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Supporting central banks and financial regulators in emerging markets and developing economies in their response to climate change:

Insights from the project Greening the Financial Sector in Malawi

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Authors

Thomas Dale, Elisabeth Resch

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Introduction

Over the last decade, central banks and financial regulators[1] (CBFR) have increasingly come to view climate change as a material risk to their core mandates, namely ensuring price stability and financial stability.

Drawing on insights gained from the project *Greening the Financial Sector in Malawi*, this paper seeks to provide practical guidance to CBFRs in emerging markets and developing economies (EMDE) on exploring their role and their options to ensure they are able to achieve their mandates in the face of climate change. As the recognition that CBFRs have a role to play in the global response to climate change has gained momentum, a growing pool of literature has emerged on this topic centred on the experiences of CBFRs in advanced economies. In contrast, there is notably less analysis focused on CBFRs in EMDEs and particularly least developed countries (LDC) such as Malawi (United Nations Trade and Development [UNCTAD] 2023). This is despite the fact that these CBFRs typically face a different set of challenges to their peers in advanced economies. This paper aims to contribute to closing this gap in literature by highlighting the unique challenges facing CBFRs in these settings, and by drawing on real-world experience from Malawi to inform and support peers operating in similar environments.

Section 1 discusses why CBFRs are increasingly interested in responding to climate change, how they can do this, and the barriers that hinder CBFRs in EMDEs respond effectively to climate change. Section 2 presents a series of insights and lessons obtained from the project *Greening the Financial Sector in Malawi* that can inform future projects supporting CBFRs in EMDEs as they respond to climate change.

1. Central banks, financial regulators and climate change

Why are central banks and financial regulators increasingly taking measures to respond to climate change?

Climate change adversely impacts economic activity and exposes the value of some financial assets to substantial risks. These risks can arise through two main channels: physical risk and transition risk (Task Force on Climate-Related Financial Disclosures [TCFD] 2017). Physical risk refers to the increased risk posed by acute climate-related events (e.g. floods, wildfires, drought) and longer-term shifts in climate patterns (e.g. rising sea levels and increases in extreme temperatures). These directly impact livelihoods and businesses by destroying assets and reducing the productivity of economic activities due to long-term deterioration in environmental or working conditions (Network for Greening the Financial System [NGFS] 2024a). In the immediate term, this impacts the ability of households and companies to repay debt and thereby results in losses for the banking system (Bank for International Settlements [BIS] 2021, Dafermos 2021). In the longer-term however, acute climate-related events and longer-term shifts in climate patterns impact the demand side of the economy, as reduced income, wealth and consumer and investor confidence lead to downward pressure on consumption and investment. This, in turn, is liable to impact the profitability of financial institutions, as credit markets are likely to contract due to rising the cost of credit for households and businesses – driven by, inter alia, the declining value of assets that can be used as collateral and higher external finance premiums (NGFS 2024a). Transition risk, meanwhile, refers to the risk posed by the implementation of policies, technological innovations and changes in consumer behaviour

associated with the transition towards a low-carbon climate-resilient economy (TCFD 2017). Such changes, particularly under a disorderly transition,[2] could trigger a sudden decline in demand for carbon-intensive products (e.g. fossil fuels), resulting in assets linked to their production becoming stranded. The materialisation of this risk would negatively affect the financial position of the owners of these assets and their lenders (Dafermos 2021).

In light of these risks, over the last ten years, CBFRs increasingly view climate change as a threat to their core mandates of ensuring price stability and financial stability (NGFS 2018 and 2023b, Dafermos 2021).[3] Given that CBFRs are entrusted with safeguarding the stability of the financial system, it is now broadly recognized that they should assess these risks and explicitly incorporate them into their operations (Dafermos 2021, NGFS 2024b, World Bank 2024a).

There is also increasing recognition that climate change may affect the transmission channels of monetary policy, thereby undermining the ability of CBFRs to attain their monetary policy objectives such as meeting inflation targets and controlling exchange rates (NGFS 2020 and 2024, Dafemos et al. 2021, UNCTAD 2023). This adds another layer of complexity to the challenges climate change presents for CBFRs as beyond its direct and material impact on monetary policy objectives, climate change also weakens the capacity of CBFRs to effectively respond. [4]

How should central banks and financial authorities respond to climate change?

The response of CBFRs to climate change can have two potential objectives. The first is to ensure that climate-related financial risks are adequately understood and managed by actors in the financial system, including by CBFRs themselves (D'Orazio and Popoyan 2019, Oustry et al. 2020, Baer, Campiglio and Deyris 2021, Dafermos 2021, Dafermos and Nikolaidi 2022, Bosch 2023, UNTCAD 2023, NGFS 2024b). The second is to support the transition to a low-carbon climate-resilient economy by increasing the availability of finance for mitigation and adaptation (hereon in captured by the term 'climate finance' – Oustry et al. 2020, Baer, Campiglio and Deyris 2021, Dafermos 2021, NGFS 2024b).

There is an emerging consensus that ensuring that climate-related financial risks are understood and managed by financial actors is relevant for all CBFRs (NGFS 2024b). However, there is less agreement amongst CBFRs that they should be actively taking steps to support the transition to a low-carbon climate-resilient economy. Whether or not CBFRs perceive supporting this transition to be within their jurisdiction is strongly determined by the nature of its legal mandate (UNCTAD 2023, NGFS 2024b).

CBFRs with mandates that either imply or explicitly state that they should strive to support government policy goals or sustainable development are more likely to perceive that they have license to take measures to support the transition to a low-carbon climate-resilient economy. [5] However, CBFRs with narrow mandates centred around ensuring price stability and financial stability are liable to view that this falls outside of their mandate. In such cases, responsibility for driving the transition to a low-carbon climate-resilient economy is often seen as falling solely under the jurisdiction of government. (Dikau and Volz 2021, Dafermos 2021).[6]

What tools do central banks and financial regulators have at their disposal to respond to climate change?

To respond to the threats posed by climate change, CBFRs have a range of tools available to them (referred to as climate tools from hereon in). Typically, applying these climate tools involves adjusting – or expanding – existing tools applied by CBFRs.

Table 1 presents an overview of climate tools available to CBFRs discussed in grey and academic literature. Table 1 organises these tools by their relevance to broad operational areas within central banking and financial sector regulation.

With the exception of tools applied to a CBFR's non-monetary policy portfolios,[7] which are applied to reduce the CBFR's own exposure to climate-related financial risks and/or its climate impact; climate tools available to CBFRs aim to decrease exposure to climate-related financial risk or increase climate finance through changing the investment behaviour of financial institutions within their jurisdiction. They can drive this change through one of three ways: (i) improving information about assets, counterparties, and financial institutions' exposure to climate-related financial risks or climate impact, (ii) creating financial incentives for financial institutions to provide finance to low-carbon climate-resilience enhancing assets or activities, or (iii) imposing direct quantitative controls on financial flows, directing finance either towards low-carbon and climate resilience enhancing assets and activities, or away from high-carbon and climate resilience degrading assets and activities. (Baer, Campiglio and Deyris 2021).

Table 1 demonstrates that there are a wide variety of climate tools available to CBFRs. However, as many of these tools are relatively new, empirical evidence on their effectiveness for achieving climate-related goals and their potential to lead to unintended consequences – e.g. undermine the ability of CBFRs to ensure financial stability or reduce financial inclusion – is limited (World Bank 2024a).[8] As a result, a number of the climate tools are viewed by many as risky as they either sufficient evidence of their effectiveness is lacking or existing evidence is mixed. For example, in their review of ten emerging climate tools available to CBFRs, World Bank (2024a) concluded that sufficient evidence that climate tools could be effective in achieving climate finance objectives while supporting financial stability was available for only three tools.[9] Of the remaining eight, it judged that five showed potential but further evidence was required before they could be deemed to be effective,[10] while two were not recommended as available evidence suggests that they are either ineffective or undermine financial stability.[11] [12]

Furthermore, even when CBFRs consider certain tools to be desirable, applying these tools may not be viable – at least in the short-term. The presence of a number of factors may prevent CBFRs from being able to implement these tools. These include internal factors such as inadequate skills, knowledge and technical capacity within CBFRs to successfully apply certain climate tools. Or external factors such as (i) inadequate capacity amongst financial actors to interact with certain climate tools, (ii) an absence of climate taxonomies and climate-related financial risk disclosure frameworks required to provide definitions for low-carbon and climate-resilient economic activities, assets, or investments and determine what is a material climate-related financial risk, (iii) a paucity of climate and financial data and climate and economic models required to robustly assess exposure to climate-related financial risks, and (iv) the shallowness of financial markets relevant to certain climate tools that limit their potential effectiveness.

Table 1 Tools available to central banks and financial regulators for greening their financial systems (adapted from World Bank 2024a)

Operational area	Climate tools
Microprudential	• Guidelines for climate-related risk management and disclosure for financial institutions[a] • Guidelines for the preparation of transition plans by financial institutions[a] • Climate-adjusted risk weights[b] (i.e. a green supporting factor or brown penalizing factor) • Post-disaster regulatory response[c]
Macroprudential	• Climate scenario analysis • Climate-adjusted macroeconomic projections • Climate-adjusted loan-to-value ratio[d] • Climate exposure concentration thresholds[e] • Climate-related sectoral systemic risk buffer[f]
Credit allocation policies	• Climate-related direct credit guidance (e.g. via climate-conscious direct controls on interest rates or climate-related minimum and maximum credit quotas) • Climate-related window guidance[g]
Central bank tools	• Targeted refinancing operations[h] • Climate-adjusted collateral management[i] • Green quantitative easing[j] • Climate-adjusted reserve requirements[k]
Management of central banks and financial regulators' non-monetary policy portfolios	• Assessment and disclosure of climate-related risks in non-monetary policy portfolios • Application of green criteria to investments in non-monetary policy portfolios

Notes:

[a] Guidelines can be voluntary or mandatory.

[b] Adjustments to risk weightings based on an asset, portfolio or financial institution's exposure to climate-related financial risks.

[c] Temporary regulation stipulating that financial institutions provide relief to borrowers in the aftermath of a natural disaster (e.g. through postponing loan repayments).

[d] Adjustments to required loan-to-value ratios for assets that meet specific climate-related criteria.

[e] Limitations on the extent to which the portfolios of financial institutions can be exposed to geographical regions or sectors that are highly exposed to climate-related financial risks.

[f] Requirement for financial institutions to hold additional capital against exposures to sectors that are highly exposed to climate-related financial risk.

[g] An informal policy instrument used to encourage financial institutions to increase lending to low-carbon climate resilient activities and reduce credit to lending to heavy-polluting industries.

[h] Loans offered to financial institutions by CBFRs at concessional rates or longer tenor periods to incentivise lending to certain sectors and activities.

[I] Collateral frameworks are adjusted to incorporate climate-related financial risks.

[J] Green criteria applied to quantitative easing programmes.

[K] Adjusting reserve requirements based on the greenness of a financial institution's portfolio.

What barriers hinder the application of climate tools by central banks and financial regulators in EMDEs?

All CBFRs face significant challenges in applying climate tools. However, CBFRs in EMDEs typically face even greater challenges due to limited internal resources and capacity constraints, and weaknesses in the wider financial sectors they oversee. While literature focusing on EMDEs is presently limited (this is especially the case for literature of focusing on LDCs – UNCTAD 2023), existing literature points to six broad factors that limit the ability of CBFRs in EMDEs to respond to climate change.

Capacity and resource constraints within central banks and financial regulators. The internal capacity of CBFRs in EMDEs commonly represents a key constraint to taking action to address climate change. For example, CBFRs in EMDEs typically face greater financial and human resource constraints that will limit their ability to build the human and technical capacity required to move quickly into new areas such as climate scenario analyses (Arndt, Loewald and Makrelov 2020, UNCTAD 2023). Similarly, due to the costs associated with building in-house capacity, CBFRs in EMDEs – especially those in smaller economies – are often dependent on third-party systems to carry out their monetary policy operations (e.g. they rely on external parties for collateral valuation, risk assessment, custodial arrangements, among other services). This reliance poses an additional challenge, as it necessitates collaboration with external providers. Consequently, the ability of these CBFRs to address climate change is contingent on the willingness and capacity of these third parties to incorporate climate-related considerations into their systems (NGFS 2024b).

Finally, the more limited scope of CBFR's operations in some EMDEs will prevent them from being able to apply certain climate tools. For example, the fact that macroprudential policy is less commonly utilised by African CBFRs will mean that these CBFRs are unable to use climate tools that rely on the adjustment of traditional macroprudential policy tools to reduce exposure to climate-related risks and/or increase green finance (Christensen and Upper 2017). Similarly, it would be premature to develop guidelines for climate-related financial risk management and disclosure (CRMD) in EMDEs where financial supervision is weak (UNCTAD 2023, World Bank 2024a).

Low capacity within financial institutions. As climate-related risk management and green finance is a nascent area in many EMDEs, financial institutions in EMDEs often lack the required human and technical resources to interact with climate tools applied by CBFRs. For example, various studies have found that financial institutions in EMDEs lacked the human and technical resources to adequately adhere to CRMD guidelines and develop high-quality transition plans (African Development Bank, Global Center for Adaptation and United Nations Environment Programme Finance Initiative [UNEP FI] 2021, International Finance Corporation [IFC] 2023, World Bank 2024b, Reserve Bank of Malawi and World Bank 2024). Among financial institutions, evidence suggests that capacity gaps are particularly prevalent in domestic financial institutions that are not subsidiaries of international banking groups (IFC 2023).

Underdeveloped climate policy frameworks. While many CBFRs in EMDEs have begun to apply climate tools, climate policy frameworks in many of these countries remain underdeveloped. A comprehensive and credible long-term climate strategy that is – ideally supported by legislation – is required to provide financial institutions with confidence that the government is committed to facilitating the transition to a low-carbon climate resilient economy (IFC 2023, World Wildlife Fund 2024). Without this clear commitment from the government, financial institutions may not have full confidence that engaging in climate finance will

lead to a material return on investment and therefore may be reluctant to engage fully in climate tools applied by CBFRs, limiting their effectiveness.

Lack of robust climate taxonomies and climate-related disclosure frameworks. While work is ongoing in many EMDEs to develop such frameworks, progress putting binding and non-binding frameworks in place in these countries is significantly behind advanced economies (Inter-American Development Bank 2019, African Development Bank, Global Center for Adaptation and UNEP FI 2021, World Bank 2024a). This is particularly the case with climate taxonomies where only ten percent of EMDEs are covered by green taxonomies compared with 76 percent of advanced economies (World Bank 2024a). Furthermore, a survey of financial institutions operating in EMDEs by IFC (2023) suggest that many of the climate taxonomies that are in place have major shortcomings in the areas of transparency, governance and auditability. These shortcomings have been found to have led to extensive green washing and will thereby limit the effectiveness of CBFR climate tools that use these taxonomies to define green financial products (Amenc, Goltz and Liu 2021).

Lack of data and models. Financial and climate data is less available in EMDEs – particularly in LDCs (UNCTAD 2023b); with such data often being insufficiently granular or incomplete to allow for robust assessments of (i) asset or counterparty exposure to climate-related financial risk or (ii) asset or counterparty alignment to criteria established by climate taxonomies (Arndt, Loewald and Makrelov 2020, Financial Stability Board [FSB] and NGFS 2022, IFC 2023). Furthermore, while approaches, methodologies, tools and models for overcoming data gaps and limited modelling capacities are constantly being developed, the relevance of these products to EMDEs is often limited (UNCTAD 2023). For example, the NiGEM global macroeconomic model used in the climate scenario analyses of many CBFRs in advanced economies (FSB and NGFS 2022) cannot be used by most EMDEs in its current form. At present, NiGEM model includes individual country models for each of the OECD countries and a select number of large emerging market countries (e.g. Brazil, India, South Africa). Other EMDEs are included in the model as part of large regional blocks (e.g. sub-Saharan Africa), meaning that the outputs of the NiGEM model are not sufficiently granular to support climate scenario analyses in these countries.

Underdeveloped financial markets. The relevance of certain climate tools is sometimes limited due to characteristics commonly associated with the financial sectors and/or real economies of EMDEs (NGFS 2023b, UNCTAD 2023, IFC 2023). For example, limited corporate bond markets mean that developing green bond guidelines, green quantitative easing and tools based on adjustments to asset purchase programmes are less likely to be relevant to CBFRs in these countries (UNCTAD 2023). Similarly, shallow pools of bankable climate projects in EMDEs can limit the potential impact of adjusting credit operations (NGFS 2023c).

Due to the aforementioned factors, CBFRs in EMDEs are at a clear disadvantage when it comes to responding to climate change. However, CBFRs in EMDEs do possess certain characteristics that could be viewed as advantageous when responding to climate change. For example, in many EMDEs, CBFRs are mandated to support the implementation of government policy and as such, coordinate much more closely with national governments than CBFRs in high-income countries (Dikau and Volz 2021, UNCTAD 2023). When this is the case, CBFRs have greater scope to adopt a transition approach to responding to climate change (UNCTAD 2023, Wambui, Feyertag and Monnin 2023). Moreover, CBFRs in EMDEs are more likely to have experience applying quantity-based tools such as credit controls to support their development and industrial policy targets (Dikau

and Ryan-Collins 2017, World Bank 2024a). Similar approaches could be used to promote low-carbon climate resilient financial flows, which are typically avoided by CBFRs in advanced economies due to concerns about market neutrality (Dikau and Ryan-Collins 2017, Augoyard et al. 2021, UNCTAD 2023, IFC 2023).

This is not the case in all EMDEs however. In their review of CBFRs mandates in LDCs, UNCTAD (2023) identifies five LDCs (including Malawi) where CBFRs have no development mandate.

2. Insights from the project Greening the Financial Sector in Malawi

Having explored the unique challenges CBFRs face in EMDEs in Section 1, Section 2 distils lessons from the project Greening the Financial Sector in Malawi, offering practical insights to guide future initiatives that strengthen the capacity of CBFRs in EDMEs to respond to climate change.

Introduction to Malawi

Malawi is classified as an LDC and is one of the poorest countries in the world. World Bank data indicates that in 2019, 70 percent of the population live off less than 2.15 United States Dollars a day (World Bank n.d.). Malawi's economy lacks diversification and is characterised by a heavy reliance on natural resources, in particular low productive rainfed agriculture (World Bank 2022). Its national circumstances, combined with its high exposure to climate risks, means that Malawi is one of the most vulnerable countries in the world to climate change, ranked 161st of 187 on the Notre Dame Global Adaptation Initiative's vulnerability rankings (University of Notre Dame 2022).

In line with many other LDCs, Malawi's financial sector is dominated by a traditional and highly risk-averse banking sector, possessing relatively small pension and insurance sectors (Reserve Bank of Malawi and World Bank 2024). Similarly, Malawi's capital markets are underdeveloped and not well positioned to provide adequate and suitable long-term finance required for economic development (Reserve Bank of Malawi and World Bank 2024). There is negligible participation in formal financial markets by non-financial corporates (particularly micro, small and medium-sized enterprises) and households due to high barriers to entry (*ibid*).

Management of climate-related financial risk in the Malawian banking sector is in its nascent stages. A survey by Reserve Bank of Malawi and World Bank (2024) indicates that only 14 percent have integrated climate risk management into their internal governance structures, less than half have integrated climate change into their risk management framework and only 29 percent have attempted to assess their exposure or vulnerability to climate risks.

Introduction to the project Greening the Financial Sector in Malawi

The project Greening the Financial Sector in Malawi was a collaboration between UNEP Copenhagen Climate Centre (UNEP-CCC) and the Reserve Bank of Malawi, Malawi's monetary authority and financial regulator.

At the project's onset, the Reserve Bank had only just started considering the impact of climate change on its core mandate of ensuring price and financial stability. Its response to climate change was not coordinated across the Reserve Bank's departments. It was limited to the Bank Supervision department developing voluntary guidelines for managing and disclosing climate-related and environmental financial risk for banks and banking groups and an ongoing collaboration between the Reserve Bank and the World Bank to conduct an assessment of the banking and insurance sectors' vulnerability to climate risks. Similarly, human

capacity within the Reserve Bank on the topic of climate change was limited to a small number of individuals dispersed across a handful of departments.

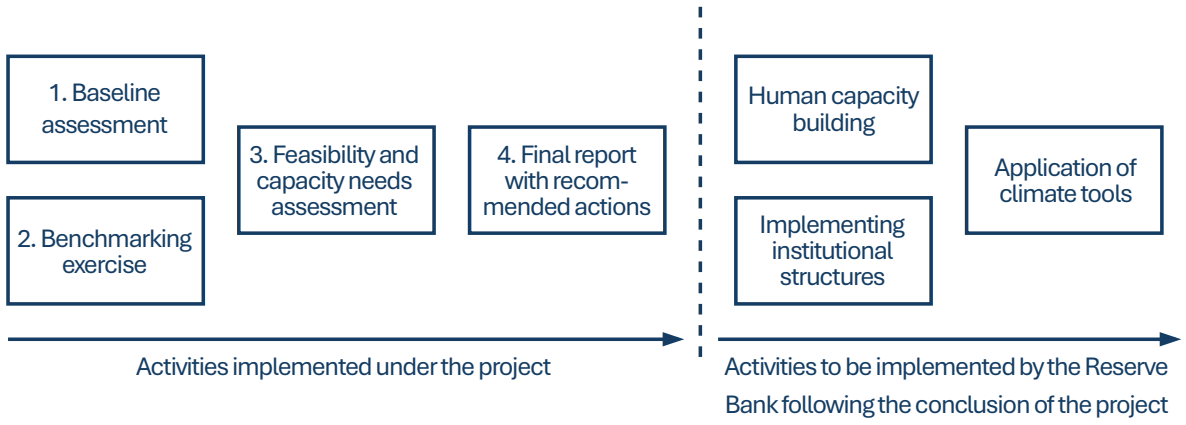
Against this backdrop, the project sought to explore the role of the Reserve Bank in greening the financial sector in Malawi. Its final output was a report containing an abbreviated list of actions that the Reserve Bank and other stakeholders *could* pursue in the near-, medium- and long-term to reduce the financial sector's exposure to climate-related financial risks and increase climate finance.

The preparation of the project's final report was informed by three activities: (1) **a baseline assessment** – assessing the extent to which the Reserve Bank's departments, financial institutions, and other key stakeholders in Malawi were ready to engage with, or support, climate action; (2) **a benchmarking exercise** – mapping global advances by CBFRs in responding to climate-related and environmental financial risk, with special focus on the steps taken by CBFRs in the Africa region to respond to climate change and identifying lessons learned during these processes that are applicable to the Malawian context; and (3) **a feasibility and capacity needs assessment** – evaluating whether potential climate tools identified under the benchmarking exercise were feasible in the Malawian context and, if so, the capacity needs that need to be addressed before they can be effectively implemented.

Due to significant capacity gaps and absence of infrastructure for coordination within the Reserve Bank and with other key national actors, the project's final report emphasizes the need for the Reserve Bank to build internal human capacity and put in place appropriate institutional arrangements internally and externally, prior to fully integrating climate change into its operations.

Since the launch of the report in November 2024, the Reserve Bank has already institutionalised climate change within its organisational structure through establishing the Reserve Bank of Malawi's Climate Change Centre. While as at April 2025, a cross-departmental effort is ongoing to integrate capacity building needs related to climate change into the Reserve Bank's training plan.

Figure 1 Process implemented under the Greening the Financial Sector in Malawi project and anticipated follow-up



Reflections for future projects supporting central banks and financial regulators in EMDEs to respond to climate change based on insights from the Greening the Financial Sector in Malawi project

The following section presents six key reflections based on UNEP-CCC's experiences in implementing the project Greening the Financial Sector in Malawi. These reflections are based on lessons learned through collaborating with the Reserve Bank of Malawi as well as those from semi-structured interviews with CBFRs in the Africa region and/or in LDCs conducted as part of the benchmarking exercise.

1. Central banks and financial regulators at the beginning of their climate journey should seek to institutionalise climate change within their organisational structure as a first step. Establishing a dedicated cross-departmental institutional structure for addressing climate change would serve as a hub for building climate expertise and facilitate the effective cross-departmental coordination, collaboration, and knowledge sharing required to develop and implement a whole-of-organisation strategy for responding to climate change.

Additionally, it would provide a clear focal point for engaging with external stakeholders (e.g. government ministries, development partners, and international initiatives) and reporting to the CBFR's executive management on its climate initiatives. A centralized point of contact for engaging with external stakeholders can enhance coordination and streamline collaborations, reducing the risk of duplication. Meanwhile, periodic reporting to the CBFR's executive management can elevate the visibility of its climate, facilitating greater recognition at the leadership level and helping to secure the necessary buy-in for sustaining and potentially expanding this agenda.

There are several potential models for dedicated cross-departmental institutional structure for addressing climate change, with different funding implications. For example, a cross-departmental working group composed of staff from different departments who work on climate issues alongside their existing duties (i.e. part-time) could represent a cost-effective means of putting in place a coordination mechanism for climate activities. Meanwhile, a dedicated unit with staff working on climate issues fulltime would be more resource-intensive but would allow for a more rapid generation of expertise within the CBFR.

The structure and size of institutional structures can start small and evolve over time, however. In fact, a number of CBFRs in EMDEs (e.g. South Africa and Morocco) have started with single climate/green finance focal point that have gradually developed into climate/green finance units as their climate activities increased and more resources became available.

2. Resource constrained central banks and financial regulators can take advantage of free-to-access training materials targeting them. To greater or lesser extents, all organisations face financial limitations regarding how much they can invest in training and the development/acquisition of technical resources. However, CBFRs in EMDEs are liable to be particularly constrained on this front in light of limited operational budgets and their need to build capacities across a wide array of emerging issues (i.e. cyber risk, cryptocurrency), as well as more conventional competencies for CBFRs (e.g. implementing Basel Committee on Banking Supervision III reforms). This state of affairs can lead to competition for financial resources within the bank, increasing the likelihood that insufficient funding will be allocated towards building the bank's capacity to address climate change.

Over the last five-years however, there has been an increasing availability of free-to-use training materials targeting CBFRs covering the topics of

climate-related financial risk management and climate finance. These resources increasingly cover a wide range of topics (e.g. CRMD, climate scenario analysis, green bonds), and while not a substitute for tailored training provided by specialists, can serve as a useful means for staff to gain basic knowledge and competencies about chosen subjects.

Thus, where possible, when developing training plans for staff, CBFRs should seek to take advantage of the increasing availability of free-to-use training materials targeting CBFRs covering the topics of climate-related financial risk management and climate finance.[13]

3. The emergence of effective peer-learning networks enables central banks and financial regulators in the early stages of addressing climate change to gain valuable insights from those further along in the process. In addition to free-to-access training materials, CBFRs in EMDEs should also seek to learn from other CBFRs in similar contexts. By engaging with peers who have implemented or are in the process of implementing climate-related tools, CBFRs can gain valuable insights into potential obstacles to- and trade-offs associated with implementing these tools, and effective strategies for overcoming/mitigating these. Learning from the experiences of others can speed up the implementation of climate tools as it should enable CBFRs to better avoid certain obstacles faced by their peers. Furthermore, empirical evidence of a climate tools' effectiveness in other jurisdictions may ease concerns about potential negative implications of implementing a tool (e.g. implications for financial stability and financial inclusion).

International initiatives such as the Network for Greening the Financial System (NGFS) or Sustainable Finance Network provide CBFRs with a platform for collaboration (e.g. through thematic working groups) and knowledge exchange on climate, green and sustainable finance related issues. As such, CBFRs in EMDEs should leverage these networks as a place to engage with peers in other jurisdictions.

4. Close cooperation with the ministries of finance and environment is a prerequisite for implementing many of the climate tools at the disposal of central banks and financial regulators. Most CBFRs have operational independence from the government and thus a license to pursue measures it deems to be aligned with their legal mandates. For a number of climate tools however, CBFRs will likely require the action or support from the ministries of finance and environment. For example, tools for increasing climate finance require some form of criteria or taxonomy to be in place to provide a clear definition of what can qualify as climate finance. Putting a criteria or taxonomy in place however, usually led by the ministry of finance with technical support from the ministry of environment (IFC 2023). Similarly, CBFRs are generally not in the business of collecting climate data (particularly physical climate data) or developing climate scenarios. As a result, when conducting climate scenario analyses, CBFRs need to rely on climate data provided by external providers; with one obvious source of climate data typically being the ministry of environment. As such, when planning their response to climate change, CBFRs need to establish communication channels with their ministries of finance and environment to coordinate efforts and – where necessary – petition for the ministries to provide certain forms of support or undertake certain actions. One effective means of doing this would be for CBFRs to join pre-existing national bodies for coordinating climate action – e.g. national climate change committees.

5. To enable effective cooperation, ministries of finance and environment may also require capacity building. In addition to the above, ministries of finance and environment will require capacity building before they are able to implement the measures or provide the support required to

make climate tools viable. For example, developing climate finance criteria or taxonomies requires significant technical capacity, that the ministries of finance and environment of EMDEs are not likely to possess. Similarly, climate datasets, models and scenarios possessed by ministries of environment may require further development before they are suitable for informing climate scenario analyses. Thus, efforts to support CBFRs in EMDEs to respond to climate change should be cognisant of the capacity building needs of other key actors.

6. Central banks and financial regulators should favour a phased approach to responding to climate change. While the world needs to urgently respond to climate change (UNEP 2024a and 2024b), the response of CBFRs needs to be measured. Firstly, to ensure that climate tools are effective in achieving the desired outcomes, CBFRs need to ensure that (i) they and other actors in the financial ecosystem (e.g. financial institutions, relevant government ministries) possess the required capacities to apply/interact with the tools being applied and (ii) that the necessary resources (e.g. climate data and tools, country-specific climate scenarios, climate scenario analysis of the financial system) and infrastructure (e.g. CRMD guidelines and taxonomies) are in place to facilitate the tool's implementation. Building this capacity and ensuring the availability of these resources and infrastructure takes time, therefore CBFRs need to adopt a multiyear, phased approach to adopting climate tools (World Bank 2024a).

Secondly, and most importantly, CBFRs need to ensure that the application of climate tools does not have any unintended trade-offs upon other policy objectives, particularly their core objective of ensuring price and financial stability (UNCTAD 2023, World Bank 2024a). Aside from being a CBFR's raison d'etre, financial stability is also important from a climate finance perspective as non-climate shocks to the financial system will severely reduce the availability of climate finance.

Endnotes

[1] Acknowledging that central banks and financial regulators are separate entities in many countries with clearly defined operational jurisdictions, for ease of communication this paper does not distinguish between central banks and financial regulators when discussing how these organisations can respond to climate change.

[2] The term disorderly transition describes a scenario in which the implementation of climate policies is delayed, resulting in an abrupt policy response by national governments in order to limit global warming. Due to the delay, the policy response is stronger than it would need to be if action had been taken earlier (a scenario know as orderly transition), therefore leading to higher transition risk (NGFS 2024b).

[3] The movement of central banks towards addressing climate change is seen to have started in earnest in 2015, heralded by the speech *Breaking the tragedy of the horizon – climate change and financial stability* by the Governor of the Bank of England (Carney 2015).

[4] Physical and transition risks can negatively impact asset prices, exchange rates, expectations, and bank lending. Since these are key channels through which policy rate adjustments affect price dynamics, it has been argued that climate change may weaken the effectiveness of the inflation-targeting framework, which lies at the core of central banks' operations (Dafermos 2021).

[5] The mandates of central banks rarely state explicitly that the central bank should take climate action (Dikau and Volz 2021). However, a significant number do have state that the central bank has a responsibility to support government policy or support sustainable development. Where legal mandates provide them with a responsibility to support government policy, central banks can justify taking measures to increase climate finance when addressing climate change is government policy. Similarly, where legal mandates provide them with a responsibility to sustainable development, central banks can justify taking measures to mobilize increased climate finance due to the fact that transitioning to a low carbon climate-resilient economy is a key component of sustainable development (Intergovernmental Panel on Climate Change 2022).

[6] It should be noted however that a narrow legal mandate does not necessarily prohibit a central bank from taking measures to support the transition to a low-carbon climate-resilient economy. Robins, Dikau and Volz (2021) and Dafermos (2021) argue that instead rethinking interpretations of and conventions surrounding existing mandates could be sufficient to enable central banks to pursue this aim. Meanwhile, Dafermos (2021) argues that central banks with narrow legal mandates could take measures to support the transition to a low-carbon climate-resilient economy on the basis that adequately mitigating and adapting to climate change is the only way to prevent climate change posing an increasing risk to financial stability.

[7] The term non-monetary policy portfolio refers to investment portfolios held by the central bank that are not used to achieve the central bank's mandated policy objectives. They can include own funds, pension fund portfolios, and non-policy foreign exchange portfolios.

[8] For example, tilting asset purchases towards greener issuers should lead to reductions in a central bank's exposure to transition risks; however, excessive tilting may result in substantial increases in concentration risk (NGFS 2024b).

[9] Guidelines for preparing transition plans, post-disaster regulatory response, and climate-adjusted loan-to-value ratios.

[10] Climate exposure concentration thresholds, sectoral systemic risk buffers, targeted refinancing operations, climate-adjusted collateral management, and climate-adjusted reserve requirements.

[11] Climate-adjusted risk weights and climate-related direct credit guidance were "not recommended".

[12] Guidelines for climate-related risk management and disclosure, climate-adjusted macroeconomic projections, climate scenario analysis, window guidance, green quantitative easing, and tools applied to the management of non-monetary policy portfolios were not reviewed by World Bank (2024a).

[13] For example, through their institution's membership of BIS, International Association of Insurance Supervisors, NGFS and Sustainable Insurance Forum, many employees of CBFRs will have access to the Supervisors' Climate Training Alliance (CTA) Portal.

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