysis: Flooding risk in Dutch residential mortgage portfolio

Secondly, we carried out an assessment of flooding risk for the Dutch Residential Mortgage (DRM) portfolio with external data input from an external consultant. The Netherlands today is in part the result of the continuous fight against water. In the past centuries, both the North Sea and some of Europe's largest rivers that pass through the country have caused large-scale flooding. Over time, in response to these threats, the Dutch have established a flood defense system which is known to be one of the safest in the world. At the same time, continuous use, maintenance and improvement of the flood defense systems remains crucial for survival as 55 percent of Dutch territory is flood prone: 26 percent of the country is below sea level and 29 percent is susceptible to river flooding. Moreover, 70 percent of the economic activity and 52 percent of the population is based in these flood prone areas. Rabobank is one of the largest retail mortgage providers in the Netherlands.

Insight

[21] De Nederlandsche Bank, "Waterpoof? An exploration of climate-related risks for the Dutch financial sector," 2017.

Next Step

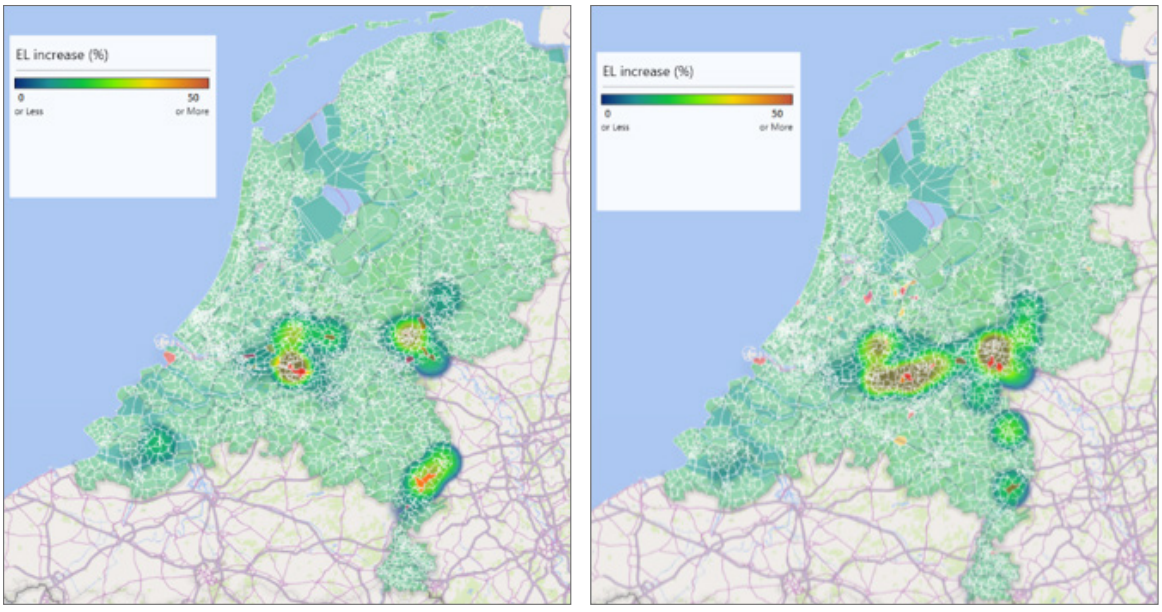
These facts combined underline the relevance for Rabobank to assess flooding risk in the context of climate change. The assessment, a methodology modeled by our own credit modelers, indicates a material increase of the sum of expected losses over the next 100 years due to flooding. This result justifies our proposed plan to further investigate flooding risk in the Netherlands, for instance by increasing the scope, challenging the underlying assumptions and considering governmental support to homeowners in case of flooding.

The preliminary analysis shows that extreme weather events (such as high discharges on the river Rhine and Meuse and storm surges) are possible within a 100-year return period and could cause flooding leading to material damage in our Dutch mortgages portfolio. We think that the main areas at risk are concentrated around the big rivers.

Insight

The flooding risk assessment also indicates that there is a potentially material but manageable risk in the Dutch Residential Mortgage (DRM) portfolio of Rabobank. Material risks occur for both the current 2019 situation and for the expected 2050 state of the flood defense system and climate, i.e. after realization of levee reinforcements to meet the new government-imposed standards and to anticipate on climate change impacts.

Figure 2 Heat map of zip code areas causing EL to increase. Left: current situation. Right: 2050 after levee reinforcements and climate change



7.2 Findings and limitations

Quantifying climate change risk is very challenging and complex. The analyses suggest that both physical and transition risk could have a high impact on credit portfolio quality, in particular due to the combination of large exposures in portfolios. This emphasizes the urgency of the matter. We conclude that most climate risk assessment methods are not yet completely suitable for decision making and steering purposes, such as capital requirements. On top of that, data gaps between what we need and what we have can be relevant and various methodologies are still in development.

Challenge

Despite the complexity, data gaps and limited scenarios, we see these analyses as an important step forward in starting to think about climate change risk assessments. These first attempts highlight that a lot of work still needs to be done to quantify climate risk, but we are convinced that the sooner you start, the sooner you can act. We have aimed to address this through a long-term plan for embedding climate change into our risk management framework. This plan has a five-year horizon (2020-2024).

We also found that getting everyone aligned internally on how to look at climate change risks is crucial. That is why the Climate Program is set up by Rabobank and we are booking steady progress as the climate risk topic is already widely supported by all employees. Also, to address climate risk a professional cross functional team needs to be set up permanently, as climate risk is a new risk type.

Insight

7.2.1 Findings on analysis

Insight

- **Stress Testing**. For conducting the stress test we quantified the impact of climate change by translating the respective scenario to macro-economic variables that were fed into the stress test framework. It is expected that some sectors and/or groups of clients will be hit more severely by the scenario than others. For this reason, it is important to differentiate the impact of climate across sectors. We learned that the sector-specific risk adjustment methodology must be used and calibrated in the stress testing framework to take account of sector and regional non-macroeconomic effects. Furthermore, more scenarios should be used to create a possible range of outcomes and gain more perspective on the impact of the transition to a low carbon economy for the risk profile of Rabobank's portfolio.

Challenge

- **TCFD**. The transition methodology developed by the UNEP FI has been an important stepping-stone for us to understand transition risk and create awareness within the bank. However, the methodology does not use bottom-up information on individual debtors which would allow to differentiate winners from losers, and thereby help steer overall credit/ risk strategy.

Next Step

- **Water Stress**. The assessment shows that water stress is likely to have a high impact on EL of our worldwide F&A portfolio. We acknowledge that water stress must be included more structurally in the bank's risk management and underlying methodologies. We are working on a more detailed analysis of the water stress impact with a greater focus on specific countries and with the involvement of the local offices.
- **Flooding Risk in the Netherlands**. We believe that despite the limitations to the data used there is sufficient indication that flooding risk can be material in our mortgages portfolio. The assessment method and underlying data will benefit from further improvements in order to determine the Unexpected Loss (e.g. at 99.9%) as realistically as possible. Furthermore,

Challenge

extensive scenario analysis should provide more insights on which sequences of events are realistic for flood-prone geographic areas and on the corresponding catastrophic losses and/or gradual deterioration of loan qualities. This information could then serve as the basis for how to manage this risk. Finally, on flooding risk and the real estate value impact, we learned that data providers show different scenario's regarding flooding risk. Some data providers are more conservative than others regarding broken levees, for example.

7.2.2 Limitations

Challenge

Since this preliminary assessment illustrates perhaps a fraction of the potentially inexhaustible climate scenarios and pathways, we believe that the findings in this document could well reflect the lower end of the impact range which climate change could have on Rabobank's portfolio. This is due to the complexity of the material, driven by several factors:

Next Step

- Climate change risk depends on the physical location of business activities. We believe that the effects encountered can be much more localized and could differ per region. This requires more granular analyses (and datasets).

Challenge

- One of the challenges we highlight is the fact that the frequency of (physical) events plays an important role for the flooding methodology, while the occurrence of extreme events is likely to be significantly altered by climate change.

Challenge

- Climate related scenarios are surrounded by very high uncertainty. As a result it is likely that not all climate-related risks have been identified, while the probability of known risks materializing is characterized by large error margins and could lead to major disruptions. For example, tipping points regarding the loss of biodiversity or services provided by ecosystems are difficult to predict with a high degree of certainty and may have major consequences.
- Climate change risk has a very different time horizon than most other risk analysis. Instead of the five-year horizons specific to most internal risk assessments/stress testing exercises, climate change risk is covered by horizons spanning decade(s).

Challenge

- The scarcity of (historical) data and of consistent and mature methodologies makes climate-change risk assessment very complex. As recent history is not representative for the future, assessing climate risk is particularly complex as this means there is no historical data we can build on. The lack of a consistent and comprehensive methodology to assess risk is also a challenge. For example, the methodology developed by the UNEP FI TCFD working group during the 1st pilot is not applicable to Rabobank's entire credit exposure as it does not cover all sectors. Data availability is crucial, both internal customer data and data used from external sources. The situation gets more complicated when assessing the impact for non-listed companies: small to medium-sized enterprises (SMEs). As a result, we identify a clear need to develop infrastructure to record climate-related information that would enable a bottom-up assessment. Rabobank has set-up a sustainability data and analytics team and is revamping internal sustainability tools, and that should help address this issue over time.

Challenge

- A rapidly evolving environment (multiple regulations and policies, guidelines and research still in progress) poses a challenge.

Challenge

- The overall severity of climate change impact can be huge according to scenarios that consider the socio-political consequences or the systemic risks arising from the interaction of climate change with the real economy and international trade flows.
- Last but not least, climate change risk is a matter of not just vulnerability but also of resilience, making an assessment even more complex. For example, if a company can easily switch crops to adjust to changing weather patterns and it can afford to do so, then the company is resilient and the risks it bears are lower.

Recommendation

Despite these challenges Rabobank has started on a journey which will take many years with many uncertainties but with a clear commitment. We believe that success is possible if banks, government, businesses, NGOs and civil society form strong alliances and work on comparable measurements. Many are already deeply committed to quantify and qualify climate change but by working together, we can make an even bigger difference.

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8 ING

8.1 How portfolio alignment meets climate risk assessment

Climate change impacts companies and companies have an impact on climate change. As banks, we need to understand the risk climate change poses for our clients and be ready to safeguard our business by taking the implications of climate change into account in our risk processes. We also have a role to play in financing the transition to a low-carbon, climate-resilient economy. This is where portfolio climate alignment comes in.

In this chapter, we will outline how climate risk assessment and portfolio alignment relate and together can inform a bank's risk appetite and lending strategy in a world facing climate change. Therefore, we will deep dive into ING's Terra approach, a way to align a bank's lending portfolio with the well-below two degree goal of the Paris Agreement and show how this approach feeds into climate risk assessment as well as supports mitigation.

Governance

Climate governance

ING has instituted a Climate Change Committee (CCC) to oversee and set priorities for the implementation of the TCFD recommendations and other strategic climate-related topics that impact the group. The CCC is chaired by ING's chief risk officer and Management Board Banking member, and co-chaired by the board member responsible for Wholesale Banking. It is further comprised of a number of board members and senior managers from the Wholesale and Retail businesses. The CCC is advised by an internal Climate Expert Group (CEG) with experts from Wholesale Banking front office, global Sustainability, and Risk.

The CCC is responsible for:

- Mandating processes for identifying and managing climate-related risks and opportunities.
- Guiding climate-related policies, strategy, objective-setting and performance monitoring.
- Monitoring and overseeing progress on relevant goals and targets.
- Guiding external disclosures.

The CCC meets six times per year and follows an agenda prepared by the CEG, which meets monthly.

8.2 Two sides of the same coin

Approach

What does it mean to align a bank's lending portfolio with the world's climate goals? How does this relate to climate risk assessment and how do both sides of the climate impact coin inform strategic choices in financing?

At ING, we have chosen an integrated strategy. On the one hand, we have developed an approach to align our lending portfolio with the goals of the Paris Agreement, financing the changes needed for tomorrow's world. We call this approach Terra. On the other hand, we are working on an end-to-end risk framework for climate risk management, which should ultimately translate into financial risk metrics embedded in our credit risk assessment. Two sides of the same coin which together climate-proof ING's lending portfolio.

In a nutshell: ING's Terra approach draws on two main methodologies, the Paris Alignment Capital Transition Assessment (PACTA) and the Science Based Target Initiative's Sectoral Decarbonization Approach (SBTi SDA). These methodologies allow the bank to show how its lending portfolio is aligning with science-based climate scenarios or transition pathways per sector and to set targets.[22]

It provides climate risk identification, in particular related to transition risk, pinpointing under or over-exposure to low-carbon or high-carbon technologies, which could be useful for banks as a first step towards understanding financial risk as part of TCFD. However, this analysis is not translated to financial risk metrics yet nor does it take into account physical risk. But Terra does provide a scenario-based climate alignment portfolio assessment for each sector. Let's have a closer look.

8.3 About Terra, ING's portfolio climate alignment approach

Terra is an inclusive, forward-looking and engagement-driven approach. With Terra we focus on the sectors in our loan book that represent the majority of emissions globally – roughly 75%. Terra adheres to a number of underlying principles. Perhaps the most critical principle is that we steer our portfolio per sector. This sector-based approach respects the fact that each sector has its own transition pathway, or 'technology roadmap', for it to contribute to a low-carbon world. For example, the automotive sector will need to shift to producing more zero-tailpipe emission vehicles while power generation will need to shift significantly to renewables within a certain timeframe.

This brings us to our second key principle of Terra: we prioritise 'asset-level data' (ALD) for accurate measurement. The impact our clients make is driven by the types of energy, vehicles, buildings, aircraft, ships and plants that they own, operate or produce. In other words: their assets. Real change will be at the core of our clients' businesses and their strategies for transition. Terra looks at the changes that each sector needs according to the relevant Paris transition pathway and steers towards these changes.

This approach also provides opportunities to work with clients on the challenges they face and support them on their journey. We use detailed insights into the trends and changes needed in each sector, which then facilitate discussions with clients about their own strategies. Ultimately, this sector-based approach allows ING to be more effective in steering each sector portfolio towards Paris. See section 2.2 below for more on how we steer.

Insight

To be sure, it also comes with its own set of complexities. Taking a sector-based approach means that each sector must be treated, steered and monitored separately. It means that each sector has its own methodology, scope, target and metrics. That's because each sector's transition pathway focuses on what the companies in that sector are producing. For example, in power generation we look at what type of technology is used to generate power, e.g. wind turbines or gas-fired power stations.

[22] In September 2019 ING published its first Terra Progress Report, which presents the bank's pathway towards climate alignment in the sectors most responsible for climate change and is intended to be published every year.

This results in a Terra 'Toolbox' of methodologies and the metrics used to set targets for each sector, see the table below. As the saying goes, 'to a hammer, every problem looks like a nail'. But if we want to truly address and support transition in each sector, we need tailored and sharpened tools for each sector's set of challenges that will help us to identify and anticipate each client's needs.

Table 1 Terra 'Toolbox' of methodologies

Sector	Measurement Methodologies	Target-setting Methodologies	Metric used
Power generation	PACTA[3]	PACTA	kg CO2/MWh
Automotive	PACTA	PACTA	kg CO2/km
Commercial real estate (NL)	DeltaPlan	Paris Proof Method	kg CO2/m2
Residential real estate (NL, DE)	PCAF[4]	SBTi SDA	kg CO2/m2
Cement	PACTA	SBTi SDA	kg CO2/tonne cement
In development			
Steel	PACTA	SBTi SDA	kg CO2/tonne steel
Fossil fuels (oil, gas and coal)	PACTA	PACTA/Carbon Tracker Initiative	In progress
Shipping	Poseidon Principles	Poseidon Principles	kg CO2/tonne nautical mile
Aviation	PACTA	SBTi SDA[5]	kg CO2/passenger km

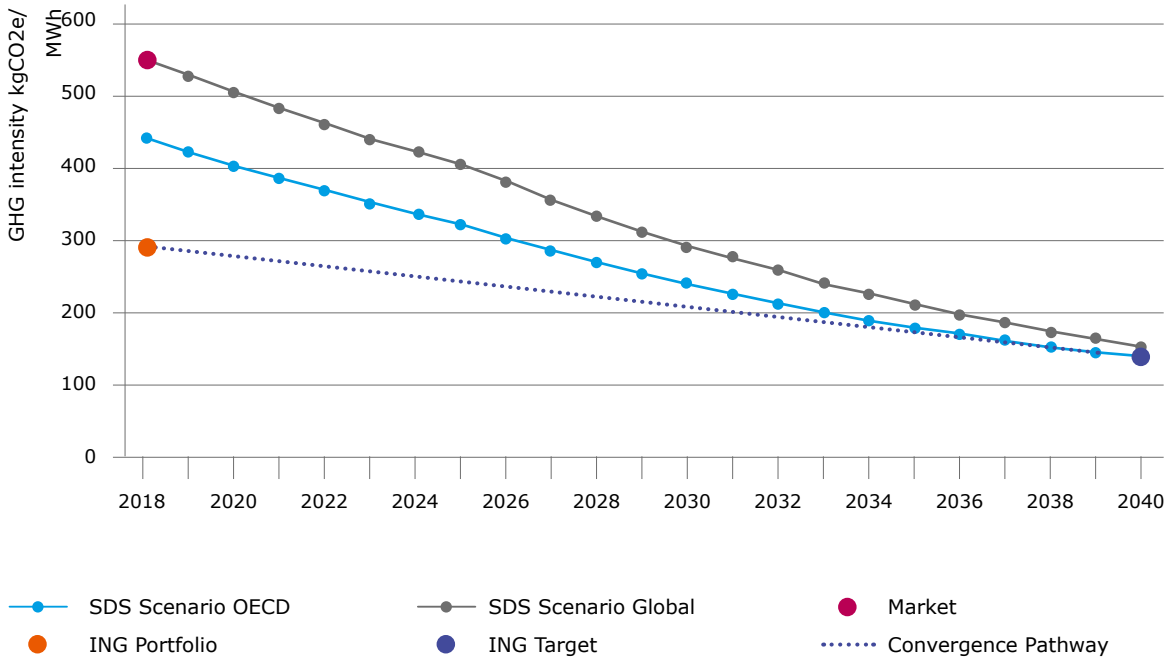
1. The targets are determined by the applied scenario, which also differs by sector. For example, the energy supply sector (power) utilise the IEA Sustainable Development Scenario (SDS) which focuses on achieving a median temperature rise of 1.7-1.8 °C while achieving, among other things, universal access to energy while the Beyond 2 Degrees Scenario (B2DS), which aims for an average temperature rise of 1.75 °C, is applied to energy demand sectors, as ik focuses more on the deployment of the most efficient technologies – a 'technology push'.
2. These methodologies and applied scenarios are further elaborated upon in the technical annex.
3. PACTA: Paris Alignment Capital Transition Assessment methodology of the 2°C Investing Initiative, technology-based, utilising asset-level data and forwards looking capital expenditure plans of clients (where possible).
4. PCAF: Partnership for Carbon Accounting Financials – carbon accounting framework which prescribes the use of building energy performance certificates (EPC) as proxy for CO2 or energy consumption data for residential real estate.
5. SBTi/SDA: Sience Based Targets initiative Sectoral Decarbonisation Approach – sets out sector decarbonisation pathways designed so as to be in line with the IEA ETP's B2DS scenario using intensity metrics.

8.3.1 Climate Alignment Dashboard

In the 2019 ING Terra Progress Report, we present the results of our first analysis: ING's climate alignment per sector as measured by Terra via our Climate Alignment Dashboard (CAD). For ING, 'climate alignment' is about steering our portfolio in line with the well-below two degree goal of the Paris Agreement. Being 'climate-aligned' therefore means that we are outperforming the scenario (transition pathway) or are on track with our defined convergence pathway towards the climate scenario target in each sector.

The Climate Alignment Dashboard (CAD) demonstrates the CO2 equivalent (CO2e) intensity per sector of our portfolio (year-end 2018) compared with the market and the relevant climate scenario or transition pathway. It also displays the climate alignment per sector and ING's intended decarbonisation pathway per sector to converge towards the target. Using a red-green indicator, we show whether the sector portfolio is outperforming the scenario or on track with the convergence pathway (green) or not (red), see the Power Generation example below.

Figure 1 Power Generation – Global and OECD Decarbonisation Pathway



8.3.2 How we steer

Insight

There are two main ways ING can influence the CO2e intensity of our sector portfolios in scope: 1) engage with and support existing clients to shift investments more towards low-carbon technologies, and 2) shift our own capital allocation choices more towards low-carbon technologies and away from high-carbon; like financing more renewables while reducing exposure to coal or financing new clients whose strategies focus on low-carbon activities. The latter also contributes to the de-risking of our portfolio.

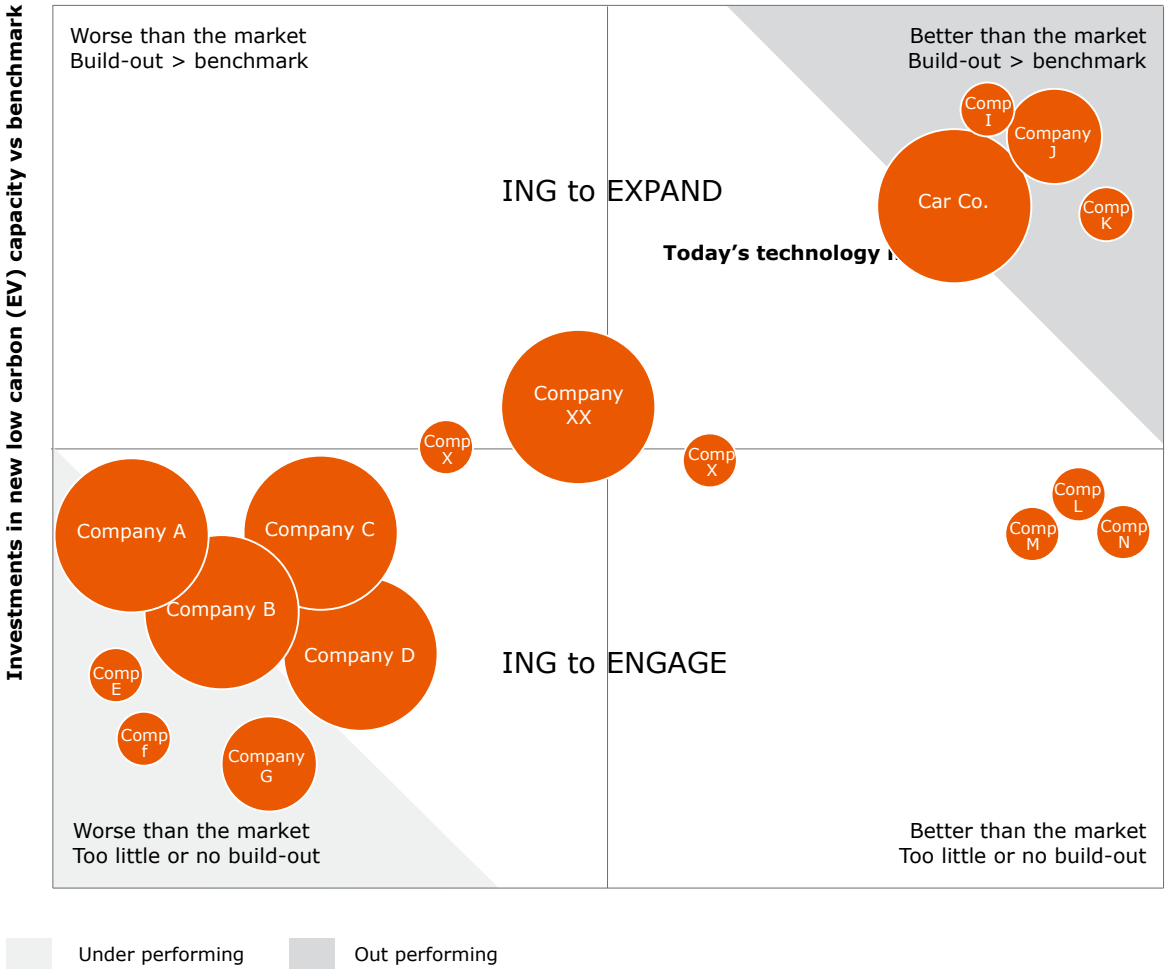
Regarding the former, Terra is first and foremost an inclusion-based strategy. ING believes that we can have the most impact by supporting clients via our products and services and by simultaneously working with the banking sector to scale and leverage this impact. To support client engagement, we have developed client-level CADs that provide in-depth analyses of how individual client's current performance and future strategies compare with climate scenarios, their peers and the market.

8.3.3 Client engagement: how to galvanise opportunities

To that end, it is important to note that while we currently measure and report on CO2e intensity per sector, the steering is informed internally by client-level data in line with the PACTA methodology, for example. Where possible, we focus not only on what a client currently owns and operates, but also on what they plan to build in the coming years in both a relative and absolute sense and whether or not this will contribute sufficiently to climate goals. With these insights, we can have a meaningful discussion about a client's current performance and strategy for the years ahead.

The bubble chart below demonstrates the forward-looking, client-level data that the analysis provides. This analysis allows us to engage with clients using insights into how their production compares with the market, peers and the climate benchmark both today and in the future based on their CAPEX plans. In this example, automotive companies are compared based on their current and future production of Battery Electric Vehicles.

Figure 2 Current technology mix vs. new capacity additions of ING's Automotive portfolie



This means we can identify clients that may need ING's help the most to fund future buildout of green production capacity. We can then identify the green financial products that would best fit their needs and would offer the greatest financial benefit – whether that's a green loan, a sustainability improvement loan, green investments or supporting them with raising funds via a green bond. This information can also inform ING about which clients may be exposed to higher transition risks if they are not transitioning on time. Finally, the analysis will also point out the leaders in the market that are also shifting their business to become more future-proof, giving ING an incentive to continue to do business with them.

8.4 Challenges regarding portfolio alignment

Challenge

8.4.1 Methodology refinement

We recognise that methodology development is still underway, also within the context of the initiatives ING is active in, such as the Science Based Targets Initiative, the PACTA pilot and the UNEP FI TCFD working group. We will need to continuously assess whether current methodologies and scenarios are the most appropriate or accurate and update our toolbox and transition pathways accordingly. In short, this is a new and evolving field and all involved will need to be agile and adapt to new developments.

8.4.2 Bank standardisation

Recommendation

One of the desired outcomes is that a viable standard will emerge for banks globally in terms of measuring climate alignment of their loan books; a standard that allows for comparison and aggregation of data across the sector. To achieve this, uniformity must be achieved on many levels, starting with physical, asset-level client data. Further, comparison will depend on other methodological choices like attribution and scope. We see great possibilities for standardisation within the bounds of the target setting methodologies ING has applied, SBTi SDA and PACTA. This needs to be a collaborative and iterative process, one we are in the early stages of.

Recommendation

However, ING also sees the pragmatic necessity for each bank to consider approaches in the context of its own portfolio composition. Due to the fact that different banks will have very different sector focuses, this may result in the need for a varied set of methodologies and approaches to be applied. As such, we see the conclusion emerging that the most like-for-like comparison scope across banks might be sector specific alignment, for example, by comparing power generation portfolio results among banks active in that sector. For that reason, ING encourages stakeholders to look at each bank individually given their specific portfolios and to consider comparing performance on a sector level.

8.4.3 Scope expansion

Challenge

We have made a deliberate choice to initially focus on the sectors that contribute a significant carbon footprint globally. However, we are regularly asked what will happen when we have completed our work on these carbon-intensive sectors. The methodologies currently being developed and applied are limited to a specific scope of sectors. Expansion will require more data, new scenarios to be developed and more iterative testing phases.

Next Step

To that effect, we are discussing with peers and partners which sectors should be in the next wave. For example, the agriculture and land use sector has long been identified as a major contributor to GHG emissions but due to the lack of data and climate scenarios specifically tailored for this sector, alternative approaches need to be developed. We are keen to continue these types of exploratory discussions and in the meantime are also committed to finalising the work in the remaining four sectors in scope of Terra.

8.4.4 Outcomes vs impact

Insight

In our view, there is a fundamental difference between the outcomes of portfolio climate alignment, expressed in CO2 intensity, and the impact of absolute GHG emissions reduction in the real economy. First of all, challenges such as carbon leakage present limitations to how much a bank can

Challenge

control in terms of climate impact, especially when applying capital allocation choices as a tool for steering. But more importantly, our influence is often indirect. As a bank, we finance companies that are operating in the real economy. We do not ourselves reduce the emissions but our clients do.

Even an inclusive approach where clients are supported in their transition presents challenges with regard to measuring and attributing actual impact to ING's actions. Should ING take robust measures to support and engage a client to transition, the client's actions may be a response to pressure from multiple stakeholders or their own internal decision-making. It would therefore be difficult to claim that impact as a result of our efforts alone.[23] It is difficult, if not impossible, at this point in time, to scientifically prove a correlation between one bank's financing and emissions reductions on the ground.

8.5 TCFD Recommendations and the Terra approach

Insight

The results of the Terra Approach, powered by methodologies such as PACTA and the SBTi SDA, are relevant to organisations reporting in line with the recommendations of the Taskforce for Climate-related Financial Disclosure (TCFD). In specific, climate alignment as an indicator/proxy for transition risk.

A starting point for our climate risk assessment has been set on high-emitting sectors and exposures to certain regions. Following the same rationale as Terra, each sector is reacting differently and hence requires its own approach. Terra can inform climate risk identification and management demonstrating in which sectors we have an over-exposure to transition-risk-sensitive sectors, i.e. under- or over-exposure to low-carbon or high-carbon technologies.

[23] To illustrate this, we use the impact framework developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO), see ING 2019 Terra Progress Report, figure 11.

In addition, Terra is paving the road ahead through developed metrics for target-setting and reporting and it informs sector strategies, for instance capital allocation choices on portfolio level. This means we are able to reduce and monitor the amount of risk being carried over time. Environmental & Social Risk (ESR) policies such as our policy on the reduction of financing to coal power generation, reducing our exposure to close to zero by 2025, can support this de-risking process.

Next Step

In parallel, we continue to work on the challenging exercise of translating potential climate risks into financial risk for ING, seeking collaboration on an international level by participating with peers in the UNEP FI TCFD pilot as well as sharing insights with other relevant stakeholders such as regulators and government representatives.

8.6 Next steps

Challenge

A comprehensive set of policies, due diligence processes, ambitions and targets in the risk and opportunity domains will help ING achieve a CO2 intensity in line with the Paris Agreement. However, it's important to note one thing: while aligning would mean reducing the CO2 intensity of our portfolio, it does not mean that CO2 intensity will be reduced for the global sector as a whole. Nor will it mean that ING has itself reduced emissions in the real economy by not financing certain clients or sectors. This is not the claim we are making. Those companies may still exist, even if we are not the bank financing them.

Recommendation

This is why we value an engagement-centred approach, supporting existing clients' transition pathways, bringing about real change. In addition, we recognise that a challenge this big will be overcome only through a concerted multi-stakeholder effort involving regulators, financiers, governments and customers alike.

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9 Conclusions of the Anthology

In this Anthology, ABN AMRO, APG, ING, Kempen, MN Services, Rabobank, Robeco and de Volksbank elaborated on how they measure climate risks, manage these risks, and which governance structure they have chosen. Each institution has organised climate risk assessment in its own way and the cases zoom in on various approaches to climate risk. They also illustrate how opportunities can be created in the transition to a low-carbon economy. In this conclusion, we discuss similarities and differences in approaches and the main insights that have been shared. We conclude with a number of possible next steps and recommendations.

9.1 Similarities

The cases illustrate that most analyses performed so far are largely qualitative. This is because availability of data is limited and methodologies are not yet robust. Also, the dependency on data provided by external parties is identified as a key hurdle. A common goal is to make analyses more quantitative and based on joint climate scenarios and shared climate-related data sets, to improve comparability. It is also clear that the issue of quality and consistent data is not an issue that financial institutions can solve individually.

In the end, the goal is to fully integrate climate risks and opportunities into risk management and strategies. All institutions that participated have already created governance structures to identify and steer on climate risks in their portfolios, by setting up climate/sustainability committees and establishing reporting lines to the Board.

Some notable similarities in the cases are a broadly held view amongst the participating banks is that flooding is a material climate risk, the carbon level (carbon emissions, carbon intensity) has been indicated multiple times as a proxy for climate (transition) risk and the macro-economic impact has been investigated in several cases. The cases also show that institutions collaborate with various knowledge institutes and consultants as well as with peers and other financial institutions.

9.2 Differences

As institutions started bottom up with the development and testing of climate methodologies, there are differences in the overall approach, in the applied scenarios and in selected asset classes. For example, institutions have opted for a Dutch or an international scope. Or choices were made between analysing a broad portfolio or a specific asset category, between emissions reporting or estimating climate risks in the portfolio. One particular contribution looked at physical risks; most focussed on transition risks.

In addition, the climate risks that were assessed differ: some institutions only differentiate between transition and physical risks, others discern more categories. Interestingly enough, the different types of conclusions drawn from the analyses are not conflicting, but rather complementary.

9.3 Main insights

A first key finding is that measurement, monitoring and management of climate-related risks and opportunities are in an incipient phase. Only a few parties already steer on climate risks in their portfolios.

There are a number of critical limitations all financial institutions experience, but have to overcome to obtain an initial insight into the institutions' specific climate risks. *Four particularly relevant challenges are:*

1. **Relevant climate data are in many cases not available, incomplete and/or not at the right level of granularity. Also, a wide range of definitions is used, hampering consistency and comparability.** The ideal solution is to engage with governments and the EU to enrich, bundle and make relevant climate data public and easily accessible, for example by setting up a new European ESG-register.
2. **There is a time horizon discrepancy**: risks are modelled/estimated by financial institutions with a limited time horizon (3-5 years), in line with current regulatory requirements. However, effects of climate change present themselves at much broader time horizons (10 or more years) and are non-linear. Uncertainties increase with extending timelines, highlighting the need for multiple scenarios. In this respect, there is also a difference between physical and transition scenarios: the former are based more on predictable (to some extent) climate science, the latter more on political and technological choices and innovation breakthroughs.
3. **Not all critical climate-related risks are known at the time of the investment/financing decision.** Or the probability of such risks cannot be assessed. For example, the loss of biodiversity, effects in ecosystems, tipping points: this is all still poorly understood and may have major consequences. This could lead to an underestimation of risks.
4. **No single model successfully accounts for all risks, neither are there widely accepted methods.** Even with regard to single assets, there are many different methods for assessing these risks. Guidance to create some consistency and comparability between financial institutions is needed from regulators. To make informed choices and value assessments correctly, financial institutions and other stakeholders must also be aware of severe limitations of models. In particular, a careful interpretation is required for the evaluation of results from off-the-shelf products.

A second key finding is that client engagement can encourage companies 'to move' to low-carbon or less carbon-intensive solutions, even though attribution of impact is difficult.

Pension funds, asset managers and banks implement engagement approaches in their investments and loans. In bank lending, the banks have also started (or have plans to do so) to incentivise clients to make the transition to a low-carbon society. A disclaimer is that the eventual 'outcome' depends on more factors than just the financing component. For instance in the built environment, behavioural aspects also play a role and changes in (environmental) legislation are a key driver. In the end, it is the corporate client or individual customer who makes the decision in lowering CO2 emissions.

INGs case on Terra/PACTA illustrates the importance of active client engagement by providing insights into individual clients' climate performance and planned investments relative to the industry as well as to relevant climate pathways per sector. Also, this approach allows for steering portfolios on a sector level. De Volksbank's and Kempen's case illustrate that applying the PCAF method is a simple way of determining the footprint and the development of the total emissions of an asset portfolio. This information can help institutions to assess the starting position of sectors and portfolios, to engage with clients on what their improvement contribution can be, to monitor the progress at high level and to design broad strategies to reduce emissions. In order to be able to do so, additional methods are also deployed.

A third finding is that the regulatory environment evolves rapidly. There are multiple new sustainability regulations and policies and additional reporting requirements of supervisors (many European, and also several global and national). Implementation of these regulations will pose challenges for financial institutions as they do not yet have all required data readily available. They need to adapt their current risk frameworks/policies, perform additional stress testing, etc. Financial institutions will need to inform their clients about climate performance of activities they finance or invest in.

9.4 Next steps and recommendations

In short, climate risk is a new and evolving field and everyone involved will need to be agile and adapt to new developments. To foster this process, we would like to make the following recommendations:

Towards the Financial sector

1. Build robust quantitative metrics to measure climate risks in portfolios and to integrate them into regular risk management.
2. Create incentives by pricing-in climate risk and footprints of activities in products and services.
3. Step up client engagement regarding climate transition. Raising awareness about climate risks can help gain greater insight into these risks and help to monitor and manage them. Long-term investors such as pension funds and asset managers have already made strides in this respect and individual banks are also taking up this challenge. It is vital to expand this aspect.

Towards government and supervisors

1. Climate change regulatory sandbox. Create an environment for experimentation by financial institutions to gain experience and also make sure that legislation and supervision is adaptive, mirroring the quick developments taking place.
2. Support initiatives for EU to establish a common ESG data register in the EU to enhance the availability of relevant and reliable ESG data, starting with climate change adaptation and mitigation objectives. This register should focus on ESG disclosure in line with the Non-Financial Reporting Directive and the EU taxonomy and should be open source.
3. Take measures to increase transparency, e.g. with a more strict and broader scope of implementation of NFRD, provided that reporting for businesses remains proportional and is effective.

4. Allow financial institutions access to real energy use data and require from customers a final energy label for houses instead of a preliminary label in order to differentiate better in lending conditions. This will allow financial institutions to reward sustainability performance and/or a significant improvement of a low performance into a better one.
5. Provide common climate scenarios, which take into account the time horizon discrepancy as described above as well as the difference between physical and transition risk.

In closing, the financial institutions that participated in this Anthology will continue to work on the challenging exercise of assessing climate risks. They will cooperate on a national and international level, for example with peers in the UNEP FI TCFD pilot. The institutions recognise that a challenge this great will be overcome only through a concerted multi-stakeholder effort involving regulators, financial institutions, governments and clients alike. They invite stakeholders to contribute to this process with specific suggestions and comments on the approaches taken.

This conclusion and the set of recommendations were drafted by representatives of the institutions that participated in the research.