

Central Banks Give a Green Light to Climate-Friendly Financial Systems

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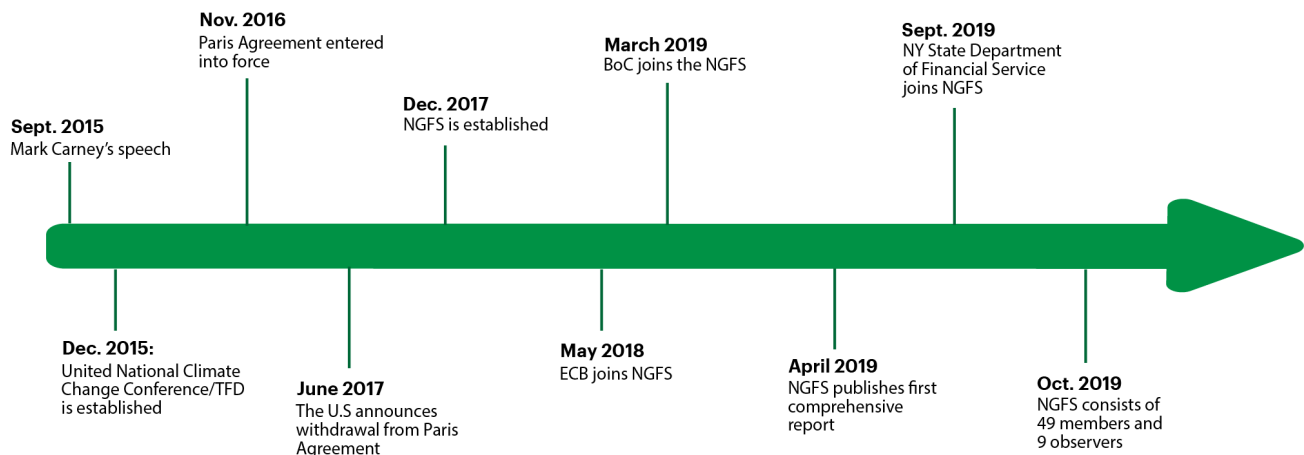
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Highlights

- More and more central banks around the world acknowledge that climate-related risks left unaddressed can materialize to have systemic impacts on the financial system.
- Uncertainty associated with the forward-looking assessment as to how (and to what extent) these risks could manifest complicates the task for central banks and regulators.
- The Network for Greening the Financial System (NGFS) supports central banks’ collective efforts in addressing the impacts of climate change on the economy.
- Central banks are revisiting their risk-management practices to incorporate climate change and call for action to do more to identify related risks and set-up a “green” macroprudential framework.

Until recently, central banks had never publicly discussed climate change. This changed in September 2015, when BoE governor Mark Carney trailblazed the idea that financial regulators should take an active role in promoting green risk management practices. In his landmark speech at Lloyds, Carney warned that climate change had become a growing risk to financial stability.¹ In step with this sentiment, eight central banks established the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) in 2017. By October 2019, the network had grown to include as many as 49 members and 9 observers.

Transition in Thinking About Climate Change Impacts on Financial Stability



Such rapid growth in the number of central banks entering the fray is indicative of an evolving consensus that climate change (and actions to address it) will have material impacts on economies and financial systems around the world. The intent of the NGFS is to mitigate the potential costs and risks as the world steers towards a lower carbon environment through the collective establishment of best practices in areas such as financial disclosure and stress testing.

Currently, the NGFS includes most of the national central banks in the European Union and almost all G7 members. One notable holdout has been the U.S. Federal Reserve (Fed), which likely partly reflects the low political priority the Trump administration has placed on climate change. However, this could change, as some regional Fed branches, such as San Francisco and Dallas Fed, have started to research the subject.

A growing risk to central banks' mandates

Central banks are acknowledging the risk that changing climate patterns pose to successfully achieving their mandates. Although operational frameworks vary across nations, most central banks combine a function of financial oversight with that of monetary policy-making. In some countries where central banks are not directly assigned with macroprudential responsibilities, they coordinate closely with national supervisors for effective crisis management as lenders of the last resort. Consequently, central bank authorities stay well informed of banks' balance sheet composition and the way it is affected by structural changes in the economy. By extension, central banks have developed significant macroprudential expertise that allows them to play an important role in mitigating risks to financial stability.

Central banks are primarily concerned with two key areas of risk related to climate change. First, physical risks stem from more frequent and severe weather events. These in turn could lead to volatility in investment and consumption, thus increasing the challenge of meeting a central bank's medium-term inflation target. Physical risks can potentially result in large financial losses, such as insurance damages, that could be severe enough to ripple through the financial sector through an increase in defaults. When compounded by the damage to collateral, it would exacerbate credit losses.

The second concern surrounds transitional risks. These risks are the direct consequence of changes in climate policies,

technology or market sentiment during the process of adjustment to a lower-carbon economy. Such developments can lead to reduced corporate earnings of more carbon-intensive companies. Similarly, a radical shift of resource allocation to low-carbon technologies could coincide with the "stranding" of high-carbon assets. Increased redirection of capital to green investments can further prompt an abrupt re-pricing of corporate bond, equity and derivative instruments. Seemingly, the risk stemming from climate change is potentially systemic – i.e. affecting the financial system as a whole – which places it in the direct purview of central banks.

Challenges in assessing climate risk

While there appears to be general agreement on these risk elements, any forward-looking assessment as to how (and to what extent) these risks could manifest complicates the task for central banks and regulators. First and foremost, the exact nature of the structural changes underway are highly uncertain. Notably, physical risks stemming from increased frequency of weather events, magnitude of natural disasters, and variability of weather are observable today but are hard to predict into the future. Historically, global economic costs from natural disasters have exceeded the 30-year average of \$US 140 billion per annum in seven of the last ten years,² while the average number of extreme weather events increased from 490 over the past 30 years to 605 in the past decade.³ However, future physical cost estimates are often inconsistent and not comprehensive enough for a holistic assessment of the future economic outlook.

Uncertainty associated with the pace of transition to a low-carbon economy creates an additional challenge to any forward-looking assessment. Data on climate-related risks and their impact on asset returns is scarce, and whatever data is currently available spans over a too short period of time. There is also a need to develop expertise in climate-related data analysis and modeling frameworks. Existing macroeconomic modeling frameworks differ in the way they incorporate assumptions related to the transition in energy, land, urban, infrastructure and industrial systems. Most of models currently in place have limitations that make them not fully suitable for analyzing climate-related risks, but all modelers generally agree that the speed and timing of transition is important to macroeconomic outcomes. If this transition is gradual and inspired by well-designed policies, the macroeconomic and financial impacts would likely deliver net macroeconomic and

financial benefits. For example, in their 2017 report, the Organization Economic Co-operation and Development (OECD) demonstrated that climate change mitigation in accordance with the Paris Agreement combined with pro-growth policies could lead to a net positive growth effect of 1% by 2021 and 2.8% by 2050 in G20 countries compared to business as usual.⁴ Moreover, if mitigation policies also reduce the costs associated with climate change damages, the net growth effect is expected to be close to 5% by 2050. In contrast, the OECD calculated that a delay in policy action until 2025 would result in average output loss of 2% after 10 years. The organization found that such a delay would have an exacerbated impact on capital markets through instability in stock markets and reduced credit supply. Countries whose economies have a greater reliance on fossil fuels would be impacted the most.

The role of NGFS

NGFS' first comprehensive report, released in April 2019, provides several major recommendations for global central banks and supervisors. Their first recommendation is to effectively monitor climate-related vulnerabilities. The Network advises that central banks and financial institutions start quantifying the impact of physical and transitional

risks on financial assets as well as accelerate efforts to develop risk indicators and analytical tools designed with climate change in mind. To support this assessment, the NGFS is developing an analytical framework for scenario analysis that incorporate two dimensions – the extent of mitigation (policy) action and whether the transition is orderly or disorderly. Although financial firms have been running various scenarios since the Global Financial Crisis, “green stress testing” is more complex and requires collaboration from the scientific community (we discuss this in more detail in the appendix).

Leading by example, members of the NGFS are committed to integrating sustainability factors in their own portfolio management as part of their second recommendation. Recent analysis by the Bank for International Settlements (BIS) explored the feasibility of incorporating sustainability within central banks' existing reserve management frameworks.⁵ This can be done explicitly by adding sustainability as an objective (which may have mandate complications), or implicitly by recognizing its impact to existing objectives of liquidity, safety, and return. Implementing these strategies may pose some challenges for central banks' investment and risk management practices. According to the report, adding sustainable in-

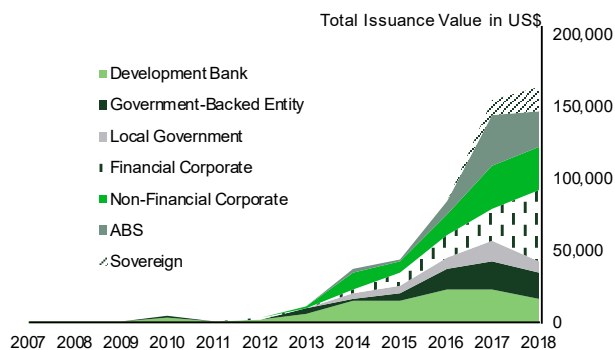
Box 1: Growth of Green Bonds

Improvement in disclosures has increased investor appetite for climate-friendly investment opportunities. And the need for capital supporting climate-related projects is large. The OECD estimates that US\$6.9tn a year is required up to 2030 to meet infrastructure climate and development objectives alone.^a Increased demand has also encouraged a more diverse participation in issuance, shifting the share towards private sector growth. Financial sector participation has grown substantially from 4% of the total global bond issuance in 2014 to 30% issuance in 2018, the largest share of total issuance that year (Chart A).

While growth has been strong since inception, the market only reached annual issuance of \$US 170 billion in 2018, a far cry away from the trillions of dollars needed annually as estimated by the OECD. Centrals banks acknowledge that standardizing green finance reporting can support the growth of this market.

a. <https://www.oecd.org/environment/cc/climate-futures/policy-highlights-financing-climate-futures.pdf>

Chart A: Financial Corporations Have Grown their Participation of Green Bond Issuance*



* data represents labeled green bonds included in the CBI green bond database. Source: Climate Bonds Initiative (CBI), TD Economics

vestments will likely help generate diversification benefits and, hence, improve the risk-adjusted returns. However, each central bank would have to consider how to effectively incorporate the new strategy given still-relatively-limited choice of green assets (as we discuss in Box 1 on page 3).

Finally, central banks recognize that there are significant knowledge and resource gaps that impede their ability to assess climate related risks and opportunities. To address this gap, the NGFS recommends expanding their in-house capacity by developing training and collaborating with other institutions, academics, and think tanks. Relatedly, a lack of harmonized data puts knowledge advancements at risk. In this regard, developing a standard taxonomy of economic activities and supporting a framework for standard climate change public disclosures are imperative. Therefore, the NGFS encourages policymakers develop a taxonomy that enhances the transparency around which economic activities contribute to the transition to a low-carbon economy and are exposed to climate risk. In addition, the Network recommends engaging with financial institutions to share their expectations regarding the type of information to be disclosed as part of the initiatives of the Task Force on Climate-related Financial Disclosures (TCFD).

Demand for climate-related information

In a sense, a coordinated push of central banks around greater financial disclosure would fan trends in capital markets that have emerged in the wake of growing demand for ESG products. Like central banks, investors find climate-related impacts difficult to quantify. To help guide their assessments, investors have been encouraging publicly-traded companies to be more transparent on how they consider climate change in their respective outlooks. Consequently, global corporations have seen a rise in climate-related investor activism in recent years. The One Planet Summit in 2017 established Climate Action 100+, an investor-led initiative with over 320 investors and USD \$33 trillion in assets under management focused on driving business action from the world's largest polluters to address climate change. In 2019, Climate Action 100+ investors led the climate change shareholder resolution committing BP to a business strategy consistent with the goals of the Paris Agreement.

Debt rating agencies are also responding to increasing appetite for climate change-related assessment. For example, S&P Agency reviewed corporate ratings between July 2015

and August 2017 and found cases where environmental and climate factors resulted in a change of rating, about 68% of which were downgrades and 32%- upgrades.⁶

Central banks and climate change: work in progress

Among the NGFS members are Bank of England, the European Central Bank, and most recently Bank of Canada; all of whom have included climate-related risks in their recent respective Financial Stability reports using the framework outlined by the NGFS. Additionally, by naming climate change a vulnerability to the financial system, these central banks have sent a clear message that financial institutions should evaluate climate-related risks and incorporate them in risk management practices.

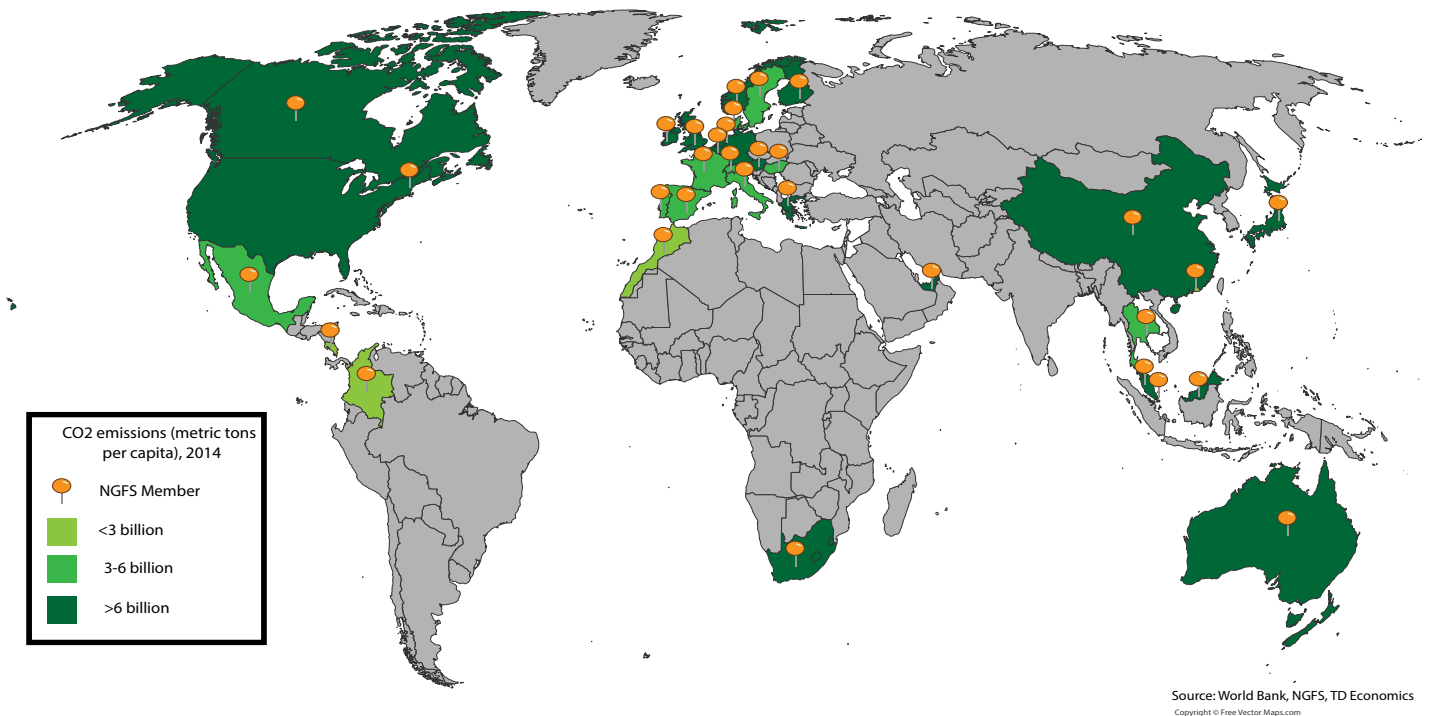
Bank of England

As mentioned above, the Bank of England (BoE) was the pioneer central bank in this “transitioning in thinking.” The BoE together with Prudential Regulatory Authority (PRA) have been at the forefront of examining climate change risks as they relate to the national insurance and banking sectors.

In 2018, PRA surveyed UK banks on whether climate change is considered a core financial risk. The majority (60%) of the respondents confirmed that they use mostly a bottom-up approach in identifying climate-related factors that could lead to credit losses in the short-to-medium run. Another 10% of banks recognized the need for developing a strategic, long-term approach, some of them have even integrated climate change into their internal stress testing used for their Internal Capital Adequacy Assessment Process. The rest of the firms tend to view climate change as a source for reputational rather than financial risk.

PRA emphasized that there is a growing need for setting supervisory expectations for banks to incorporate climate-related risks in their long-term strategy. To support this task, the PRA and Financial Conduct Authority established the Climate Financial Risk Forum in 2019 that provides technical expertise and analytical tools. In turn, the BoE plans to assess climate related risks from the system-wide perspective and will include climate change risks in their 2021 biennial stress testing exercise. In the upcoming months, the BoE is planning to release a discussion paper to gather feedback on the scenario design.

Members of the Network for Greening the Financial System



European banks

Similarly, the European Central Bank (ECB) with support of the European Systemic Risk Board (ESRB) is planning to include climate risk scenarios into stress-test exercises and is developing a climate-related analytical framework and methodologies. The ECB acknowledges that the biggest impediment to a comprehensive analysis of euro banks exposures is data availability. However, preliminary analysis based on European banks' exposures to carbon emitters shows that a disorderly transition to a low-carbon economy could be systemic.

In her answers to the European Parliament questionnaire, President of the ECB Christine Lagarde stated that the ECB should “contribute substantively” to climate change effort and “devote significant resources.”⁷ Lagarde highlighted the need of redirecting private financial flows to green products and enhancing pricing of climate-related risks. To do this effectively, the ECB is planning to expand its efforts in developing standards for what constitutes a green asset. The ECB has already purchased several green bonds as part of its existing asset purchase program but hasn't explicitly targeted green assets – a practice that

would extend sustainability efforts into the realm of monetary policy. Another tool the ECB is reviewing is reducing risk-weights for green assets held on banks' balance sheets. This practice requires further analysis to ensure that the underlying premise of this proposal – green assets are less risky than non-green assets – is supported empirically. These unorthodox tools could help with the ECB goal of developing markets for green instruments by spurring the demand but are also highly controversial as they carry a risk of undermining central bank's policies and creating unintended consequences.

Another European central bank - the Dutch National Bank (DNB) – has proposed a top-down stress testing framework to evaluate the transition to a low carbon economy. The DNB started by identifying the “transition vulnerability factors” of each industry based on their CO2 emissions. DNB scenario narratives combine assumptions on policy action and degree of technological breakthrough. These assumptions in turn feed into transition vulnerability factors used to stress assets held by national financial institutions to calculate an approximate impact on respective supervisory ratios. The report concluded that although

financial institutions may see significant losses because of the transition, they could mitigate these losses by incorporating transition risks into their risk management practices. Additionally, the DNB has stated that, as part of their strategy, they plan to integrate climate-related risks into their supervisory framework and has asked financial institutions to conduct a climate change self-assessment.

Bank of Canada

Like its European peers, the Bank of Canada (BoC) added climate-related risks to its Financial System Review and acknowledged the need for data collection and development of sophisticated analytical tools. In the recent press conference, Deputy Governor Carolyn Wilkins supported the idea that investors and regulators should have sufficient information on climate-related exposures in the financial system. Drawing a parallel to the Global Financial Crisis, she argued that “when risks are priced properly, then their effects when they materialize are usually less.”⁸

With existing policies in place, Canada is expected to reach only a 4% decline in GHG emissions by 2030 vs. the target of 30% (chart 1). Even with additional measures (policies announced but not yet implemented), Canada is still about 11% short of its target. This means that achieving Paris Accord targets will require more stringent measures in future years and higher transition costs.

In contrast to its European peers, the BoC has not yet acknowledged its openness to the idea of “green stress testing.” These efforts must be coordinated with the regulator of Canadian financial institutions: the Office of Superintendent Financial Institutions (OSFI). But given the bank’s

participation in the NGFS, one could expect that climate change narrative will be incorporated into the bi-annual Macroeconomic Stress Test in the future. Besides, a recent report by the Expert Panel on Sustainable Finance states that “it is appropriate that climate tail risk scenarios (i.e., high impact, low probability events) fall under the suite of stress tests that financial institutions must discuss with their boards and present to OSFI.”⁹ As of now, the Bank confirmed that it is expanding its research efforts and plans to collaborate with international partners and integrate physical and transitional climate-related risks into financial stability analysis.

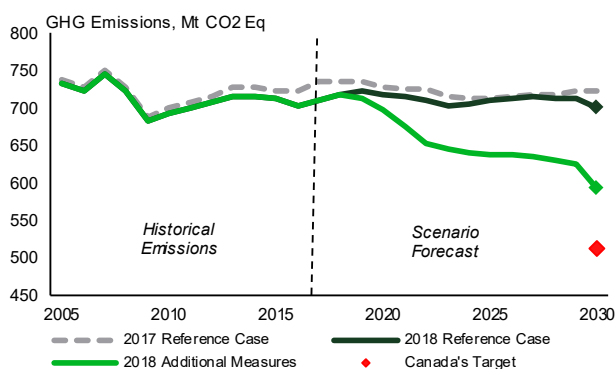
The Fed’s contrarian view

In the U.S., the Trump administration announced its withdrawal from the Paris Accord in 2017 and formally began the process in November 2019. In further distancing themselves from peers, the U.S. administration has introduced new environmental policies to weaken the existing regulation that limits emissions and reduces U.S. contribution to climate change.

Considering this policy landscape, it would be challenging for the U.S. Federal Reserve to add climate-related risks to its supervisory framework. But neither has climate change completely fallen off the central bank’s radar. In March 2019, the Federal Reserve Bank of San Francisco released an economic letter on climate change. In this letter, senior policy advisor Glenn Rudebusch agreed that severe environmental shocks and long-term factors related to climate change are relevant for the central banks to consider as part of their research, with the caveat that “the Fed is not in a position to use monetary policy actively to foster a transition to a low-carbon economy.” Further, in his recent testimony to the Senate, Jerome Powell stated that he sees climate change as a longer-run issue and doesn’t “know that integrating it into the day-to-day financial supervision of financial institutions would add much value.” In other words, the Fed is open to contributing to climate risk research but is not actively pursuing adding climate risk to their risk-management tool-kit.

Other U.S. agencies appear to have a different opinion on the issue. The U.S. Commodity Futures Trading Commission (CFTC) acknowledged the potentially devastating impact of climate change on the commodity and financial markets. In the opening statement before the

Chart 1: Canadian GHG Emissions Projections - How to Achieve Target Levels?



Source: Environment and Climate Change Canada, TD Economics

Market Risk Advisory Committee, Commissioner Ros-
tin Behnam stated that “assessing climate-related market
risk must be a priority – and it must start now.”¹⁰ The
agency is calling for action to examine climate change risks
holistically throughout all financial markets. Further, on
September 24th, 2019 the New York State Department of
Financial Services – a state banking regulator – joined the
NGFS. In his remarks, Superintendent Laceywell stated that
“the global banking and insurance industries have a critical
role to play in addressing climate change, and [NY DFS]
will be collaborating with [their] international partners as
well as working closely with [their] regulated entities to
build a sustainable future.”¹¹ Most recently, on November
7th, 2019 Executive Vice President Kevin Stiroh of the
Federal Reserve Bank of New York highlighted climate-
related risks as one of the emerging risks for risk managers.
In his remarks, Stiroh acknowledges that supervisors can
use their existing toolkit to ensure financial institutions are
resilient to climate-related events.¹²

Conclusion

Without a doubt, the primary objective of central banks is to
maintain price stability. Nevertheless, there is an emerg-
ing consensus among global central bankers that climate
change is posing a growing risk to financial stability, which
falls under their purview. As a result, central banks are revis-
iting their risk-management practices to incorporate climate
change and call for action to do more to identify related risks
and set-up a “green” macroprudential framework.

The Network for Greening the Financial System (NGFS)
provides an important outlet for central banks as they ex-
plore climate change impacts on their financial landscape.
With the support of the NGFS, central banks consider
the unique characteristics of their economic jurisdiction
when developing climate change initiatives while offer-
ing support to financial systems in transitioning to a low-
carbon economy.

Appendix: Green Stress Testing

One of the biggest road blocks in analyzing implications of climate change is the lack of a uniform approach to incorporating physical and transitional risks and their transmission to macroeconomic and financial variables. Non-linearity of climate change, assumptions on the level of adaptation, rate of technological process and climate policy are all complicating the matter. Additionally, feedback loops between the economy and financial systems can create major systemic shocks but are largely unexplored from the climate-risk perspective.

Existing climate change modeling approaches provide a very wide range of estimates. Complex macroeconomic models that account for uncertainties exist but are computationally intensive. Further, while these models have evolved over the past several decades, they differ in how assumptions are transmitted to economic variables. In contrast, financial models are mostly based on spreadsheet analysis or case studies, although some newer frameworks incorporate analysis of energy and socioeconomic systems. Differences in sectoral disaggregation and geographical distribution compound the overall complexity, making it difficult to interpret for a business strategy.

Central banks are responding to these challenges by developing modeling approaches and hypothetical scenarios that will have a uniform set of assumptions related to climate change risk. Since the Global Financial Crisis, the macroprudential toolkit has expanded to include several innovations, one of which is stress testing. In the context of climate-related risks, stress tests seem particularly valuable for evaluating the hypothetical nature of future climate change pathways. Undoubtedly, climate stress testing is more complex than other types of stress tests as it must be reinforced by climate science.

To support efforts like climate change stress testing, the scientific community, in collaboration with the OCED, has developed several narratives where socioeconomic factors and policy changes represent different future outlooks.¹³ Combined with distinct temperature pathways, these economic narratives create a wide range of scenarios to use for stress testing. For example, Chart B depicts a potential range of real GDP profiles under two representative concentration pathways (RCP¹⁴) 2.6 and 6.0 used by scientists to describe emission concentration levels that are likely to lead to 2°C and 4°C above pre-industrial temperatures, respectively. The assumptions described in Table 1 underline socioeconomic factors that result in GDP contours under various mitigation outcomes in line their respective RCP.

Different combinations of temperature paths and policy assumptions could be the basis for developing hypothetical stress scenarios on the national level taking into consideration specifics of national economies. A holistic assessment that includes scenario analysis would require additional data collection, development of robust methodologies, and supplementary research. Therefore, supervisory guidance is instrumental for formally incorporating climate-related risks into the financial risk management paradigm. In the meantime, commercial banks should be involved in assisting the regulators in developing proper measurements. In fact, one of the NGFS's recommendations includes guidance for financial institutions to "initiate their own structured analytical work to identify risks and vulnerabilities, which, successively, can become more and more quantified and sophisticated." This can be achieved by including climate change knowledge into the existing bottom-up risk identification process.

Chart B: Range of Economic Growth (GDP/PPP) Projections (Dellinik et al, 2016) under <2°C* and <4°C Rise in Temperature Assumption**

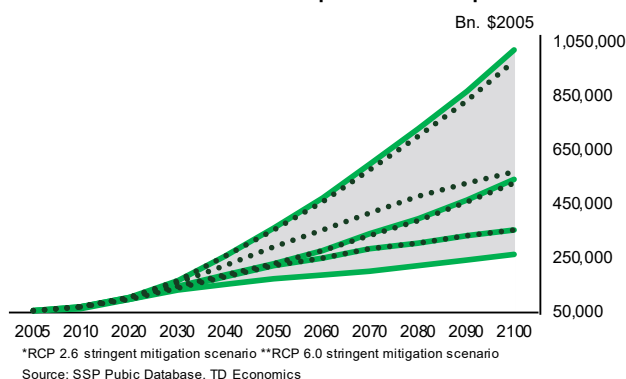


Table 1

Shared Socioeconomic Pathways	Narrative
SSP1 Sustainability – Taking the Green Road	The world shifts toward a more sustainable path, the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity. This scenario does not result in RCP 6.0 (not in the chart for RCP 6.0).
SSP2 Middle of the Road	In this scenario, the world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations.
SSP3 Regional Rivalry – A Rocky Road	The most stressful scenario from mitigation and adaptation perspective is SSP3, which is not attainable in RCP 2.6 (not in the chart for RCP 2.6). This scenario narrates a story of the world with diverging regions primarily pre-occupied with short-term domestic interests and weak intergovernmental bodies. Relatedly, it has the highest barriers to trade and inequality. Under this scenario, the world is unlikely to achieve the goal of keeping global warming likely below 2°C above pre-industrial temperatures.
SSP4 Inequality – A Road Divided	The scenario portrays highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power. Over time, inequalities between countries widen which is reflected in the low global economic growth projections. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive and low-carbon energy sources.
SSP5 Fossil-fueled Development – Taking the Highway	The path that provides the highest economic growth is the one assuming an increasingly integrated global markets with strong investments in human and social capital but coupled with exploitations of low-cost fossil fuel resources and therefore high pollution. This pathway assumes rapid technological advancements coupled with high mitigation strategies that help alleviate high GHG emissions in the early period of the scenario

Source: SSP Public Database, TD Economics

Endnotes

1. <https://www.bis.org/review/r151009a.pdf>
2. <https://natcatservice.munichre.com/overall/1?filter=eyJ5ZWYyRnJvbSI6MTk4MCwieWVhclRvJjoyMDE4fQ%3D%3D&type=1>
3. [https://www.munichre.com/content/dam/munichre/global/content-pieces/documents/302-09092_en%20\(6\).pdf](https://www.munichre.com/content/dam/munichre/global/content-pieces/documents/302-09092_en%20(6).pdf)
4. 50% probability of achieving 2°C. <https://www.oecd-ilibrary.org/docserver/9789264273528-en.pdf?expires=1573147191&id=id&accname=guest&checksum=140F7647E5F7DEDE86209EA2087D3490>
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9. <https://www.canada.ca/en/environment-climate-change/services/climate-change/expert-panel-sustainable-finance.html>
10. <https://www.cftc.gov/PressRoom/SpeechesTestimony/behnamstatement061219>
11. <https://www.dfs.ny.gov/search/site?search=ngfs>
12. <https://www.newyorkfed.org/newsevents/speeches/2019/sti191107>
13. Shared Socioeconomic Pathways (SSPs) - describe different socioeconomic reference developments spanning the space of socioeconomic challenges to mitigation and adaptation. <https://www.sciencedirect.com/science/article/pii/S0959378016300681>
14. RCPs refer to full anthropogenic forcing by the end of the century (in W/m²) https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf

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