

Climate Related Risks to the Financial Sector

Special Report

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Introduction

The mounting impacts of climate change pose substantial risks to the stability of the financial system and thus, the entire economy. Financial institutions are firms actively involved in the flow of money and credit from surplus units to deficit units of the economy. These generally comprises of banks, investment companies and insurance companies. Severe climate change can hurt the financial system through the negative effects of climate change on financial institutions. Nature disrupting the delivery of financial services is nothing new in world history. Financial institutions have coped with floods, typhoons, mudslides, earthquakes, droughts and storms since the 19th century and will continue to do so in future. But what has changed now? Two things have changed One, financial institutions have grown complex and global. This is true because many financial institutions have at least one branch in countries that are prone to climate change events. Secondly, as the number of financial institutions' branch networks continue to multiply in tropical areas where there are extreme weather conditions, so also the risk of physical damage to financial institutions' fixed assets. Financial sector will be affected by the following key risk drivers:

- **Physical risk:** With a hotter and more volatile climate, droughts decrease crop yields, undermining farmers' abilities to pay their loans; fires destroy homes, wiping out the value of real estate; floods swamp cities, grinding economic activity in entire regions to a halt. These direct threats to our infrastructure and systems are known as "physical risks."
- **Transition risk:** Inherent economic changes associated with the needed transition away from a fossil-fuel-based economy to one powered instead by clean energy could have a significant impact on firms involved in the production of fossil fuels, such as coal, oil and gas, as well as other sectors whose business models rely on using such fossil fuels or that are energy intensive (such as utilities, heavy industry, and the transportation sector). There is already evidence that the market value of equities of firms in some heavily polluting industries is being impacted by policy measures and market trends related to a transition to a low-carbon economy. These risks are known as "transition risks."

The objective of this paper is to present an introductory note on the risks that climate change pose to the financial industry. The paper proceeds as follows. The first section presents the effects of climate change on the financial sector. The second section discusses the effects of climate change on the financial system. The third part examines how shocks due to the crystallisation of climate-related risks might be transmitted to the financial system. The fourth part presents measures for mitigating climate-related risks to the financial system. The fifth section discusses responsibilities, powers and functions of supervisors as related to climate risk to the financial system which are recommended by Basel Committee for Bank Supervision (BIS). The sixth part presents what needs to be adjusted in Central; Bank operations to address Climate related risks. The seventh section presents the need for climate related information infrastructure, Finally, conclusions will be made.

1. The Effects of Climate Change on the Financial sector

The following are some of the effects of climate change on the financial sector:1

- a) Climate change can damage physical collateral. When banks lend to corporate and individual borrowers whose ability to repay is doubtful, banks would require physical collateral whose value is greater than the loan facility issued to them. Such physical collaterals may include residential estates, commercial properties, fleet of automobiles or aircraft, equipment, lands, etc. Extreme weather events such as flooding, landslide and typhoons can significantly damage some or all of the physical (and immovable) collateral intended to mitigate the exposure to credit risk. The resulting damage to collateral value caused by climate change would be reflected as a loss in the bank's profit and loss statement which would negatively affect the profitability of the affected bank.
- b) Climate change can disrupt the operations of financial institutions: Financial institutions rely heavily on communication systems through information technology infrastructure. Any damage to such infrastructure due to severe weather or hurricanes can disrupt the business of financial institutions for a considerable period of time before recovery. Climate change events such as hurricanes can damage the infrastructure used by financial institutions to communicate within the firm such as the internet, information technology etc. Severe climate change can also disrupt the ability of banks to communicate internally within the firm, thereby disrupting their operations.
- c) Climate change can disrupt the business of bank's customers climate change events such as hurricanes, landslide and floods can damage the business of banks' clients and customers. Bank customers such as manufacturing firms and agricultural firms are very prone to significant damage during hurricanes and flood events. Although the impact on banks is indirect, such events would lead to low profit margin to banks that have high exposure to the agricultural sector since the affected companies will not be able to conduct business for a considerable period of time until recovery.
- d) Severe climate change will lead to increased insurance claims and liabilities. Climate change events will increase costs for companies in the insurance industry. Businesses and individuals that have some comprehensive insurance policy with insurance or reinsurance companies are often the first to make a claim on their policy whenever climate

¹ Peterson K. Ozili" Effects of Climate Change on Financial Institutions and the Financial System" pp2-4, http://difectsofClimateChangeontheFinancialSector%20(1).pdf

change events occur that affects the insured object. When such events simultaneously affect multiple businesses and individuals, the insurance payouts will be higher, and could lead to financial difficulty for insurance companies who may have insufficient funds to pay to policyholders. Also, since other financial institutions are the major lender to insurance companies, these financial institutions could also be affected indirectly by climate change events.

- e) Insurance companies can increase insurance premiums and the associated deductibles in anticipation of climate change events which the insurance company believe is likely to occur. In other cases, insurance companies can either decrease the availability of insurance coverage for climate change events or may refuse to give any cover for climate change events when it becomes difficult to measure the likelihood and severity (or frequency) of climate change events.
- f) Climate change events can make employees in financial institutions become less productive especially when there are record-breaking temperatures making the day unbearable, and making it tough to get the job done. Extreme heat and hydration, especially when combined with hard work and long hours, can lead to mental and physical breakdown of employees in financial institutions. Severe climate change means it will be colder or hotter than ever before, and that the cold or heat may last significantly longer than it did in the past.
- g) Regulations or legislations may emerge that would require financial institutions to disclose information on their exposure to climate change risk. They may also be required to disclose the amount of risk capital they have set aside to mitigate such climate change risk. Regulations may also require financial institutions to disclose additional information on how climate change will affect the company's strategy and operational performance. However, such disclosures come at cost to financial institutions. Such disclosure regulations may be imposed by the capital market regulator to ensure that investors have a good understanding of how public companies intend to manage climate change risk. In the banking sector, disclosure regulations may be imposed by bank regulators to serve as a forward looking micro-prudential approach to deal with climate change risk. Such disclosures are costly to financial institutions because financial institutions may need to hire specialists to accurately quantify their exposure to climate change risk, and to estimate the risk capital to set aside to mitigate climate change risk.

II. Effect of Climate Change on the Financial System²

Climate change can have profound effects on the stability of the financial system The financial system is the system that allows the exchange of funds between lenders, borrowers and investors. Climate change affects the financial system through its <u>effects on financial</u> institutions, as discussed below:

2 Ibid, PP4-5

- a) Damage to payment system infrastructure. The financial system relies heavily on payment systems to settle financial obligations and to receive financial claims from counterparties engaged in business transactions. In every country, there is an interbank settlement system which helps to settle financial claims and obligations for transactions done in one or more jurisdiction. The interbank settlement infrastructure is usually installed in a physical warehouse at a disclosed or undisclosed location. Any damage to this payment infrastructure caused by severe thunderstorms, severe weather or earthquakes will disrupt the financial intermediation process since payments will not be cleared when due, which can lead to severe instability in the entire financial system
- b) Climate change can lead to capital flight. Climate change can make cities and countries become financially unstable. This is because holders of large capital will remove their money away from cities and countries that are prone to severe climate change events, leaving such cities or countries with little financial resources to recover from unfavourable climate change events. Also, high net-worth individuals will remove their money from banks and investment firms situated in climate change prone areas, leaving such financial institutions with little capital to do business, leading to the undercapitalization of financial institutions and reduced level of financial intermediation which can make the financial system become unstable.:
- c) Uncertainty that destabilizes financial markets climate risks have the potential to impact financial markets. In cities that are prone to climate change events, the uncertainty about which climate change event will occur, when it will occur, and the severity when it occurs can fuel volatility in financial markets. Investors due to fear and uncertainty can hoard capital or provide capital at a high premium which firms cannot afford. Also, financial institutions that lack the ability to mitigate climate change risk may withdraw liquidity from money markets by recalling the financial instruments they have issued to the money market, which may create a 'liquidity crunch' or a 'run on liquidity' in financial markets, and this will have negative consequences on the stability of the financial system.
- d) Climate change can confuse regulators financial system. Regulators are often economists financial economists, business economists or academic economists. The inability of macroeconomic models to forecast the probability of a climate change event occurring, can leave regulators confused about what to expect from climate change events, and confused about what to do when such events occur. Even financial institutions that were significantly affected by climate change events will seek help from the regulator, and in some cases, the regulator may be clueless on what to do. Although most regulators facing a climate change problem would seek help from the federal government, there is no guarantee that the government has a special solution that can restore the financial system to normalcy.

III. Transmission Mechanisms of Climate-Related Risks to the Financial System



Transmission channels are the causal chains linking climate risk drivers to the financial risks faced by banks and the banking sector. The transmission channels are classified as microeconomic or macroeconomic. ³ They are summarised in the following diagram⁴.

Microeconomic Channels

Microeconomic transmission channels refer to the causal chains by which climate risk drivers affect the various individual counterparties doing business with banks, potentially exposing banks and the entire financial system to climate-related

The discussions in this section are largely summarised from the following sources: i) Basel Committee on Banking Supervision" Climate-related risk drivers and their transmission Channel" PP10-19, April 2021, <u>https://www.bis.org/bcbs/publ/d517.pdf</u>; and ii) <u>https://analystprep.com/study-notes/frm/climate-related-risk-drivers-and-their-transmission-channels/</u>

⁴ P.Grippa, J.Schmittmann, F.Sunthem, IMF, Finance and Development "Climate Change and Financial Risk" December 2019

financial risk. They also include the direct effects of climate change on banks, particularly events that disrupt operations and the ability of banks to raise funds for day-to-day business However, they also include the indirect effects on name-specific assets such as bonds, and equities, among others.

The following are some of the various microeconomic transmission channels and the financial risk they create.

a) Credit Risks

i) Households

- Severe weather can damage bank-funded property. This, in turn increases the probability of default of nonperforming asset, and lowers bank equity ratios.
- Banks using residential real estate as collateral for mortgages. may see their credit risk increase if such property is damaged by adverse weather or rising sea levels.

ii) Corporates

- There's evidence that severe weather events (physical risks) reduce corporate profitability and potentially increase credit risk to lenders.
- Agricultural entities funded by banks can be hit by high temperatures and precipitation, leading to low yields and problems of repaying debt

iii) Central and Local Government Institutions

Physical risk events may lead to lower tax revenues for central and local government institutions resulting from impaired corporates, reduced household income, and an overall reduction in output. This in turn, increases the risk of default and the loss given default for banks with sovereign and municipal exposures

iv) Technological Change

Carbon-intensive technologies may be subjected to heavy taxation to discourage their use. Thus, any firm that continues to rely on such technologies may find itself unable to compete with those that quickly adopt newer, more efficient technology. Credit-related losses may be higher for banks exposed to companies that cannot adapt to carbon neutral economies.

v) Sentiments

Transitioning to lower-carbon economies may also trigger shifts of consumer and market sentiment to less carbon-intensive products or investments. One possible way such shifts could manifest is through rising expectations of detrimental future climate events making individuals more aware of climate change as physical risks materialise. Consequently, they may act in ways that would contribute to reducing the impact of climate change. For example, in the automobile industry, consumers may increasingly prefer cars with lower GHG emissions. As a result, traditional automobile manufacturers who continue to produce high GHG emission cars may see the future of their brands compromised, regardless of regulatory or technical initiatives. Additional research on the income and wealth effects of sentiment on corporates would help to enhance understanding of the nature of this transmission channel. Stakeholder sentiment and action is a potentially important transition climate risk driver for households, corporates and sovereigns. Activist measures, changes in consumption patterns or consumer awareness and behavior may drive corporates, including banks, towards more environmentally friendly business, production or investment models. For banks in particular, retail and wholesale clients may manage their savings or investments – or require that these be managed on their behalf – towards projects with a positive environmental impact. Cost of capital and funding for some corporates may increase as equity and debt investors and rating agencies include climate-related or environmental factors in their investment and rating decisions. Rating agencies have already initiated negative rating actions in response to climate risk factors such as drought and hurricane losses (S&P Global (2018)).

b) Market risk

- Future economic conditions that will affect the price and value of financial assets may result in downward price shocks and an increase in market volatility.
- Climate risk could also lead to a breakdown of long-established correlations between financial assets. This would render hedging methods ineffective and reduce the ability of banks to manage their market risks.

c) Liquidity risk

- Banks' liquidity risk may be affected directly as a result of climate risk drivers, either through their inability to raise funds or liquidate assets or indirectly as a result of customer demands for liquidity.
- Households and corporations affected by physical risks may withdraw deposits or borrow funds to cover recovery and other cash-flow needs. Actions like these may put the bank at unprecedented liquidity pressure.

d) Operational Risk

• Banks' operational ability may be reduced if physical hazards destroy transportation and communication infrastructure.

Banks and corporations may also see increased legal and regulatory compliance risks resulting from transition
risks

Macroeconomic Channels

Climate risk is expected to have the greatest impact on credit risk and market risk when considering macroeconomic factors.

a) Credit Risk:

First, there is likely to be a climate-related increase in human mortality, a situation that may result in reduced labor productivity. Second, empirical evidence suggests climate can push up the cost of debt, significantly particularly in developing countries. This means the affected industries may find it difficult to recover from disasters and will not be able to honor their financial obligations with counterparties, including banks. In addition, increased borrowing costs could bring about higher taxes, lower government spending and reduced productivity levels, all of which may indirectly impact the credit risk for the bank.

A global shift away from fossil fuels to meet the targets of the Paris climate accords is projected to result in the majority of fossil fuel reserves (around 80%) becoming stranded resources, including as much as 90% of Africa's coal reserves, implying material losses for many countries (Bos and Gupta (2019)). Such a shift could have significant implications for government revenues and spending in some of the poorest countries reliant on fossil fuel revenues. Climate-related income effects on sovereigns could hamper their ability to service their debts, in turn impacting the value of their bonds, their credit ratings and the credit ratings of those institutions associated with the sovereign. In turn, this is expected to increase the credit risk of banks facing these counterparties. As noted above, transition risk drivers can affect the income of banks' counterparties, which, in aggregate, could have macroeconomic effects. For example, the income effect could result from carbon emission taxes, increased prices in carbon-intensive supply chains or changed consumer preferences. Higher costs of production reduce profitability, which lowers investment and equity prices. Firms could respond to higher production costs by raising prices, in turn curtailing household disposable income and lowering consumption. The combination of lower consumption and investment reduces GDP. Households could then suffer diminished income, as a result of slower GDP growth or higher unemployment due to structural shifts in the economy caused by climate change impacts or mitigation efforts. A contraction in households' wealth and income could lead to a deterioration in their ability to service their debts, increasing the credit risk of their banks.

b) Market Risks:

Currently, there's little research that seeks to establish how the interaction between macroeconomic factors and climaterelated risks can affect the market risk for banks. However, some evidence suggests that changes in government policy might affect the value of assets in certain industries that significantly contribute to the overall economy

IV. Measures for Mitigating climate-related risks to the Financial System

This section considers actions that financial institutions and authorities are taking and/or could take to mitigate risks from climate change.⁵

a) Actions by financial institutions

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Some financial institutions have incorporated – and could in future continue to incorporate their exposure to climate risks in their investment, lending and underwriting decisions, and integrated these risks into their broader risk management processes. This might go some way towards limiting firms' exposures to both physical and transition risks. Examples of actions taken by some financial institutions include:

- Heightened due diligence or categorical rules. Some financial institutions undertake negative screening in their selection of firms to whom they lend, in which they invest or whom they underwrite. Many financial firms that implement some sort of exclusion policy include industries with high exposure to climate-related risks as part of such policies.
- Engagement with investees and clients. Many investors engage collectively with companies in order to encourage them to reduce their emissions. Some banks also engage clients in the energy sector to do so. Insurers are increasingly taking steps to reduce their exposure to climate-related risks by providing incentives for customers to mitigate such risks and guidance as to how they might do so.
- Use of metrics that track (and in some cases reduce) financial firms' exposures to climate risk. Such metrics focus on transition risk and include, for example, firms' carbon footprint, carbon intensity, or financed emissions. That said, only a minority of financial institutions define exposure limits based upon these metrics, or use an explicit framework to measure emissions (though some are in the process of developing such frameworks). Specific environmental and climate-risk scores have also proliferated in recent years and gained traction as a tool to support investment decisions and portfolio allocation.
- Integrating climate-related risks into their assessments of borrower credit risk and investment decisions. Newer climate-based models and techniques have also emerged to support management of climate risk in investments. These include climate Value-at-Risk (VaR), which aims to provide a forward-looking and return-based valuation assessment to measure climate related risks and opportunities in an investment portfolio.
- Integrating climate risk management into institution-wide governance, strategies and risk management frame-

FSB: "The Implications of Channels of Climate Change for Financial Stability" 23 Nov. 2020, pp 28-31https://www.fsb.org/wp-content/uploads/P231120.pdf

works. Many financial institutions, particularly larger firms, place accountability and management responsibility of climate-related risks with their Board and/or senior management. Many also integrate consideration of climate related risks into their business strategy. An increasing number of financial institutions are integrating climate-related risks into their overall risk management frameworks, but only a minority do so fully.

- Financial institutions may use scenario analysis to identify and assess the potential implications of climate change, and to test the resilience of firms' overall approach to climate-related risks. Scenario analysis is typically based on a range of pathways for the progression of climate change as well as firms' exposures to climate-related risks. Scenarios are hypothetical constructs, not designed to deliver precise outcomes or forecasts, but to let organisations consider how the future might look if certain trends continue or conditions are met for example, how various combinations of climate-related risks may affect its businesses, strategies, and financial performance over time.
- The major credit rating agencies (CRAs) also now consider environmental, social and governance (ESG) factors, including climate risks, in their ratings, to varying degrees. Climate risk is a driver of ratings changes in certain sectors, including for sovereigns exposed to climate risk, utilities and power companies, and fossil fuel sectors. However, other evidence, such as work by the Principles for Responsible Investment, has identified challenges to the effective integration of climate risks into credit ratings.

b) Financial authorities' actions

Some financial authorities are exploring possible approaches to reduce climate-related financial risks. They are generally less developed than tools to address other types of financial risk. However, they started to implement micro and macro-prudential policies.⁶

i) Micro-prudential policy

Financial authorities are beginning to assess how climate-related risks are managed by financial firms, and to take actions to encourage firms to mitigate such risks. Most financial authorities which started supervising climate related risks have engaged in awareness raising of climate risks and many have surveyed the institutions they supervise to understand how they manage climate risk. Some authorities have issued or are in the process of issuing supervisory expectations, which tend to cover some set of institutional risk management elements (i.e., governance, strategy, scenario analysis, and/or risk management); Some financial standard-setting bodies are also starting to work on supervisory guidance related to climate risk.

6 ibid

ii) Macro-prudential policy

Scenario analysis can be used by financial authorities to quantify the totality of exposures of financial institutions to climate-related risks within their jurisdiction (this is sometimes called a 'climate stress test'). Such estimates are similar to firm-specific scenario analysis, but are based on a common scenario (or scenarios) specified by financial authorities, which allow for a comparison of results across firms. To date, such scenario analysis is being developed by the Bank of England, Banque de France/ ACPR, and the European Central Bank. Some authorities have also voiced support for considering macro-prudential policies to mitigate the climate related risks to financial stability.

V. Responsibilities, Powers and Functions of Supervisors as Related to Climate Risk to the Financial System which are Recommended by Basel Committee for Bank Supervision (BIS)

In conducting supervisory assessments of banks' management of climate-related financial risks, supervisors should utilise an appropriate range of techniques and tools and adopt adequate follow-up measures in case of material misalignment with supervisory expectations. The following are key powers and functions of supervisors as related to climate risk to the financial system⁷.

- Supervisors should set expectations in a manner proportionate to the nature, scale and complexity of relevant banks' activities.
- To foster cross-border collaboration, home and host supervisors of cross-border banking groups should share information related to the climate risk resilience of banks and banking groups, leveraging existing frameworks for sharing information and undertaking collaborative work.
- Supervisors should take regular stock of existing skills and projected requirements, taking into account relevant evolving market practices and supervisory practices in this landscape, and take timely measures to build adequate expertise in identified skill sets. Where aspects of climate-related risk assessments are outsourced, supervisors should maintain appropriate knowledge to ensure that the results of the outsourced analysis are credible and realistic.
- Supervisors should engage a broad and diverse range of stakeholders to facilitate a collective understanding and measurement of climate-related financial risks and allow for optimisation of climate-dedicated resources.

⁷ Basel Committee for Bank Supervision (BIS): "Principles for Effective Management and Supervision of Climate Related Financial Risks" <u>https://www.bis.</u> org/bcbs/publ/d532.pdf, June 2022.pp-9-10

- Supervisors could use existing regulatory reports to assess the materiality of climate-related financial risks to banks. In case of data gaps, supervisors may collect additional information from supervised banks such as sector exposures and banks' internal reports.
- Supervisors should clearly articulate their specific objectives for supervisory climate scenario analysis, including stress testing, which could include, for example: (i) exploring the impact of climate change and the transition to a low-carbon economy on supervised banks' strategies and the resiliency of their business models; (ii) identifying and assessing relevant climate-related risk drivers affecting individual banks or the banking system; (iii) facilitating information sharing and identifying common data and methodological gaps and limitations in climate-related risk management; and (iv) informing the adequacy of supervised banks' risk management frameworks, including their risk mitigation options.
- In designing scenario analysis, supervisors should consider material climate-related financial risks, including physical and transition risks, that take into account the nature, scale and complexity of the banks within their jurisdiction. The scenarios used should incorporate a range of plausible climate pathways. Supervisors should consider a range of time horizons, from short- to long-term, depending on the objectives of the exercise. For instance, shorter time horizons may be useful to analyse the types of climate related financial risks that could crystallise within traditional capital planning horizons and to assess their potential impact on regulatory capital, while longer horizons, which carry higher levels of uncertainty, may be useful to gauge exposure to structural changes in the economy or financial system or the distribution of risks.
- Supervisors should build sufficient capacity and expertise to conduct climate scenario analysis. Supervisors are encouraged to collaborate with a broad and diverse set of stakeholders, including the climate science community, to develop scenarios that can inform comprehensive assessments of climate related financial risks, and should keep abreast of emerging practices in scenario design and implementation.
- As scenario analysis continues to evolve, supervisors should recognise the limitations of their analyses when communicating their results or using them in supervisory assessments. Ongoing dialogue among supervisors and between supervisors and banks will contribute to the development of deeper insights on banks' climate-related vulnerabilities and their strategies to mitigate climate-related financial risks.
- Supervisors should take into account the level of uncertainty associated with scenarios when determining whether to disclose results. Supervisors may consider disclosing scenario analysis results at an appropriate level of aggregation and should include the appropriate level of detail on methodologies, assumptions, the

level of uncertainty and key sensitivities when disclosing results.

• To foster information-sharing, cross-border collaboration and efficient resource utilisation, home and host supervisors are encouraged to establish frameworks for communicating and coordinating scenario analysis with other relevant domestic and cross-jurisdictional authorities where appropriate.

VI. Adjusting Central Bank Operations to Climate Risk

The menu of options available to central banks to factor climate-related risks into their operational framework is potentially large adjustments that could be considered across the main operational functions that central banks carry out for the purposes of implementing monetary policy. This report analyses possible changes to three of the most important policy fields: credit operations, collateral policies, and asset purchases.

The review concentrates on potential measures on the asset side of a central bank's balance sheet. Hence, the stylised options listed in the Table below which pertains to liquidity-providing instruments. Based on the available literature and expert analyses, the review by the Network for Greening Financial Institutions (NGFS) group of experts focuses on nine stylised options across these three main policy fields.

Credit Risk		
1. Adjust pricing to reflect counterparties' climate-related lending	Make the interest rate for central bank lending facilities conditional on the extent to which a counterparty's lending (relative to a relevant benchmark) is contributing to climate change mitigation and/or the extent to which they are decarbonising their business model	
2. Adjust pricing to reflect the composition of pledged collateral	Charge a lower (or higher) interest rate to counterparties that pledge a higher proportion of low-carbon (or carbon-intensive) assets as collateral or set up a credit facility (potentially at concessional rates) accessible only against low-carbon assets	
3. Adjust counterparties' eligibility	Make access to (some) lending facilities conditional on a counterparty's disclosure of climate- related information or on its carbon-intensive/low-carbon/green investments.	
Collateral		

Selected Stylised Options for Adjusting Central Bank Operational Framework to Climate Related Risk 8

⁸ Source: Network for Greening Financial Institutions (NGFS) Technical Document, NGFS Secretariat, Banque De France March 2021. <u>https://www.ngfs.net/</u> sites/default/files/media/2021/06/17/ngfs_monetary_policy_operations_final.pdf

4. Adjust haircuts	Adjust haircuts to better account for climate-related risks. Haircuts could also be calibrated such that they go beyond what might be required from a purely risk mitigation perspective in order to incentivise the market for sustainable assets.
5. Negative screening	Exclude otherwise eligible collateral assets, based on their issuer-level climate-related risk profile for debt securities or on the analysis of the carbon performance of underlying assets for pledged pools of loans or securitised products. This could be done in different ways, including adjusting eligibility requirements, tightening risk tolerance, introducing tighter or specific mobilisation rules, etc.
6. Positive screening	Accept sustainable collateral so as to incentivise banks to lend or capital markets to fund projects and assets that support environmentally friendly activities (e.g. green bonds or sustainability linked assets). This could be done in different ways, including adjusting eligibility requirements, increasing risk tolerance on a limited scale, relaxing some mobilisation rules, etc.
7. Align collateral pools with a climate-related objective	Require counterparties to pledge collateral such that it complies with a climate-related metric at an aggregate pool level
Asset Purchase	
8. Tilt purchases	Skew asset purchases according to climate-related risks and/or criteria applied at the issuer or asset level
9. Negative screening	Exclude some assets or issuers from purchases if they fail to meet climate-related criteria.

Credit operations are widely used to provide aggregate liquidity and usually take the form of collateralized lending;

- 1. Collateral policy defines the range of assets that can be pledged to secure central bank credit operations, as well as the risk control measures that apply to them;
- 2. Central banks may buy a variety of assets from both public and private sectors, typically in an effort to exert greater influence on longer-term interest rate levels and spreads while improving market liquidity.

Central Banks need to be also involved in Green Market Development, in addition to Adjusting their operational framework to address climate related risks. This require developing green financial markets, which would serve to transmit the green impact of monetary policy and to develop the pool of assets that can be used as collateral for lending operations or for asset purchases. The contribution of the central bank to support market development would include expanding its eligible collateral to include green assets, the central bank can also work as a catalyst, including in standard setting, encouraging disclosure, influencing regulations, and fostering market practices. The sovereign green bond landscape consists of issuance

by 16 countries in 2020 with Europe dominating global sovereign issuance. France is the largest issuer, followed by Germany, Netherlands, Belgium, and Italy

VII. The need for Climate Related Information Infrastructure

To support the transition to a low-carbon economy and to mitigate the impact of climate change on the financial sector, significant information and challenges need to be overcome. However, currently there is a lack of relevant and useful information, and there are limitations in terms of its quality, comparability and consistency. The following are key objectives for improving the availability of climate-change-related financial information⁹:

- i) Assessing and pricing of risks. Financial information is generally meant to support the assessment and pricing of firm level risk, and thus facilitate the efficient allocation of capital. Therefore, to the extent that climate change affects the riskiness of assets, there is also a need for high-quality, climate-related information.
- ii) Monitoring and maintaining financial stability. Central banks and financial regulators increasingly acknowledge the potentially systemic risks posed by climate change. Improving climate related information is a necessary condition to understand and measure such risks to financial stability.
- iii) Supporting the climate transition. Climate-related information can change corporate behavior, and thus foster the transition to a low carbon economy. For example, sustainable investment funds can influence firms' actions with respect to climate change. However, for sustainable finance markets to function, reliable and comparable information is a prerequisite to prevent greenwashing and to maintain investor confidence. There are also other stakeholders outside of the financial system that could benefit from such information. For example, disclosures can be used by consumers or employees to encourage firms to transition to a more climatesustainable business model.

Strengthening the climate information architecture is paramount to promote transparency and global comparability of data and thus improve market confidence, safeguard financial stability, and foster sustainable finance. There are three buildings blocks that require strong global coordination and international commitment to achieve progress and convergence:¹⁰

i) High-quality, reliable, and comparable data.

⁹ IMF Online Training on "Macro-economics of Climate Change: Climate Risk for the Financial Sector".

¹⁰ Caio Ferreira, D. Lukas Rozumak, Ranjit Singh and Felix Suntheim, "Strengthening the Climate Information Architecture" IMF September 2021, P2 CL-NEA2021003%20(4).pdf

- There is a need for more forward-looking and granular data that is accessible, and whose quality and comparability is ensured through verification and audit mechanisms.
- Supporting the NGFS and Financial Stability Board (FSB) efforts to identify data gaps and improve the availability of data is a necessary step to enhance access to information by investors, policymakers, and other stakeholders.
- ii) A globally harmonized and consistent set of climate disclosure standards.
 - There is an urgent need to address the fragmentation of disclosure frameworks by developing a globally harmonized and consistent set of climate reporting standards. The International Financial Reporting Standards (IFRS) Foundation's effort to develop such standards, building on existing frameworks, is of critical importance and should be supported.
 - The new reporting standards should reflect the interdependency between creation of value to investors, addressing climate risks from a financial stability perspective, and taking into account the interests of the broader society. They should provide a basis for coordination across stakeholders and allow for additional reporting requirements that capture wider sustainability impacts and information needs.
 - A timely and consistent global implementation of these standards should provide a clear pathway toward eventual mandatory adoption, while recognizing individual jurisdictions' institutional and legal specificities. Costs and benefits should be carefully considered, especially for small and medium enterprises (SMEs) and firms from emerging markets and developing economies (EMDEs).
- iii) Globally agreed upon principles for climate finance taxonomies and other classification approaches to align investments with climate goals.
 - Globally agreed upon principles for Climate finance taxonomies and other classification approaches are required to increase comparability and consistency of terms and metrics, harmonize the development of transition pathways, provide investors with easy to interpret information, and minimize green-washing, thus allowing to scale up sustainable finance and mobilize urgently needed investment in climate change adaptation and mitigation.
 - The principles should encourage and incentivize investments toward a climate-sustainable economic model, while taking into account the economic development and environmental characteristics of an economy.

The IMF plays an active role in supporting the development of a climate-information architecture, through analytical work that is being carried out to achieve better disclosures and more standardization. One such way is through the Climate Change Indicators Dashboard (CID). This dashboard is a result of a large collaborative effort between the IMF, the World Bank, United Nations, European Commission, OECD, and INFORM. INFORM is a multi-stakeholder forum for developing shared, quantitative analysis relevant to crises and disasters. The objective of the Climate Change Indicators Dashboard is to provide a platform for disseminating climate change data for macroeconomic and financial policy analysis. In collaboration with other international organisations, the Fund has identified and developed a range of distinctive data available through climate data.imf. org. The indicators are grouped in the following five broad categories: i) economic activity indicators, ii) cross border indicators, iii) financial and other risk indicators and iv) government policy indicators. Each category and indicator group are clickable to allow users direct access to the data. The CID provides value added in several aspects. First, it provides easy access to climate change data for macroeconomic and financial stability analysis. Second, the CID presents experimental indicators to test the use cases. Nine of the indicators covered in the CID are experimental indicators developed by the IMF staff. Third, the CID aims to improve the timeliness for certain indicators based on the IMF staff estimates. Fourth, the CID provides a broader country coverage compared to existing databases and finally, it provides a platform for international cooperation.¹¹

VIII. Concluding Remarks

Financial institutions have the ability to direct capital and demonstrate to markets the opportunities, risks and potential returns of investments. They play a pivotal role in helping investments and assets support implementation of low carbon, climate resilient development pathways. To deliver climate smart financing at scale, and to achieve core business objectives and obligations, financial institutions will need to deepen existing efforts to integrate climate change considerations systematically and explicitly across all levels of its strategies, programs and operations. In order for financial institutions to address climate change, two simultaneous activities are likely required: scaling up capital for the low-carbon transition; and addressing the risks posed by climate change.¹²

Since, climate change and climate policies have an impact on price and financial stability, therefore, the issue of climate change should be of concern also to central banks. Central banks can make a direct contribution to effective climate management and a sustainable economy. They are well suited for monitoring the economic conditions for climate protection. Central banks as supervisors of financial institutions can facilitate the disclosure of financially relevant physical and transitional climate risks and stimulate the greening of finance.¹³

11 IMF Online Training on "Macro-economics of Climate Change: Climate Risk for the Financial Sector".

12 World Bank "Mainstreaming Climate Action within the Financial Institution" https://www.worldbank.org/content/dam/Worldbank/document/Climate/5Principles.pdf

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