

Central banks and climate change: taking up the challenge

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Climate change. Quite possibly the greatest, most unique, and most far-reaching systemic risk ever encountered. Permeating all levels of society, from private individuals, through business, to policy makers and governments, the effects of climate change will have an impact.

Many investors, institutional and individual alike, are increasingly focusing on the implications of climate change for their portfolios and taking action. According to estimates, around USD 23 trillion are already managed in line with some form of so-called environmental, social and governance (ESG) principles.

Yet despite this growing focus by investors on climate change, for central banks it has only become a topic of discussion in recent years. And for some of these investors, its rise to the top of the agenda is even more recent than that.

In this paper, we discuss climate risk from a central bank's perspective, with a specific focus on the asset management activities of these institutions.

The key questions we address are:

- What can central banks do to fight climate change with regards to the management of their assets, and how?
- In particular, are they actually willing to go beyond their established ESG processes and take additional steps specifically addressing climate risk?
- What are the unique challenges faced by central banks and what are the alternatives open to them when considering how best to tackle those challenges?
- Can the central banks set standards and processes which inform and are of benefit to the wider financial markets?

Our findings are informed in part by the results of the 2019 UBS Reserve Management Survey (carried out in May/June 2019). For the first time the survey contained questions that directly addressed climate risk in an asset management context. The survey is one of the most authoritative depictions of official reserve management activities available because it captures a large share of total reserves held by these institutions.

Earlier this year, the Network for Greening the Financial System (NGFS) produced their first comprehensive report, *A call for action: climate change as a source of financial risk*. In their opening paragraphs, they made clear the role which central banks have to play in addressing the climate crisis. They stated:

Even though the prime responsibility for ensuring the success of the Paris Agreement rests with governments, it is up to central banks and supervisors to shape and deliver on their substantial role in addressing climate-related risks within the remit of their mandates.

The position taken by the NGFS on climate risk reflects the role played by central banks in the economy and the scope of their mandates. In most countries, central banks' main policy objectives are:

1. Financial stability: ensuring that the financial system is stable and does not have negative effects on the economy;
2. Monetary stability: ensuring that inflation is well anchored to a pre-determined level. These policy goals can be achieved through different policy tools and the mix of tools and strategies adopted can vary from country to country.

Central banks also hold substantial assets, either in the form of reserves accumulated via financial operations in global markets (particularly in emerging markets), or due to

an expansion of their balance sheet via quantitative easing (mostly in advanced economies). The assets held by central banks represent a substantial part of overall assets managed by institutional investors globally and are invested across a wide range of asset classes, including government bonds, corporate bonds and, to a lesser extent, equities.

There is growing empirical evidence that climate risk affects the two policy goals pursued by central banks.

Extreme weather events and disruptions in climate patterns – the so-called physical risk - impact financial stability via negative impacts on the banking and insurance sectors. But extreme weather events can also impact the monetary stability goal, as they have the potential to increase uncertainty with regards to inflation and growth forecasts which are the basis for the setting of interest rates.

The policies being implemented across countries by governments aimed at fighting climate risk can also impact central banks – the so-called transition risk. The corporate and financial sectors will have to adapt to the evolving policy and regulatory framework surrounding climate risk (i.e. reduction of CO₂ emissions and carbon pricing) but significant uncertainty exists about the forms and the timing of these changes. What is certain is that these policies will create disruption as institutions adapt, potentially impacting both the financial stability and monetary policy goals of central banks.

Overview table: Climate risk and Central Bank mandates

	Climate risk	
	Physical risk Including – Extreme weather events – Sea-level rise – Disruptive changes in local climate patterns	Transition Risk Including – Climate policy evolution through time and countries – Technology – Consumer preferences
Financial stability risk	Financial contagion and wider economic deterioration impact the financial system causing financial market losses, credit market losses and rising operational and liability risks. Some studies estimate the financial value at risk up to 17% depending on different rising temperature scenarios.	Transition effects related to the potential negative impact of policy measures on the economy through lower output, capital misallocation and changes in energy prices. The impact on asset prices and credit worthiness are difficult to estimate but are potentially high, particularly when policy measures are unexpected (i.e. sudden increase in carbon prices).
Monetary stability risk	Physical risk can be taken into consideration in the short-term	The short-term time horizon of monetary policy (i.e. 3 years) does not match with the longer-term horizon of transition process. Monetary policy is impacted by transition policies.
Asset management	Potential financial losses in specific sectors (i.e. insurance/banking) impact portfolios of central banks. Government bonds are not immune as countries' debt levels could rise.	Disruption caused by transition policies across asset classes exposing central banks portfolios to permanent losses. Uncertainty over the disruption magnitude and timing

Source: NGFS, 2019 and UBS AM

Climate risk also impacts the asset management operations of central banks. Like any other institutional investor, the portfolios of central banks are exposed to climate risk. And as countries and sectors adjust to the new realities caused by climate change, central banks could face losses on those asset holdings which are more exposed to climate risk, as these are likely to underperform. Risk mitigation will be needed therefore to minimize the potential losses arising from a changing policy and regulatory environment.

Could central banks be asked to be more active in fighting climate risk in the pursuit of their policies?

According to the NGFS, this appears to be the case. Despite their independence, central banks still form part of the government apparatus in the countries where they operate. If governments implement the commitments they have made through the Paris Agreement, or even increase them, then it

seems only natural that central banks could be asked to play a part as well. A more active involvement of central banks on climate change policies might be controversial, as it may be regarded as falling outside the scope of their mandates.

Climate change and central banks: A unique challenge

If anyone is in any doubt as to the seriousness of climate change risk, they need look no further than the World Economic Forum's Annual Global Risk Report. For the past two years, environmental risks have topped the table of most likely risks and are second only to the threat posed by weapons of mass destruction in terms of the potential impact.

Climate change has also taken hold in the public consciousness around the world in a way which is unprecedented. Led by Swedish schoolgirl, Greta Thunberg,

Top 5 global risks in terms of likelihood

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st	Asset price collapse	Asset price collapse	Storms and cyclones	Severe income disparity	Severe income disparity	Income disparity	Interstate conflict with regional consequences	Large scale involuntary migration	Extreme weather events	Extreme weather events	Extreme weather events
2nd	Slowing Chinese economy (<6%)	Slowing Chinese economy (<6%)	Flooding	Chronic fiscal imbalances	Chronic fiscal imbalances	Extreme weather events	Extreme weather events	Extreme weather events	Large-scale involuntary migration	Natural disasters	Failure of climate-change mitigation and adaptation
3rd	Chronic disease	Chronic disease	Corruption	Rising greenhouse gas emissions	Rising greenhouse gas emissions	Unemployment and under-employment	Failure of national governance	Failure of climate-change mitigation and adaptation	Major natural disasters	Cyber-attacks	Natural disasters
4th	Global governance gaps	Fiscal crises	Biodiversity loss	Cyber-attacks	Water supply crises	Climate change	State collapse or crisis	Interstate conflict with regional consequences	Large-scale terrorist attacks	Data fraud or theft	Data fraud or theft
5th	Retrenchment from globalization	Global governance gaps	Climate change	Water supply crises	Mismanagement of population	Cyber-attacks	High structural unemployment or under-employment	Major natural catastrophes	Massive incident of data fraud/theft	Failure of climate-change mitigation and adaptation	Cyber-attacks

Top 5 global risks in terms of impact

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
1st	Asset price collapse	Asset price collapse	Fiscal crises	Major systemic financial failure	Major systemic financial failure	Fiscal crises	Water crises	Failure of climate-change mitigation and adaptation	Weapons of mass destruction	Weapons of mass destruction	Weapons of mass destruction
2nd	Retrenchment from globalization (developed)	Retrenchment from globalization (developed)	Climate change	Water supply crises	Water supply crises	Climate change	Rapid and massive spread of infectious diseases	Weapons of mass destruction	Extreme weather events	Extreme weather events	Failure of climate-change mitigation and adaptation
3rd	Oil and gas price spike	Oil price spikes	Geopolitical conflict	Food shortage crises	Chronic fiscal imbalances	Water crises	Weapons of mass destruction	Water crises	Water crises	Natural disasters	Extreme weather events
4th	Chronic disease	Chronic disease	Asset price collapse	Chronic fiscal imbalances	Diffusion of weapons of mass destruction	Unemployment and under-employment	Interstate conflict with regional consequences	Large-scale involuntary migration	Major natural disasters	Failure of climate-change mitigation and adaptation	Water crises
5th	Fiscal crises	Fiscal crises	Extreme energy price volatility	Extreme volatility in energy and agriculture prices	Failure of climate-change mitigation and adaptation	Critical information infrastructure breakdown	Failure of climate-change mitigation and adaptation	Severe energy price shock	Failure of climate-change mitigation and adaptation	Water crises	Natural disasters

Source: World Economic forum 2009–2019, Global Risks Reports. **Note:** Global risks may not be strictly comparable across years, as definitions and the set of global risks have evolved with new issues emerging on the 10-year horizon. For example, cyber attacks, income disparity and unemployment entered the set of global risks in 2012. Some global risks were reclassified: water crises and rising income disparity were re-categorized first as societal risks and then as a trend in the 2015 and 2016 Global Risks Reports, respectively.

children from countries as far afield as South Korea, India, Australia, the US and Europe have been abandoning their classrooms to hold regular climate strikes in protest at the potentially catastrophic effects of climate change and the consequences for their generation.

The WEF, in their 2019 report, gave more color around the reasons why environmental risks rank so highly in their annual Global Risks Perception Survey. Concerns are no longer focused solely on the short-term impact of extreme weather events but rather the possible failure of environmental policy, as the consequences of climate inaction become ever clearer. According to the survey respondents, that link between failed climate-change mitigation and adaptation and ever more extreme weather events is the most likely risk interconnection.

The evidence that our climate is changing is clear to many. 2018 saw a summer of heatwaves in Northern Europe, starting as early as May. Later in the year, California was beset by a series of wildfires, while on the eastern seaboard, a study¹ showed evidence of sea levels rising by as much as 5 inches per year, leading to so-called 'sunny day flooding' – a phenomena which had not been expected to occur for several decades to come.

This series of events had an impact on the key economic variables which central banks monitor closely. In turn, this had implications for the economic forecasts used to set the stance

of monetary policy. In Germany, for instance, low water levels of the Rhine river actually led to a temporary slowdown in German export machine.

Worldwide, extreme weather events such as these have more than tripled since the 1980's, while in monetary terms, 7 out of the last 10 years have seen the economic costs arising globally from natural disasters exceeding the 30 year average of USD 140 billion per annum.

In that context, the series of stark warnings set out by the Intergovernmental Panel on Climate Change in October 2018, (IPCC) are not so surprising. According to their latest findings, there is a window of just 12 years to limit global warming to 1.5 degrees celsius above pre-industrial levels if the planet is to avoid irreversible damage brought about by climate change.

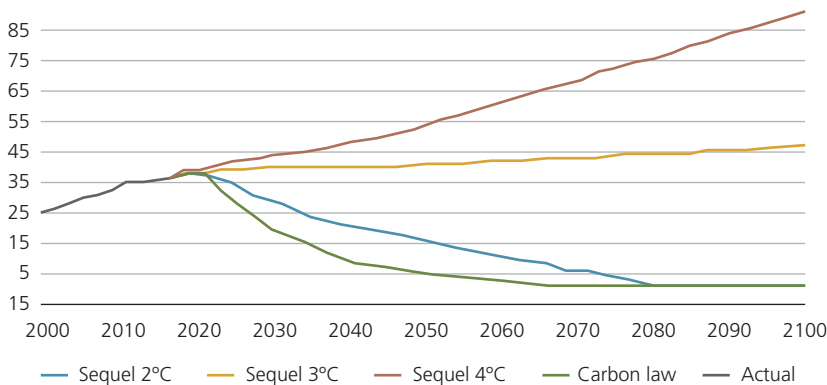
There are a number of defining characteristics which make climate change a unique challenge, and these carry important implications for central banks' policy making.

Unlike many systemic shocks, such as the financial crisis, the significant future physical, economic and societal outcomes arising from climate change are foreseeable. Although the exact quantum and timing of the outcomes may be unclear, scientific modelling and observations are providing continuous information streams which deepen our understanding and enable more accurate predictions to be made as to the

1 Spatial and temporal variability of sea level rise hot spots over the eastern United States; Arnoldo Valle-Levinson, Andrea Dutton, Jonathan B.Martin
<http://orcid.org/0000-0001-7047-0321>

Emissions pathways for climate scenarios

Annual GtCO₂ Emissions (fossil fuel and industrial only)



Source: Mercer

Cumulative carbon emissions (2018–2100)

Scenario	GtCO ₂
Sequel 2°C	1.100
Sequel 3°C	3.500
Sequel 4°C	5.100
Global carbon law	650

Emissions in the last decade: 350 GtCO₂
Emissions in 2010: 49 GtCO₂eq.

Note: The CO₂ emissions shown on the graph and above do not include land-use-related emissions, which are currently about five GtCO₂ annually, which must also reach net-zero or below, nor does it include the CO₂ equivalent of other GHGs.

Cambridge Econometrics did not model land-use CO₂ emissions and other GHG emissions.

likely consequences. This means that climate risk can be incorporated into the models used by policy makers, including central banks, when they formulate financial stability and monetary policies. As the NGFS highlighted in their recent paper, sophisticated modellings have demonstrated that global incomes could fall, on average, by up to 25% by the end of this century.

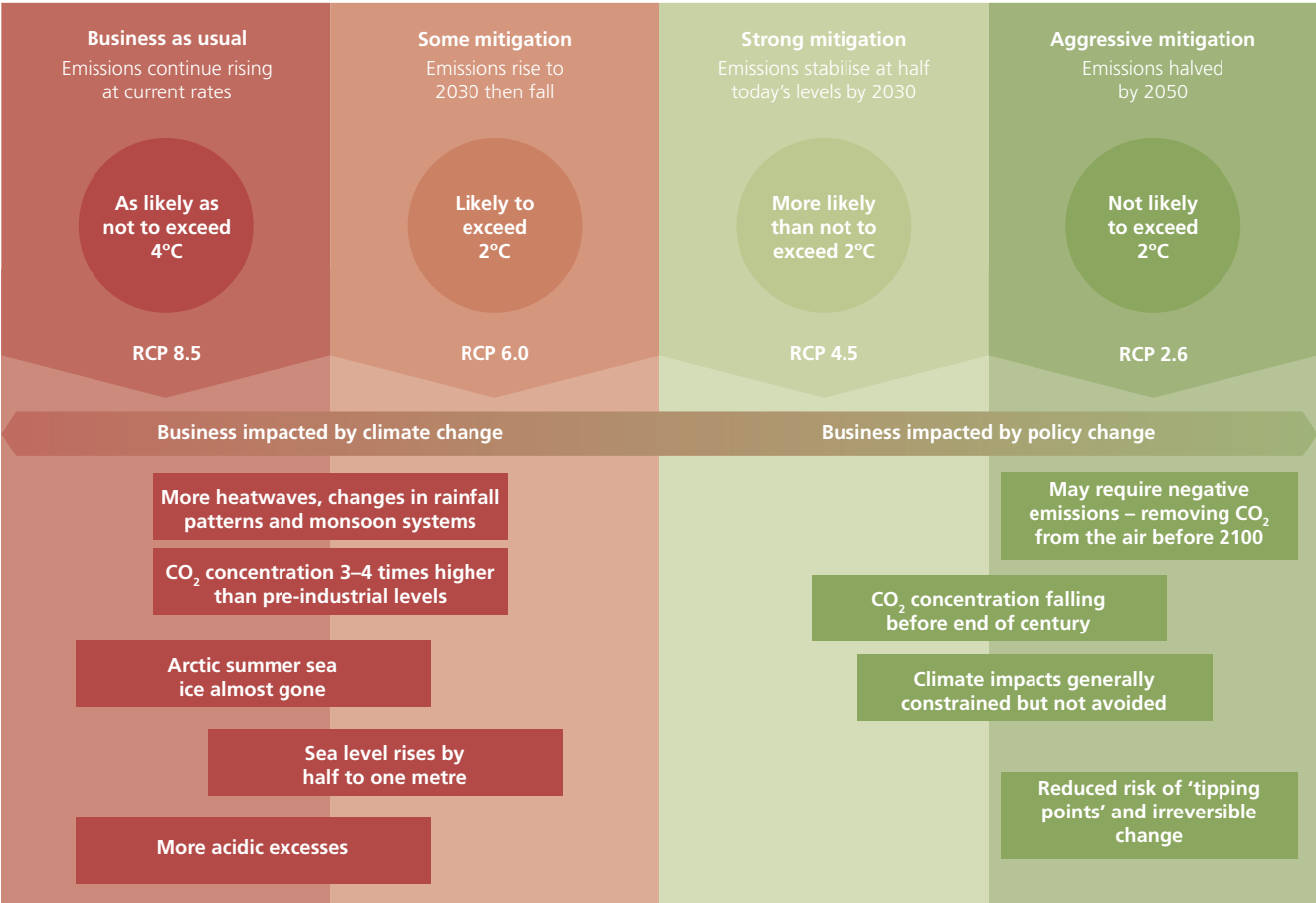
Those studies and observations have also reinforced the fact that it will be impossible to reverse many of the effects of global warming. At this point in time, there is no scalable means by which greenhouse gases can be removed from the atmosphere. Instead, the current focus is on emission reduction. According to the IPCC, limiting global warming to 1.5 degrees celsius by 2030 would mean carbon pollution would have to be cut by 45% from current levels by 2030 and by 2050 we would have to reach zero emissions. To a large extent, models point to the irreversibility of climate change and its disruptive effects.

A question of timing

Given the urgency with which action needs to be taken, short-term actions are clearly going to determine the long-term impacts. This timing mismatch is relevant for central banks as well. Whilst it is true that central banks can take a long-term view in the pursuit of their policies, their policy time horizon is relatively short. Often, short-term developments (i.e. unexpected shocks such as a sudden increase in oil prices or financial market events) prompt them to act. But in order to mitigate climate risk, central banks need to adopt a much longer time horizon, as it could take decades, not years, for the impact of climate change to materialize.

To be truly effective, this will necessitate a high degree of collaboration, not just from high level policy makers such as governments and their institutions, but from the capital markets, businesses and private individuals as well. Even allowing for technological innovation which can help to mitigate climate change, reaching net zero emissions by 2050

The choices we face now



Source: Climate Change: Action, Trends and Implications for Business, Cambridge University Press, 2013, based on the Intergovernmental Panel on Climate Change, Fifth Assessment Report (AR5)

will demand substantial changes in the way we live, including our diet and housing, as well as the way we travel and work.

Such a goal will go well beyond the current mandate of central banks, given their concern centers more around macroeconomic sustainability, rather than acting on the pace of growth. However, we have already seen quantitative easing policies extend the mandate of central banks well beyond inflation targeting; if climate change becomes a major drag on economies then a more substantial involvement of central banks in facilitating the transition to a low carbon emission equilibrium would be justified.

It should also not be forgotten that the impacts of climate change will not be felt equally. In 2018 for example, hundreds of thousands of Rohingya refugees were affected by secondary displacement due to extreme events, heavy rain, flooding and landslides².

Consequently, a high degree of international co-operation will be needed if we see a rise in such events. At present, the mandate of central banks is focused very much on domestic goals, and while there is a high degree of collaboration among these institutions (particularly during periods of economic and financial stress, i.e. in the aftermath of the global financial crisis) their operations, including those of asset management, are largely driven by domestic factors.

Given the unique nature of climate change, and the magnitude and breadth of its impact, the policy response of central banks will have to adapt to the nature of the challenge with a long-term, broad, pervasive and internationally coordinated policy framework. International institutions such as the BIS (Bank for International Settlements), IMF (International Monetary Fund), the World Bank and the OECD (Organization for Economic Cooperation and Development) are also likely to play an important role, given the potential contribution that global capital markets can make in the transition.

Central banks and climate change: Still in the early stages

As we have highlighted, climate risk was not a topic for central banks until relatively recently. Very few central banks were considering ESG factors, and climate change was certainly not a priority. But in 2015 that changed. For the first time Mark Carney, Governor of the Bank of England, referred to a link between climate change and stability risk. This move by the Bank of England triggered a reaction. More and more central banks started to act and two years later the NGFS was established in collaboration with leading central banks like the Banque de France and the People's Bank of China.

The Central Banks and Supervisors Network for Greening the Financial System is a joint initiative. Currently comprising more than 30 central banks³ and regulators, it carries the aim of contributing to financial stability by stepping up the efforts needed to achieve the targets of the Paris Climate Agreement. While the US is not part of the network at this point in time, the reach of those central banks and regulators who are involved already covers almost half of global GDP and two thirds of systemically important banks and insurers.

At an organizational level, the NGFS is running a number of work streams led by different central banks. The Bundesbank is in the lead when it comes to the dual questions of how to scale up green finance and how central banks can support the transition to a more sustainable economy. Another work stream, chaired by the PBoC, focuses on the supervision of the financial sector and ensuring that climate risks are properly taken into account. The Bank of England leads on the development of an analytical framework for assessing climate-related macroeconomic risks.

While the focus lies on the supervisory and macro-prudential tasks related to financial and systemic risk arising from climate change, along with better disclosure standards, the NGFS also encourages their participants to lead by example via the integration of climate-related criteria in their own operations, including the management of their own funds, pension funds and official reserves.

² UNFCCC External Press Release / 27 Mar, 2019. State of the Climate in 2018 Shows Accelerating Climate Change Impacts

³ The founding members of the NGFS were the central banks and supervisory authorities from China, France, Germany, Mexico, the Netherlands, Singapore, Sweden and the UK. Additional members and observers now include organizations from Australia, Austria, Belgium, Canada, Colombia, Denmark, Finland, Greece, Hungary, Italy, Ireland, Japan, Luxembourg, Malaysia, Morocco, New Zealand, Norway, Portugal, Spain and Thailand as well as the ECB, EBA and EIOPA. The US is currently not part of the network.

The fiduciary duty towards the public is the main reason given by central banks in the UBS survey (see Appendix II) when asked what the dominant factors are for the incorporation of climate change in their investment portfolios. In the first comprehensive report⁴ published in April 2019, the NGFS outlines several benefits for the inclusion of sustainability criteria in the members own portfolio management: First, it would improve understanding of long-term risks, and therefore lead to a better risk-return profile of the invested assets, and second, it could reduce reputational risk and generate positive societal impacts

However, the NGFS acknowledges the different institutional arrangements of its members in each jurisdiction, and points out that efforts towards the integration of climate risk in central banks' operations should be made, so far as is possible, without conflicting with the mandate and status of the respective central bank.

In fact, the network points out that mandates (and investment objectives) may limit many participating central banks when it comes to promoting a climate-conscious agenda with their investment portfolios. Notably, when it comes to portfolio management, the network refers predominantly to sustainability criteria in general. It does not seem to advocate or promote specific climate-related actions that might go beyond the sustainability frameworks which many central banks already have in place.

These concerns are also reflected in the UBS Reserve Management Survey, where aside from data availability and benchmarking issues, some of the key reasons mentioned by respondents for not including climate risk in their investment portfolios revolved around conflicts with the mandate of their institutions.

The NGFS is definitely the most important initiative of central banks in this area, largely because it has created a forum where common standards and approaches can be discussed

and finalized. However, a select few central banks have taken individual initiatives as well, which are also important in terms of moving forward the agenda on climate risk. In the Appendix we provide an overview of the most relevant of these individual initiatives.

Preferred approaches

A review of the recommendations put forward by the NGFS, and the initiatives undertaken by individual central banks, suggests that most central banks approach climate risk primarily from a supervisory perspective. Financial risk is something they think about largely in the context of banking and insurance regulation (physical risks for insurances and bank loan books, transition risks for financial markets overall).

The central banks will, in addition, consider macro-prudential regulation and the overall economic impact of climate risk, given the long-term implications this has for monetary policy (for example banks becoming less willing to give loans to sectors affected by physical or transition risk). They are also actively looking for ways to green the financial system by setting up structures for green finance markets and by promoting green bonds.

Finally, it should be noted that the central banks' various public activities, in the form of papers, public speeches and involvement in conferences and networks, play a crucial role in establishing the consequences of climate change as a valid (financial) risk category that corporations can no longer ignore.

However, while it appears that central banks play a crucial role as amplifiers which can mobilize institutions under their supervision, they seem more hesitant to "lead by example", i.e., by singling out specific climate-related measures in the management of their own assets beyond what is defined in their general sustainability framework. The Banque de France took the most profound steps in reshaping its asset management guidelines to reflect specific climate-related goals (see Appendix).

Key recommendations from NGFS

- Integrate climate-related risks into financial stability monitoring and micro-supervision
- Integrate sustainability factors into own-portfolio management.
- Bridge data gaps
- Build awareness and intellectual capacity and encourage technical assistance and knowledge sharing.
- Achieve robust and internationally consistent climate and environment related disclosure.
- Support the development of a taxonomy of economic activities.

⁴ A call for action – Climate change as a source of financial risk. NGFS, April 2019.

Incorporating climate risk into asset management activities: Issues and challenges for central banks

Central banks comprise an important segment of the institutional investment market. The bulk of the assets which they manage globally are represented by FX reserves of over USD 10 trillion. In addition, they also hold a substantial quantity of assets purchased through quantitative easing and other unorthodox monetary policy measures. According to recent estimates, the assets on the balance sheet of the leading central banks⁵ amount to over USD 21 trillion. Finally, they often manage the assets held by the pension funds of their institutions, as well as assets which they own as an institution. Therefore, in addition to holding the financial stability and monetary policy mandates, central banks are large investors in global capital markets. Their investment activities are substantial, particularly in fixed income markets, and changes in their investment style have implications for global financial markets as a whole.

So should central banks do more to integrate climate risk in their asset management operations? There are several reasons why they are more cautious when it comes to the adaptation of specific climate risk measures in the management of their own assets. Some are unique to their mandate and mission; others are more operational and common to other institutional investors.

Can central banks realistically adopt a more (climate-) activist approach?

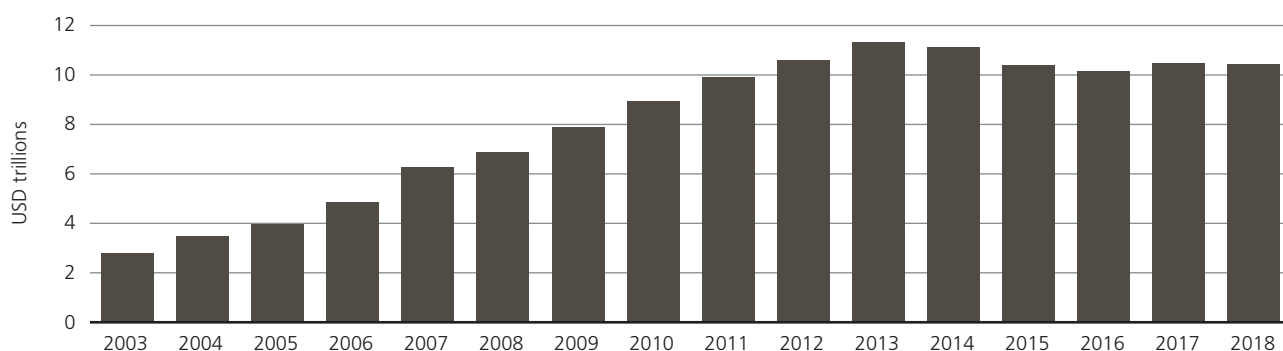
When it comes to the management of their own assets, the objectives that central banks have to consider differ from those of the average investor. While a preference for high liquidity is not unusual for institutional investors, the objectives of market neutrality and independence (from their sovereign) are a specific feature of central banks and of utmost importance for how they define themselves as an institution.

When central banks took the dramatic step of including equities as an eligible asset class in their reserve portfolios several years ago, they often adopted a framework that would prevent any actual or perceived conflicts with the above-mentioned objectives. Due to the unique insights that central banks have into the economic development and plans of national and international regulators (often beyond those of the financial industry), active equity strategies would have been very risky from a reputational perspective.

Consequently, central banks eagerly adopted passive equity strategies. These are often built around index suites from reputable third-party providers, which are then further trimmed to exclude domestic equities. In many cases, depending on the regulatory scope of the institution, financial and insurance companies are also excluded in order to avoid conflicts of interest.

⁵ Added balance sheets of the People's Bank of China, US Federal Reserve, Bank of Japan, European Central Bank, Swiss National Bank and Bank of England.

FX reserves (USD trillions)



Source: World Bank and UBS Asset Management, 2019. FX reserves, excluding gold.

Incorporating climate risk in the management of their funds would require a more active management approach. The threat of divestment, together with shareholder votes, are direct and powerful tools that can be used to put pressure on corporations because they place incentives at the heart of their *raison d'être* - generating value for shareholders. Taking this approach requires large shareholders to outline where they want 'their' company to be over time in terms of tackling climate risk, and then communicating this vision, as well as the consequences for non-compliance. This can be done in several ways: from letters to management, through company engagement in the form of in-person meetings, and ultimately, through the use of proxy votes and calls for management changes.

This means investors need to spell out a strategy which is not just a snapshot of the current situation, but one which also takes into account a realistic transition path over many years, ideally taking changing regulation and other actions from supervisors and the political arena into consideration.

This is a significant effort that requires considerable company insights, as well as insights into the jurisdictions that are involved in rule setting. It demands access to clean and comparable data, as well as a willingness to take actions which, historically, were reserved for activist investors that wanted to push through actions which it was assumed would add value, such as spin-offs.

Central banks appear unwilling to take a more activist stance. More than 60% of the UBS Survey respondents indicated that they would not wish to change to a more active ownership approach when it comes to engagement with companies. This stance means central banks are unlikely to take a more active approach unless the reputational risk attached to such an investment strategy is properly managed through better coordination across borders.

Mandate and independence

As recently pointed out by the BIS, central banks could stick to their existing mandate of price and financial stability and at the same time:

- contribute to the identification and quantification of climate risk,
- identify actions and help in the design of financial instruments to fight climate change,
- assist in the transition to a low carbon economy, and;
- ensure a proper coordination at global level⁶.

This is very much in line with recent NGFS recommendations.

The primary objectives of central banks in the management of FX reserves are to preserve capital and ensure liquidity. Return objectives are important but only if the two primary targets are fulfilled.

These objectives are closely related to these institutions' dual mandates: financial and monetary stability. Consequently, the management of reserves is also aligned to these goals, which is why capital preservation and liquidity dominate over return. This differentiates central banks from other institutional investors, such as pension funds and insurance companies, which, due to their liabilities, are required to generate a target return on accumulated assets.

The dominance of liquidity and capital preservation is reflected in the ways in which central banks invest reserves. The bulk are invested into liquid fixed income assets, with government bonds of advanced economies representing the majority. Over the last decade, diversification into corporate bonds and equities has increased, but the investment framework of central banks is still conservative relative to other institutional investors such as pension funds.⁷

⁶ Research on climate-related risk and financial stability: An "epistemological break"?, Luiz Awazu Pereira da Silva, Deputy General Manager of the BIS.

⁷ On why central banks are more conservative than other institutional investors see M.Castelli and S.Gerlach, Central banks are too risk averse as investors, SUERF Policy Note, Issue 78, June 2019.

A further consideration is the means by which specific measures promoting a climate risk agenda might find their way into a central bank rule book. Central banks value and protect their independence in the pursuit of their mandate. The launch of QE and other unorthodox monetary policies has already exposed them to increasing scrutiny by politicians and the public at large. If central banks are required to do more to climate risk by their respective governments, how should these measures be agreed upon?

Finally, a key challenge comes from the specific nature of the asset pool central banks manage. Foreign exchange reserves are, by definition, assets that must be held in forms denominated in foreign currencies. This implies that central banks would be expected to understand and manage the transition risk of companies that fall under the regulatory supervision of other countries. This might be controversial as central banks do not want to be perceived as taking a position on individual companies outside their borders. This problem does not arise in the case of QE assets as these instruments are issued in the countries where central banks operate.

Consequently, in order to avoid interference in the transition processes of other countries, most central banks would most likely show a clear preference for international solutions and cooperations instead of acting alone. That begs the question: are existing international networks strong enough to set up and run the necessary processes needed to co-ordinate such an approach?

Organization and investment management

The relatively simple, but necessary, passive investment framework that many central banks employ could be challenged by the demands coming from new requirements that promote a specific climate risk agenda in the investment portfolio of central banks. When implementing climate risk measures in the management of a portfolio, a number of investment management and organizational processes will require adaptation.

First, the strategic objectives in relation to climate risk have to be clearly defined. Next, a complex taxonomy has to be developed and aligned with the overall investment strategy.

Here, a key challenge for central banks and institutional investors alike is that it is still difficult to get clean data about company (and country) behavior in the climate space. Current disclosures are not standardized. Hard data in annual reports or on corporate websites is often mixed with information which is well-meaning and nicely illustrated, but ultimately irrelevant. This makes it necessary to rely on external data providers who can fill the gaps with internal models.

The current passive strategies that are most commonly employed by central banks work well for the purpose of spreading risk and avoiding conflict of interest, but they dramatically increase the number of companies, and therefore data points, that have to be collected when compared with more concentrated active strategies. In general, there is a fundamental conflict between a passive approach and 'know your investments'.

When deciding on the actual weightings of the investment portfolio, transition risk has to be carefully balanced and long-term objectives have to be broken down into short-term guidance to companies.

This guidance has to show affected companies a realistic multi-year transition path which should be aligned with the overall strategy of the home nation. Otherwise, the central bank could, for example, be exposed to accusations that their actions resulted in job losses that the economy could not adequately compensate in time.

Therefore, strategic and analytical processes cannot be undertaken for a single point in time, but instead need to be forward-looking in order to make assumptions about expected changes in corporate behavior while the regulatory environment and the role of new emerging industries are changing. The question that must be asked is: do central banks and their supervisory bodies feel ready for that?

For the investment team, further challenges exist when integrating climate risk holistically in the investment portfolio. For example, the assessment of transitional risks in a specific sector could reveal that many affected companies might themselves have an acceptable climate-risk rating, but they are suppliers to companies who are affected by transition. Suppliers in the energy and auto sector may therefore experience severe declines in business activities, even though their own efforts and climate ratings might be high.

On the flip side, the central bank must also be conscious that companies with a negative carbon rating might be needed to manage the transition of the economy over the coming decades. Here, drastic measures (including divestment) could lead to stranded assets and layoffs.

Further issues exist in the area of benchmarking as well as performance. In the UBS Survey, the majority of respondents indicated they are willing to tolerate a decrease in performance when incorporating climate risk in their portfolios. However, they also indicated that they tolerate a lower performance only if the benchmark is changed accordingly.

Most of these operational issues concern any type of investor. However, central banks have some advantages: a) their independence; b) the fact that return is not the dominant goal; and c) the ability to coordinate themselves across borders. The development of a green taxonomy, the finalization of internationally agreed scenarios and the development of green products (i.e. green bonds) are the areas where central banks can actually lead by example.

Following the financial crisis, central banks played a key role in redesigning the regulatory framework for the banking and the financial sectors whilst protecting their independence. There is no real impediment for central banks to lead by example in finalizing a robust, realistic and internationally agreed methodology to incorporate climate risk in the asset management operations of institutional investors.

Portfolio management

According to the UBS survey, a significant number of respondents (45%) said that the inclusion of climate risk criteria in their asset management activities would be achieved through an exclusion list. This would be in line with the passive investment approaches generally adopted by central banks.

The asset classes where central banks see greater scope for the inclusion of climate risk are corporate and government bonds. The fact that equity ranks lower in the survey is probably a reflection of the fact that even though the number of central banks investing in equity has risen over the last few years, numbers are still limited, which explains their focus on fixed income assets.

In the corporate bond and equity space, central banks are already in a position to incorporate climate risk in most of their portfolios, including pension fund assets and their own capital. By relying on an externally provided methodology, or by developing its own one, central banks could lower the climate risk in their equity portfolios and corporate bond portfolios.

With regard to government bonds, the largest asset class in which central banks invest their reserves, the issuance of green sovereign bonds is growing rapidly but size is still limited (green bonds currently account for less than 2% of global debt issuance). Central banks could definitely play a role in boosting the issuance of green sovereign bonds by working closely with governments in setting up a robust green bond issuance framework. International institutions such as the World Bank or the European Investment Bank could also play an important role.

A major contribution central banks can provide in the greening of the financial system is to create standards and an international level playing field. The scenario and methodology adapted to rank companies on climate risk, and the benchmarks adopted, should be communicated externally, so leading by example across the whole industry. Given the reputational risk attached to such an approach (including cross border and sector sensitivities) the more widely that the methodology is adopted across the central bank community then the better the outcome.

Climate risk: A new frontier for central banks?

Climate change is probably the greatest and most far-reaching systemic risk ever encountered. Whilst there is a debate on the timing and magnitude of its impact, its disruptive effects across sectors and companies are generally accepted. As economies adapt to a low carbon emission, productive and consumption model disruption will likely be significant.

The NFGS clearly highlighted the link between climate risk, financial stability and macro policies. Therefore, central banks would be within their mandate if they were to incorporate climate-related risk into their financial stability monitoring and micro-supervision. This process is already in motion and we expect further action in the future, particularly with regard to the development of green taxonomies, scenario analysis tools and data quality regulation. These are all areas where central banks have the ability to lead by example, with positive spillover effects across the broader investment landscape. The main value add of such activities is the establishment of proper coordination at a global level.

A key challenge faced by central banks is the integration of climate risk into their own asset management activities. Such integration raises several questions including the potential impact on their mandate and their independence, including their traditionally "passive" investment strategies. Last, but not least, is the conservative asset allocation approach adopted by the majority of these institutions. An important issue here is the extent to which central banks can become more activist in the preferential treatment of countries, sectors and companies, thus assisting in the transition to a low carbon economy.

In the table below, we outline the type of assets, as well as the asset classes, where central banks can potentially consider climate risk. The scope is quite large and covers the majority of assets managed by these institutions. In the case of corporate bonds and equities, nothing currently prevents central banks from incorporating climate risk into their investment decision.⁸ This can even be done by keeping the traditional passive investment strategies adopted by central banks. Indeed, we are seeing many central banks looking to "green" their equity and bond portfolios to reduce potential losses.

⁸ For instance, in a recent paper prepared by the Council on Economic Policies, Pierre Monnin, Integrating Climate Risks into Credit Risk Analysis, Discussion Note 201/4, December 2018, the impact of climate risk on the ECB's CSPP portfolio is estimated by using a methodology developed by CarbonDelta (<https://www.carbon-delta.com>). About 5% of the corporate bond issuers would fall out of the investment grade category when both physical and transition risks are incorporated in the analysis.

Central banks: asset types and asset classes – What could they do?

	Fixed Income		Equities		Alternatives
	<i>Government & government related</i>	<i>Corporates & ABS</i>	<i>Passive</i>	<i>Active</i>	<i>Green Infrastructure/ Real Estate</i>
FX Reserves	Green bonds	Under/overweight depending on climate ranking + Green Corporates/ABS	Under/overweight depending on climate ranking	Active selection influenced by financial and non-financial criteria (climate ranking)	Green Infrastructure/ Real Estate
Pension funds	Green bonds	Under/overweight depending on climate ranking + Green Corporates/ABS	Under/overweight depending on climate ranking	Active selection influenced by financial and non-financial criteria (climate ranking)	
Collateral framework	Preferential treatment for green bonds in collateral framework + exclusion list	Under/overweight depending on climate ranking			
QE assets	Preferential treatment for green bonds in QE program + exclusion list	Under/overweight depending on climate ranking	Under/overweight depending on climate ranking (e.g. Japan)		
Own funds	Green bonds	Under/overweight depending on climate ranking + Green Corporates/ABS	Under/overweight depending on climate ranking	Active selection influenced by financial and non-financial criteria (climate ranking)	Green Infrastructure/ Real Estate
Key challenges	– Limited supply of Green Bonds (Govt, Agency, State, Muni, MDB)	– Data quality – Selection methodology – Benchmarking – Collateral holdings often unlisted and unrated		– Data quality – Selection methodology – Benchmarking	– Illiquidity – Benchmarking – Ratings

Government bonds are and will remain the largest asset class for central banks. Here the scope for integrating climate risk is lower, given the sovereign nature of these assets and the lack of an adequate supply of green government bonds. However, this is likely to change as more governments issue green bonds. Eventually, when governments accelerate their commitments to allocating more investments into green infrastructure, the scope for greening the government bond portfolio of central banks will increase.

A significant feature of central banks' allocation is that the majority of these institutions do not invest into alternative asset classes (i.e. infrastructure and real estate). The shift to a low carbon emission economic model will require a massive allocation of funds to green investments, particularly in the infrastructure and utility sectors. In many countries FX reserves are well above the level required for macroeconomic and financial stability and could be partly invested into green infrastructure projects.

The integration of climate risk into the management of assets managed by institutional investors has just started and will only accelerate in the future. It remains for fundamental issues of independence and neutrality to be addressed, and changes to the investment organization and investment frameworks can be substantial.

Looking forward, how will central banks realistically address these issues? The results of our RMS survey hint that most prefer to implement (or, in many cases, have already implemented) a comprehensive ESG framework with the help of established data providers. In such frameworks, climate risk will be an important factor, but by no means the only one, and the ultimate ranking of investments will be determined by a large variety of factors, ranging from Corporate Governance to cybercrime prevention to employee equality and energy savings.

It remains to be seen whether, over the coming years, this will be convincing enough for politicians and supervisory bodies, which will continue to "feel the heat" with every extreme weather event that will trigger media coverage and protests by the next generation of voters. We strongly advise all public institutions to take the impact of climate risk on their own operations seriously and act proactively.

Appendix 1

Policy initiatives on climate risk by individual central banks

The Dutch Central Bank (DNB) counts as one of the early movers when it comes to addressing the consequences of a changing climate and the transition to a carbon-neutral economy.

Public awareness of climate risk in the Netherlands is high. With about a quarter of the country lying below sea level, climate-related developments over the coming decades might expose the country to extreme risks and put additional pressure on all stakeholders to act. Therefore, as a supervisory authority, the central bank is under particular scrutiny to demonstrate a deep understanding for the risks, particularly for the Dutch economy. In a report⁹ published in 2017, the bank outlined the risk for insurers from extreme weather and flooding, but also for the loan book of banks of which almost half is collateralized by real estate with poor energy labels.

The DNB is a founding member of the Central Banks and Supervisors Network for Greening the Financial System, which is currently also chaired by DNB executive director Frank Elderson (see separate entry on the NGFS).

Other actions include the establishment of the Sustainable Finance Platform to raise awareness and promote sustainable funding in the Dutch financial sector. The Climate Risks Working Group comprises one of the streams, as does the Platform Carbon Accounting Financials (PCAF) Working Group.

When it comes to the management of its reserve portfolio, climate risk is one part of a broader ESG framework. The DNB is also a signatory of the United Nations Principles for Responsible Investment (PRI) - the first central bank in the world ever to do so. The PRI comprises a voluntary set of six investment principles that outline actions for incorporating ESG considerations into investment practices.

As a consequence, in March 2019, the DNB adopted a Corporate Social Responsibility (CSR) Charter, where the bank commits to screening its investment universe and potential counterparties, integrating ESG criteria in the investment process, promoting green finance and responsible investing, reporting on its responsible investment approach and to further develop the approach.

Another pioneer when it comes to promoting green finance and raising awareness for climate risk is **Banque de France** (BdF) the French Central Bank.

Since the adoption of the Paris Agreement by 195 nations in 2015, Governors of the Banque de France have frequently pointed out the need for central banks and other financial supervisors to better understand and manage the risks to financial stability from climate change. The BdF is a pioneer in developing the French market for green bonds (debt securities issued and designed to finance activities or projects of environmental benefit), and it is participating in the G20 Green Finance Study Group (GFSG). It is also one of the founding members of the Central Banks and Supervisors Network for Greening the Financial System (NGFS).

The BdF has set up a responsible investment charter that applies to its own funds and pension liabilities' investment portfolios (excluding those in the Euro system framework). In this charter, the BdF stresses its support for various objectives of the international community, including the UN Sustainable Development Goals, the principles of the UN Global Compact as well as the global response to the Paris Climate Agreement of 2015.

The charter outlines 3 key commitments that are further broken down into 9 implementations, several of which specifically address the investment consequences of climate risk:

- Formalise the approaches used to identify and assess the risks and opportunities related to the environmental transition, in particular to climate change, in asset portfolios.
- Improve analysis tools and environmental impact indicators in order to ensure the gradual alignment of asset portfolios with the target of limiting global warming to 2°C.
- Mobilize research resources to contribute, in particular, to a better knowledge of techniques to incorporate environmental factors into risk management tools and asset allocation construction

The BdF also announced it would increase its attendance rate at general meetings and adopt a voting policy that will favor non-financial transparency.

⁹ Waterproof? An exploration of climate-related risks for the Dutch financial sector. De Nederlandsche Bank, 2017.

Bank of England (BoE)

The Governor of the Bank of England, Mark Carney, is a leading figure when it comes to the promotion of green finance and raising awareness of the risks to the financial system from climate change as well as transition risks for the overall economy during the complex adjustment process to a lower-carbon economy.

First and foremost, the bank considers climate change to be a challenge for its supervisory objectives. It sees clear evidence of emerging financial risks that are of high relevance to central bank mandates.

In a paper published in 2017¹⁰, the BoE outlined two channels on which climate-related financial risk is focused: physical risk (due to an increase in frequency and severity of extreme weather events) and transition risks (disruptions during the adaptation towards a lower-carbon economy).

The BoE also highlights two core elements of mitigating this risk: on the one hand the need to engage with regulated firms on climate-related risks through prudential supervision. On the other, the need to enhance the resilience of the UK financial system by engaging with initiatives to support an orderly market transition to a lower-carbon economy.

When it comes to its own activities, the BoE outlined a commitment to reduce the carbon footprint of its own operations in its 'Greener Bank' program.

It is also important to note that in the UK, other regulators and supervisors are pushing ahead on climate risk as well. The Financial Conduct Authority (FCA) and the Prudential Regulation Authority (PRA) have recently hosted the first Climate Financial Risk Forum (CFRF), which brings together regulators, banks, insurers, asset managers and other industry firms to develop and share best practices for responding to the financial risks posed by climate change.

10 The Bank of England's response to climate change. BoE Quarterly Bulletin 2017 Q2.

The BoE's strategic response to climate change and current activities



People's Bank of China (PBoC)

With pollution a key concern after decades of rapid industrialization, the Chinese government is at the forefront of taking coordinated efforts to promote green industries and green finance. Over recent years, China has introduced various groundbreaking measures, including restrictions of funding for companies that do not comply with environmental rules, while at the same time encouraging lending to green projects, as well as mandatory disclosures, clear taxonomy frameworks and the possibility for banks to earn 'green points' that can lower the risk assessment by the PBOC if there is, for example, empirical evidence for lower NPL ratios among green bonds.

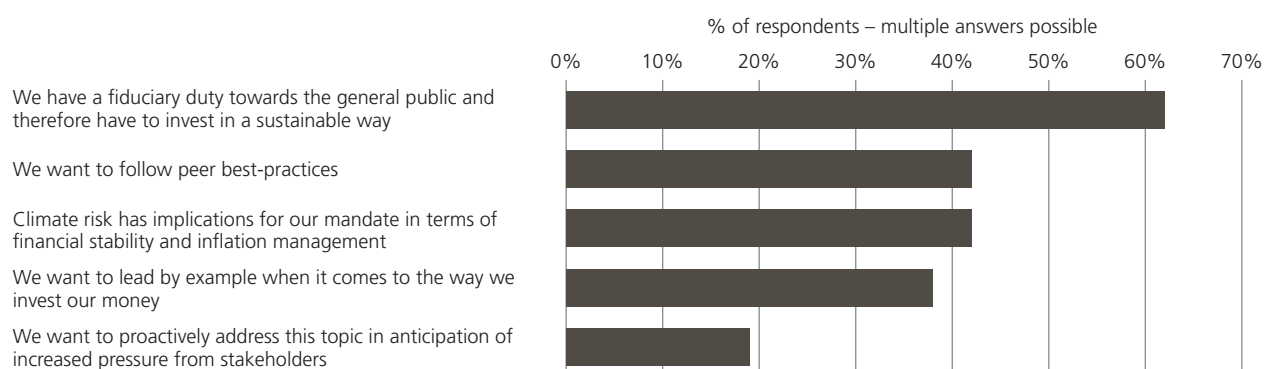
As a consequence, the PBoC is a founding member of the Central Banks and Supervisors Network for Greening the Financial System where the institutions chairs a work stream that focuses on supervision with the objective of mapping current efforts to include climate risk in macro-prudential frameworks and to encourage climate risk disclosures by financial institutions.

Appendix 2

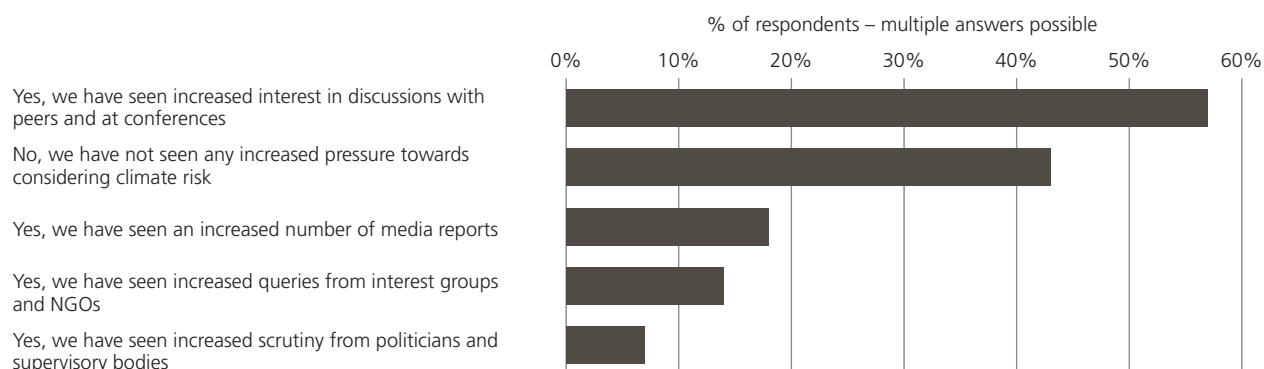
The results of the 25th UBS Reserve Management Survey (RMS)

The UBS RMS is among the most authoritative depictions of official reserve management activities available because it captures a large share of total reserves. The survey is sent out to participants of the UBS Reserve Management Survey seminar in May/June of each year and the results are presented during the event in June. In 2019, we added several questions specifically about climate risk to the survey. Below we highlight what we learned from the preliminary results which were available to us in the week before the event:

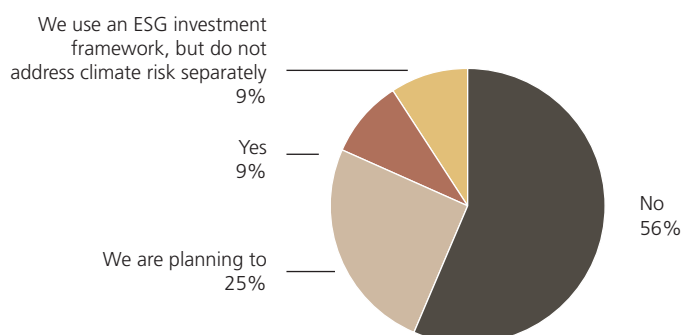
What are the key reasons for central banks to specifically consider climate risk in the investment portfolio?



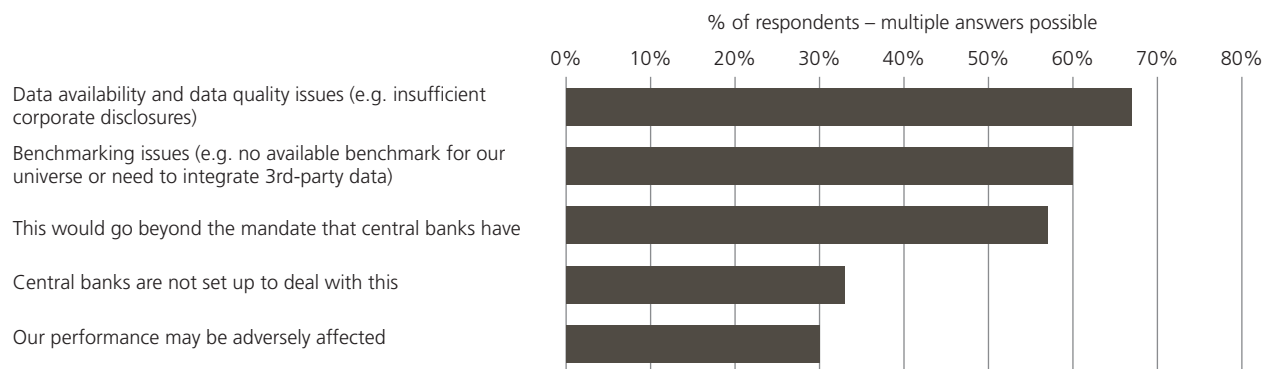
Have you experienced increased pressure to consider climate risk in your portfolio over the past year?



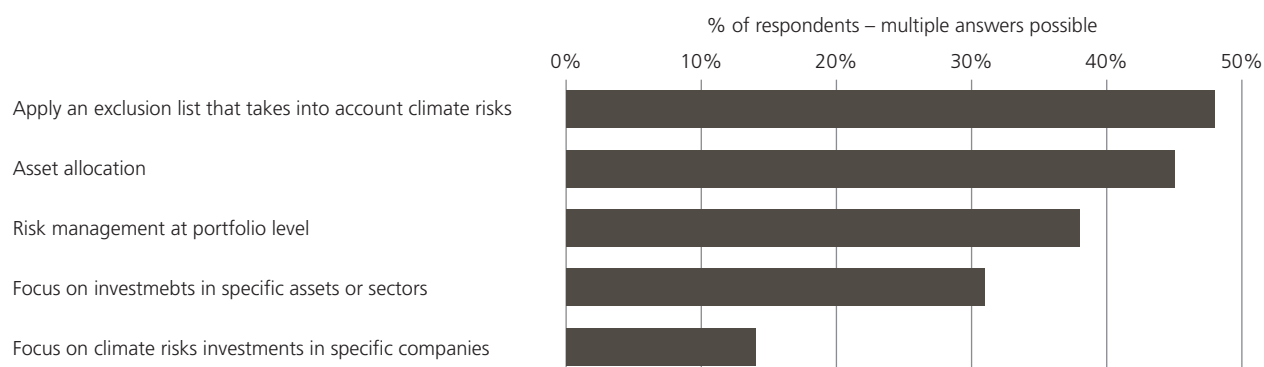
Do you specifically consider the impact of climate change on your investment portfolio (beyond your ESG framework)?



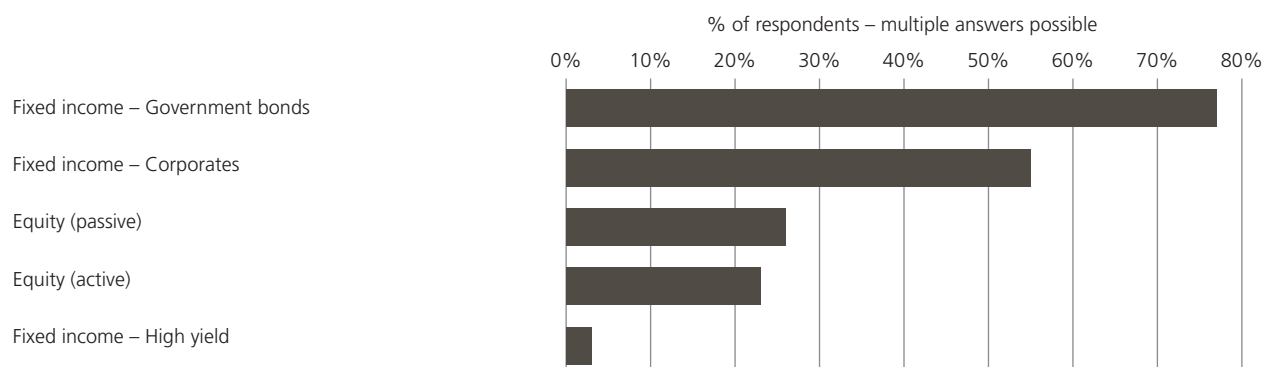
What are the key reasons for central banks to NOT specifically consider climate risk in the investment portfolio?



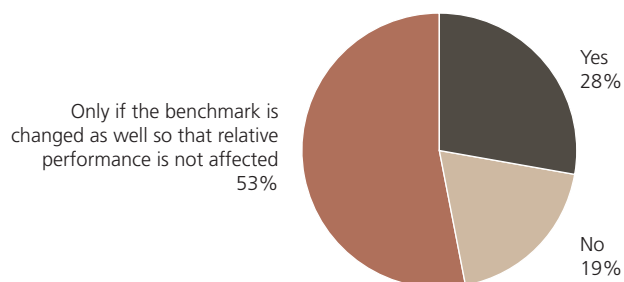
What is (or would be) your approach to considering climate risk specifically?



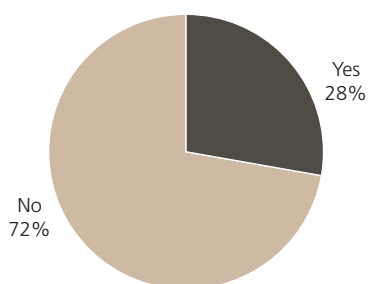
What asset classes in your portfolio would you consider managing sustainably?



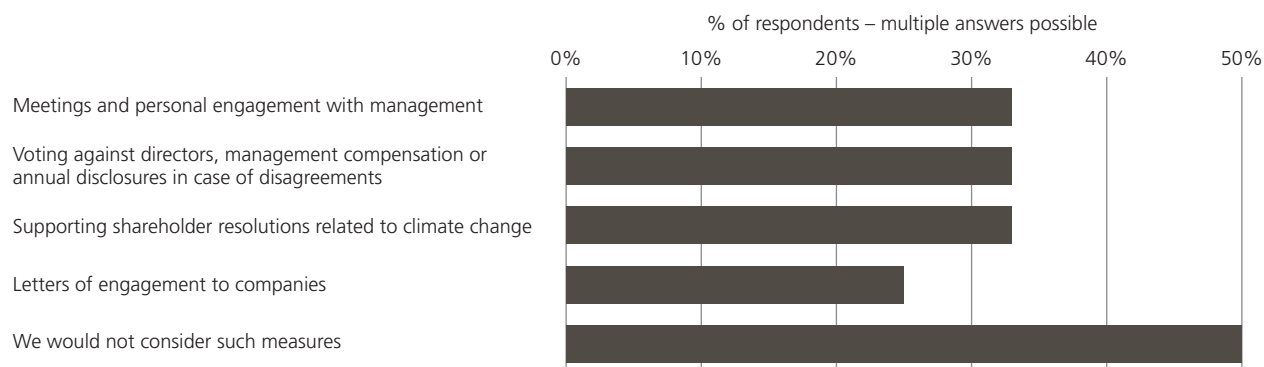
Would you be willing to tolerate a decrease in performance when considering climate risk in your portfolio?



Would your institution consider an 'active ownership' approach to promote the convictions of your organization?



If YES, which of the following 'active ownership' approaches would you consider to promote the convictions of your organization



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