

# Inclusive green finance: A new agenda for central banks and financial supervisors

June 2023

## Summary

Climate change and environmental degradation can have profound economic impacts, which may translate into micro- and macro-financial risks that need to be addressed by central banks and financial supervisors. Green finance and financial inclusion have mostly been treated by central banks and financial supervisors as two distinct and largely unrelated agendas, despite meaningful overlaps between these two areas. Key target groups for financial inclusion tend to be disproportionately exposed to the impacts of climate change and environmental degradation, while also playing an important role in adapting to and mitigating environmental change.

Against this backdrop, central banks and financial supervisors can combine green finance and financial inclusion policies in an integrated inclusive green finance (IGF) approach. By accounting for equity concerns in the design of green policies, this policy approach can avoid any potential adverse effects on economically vulnerable groups, and enable central banks and financial supervisors to foster a just transition to an environmentally sustainable economy.

Central banks and financial supervisors have various tools at their disposal to translate the concept of IGF into actionable policies. By bringing together the complementary aims of green finance and financial inclusion, they can help to improve the livelihoods of low-income households and the business prospects of micro, small and medium-sized enterprises (MSMEs) while simultaneously contributing to climate change adaptation and mitigation, minimising associated risks for the financial sector.

The instruments that central banks and financial supervisors can use to leverage IGF for climate change adaptation and mitigation can be divided into market-shaping [indirect] policies and direct interventions. A range of IGF policies have already been adopted by the banks and supervisors, and there are emerging examples of best practice.

This paper is part of a toolbox designed to support central bankers and financial supervisors in calibrating monetary, prudential and other instruments in accordance with sustainability goals, as they address the ramifications of climate change and other environmental challenges. The papers have been written and peer-reviewed by leading experts from academia, think tanks and central banks and are based on cutting-edge research, drawing from best practice in central banking and supervision.



Ulrich Volz  
(SOAS & LSE)



Peter Knaack  
(Council on  
Economic Policies  
& SOAS)



Centre for  
Sustainable Finance

SOAS University of London



Grantham  
Research Institute  
on Climate Change  
and the Environment

## 1. Introduction

Climate change and environmental degradation pose significant micro- and macro-financial risks. Climate and nature risks, as identified by the NGFS (2022), affect the real economy through a multitude of channels, threatening financial and macroeconomic stability. This is a problem that therefore needs to be addressed by central banks and financial supervisors. Moreover, the impacts of environmental change can have profound negative social consequences that need to be considered as they could in turn have adverse effects on the economy.

Having ignored climate change and nature loss for a long time, central banks and financial supervisors have started to incorporate climate risk into their policies. Policymakers are updating prudential supervisory frameworks and guiding financial institutions to factor in their exposure to climate and – more recently – nature risk. While such efforts are important to safeguard financial stability, financial supervisors have not yet sufficiently taken into account the negative impacts of such risk on financial inclusion<sup>1</sup> and the potential unintended negative consequences of green financial policies.

Physical risk, both in its acute (e.g. cyclones, wildfires) and chronic (e.g. ocean acidification, desertification) forms, can threaten financial inclusion. Micro, small and medium-sized enterprises (MSMEs) and lower-income households tend to be disproportionately exposed to the physical risks and impacts of local and global environmental change (Chancel et al., 2023; Hallegatte et al., 2015; Volz et al., 2020). Environmental degradation and climate change affect firm productivity and the reliability of collateral, which makes MSMEs and vulnerable households even higher-risk customers. Concerned with the profitability in terms of risk-adjusted returns, financial institutions may offer services at higher rates, or not offer them at all (UNEP FI, 2002). In other words, increased physical risk may drive financial institutions away from low-margin and high-risk customers. Such financial sector retrenchment can lead to financial exclusion, leaving vulnerable segments of the economy without any access to formal financial services.

Transition risk may also have a negative impact on financial inclusion. Environmental policies, new technologies and changes in consumer and investor sentiment may tilt the financial sector away from serving ‘dirty’, polluting sectors. While divestment from environmentally harmful activities is important and welcome in principle, it may affect MSMEs more than large firms that have better access to private equity and other sources of funding. Moreover, financial sector policies designed to advance the transition to a low-carbon economy can have unintended consequences. New environmental standards requiring businesses to adopt clean technology may threaten the survival of MSMEs that are not able to make such investments without access to affordable financial services. Similarly, agricultural producers may not be able to adopt climate-resilient and sustainable production methods unless they obtain credit to finance this. Furthermore, financial institutions may grant preferential treatment to the financing of ‘green’ companies and projects and punish ‘dirty’ ones. Yet MSMEs struggle to pay for green credentials such as a sustainability assessment by third parties, meaning they might not qualify for access to green financing channels even when their activities are environmentally sound. Thus, despite being well-intentioned, green finance policies may exacerbate financial exclusion.

“Financial supervisors have not yet sufficiently taken into account the negative impacts of climate and nature risk on financial inclusion.”

<sup>1</sup>According to the World Bank (2022) definition: “Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way.”

Still, financial services are essential to adapt to and mitigate climate- and nature-related risks and shocks. Vulnerable households and companies can climate-proof their property or business and invest in sustainable technology, but only with the help of financial services or public support such as government grants. Financial exclusion not only limits the capacity of vulnerable groups to protect themselves from the effects of environmental change and boost their resilience, but it also limits the scope for effective mitigation strategies. If a significant share of the population and economy is excluded, unwilling or unable to adapt to and mitigate climate change and environmental degradation, vulnerability to economic shocks is heightened, with potentially material negative repercussions for financial stability. In this ‘unjust transition’ scenario, social inequity and exclusion from economic opportunities may also breed political dissatisfaction and opposition to environmental policies.

Central banks and financial supervisors should therefore consider the financial inclusion challenges posed by climate and nature risk and their own related policies. To address these issues, central banks and financial supervisors should adopt an equity lens and develop strategies to support inclusive green finance (IGF). For instance, policymakers should seek to mitigate some of the financial risk involved in adaptation and mitigation finance by providing guarantees to vulnerable sectors, making sustainable finance affordable for exposed segments, and investing in public information infrastructure to assess and certify the sustainability of farmers and MSMEs. It is imperative that central banks and financial supervisors address both environmental and financial exclusion risks to the stability and functioning of the financial system through proportionate prudential policy and by supporting the scaling up of IGF.<sup>2</sup>

IGF is not a panacea, but it can play an important role in helping vulnerable groups to adapt to global environmental change and strengthen their resilience. IGF can also facilitate mitigation action by vulnerable groups while supporting their economic opportunities. Without empowering households at the bottom of the economic pyramid and enhancing the business opportunities of MSMEs, a just transition to an environmentally sustainable economy will be impossible to achieve.

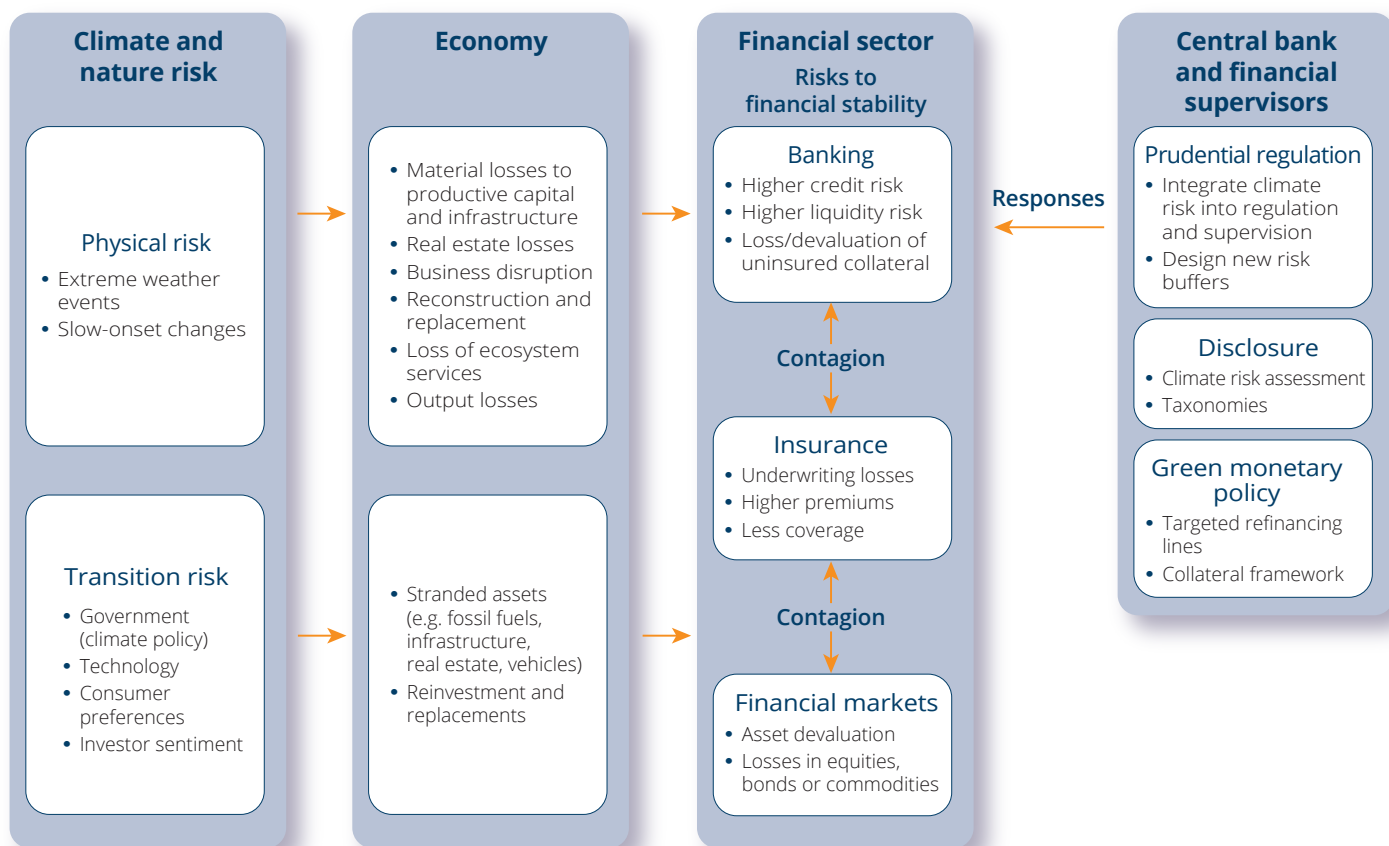
This paper is structured as follows. Section 2 highlights the shortcomings of the conventional approach adopted by central banks and financial supervisors to address climate and nature risk and why they should consider adverse effects on households and companies at the bottom of the economic pyramid. Section 3 discusses how the banks and supervisors can incorporate equity concerns into their green/climate policies and implement targeted policies in support of IGF. Section 4 discusses the potential impact and limitations of IGF policies. Section 5 provides recommendations and concludes.

“Inclusive green finance can facilitate mitigation action by vulnerable communities while supporting economic opportunities.”

<sup>2</sup>See Knaack and Zetterli (forthcoming) for a conceptual framework on the nexus between climate risk and financial exclusion from a regulatory/supervisory perspective.

## 2. The conventional approach

Figure 1. The nexus between climate risk and financial stability



Source: Knaack and Zetterli (forthcoming).

Note: 'Contagion' refers to the spread of negative impacts of climate risk between banking, insurance and financial markets.

Central banks and financial supervisors have mostly treated green finance and financial inclusion as two separate agendas, often with different teams working on these issues. However, regulatory thinking about the relationship between environmental change and financial stability has come a long way in recent years. To date, the banks and supervisors have focused mainly on mitigating climate-related financial risk and scaling up green finance. Figure 1 outlines the consensus among central banks and financial supervisors on how climate change poses risks to financial stability (BCBS 2021a, b; NGFS 2018, 2019).

### 2.1. Existing policy responses to climate risk

In order to address the impact of climate change on financial stability, central banks and financial supervisors have developed three types of policy response:

1. First is the incorporation of climate risk into prudential regulation and existing risk models (BCBS, 2021a; 2022).<sup>3</sup> Climate risk is not considered a new risk category, but rather feeds into existing risk categories known to financial supervisors, such as credit, market and liquidity risk. Consequently, policymakers have started to discuss a recalibration of key variables in current supervisory frameworks, such as climate-adjusted probability of default or the extent of potential financial losses (value at risk). In addition, regulators are considering devising new prudential tools, including a climate systemic risk buffer (additional capital requirement) that responds to the climate exposure of a bank's loan portfolios.

<sup>3</sup>The prudential framework developed by the Basel Committee on Banking Supervision (BCBS) features three pillars, namely: (i) capital requirements; (ii) risk management and supervision; and (iii) market discipline. See: <https://www.bis.org/bcbs/basel3/b3summarytable.pdf>

2. The second response is to nudge or require financial and non-financial corporations to enhance their climate-related disclosures. New guidelines require them to disclose how they are exposed to climate risk and how that changes their risk management and strategy (TCFD, 2017). Corporates are widely scrutinised on their environmental, social and governance (ESG) performance. This enables investors to assess risk factors that may not be fully priced into existing valuations, reward environmental awareness or punish unsustainable corporate behaviour. Increased disclosure is expected to catalyse the kind of market discipline that also underlies Pillar III of the Basel framework. To complement this more granular assessment of corporate environmental performance, policymakers have developed taxonomies that provide a simple distinction between green and dirty sectors and activities.
3. The third response moves beyond the realm of financial supervision to monetary policy (Dikau and Volz, 2021). Central banks are increasingly considering adjusting existing policy tools to give preferential treatment to green assets or tighten conditions for dirty assets, for example in the collateral framework or corporate asset purchase programmes. Some central banks also try to stimulate the provision of green loans by commercial banks at preferential rates by establishing targeted refinancing operations.<sup>4</sup> The purpose of such monetary policy tools is to account for climate-related financial risks and increase financial flows that facilitate the transition to a low-carbon economy.

“Climate change and environmental degradation are bound to undermine the productivity of firms, the value of their assets and their probability of business continuity.”

## 2.2. Impacts on financial inclusion

Currently, central banks and financial supervisors adequately identify the transmission channels from climate risk, and more recently nature risk, to financial stability. But there is consideration of neither the negative impacts of climate change and environmental degradation on financial inclusion nor the potential unintended, adverse consequences of green finance policies on financial inclusion.

The direct impact of physical risk on financial exclusion is becoming evident. Financial institutions serve customers only when it is profitable, i.e. when risk-adjusted returns are positive. But climate change and environmental degradation are bound to undermine the productivity of firms, the value of their assets and their probability of business continuity in the wake of extreme weather events. Recognition of these negative effects can lead financial institutions to raise the price of services for customers exposed to climate risk – or exclude them altogether. Indeed, firm-level data suggest that climate-related vulnerability is already having adverse impacts on firms’ cost of capital and access to finance (Kling et al., 2021).

Insurance companies first noticed a rise in extreme weather-related financial risk more than 20 years ago. Consequently, insurance premia have risen in some climate risk-exposed areas so much as to render them uninsurable (Association of British Insurers, 2004). Similarly, interest rates for mortgages on homes at risk from flooding caused by sea-level rise have risen significantly (Nguyen et al., 2022). A recent World Bank paper shows that in the aftermath of natural disasters around the world, the share of loans that are not repaid (the non-performing loan ratio) rises significantly. This phenomenon is especially pronounced in low-income countries (Nie et al., 2023). The resulting gap in affordable private insurance and credit is noticeable even in high-income areas such as Florida. It is likely even more pronounced in emerging markets and developing countries (IPCC, 2001). Such climate-driven financial sector retrenchment is likely to affect MSMEs and lower-income households first because the risk-adjusted returns to serving them have always been low.

The impact of transition risk on financial inclusion can also be considerable. Driven by environmental policies, changes in technology, and consumer or investor preferences, financial institutions may be increasingly reluctant to offer loans or other financial services to companies in ‘dirty’ industries such as transport. Such

<sup>4</sup>The Bank of Japan, the People’s Bank of China and Bank Negara Malaysia have already introduced such instruments.

divestment from activities that harm the environment is necessary and welcome, but while large companies may access private equity and other funding, MSMEs and households at the bottom of the economic pyramid have no such option. Transition finance to high-carbon sectors might be unavailable even though it is needed for investments in more sustainable technology (Coelho and Restoy, 2023). In many instances, firms and households at the margins of the financial system, especially in emerging and developing markets, may be unable to switch to less polluting or more resilient technologies because they cannot finance the upfront investment, losing the opportunity to increase their productivity and reduce their environmental impact (Volz et al., 2020). Financial exclusion can thus feed a vicious cycle, increasing transition risk as critical transition investments do not get financed.

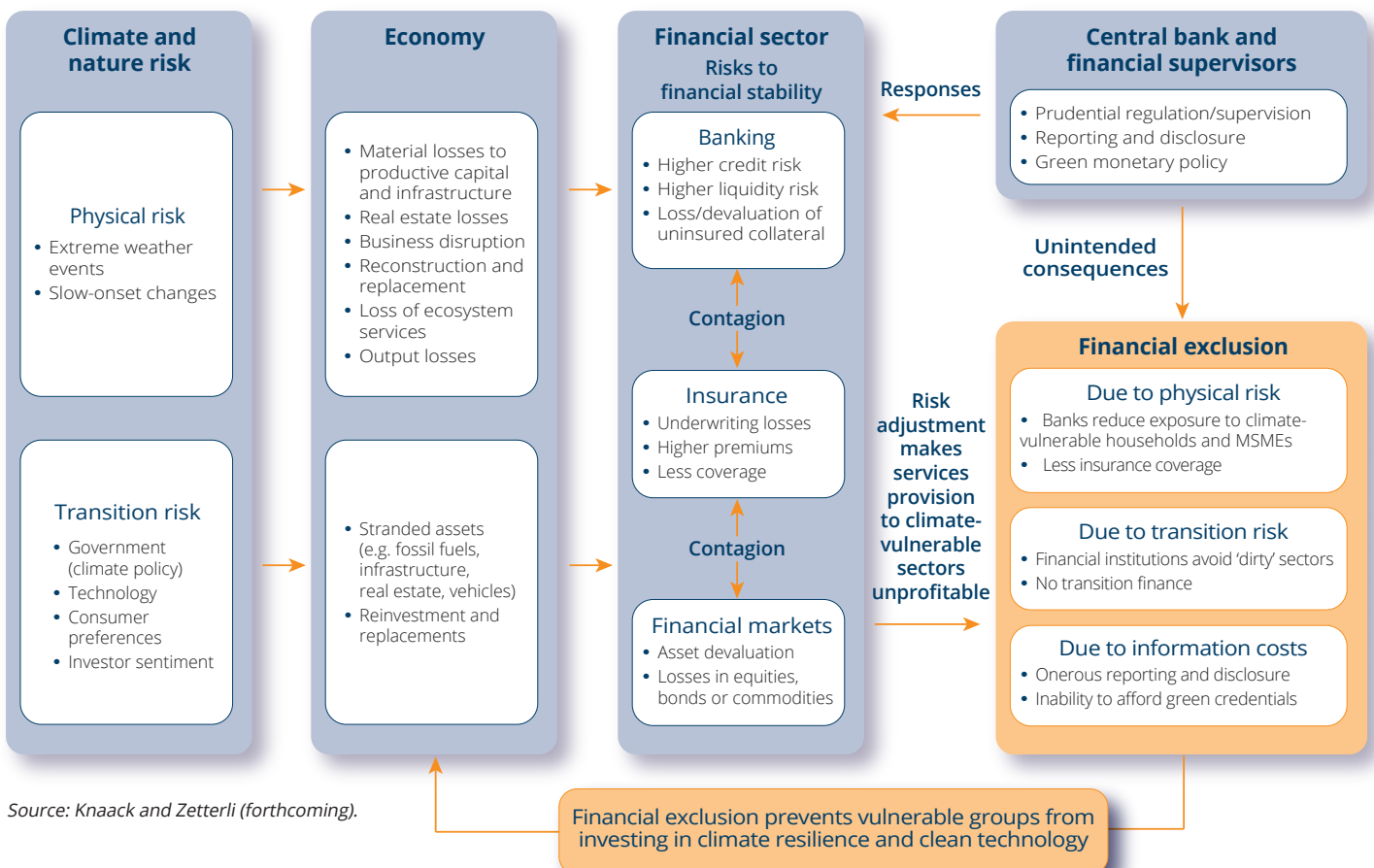
Environmental risk management requirements and green finance policies are essential to increase financial sector resilience and safeguard financial stability. But they entail significant information costs.<sup>5</sup> Financial inclusion is at risk if such rules and regulations are not implemented in a proportionate way. For example, banks and microfinance institutions will be reluctant to shoulder the cost of full environmental due diligence for the ‘small-ticket’ clients in their portfolio and might refrain from lending to them. The mobilisation of funds for green activities also requires information (ESG reports, activities matching a taxonomy, green labels). But MSMEs (and poorer households) may be unable to pay for green credentials and risk being cut off from green financing channels. Even sustainable businesses could be excluded from the kind of green financial flows that are, in principle, designed to help them.

Figure 2 outlines threats to financial inclusion posed by climate and nature risk and green finance policies that do not take a just transition into account. It also depicts

“Financial exclusion can feed a vicious cycle, increasing transition risk as critical transition investments do not get financed.”

<sup>5</sup>We define information costs here as the cost of due diligence: that is, everything an individual or company spends when investigating whether a particular investment or activity is prudent and/or likely to be profitable.

Figure 2. The nexus between climate and nature risk and financial exclusion



Source: Knaack and Zetterli (forthcoming).

the negative feedback loop between financial exclusion and economic instability. Unable to finance investment in environmental resilience and clean technology, vulnerable firms and households will be subject to climate and nature-related shocks that heighten economic volatility, feeding back into financial instability. Thus, by not addressing financial exclusion, central banks and financial supervisors can worsen the conditions for financial stability in the future.

Central banks and financial supervisors need to consider that both the physical and transition impacts of environmental change could lead to substantial structural changes in the economy in the medium and long run. Dirty sectors are set to decline while green sectors will thrive in the foreseeable future, and employment opportunities will shift accordingly. If these structural changes are not well managed – management being primarily the role of governments through fiscal, industrial, educational and other policies – the result could be an economy in which large parts of the population lose their livelihoods and have limited economic opportunities. It is important to highlight that this is not only a challenge for emerging and developing economies.

Traditionally, central banks and financial supervisors tend to be concerned more with short-term economic and financial developments and less with longer-term structural changes that are seen as exogenous, i.e. outside of their control. Moreover, the banks and supervisors may be unwilling to devise policies that target high-risk economic agents, such as climate-vulnerable farmers and MSMEs in dirty industries. However, this is too narrow a view: when wider parts of the economy are excluded from the financial system and the economy over time, and consequently are unable to adapt to structural changes triggered by global environmental change, this will feed back to the economy. An unjust transition eventually makes more people vulnerable to shocks and creates more volatility in the real economy, which ultimately threatens macroeconomic and financial stability. Central banks and financial supervisors should therefore take equity considerations seriously and develop strategies to support IGF.

Financial inclusion has always been a concern for policymakers in emerging and developing economies but it has received comparatively little attention from central banks or financial supervisors in rich countries (Cihak et al., 2016; Jones and Knaack, 2019; Knaack and Gruin, 2020). The conventional approach to financial inclusion involves a range of regulatory actions, such as requiring banks to open branches in rural areas and offering free, no-frills accounts to low-income customers. In some jurisdictions, banks are required to dedicate a certain share of their loan portfolio to underserved sectors, such as farmers and MSMEs. Complementing such regulatory policies, monetary and financial authorities sometimes support financial inclusion by subsidising credit to target groups such as farmers or female entrepreneurs, supporting microfinance institutions, and providing loan guarantees for underserved segments of the economy.

Digital technology has fundamentally changed the economics of financial inclusion, allowing modern firms (often not banks) to offer services at a fraction of the cost of traditional providers (Demirguc-Kunt et al., 2022). Digital financial services, from index insurance to agricultural marketplaces and pay-as-you-go solar financing, can make a difference for climate-vulnerable segments at the margins of the financial system (Knaack, 2022).

To foster digital financial inclusion, central banks and financial supervisors can implement four key regulatory enablers: (i) allow non-banks to issue e-money; (ii) allow kiosks and small vendors to operate as mobile money agents; (iii) adopt a risk-based approach

“Central banks and financial supervisors need to consider that both the physical and transition impacts of environmental change could lead to substantial structural changes in the economy.”

to anti-money-laundering by easing due diligence requirements for small-ticket customers; and (iv) strengthen consumer protection (Staschen and Meagher, 2018). But just as green finance approaches usually do not consider financial inclusion, financial inclusion approaches have often been blind to environmental challenges.

### 3. The sustainability-enhanced approach

Volz et al. (2020) and Knaack and Volz (2023) have put forward a holistic policy framework that central banks and financial supervisors can use to combine green finance and financial inclusion policies in an integrated IGF approach.<sup>6</sup> It highlights the importance of equity concerns in devising green policies and shows how IGF can be a key instrument for the banks and supervisors to mitigate long-term risks beyond their traditional time horizons and to foster a just transition to an environmentally sustainable economy.

#### 3.1. How can central banks and financial supervisors support inclusive green finance?

The increased exposure of vulnerable segments of the economy to climate risk and environmental degradation does not have to lead to financial exclusion. Central banks and financial supervisors have various tools at their disposal to turn the concept of IGF into actionable policies. This section outlines policy approaches that the banks and supervisors can use to leverage IGF for climate change adaptation and mitigation.

When considering the spectrum of financial inclusion policies that serve green purposes, it is useful to distinguish between direct and indirect (or market-shaping) measures (Volz et al., 2020). Indirect measures are designed to shape the market in ways that enable private actors to develop and offer services that increase financial inclusion. Rather than intervening directly, the state sets out market rules and incentive structures that guide business operations in a desired direction.

“None of the economic models reviewed explicitly incorporates the financial sector, and the granularity of trade and supply chain relationships varies considerably.”

<sup>6</sup>See Zetterli (forthcoming) for a wider synthesis paper on the relationship between climate resilience and financial inclusion.

**Table 1. A policy approach for inclusive green finance**

		Inclusive finance	
		Market-shaping policies [indirect]	Direct interventions
Green finance	Adaptation to environmental change and enhancing resilience	<ul style="list-style-type: none"> <li>Regulatory enablers for digital retail payments (mobile money).</li> <li>Lower the barriers to market entry for microinsurance and other resilience-supporting (digital) financial services.</li> <li>Environmental and social risk management guidelines that are proportionate to loan size.</li> <li>Consumer protection, awareness-raising and capacity-building measures for vulnerable end-users.</li> <li>Build data infrastructure for sharing open-source data on climate risks.</li> <li>Awareness-raising and capacity-building measures for financial institutions.</li> </ul>	<ul style="list-style-type: none"> <li>Preferential refinancing or guarantees for credit to invest in adaptation/resilience-enhancing activities or post-disaster reconstruction.</li> <li>Directed credit or sectoral credit targets.</li> </ul>
	Mitigation of environmental change	<ul style="list-style-type: none"> <li>Regulatory enablers for pay-as-you-go solar and water.</li> <li>Prudential rules that incentivise credit to green MSMEs or sustainable agriculture.</li> <li>Guidance and incentives for inclusive green fintech innovation.</li> <li>Build data infrastructure for sharing open-source data on climate impacts.</li> <li>Build information infrastructure that facilitates digital climate disclosure and reporting for MSMEs.</li> <li>Awareness-raising and capacity building measures for financial institutions.</li> </ul>	<ul style="list-style-type: none"> <li>Preferential refinancing or guarantees for credit to invest in new resource-efficient or low-carbon practices and technologies.</li> <li>Directed credit or sectoral credit targets.</li> </ul>

Source: Compiled by authors, building on Volz et al. (2020).



By contrast, direct interventions encompass all policies where the state is the protagonist, dedicating its own capacities and budgetary resources towards fostering financial inclusion, or requiring financial institutions to support specific activities. Green finance policies can be categorised as those focusing on adaptation and those on mitigation. Implementing effective IGF policies along these lines can help policymakers to structure and sharpen their thinking about this important new policy area (see Table 1).

Not all policy options listed in Table 1 will be relevant only to central banks and financial supervisors: some policies are best implemented by the executive branch in cooperation with the banks and supervisors. Moreover, some policies may be outside a given central bank's toolkit as charters differ in their mandate and regulatory perimeter.<sup>7</sup> This paper focuses only on the IGF instruments where central banks and financial supervisors can take a lead. Below we discuss how such instruments work in principle and then provide examples in Section 3.2.

**Market-shaping policies** for IGF are designed to enable the private sector to offer financial services for green projects that include support for vulnerable groups, and also to create the right incentive structures as businesses compete in delivering those services. Some of the services (such as microinsurance) are specifically designed to enhance the protection of vulnerable populations, while others serve more general purposes.

One key policy tool for central banks and financial supervisors concerned with IGF is to **implement regulatory enablers for digital retail payments** (mobile money). Digital retail payments allow climate-vulnerable households to reach out to their network of friends and family in the wake of an environmental shock, for help with emergency transfers. Such peer networks can also provide informal credit for investment in more climate-resilient or clean technology. Research has shown that this informal digital risk-sharing network has a wider geographical reach than traditional village networks, enabling people in an area affected by an extreme weather event to receive support from households in non-affected areas (Riley, 2018; Jack and Suri, 2014, 2016).

Central banks and financial supervisors can also **lower barriers to market entry for microinsurance and other resilience-supporting inclusive financial services**, many of which build on digital retail payment infrastructure. In particular, digital index agricultural insurance can serve smallholders and low-income farmers at affordable prices. However, many new providers of digital financial services struggle with high regulatory barriers to market entry, including capital and risk management requirements. Proportionate regulation will enable newcomers to offer services to a small group of customers first and also meet their requirements as big firms when they grow in scale (Knaack, 2022).

**Environmental and social risk management (ESRM) guidelines** are essential to express supervisory expectations for ensuring the financial system correctly accounts for environmental and social risks. Banks and other financial institutions need to know which questions to ask their potential clients, and which economic and social factors to consider before extending loans. However, such assessments can be time-consuming and expensive, making small loans unprofitable for lenders. To avoid burdening financial institutions with extensive due diligence work for a small loan, central banks and financial supervisors can take a risk-based approach to ESRM guidelines and make requirements proportionate to loan size.

Central banks and financial supervisors can also improve the availability of information on physical and transition risks and their impacts by helping to **build a better data infrastructure**. This can be done through innovative open data platforms and

“Market-shaping policies for inclusive green finance enable the private sector to offer financial services for green projects that include support for vulnerable groups.”

<sup>7</sup>For a discussion of central bank mandates and climate change, see Dikau and Volz (2021).

open-source base algorithms, as well as through digital disclosure and reporting requirements (Dikau et al., 2022). An open data platform with geospatial data on physical risk exposures can be used by financial institutions for physical risk analysis (ideally in combination with open-source base algorithms) and enable them to conduct risk analysis of MSMEs at very low cost. It can also help financial institutions to differentiate between low- and high-risk customers, instead of excluding both these groups. Similarly, automated data collection that is fed into an open data platform – for instance data on buildings’ electricity usage sourced from smart meters – can help financial institutions to assess the ‘green credentials’ of MSMEs, which, in the absence of such data platforms, may simply be too costly to do. Establishing digital open data platforms is comparable to creating a credit bureau (done in many countries by or with the help of central banks and financial supervisors), which collects important data that the market would not by itself make available to market participants. The banks and supervisors need not create such platforms by themselves; they can convene relevant stakeholders – including financial institutions and financial industry associations – to create a public good that would benefit both creditors and debtors.

**Direct interventions** for IGF are tools that steer capital directly to climate-vulnerable segments of the economy. Some of them involve funding by fiscal authorities or central banks. Others oblige financial institutions to offer services to vulnerable market segments they would not otherwise adequately serve. Two tools to consider are green public credit guarantee schemes and targeted refinancing operations for loans to green MSMEs.

**Greening public credit guarantee schemes** is a useful way to address common market failures that underlie financial exclusion (Calice, 2021; AFI, 2022). MSMEs struggle to access loans because they are small and relatively risky borrowers. They face difficulties in obtaining the financial support needed to invest in clean technology and more resilient production methods such as drought-resistant crops. Many jurisdictions have implemented public credit guarantee schemes as a risk mitigation instrument to encourage financial institutions to lend to MSMEs. Often, the central bank provides financial or managerial support to such schemes. Schemes can be adjusted to support MSME borrowers investing in climate change mitigation and adaptation. Credit guarantees can act both as enablers of green private finance to MSME and as shock absorbers, facilitating the provision of finance to viable companies in the wake of a climate shock. Additionally, central banks can employ monetary policy tools for IGF. In particular, targeted refinancing operations allow financial institutions to obtain central bank funds for loans provided to sectors in the real economy at below-market rates (Colesanti Senni and Monnin, 2021). Existing targeted re-lending tools can be adjusted to refinance green loans to MSMEs at preferential rates.

Finally, central banks and financial supervisors can use their macroeconomic expertise and unique access to economic and financial data to identify which sectors and regions are particularly affected by physical and transition risks and **advise the government on where it should target its efforts**. For instance, the banks and supervisors can explore the socioeconomic implications of a net zero transition for jobs and regions (Robins et al., 2021). They could use the results of climate stress-testing exercises to identify at the aggregate level sectors and regions that could have a pronounced concentration of risk as a result of the net zero transition (ibid.).

### 3.2. Example applications of inclusive green finance

This section reviews IGF policies adopted by central banks and financial supervisors to date (shown in Table 2), highlighting how they address both the financial exclusion effects of climate risk and the unintended consequences of green finance policies.

“Direct interventions for IGF are tools that steer capital directly to climate-vulnerable segments of the economy.”

Table 2. Policies for inclusive green finance implemented by central banks and financial supervisors to date

	Inclusive finance		
		Market-shaping policies [indirect]	Direct interventions
Green finance	Adaptation to environmental change and enhancing resilience	<b>Creating an enabling regulatory environment</b> <ul style="list-style-type: none"> <li>Central Bank of Kenya: supporting development of mobile money solutions</li> <li>Central Bank of Solomon Islands: supporting micro insurance</li> </ul> <b>Proportionate economic and social risk management guidelines</b> <ul style="list-style-type: none"> <li>Bangladesh Bank: exemptions for MSME loans</li> </ul>	<b>Providing micro investment options</b> <ul style="list-style-type: none"> <li>Central Bank of Kenya (with Treasury): M-Akiba</li> <li>Monetary Authority of Singapore (on behalf of Singapore government): green infrastructure bonds</li> </ul> <b>Reconstruction facilities</b> <ul style="list-style-type: none"> <li>Bangladesh Bank, Central Bank of Sri Lanka, Reserve Bank of Vanuatu, Reserve Bank of Fiji, Central Bank of the Philippines: refinancing facilities for post-disaster reconstruction</li> </ul>
	Mitigation of environmental change	<b>Building information infrastructure</b> <ul style="list-style-type: none"> <li>People's Bank of China: online labelling platform and environmental big data system for Huzhou's green finance ecosystem</li> </ul>	<b>Green credit guarantee scheme for MSMEs</b> <ul style="list-style-type: none"> <li>Central Bank of Solomon Islands: plans to launch at least one green finance product under its SME Credit Guarantee Scheme</li> </ul> <b>Targeted refinancing</b> <ul style="list-style-type: none"> <li>Bangladesh Bank: Green Fund for SMEs, Green Transformation Fund</li> <li>Bank Negara: Low Carbon Transition Facility</li> </ul> <b>Directed lending policy</b> <ul style="list-style-type: none"> <li>Reserve Bank of India: small renewable energy projects under Priority Sector Lending (PSL) scheme</li> </ul>

Source: Compiled by authors.

### 3.2.1. Market-shaping [indirect] policies

#### Creating an enabling regulatory environment

The Central Bank of Kenya has played a critical role in supporting the development of mobile money solutions. The authorities allowed non-bank firms to issue e-money, authorised kiosks and other small businesses to perform mobile banking operations such as cash-in-and-out (agent banking network), and introduced tiered know-your-customer requirements (Ndung'u, 2021). As a result of these regulatory enablers, the M-Pesa platform thrived in Kenya, providing a digital payment foundation for a variety of inclusive green financial products.

The Central Bank of Solomon Islands has sought to promote green finance products, including microinsurance, and other services to build financial resilience in households and communities through an enabling regulatory environment. For instance, it has been involved in conducting a consultation programme to obtain feedback for drafting a new insurance bill (Central Bank of Solomon Islands, 2020).

#### Proportionate economic and social risk management guidelines

Bangladesh Bank developed environmental and social risk management guidelines as early as 2011 and published an upgraded version in 2017 (Bangladesh Bank, 2017). The guidelines assign banks the role of guardians of environmental and social sustainability by requiring them to screen firms before disbursing loans to them. In particular, banks need to check all prospective borrowers against an 'exclusion list' of harmful sectors and activities, and an environmental and social due diligence checklist (which may be generic or sector-specific). However, MSME loans below 1 million taka (roughly US\$10,000) are exempt from the checklist. This reduces banks' transaction costs for due diligence in providing MSME loans.

### Building information infrastructure

Since 2015, the city government of Huzhou in China's Zhejiang province has been developing a number of IGF policies. By 2021, the city had facilitated green credit products covering all of Huzhou's 34 industrial parks for SMEs, and loan insurance of CNY192 million (US\$28.7 million) for 105 small and micro green enterprises (CCIEE and UNDP, 2021). Recognising that labelling projects or corporations as 'green' is costly and a major challenge, especially for MSMEs, the Huzhou government in collaboration with the People's Bank of China (PBOC), created an online labelling platform that is connected to the city's 'environmental big data system', enabling automatic data extraction and machine labelling. Once registered on the system, a firm can submit a green finance request. A loan made in response to this request then qualifies as a green loan, which is eligible for re-lending from the local PBOC branch at a discounted interest rate (PIGGFC and RCGFD, 2020).

### 3.2.2. Direct interventions

#### Providing micro investment options

Seeking to enhance financial inclusion for economic development, the Government of Kenya and the Central Bank of Kenya have developed a mobile banking investment option for small-scale retail investors. The issuance of M-Akiba bonds by the National Treasury has been administered by the Central Bank of Kenya. The money raised from the M-Akiba bonds is used to fund government infrastructure development projects. In a similar project called Treasury Mobile Direct, the Central Bank of Kenya enabled users to buy treasury bills and bonds on their phones. While these bonds are not sustainability-labelled (i.e. the use of proceeds is not specifically tied to green or social goals), the fact that they can be bought in small denominations through an app broadens the investor base and enables households that were previously excluded to build an investment portfolio that can be tapped into if they suffer an economic shock. In Singapore in 2022, the Monetary Authority of Singapore issued green infrastructure bonds on behalf of the Singapore government which could be purchased in small denominations at ATMs, through internet banking and mobile banking.

#### Post-crisis or reconstruction facilities

Several central banks in countries struck by frequent extreme weather events have established refinancing facilities for post-disaster recovery. Bangladesh Bank has created refinancing facilities for subsidised loans to support post-earthquake recovery and reconstruction after floods and fires. The Central Bank of Sri Lanka introduced a refinancing facility in 2017, which was extended during the Covid-19 pandemic. The Reserve Bank of Vanuatu established a Natural Disaster Reconstruction Credit Facility to assist corporations affected by Tropical Cyclone Pam, while the Reserve Bank of Fiji established its Disaster Rehabilitation and Containment Facility to support post-disaster recovery. In the Philippines, the central bank together with the Philippine Deposit Insurance Corporation and the Landbank of the Philippines created a Calamity Assistance Program to support funding of early recovery and reconstruction activities in areas affected by typhoons, disasters and other disasters (AFI, 2020).

#### Green credit guarantee schemes

Public credit guarantee schemes are operational in several jurisdictions to facilitate access to credit for clients with elevated risk exposure or no collateral, such as MSMEs. These schemes, where fiscal authorities or prudential supervisors cover part of the credit risk, allow financial institutions to offer loans at more affordable rates and to a wider range of MSME. In the Solomon Islands, the central bank and the Ministries of Commerce and Finance have jointly developed a MSME Credit Guarantee Scheme aimed at providing guarantees for climate-related disaster relief.

**“While it is unlikely that perfect and complete biophysical data will become available, ecosystem-specific data readily exists and can be used now for financial decision-making.”**

<sup>13</sup>This is despite some recent advancements. See, for example, Lade et al. (2021).

### Targeted refinancing for MSMEs

Several central banks and financial supervisors have created green MSME support schemes or are planning to do so. Bangladesh Bank – a long-time champion of both green and inclusive finance policies – has over the last decade established various green financing schemes targeted at SMEs. In 2009, it launched a revolving Green Fund for banks and other financial institutions to disburse low-interest loans for solar energy, biogas and wastewater treatment. In 2016, it established a Green Transformation Fund to provide low-cost loans to textile and leather industries for switching to environment-friendly production.<sup>8</sup>

The Central Bank of Seychelles, in collaboration with the Ministry of Finance, the UN Development Programme and the Global Environment Facility, helped to set up the Seychelles Energy Efficiency and Renewable Energy Programme, a subsidised loan scheme that since 2014 has been providing lower interest loans to MSMEs and to households investing in renewable energy systems, energy-efficient appliances and energy-saving devices (AFI, 2020).

The Central Bank of Solomon Islands, in its 'Islands National Financial Inclusion Strategy' of April 2021, announced the objective to launch at least one green finance product under its SME Credit Guarantee Scheme by the first quarter of 2023.

In February 2022, Bank Negara Malaysia (BNM) launched a Low Carbon Transition Facility "to support SMEs in adopting sustainable and low carbon practices" (BNM, 2022). The facility is open "for SMEs in all sectors that are committed to transform their business operations towards low-carbon operations" (ibid.) by investing in improved energy efficiency and more sustainable production and seeking to obtain sustainability certifications.

Other green financing schemes that offer lower interest rates or longer maturities, and can be accessed by SMEs, include: the State Bank of Pakistan's Financing Scheme for Renewable Energy; the Central Bank of Jordan's Medium-Term Advances to Licensed Banks Program; and the Central Bank of Armenia's German-Armenian Fund (AFI, 2020).

### Directed lending policy

Several central banks (including Bangladesh Bank, Nepal Rastra Bank, Central Bank of Egypt, Reserve Bank of Fiji, Reserve Bank of India) have introduced regulatory requirements for banks to allocate a certain share of their lending to green projects or MSMEs. These have been partly extended to include green priorities. For instance, the Reserve Bank of India has included small renewable energy projects under its Priority Sector Lending scheme.

## 4. Expected impacts and limitations

Scaling up IGF has two main policy purposes: (i) to facilitate adaptation to the impacts of climate change; and (ii) to mitigate climate change itself, both of which help to enhance the resilience of the economy and the financial system. While many IGF policies may serve both goals at once, some fit just one of the two categories, enabling policymakers to focus on specific areas in line with their jurisdiction's exposure to environmental risks. Depending on the country's specific context, they may prioritise policies that help vulnerable populations to adapt and increase their resilience to climate-related disasters and other forms of environmental risk in the short term. However, mitigation policies deserve attention here, in addition to strictly adaptation-related policies, as they also increase the resilience of vulnerable populations. For instance, investment in solar panels by MSMEs can enhance resilience as these businesses will no longer need to worry about power cuts. Moreover, improved access to transition finance can strengthen the viability of

**"On the whole, a broader availability of adaptation and transition finance at affordable rates will help the economy to better mitigate physical and transition risks."**

<sup>8</sup>This was later expanded to all manufacturing and export-oriented entities, irrespective of sector.

MSMEs' business models and improve their competitiveness, which will increase their overall resilience to shocks. On the whole, a broader availability of adaptation and transition finance at affordable rates will help the economy to better mitigate physical and transition risks.

IGF can also be understood as a countercyclical measure. Recent macroeconomic models that incorporate climate risk show that economic shocks due to extreme weather events increase the probability that firms will default on loans. Financial institutions in turn may react by tightening credit conditions for firms, exacerbating the shock, and reducing future investment opportunities (Dunz et al., 2022). IGF policies can be employed to 'lean against the wind', providing support for climate-vulnerable segments of the population when it is most needed.

It is important to highlight that a just transition and climate justice more broadly require an all-of-government approach. Central banks and financial supervisors cannot realise a just transition by themselves through IGF policies. Governments also need to implement fiscal, industrial, educational, social and other policies. Finance is necessary but not sufficient to support vulnerable groups. IGF should therefore be seen as complementary to other government policies and will require collaboration and coordination across different actors and institutions at the national level. IGF is part of a much larger effort to advance mitigation and adaptation to climate change and environmental degradation and should not be designed or implemented in isolation. There is a need to define which products and services are considered green or sustainable; this will assist further policy development and data collection to measure IGF progress and impact.

Devising an effective inclusive green finance strategy poses several challenges. Financial supervisors operate in a low-data environment, where information on current climate-related and environmental risk exposures is scarce (Hallegatte, 2009). Projections about future risk exposures are even harder to make as climate change and environmental degradation evolve in complex and non-linear ways. In this context, defining the target and scope of a policy intervention is not easy. Authorities would have to make decisions on what counts as 'green', and which activities are eligible for transition finance. Moreover, if access to a preferential green financing instrument requires costly proofs of eligibility or other conditions (such as a business license or bank account), inclusivity is impaired. As long as existing international guidelines lack a financial inclusion dimension, their off-the-shelf adoption will invite the risk of unintended consequences (Jones and Knaack, 2019; Beck et al., 2018). Supervisory authorities, financial institutions and their clients all need to raise awareness and build capacity to create a thriving green finance ecosystem. The answer to all the challenges of implementing IGF is not inaction, but a careful and experimental approach that incorporates new information and lessons learned in a reiterative process of testing and policy adjustment.

When developing IGF policies, it is essential to adopt a gender-sensitive and intersectional lens. Financial exclusion is more prevalent on average among women, minorities, rural and low-income households. IGF policies should take the specific needs of these groups into account to ensure that measures are targeted and effective. To this end, it is important to identify the IGF services that can contribute most to strengthening the resilience of people at the bottom of the economic pyramid. While the resilience-enhancing functions of traditional financial services should not be underestimated, digital finance holds a particular promise for providing targeted financial services at a low cost to low-income populations. It is, however, important that consumer protection is safeguarded and that those without access to internet services are not forgotten.

**“When developing IGF policies, it is essential to adopt a gender-sensitive and intersectional lens.”**

## 5. Conclusion and recommendations

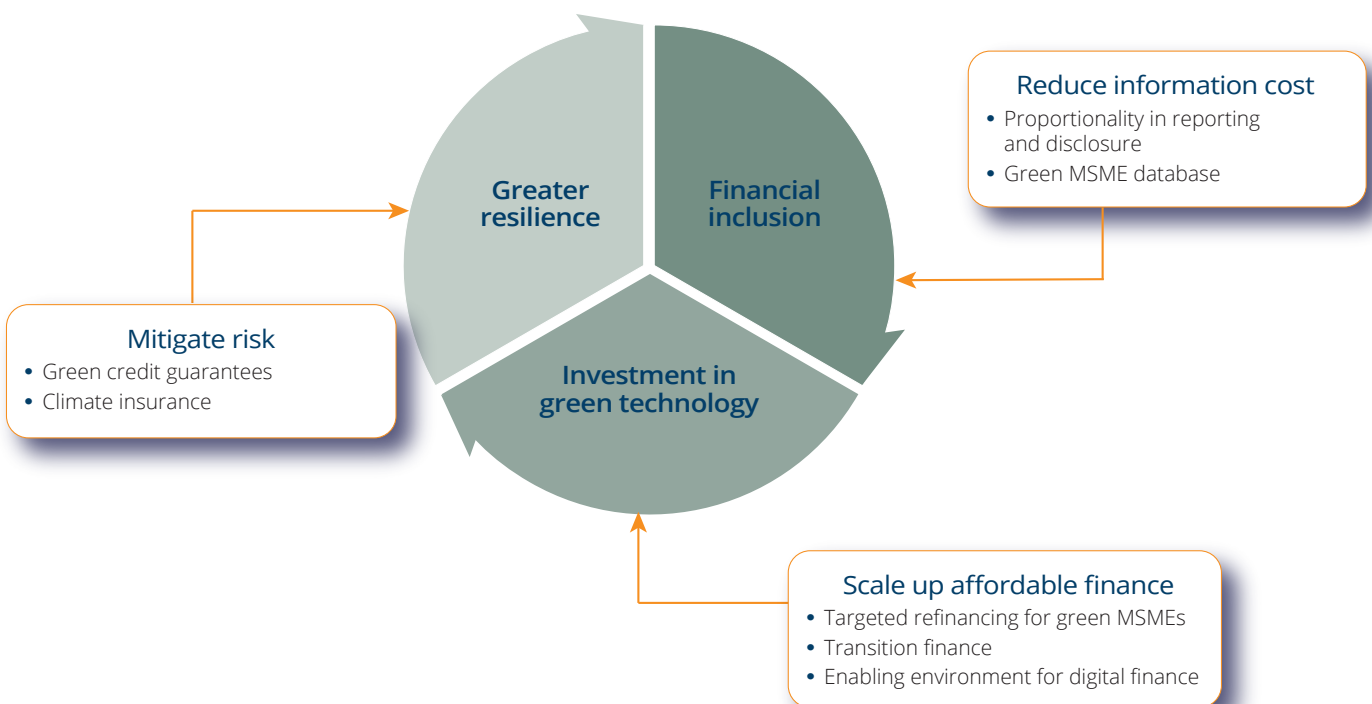
Physical risks, transition risks and the unintended consequences of climate policies and regulations can lead to a retrenchment of the financial sector, undoing years of progress in financial inclusion. Financially excluded sectors of the economy are unlikely to access the financial services necessary to adapt, invest in green technology and increase their resilience to climate and environmental shocks. This in turn threatens to exacerbate the vulnerability of the real economy, with negative repercussions for financial stability. The vicious cycle completes when financial institutions adjust to heightened physical and transition risk by retrenching further, discontinuing services to exposed, unprofitable clients. Considering this transmission channel, even supervisors exclusively concerned with financial stability have reasons to pay attention to financial inclusion.

However, well-designed, inclusive climate regulation and policy can drive a virtuous cycle of growing resilience. If economic actors at the margins of the financial system can afford the services necessary to insure themselves against shocks, invest in green technology and adapt to climate change and environmental degradation, they will increase their resilience. Clients that are more resilient to climate and environmental shocks pose lower credit, market and liquidity risk for the financial institutions that serve them. Carefully articulated green finance regulations and policies can help reduce the vulnerability of a larger part of the economy to climate shocks. A more resilient real economy in turn reduces the risks facing the financial sector, enhancing financial stability. Because this means higher risk-adjusted returns for financial institutions, inclusive green regulations and policies promise to be cost-effective. IGF policies contribute to nationally determined contributions under the Paris Agreement and can be key drivers of a just transition, helping to generate widespread political support for the inevitable transition to a sustainable, low-carbon economy.

Financial sector authorities have three available entry points to set the virtuous cycle of green inclusive resilience in motion (see Figure 3). The first is to mitigate risk. Policy tools for this entry point include credit guarantee schemes for green

“Well-designed, inclusive climate regulation and policy can drive a virtuous cycle of growing resilience.”

Figure 3. The virtuous cycle of inclusive green resilience



Source: Knaack and Zetterli (forthcoming).

MSMEs and public-private cooperation in insurance. Second, they can help reduce information costs. Here, financial sector authorities can implement environmental and social due diligence in a proportionate, risk-based way, with exemptions for small-ticket customers. In addition, they can build public information databases for smallholder farmers and MSMEs that overcome information asymmetry and channel inclusive green financial flows to segments that otherwise face the risk of exclusion. Third is to make IGF affordable. This could include creating an enabling environment for digital financial services, targeted refinancing operations and directed lending.

Domestic authorities need to make a concerted effort to connect and synchronise the inclusive aspects of a green finance strategy and the green aspects of a financial inclusion strategy. This requires cooperation between the central bank, the finance ministry, line ministries with responsibility for agriculture and transport, and specialised development finance institutions, such as for the agricultural sector. International partners can also play a meaningful role in funding IGF tools and in providing capacity-building for the private sector and public authorities.

“Financial sector authorities have three entry points to set the virtuous cycle of green inclusive resilience in motion.”



## References

- AFI [Alliance for Financial Inclusion] (2022) Green Credit Guarantee Schemes for MSMEs. Malaysia. [https://www.afi-global.org/wp-content/uploads/2022/06/Green-credit-schemes-for-MSMEs\\_260722.pdf](https://www.afi-global.org/wp-content/uploads/2022/06/Green-credit-schemes-for-MSMEs_260722.pdf)
- Association of British Insurers (2004) *A changing climate for insurance*. London. <https://engweb.swan.ac.uk/~hewstonr/A%20Changing%20Climate%20for%20Insurance%20-%20ABI.pdf>
- Bangladesh Bank (2017) *Guidelines on Environmental & Social Risk Management (ESRM) for Banks and Financial Institutions in Bangladesh*. [https://www.bb.org.bd/aboutus/regulationguideline/esrm\\_guideline\\_feb2017.pdf](https://www.bb.org.bd/aboutus/regulationguideline/esrm_guideline_feb2017.pdf)
- BCBS [Basel Committee on Banking Supervision] (2022) *Principles for the effective management and supervision of climate-related financial risks*. <https://www.bis.org/bcbs/publ/d532.htm>
- BCBS (2021a) *Climate-related risk drivers and their transmission channels*. <https://www.bis.org/bcbs/publ/d517.htm>
- BCBS (2021b) *Principles for the effective management and supervision of climate-related financial risks*. <https://www.bis.org/bcbs/publ/d530.htm>
- Beck T, Jones E and Knaack P (2018) *Mind the gap: Making Basel standards work for developing countries*. GEG Policy Brief. Oxford: Global Economic Governance Programme, University of Oxford.
- BNM [Bank Negara Malaysia] (2022) *BNM's Fund for SMEs: Low Carbon Transition Facility (LCTF)* [https://www.bnm.gov.my/documents/20124/2294076/lctf2022\\_en\\_broc.pdf](https://www.bnm.gov.my/documents/20124/2294076/lctf2022_en_broc.pdf)
- Calice P (2021) Greening public credit guarantee schemes for net zero. Blog post, 21 October. <https://blogs.worldbank.org/psd/greening-public-credit-guarantee-schemes-net-zero>
- CCIEE [China Center for International Economic Exchanges] and UNDP [United Nations Development Programme] (2021) *Paving the Way for Low-carbon Development Globally and along the Belt and Road*. <https://www.cn.undp.org/content/china/en/home/library/south-south-cooperation/paving-the-way-for-low-carbon-development-globally-and-along-the.html>
- Central Bank of Solomon Islands (2021) *Solomon Islands National Financial Inclusion Strategy 3 (2021-2025)*. <https://www.cbsi.com.sb/wp-content/uploads/2021/04/Solomon-Islands-National-Financial-Inclusion-Strategy3.pdf>
- Central Bank of Solomon Islands (2020) *More Focus on Micro Insurance*. <https://www.cbsi.com.sb/central-province-more-focus-on-micro-insurance/>
- Chancel L, Bothe P, and Voituriez T (2023) *Climate Inequality Report 2023*. Paris: World Inequality Lab. <https://wid.world/wp-content/uploads/2023/01/CBV2023-ClimateInequalityReport-1.pdf>
- Cihak M, Mare D, and Melecky M (2016) *The Nexus of Financial Inclusion and Financial Stability: A Study of Trade-Offs and Synergies. Policy Research Working Paper No. 7722*. Washington, D.C.: World Bank. <https://doi.org/10.1596/1813-9450-7722>
- Coelho R, and Restoy F (2023) *Macroprudential policies for addressing climate related financial risks: Challenges and trade offs. FSI Briefs No. 18*. Basel: Bank for International Settlements. <https://www.bis.org/fsi/fsibriefs18.pdf>
- Colesanti Senni C, and Monnin P (2021) *Aligning Central Bank Refinancing Operations with the G20 Agenda*. Zurich: Council on Economic Policies. <https://www.cepweb.org/aligning-central-bank-refinancing-operations-with-the-g20-agenda/>
- Demirgüç-Kunt A, Klapper L, Singer D, and Ansar S (2022) *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*. Washington, D.C.: World Bank. <https://www.worldbank.org/en/publication/globalfindex>
- Dikau S, Haahr M, and Volz U (2022) "Harnessing the potential of digital finance for financing sustainable development", in: Schoenmaker D, and Volz U (eds.) *Scaling Up Sustainable Finance and Investment in the Global South*. London: Centre for Economic Policy Research. <https://cepr.org/publications/books-and-reports/scaling-sustainable-finance-and-investment-global-south>
- Dikau S, and Volz U (2021) *Central bank mandates, sustainability objectives and the promotion of green finance. Ecological Economics* 184(107022). <https://doi.org/10.1016/j.ecolecon.2021.107022>
- Dunz N, Hrast Essenfelder A, Mazzocchetti A, Monasterolo I and Raberto M (2021) *Compounding COVID-19 and climate risks: The interplay of banks' lending and government's policy in the shock recovery. Journal of Banking and Finance* (106306). <https://doi.org/10.1016/j.jbankfin.2021.106306>
- Hallegatte S (2009) *Strategies to adapt to an uncertain climate change. Global Environmental Change* 19(2): 240-247.
- Hallegatte S, Bangalore M, Bonzanigo L, Fay M, Kane T, Narloch U, Rozenberg J, Treguer D, and Vogt-Schilb A (2015) *Shock Waves: Managing the Impacts of Climate Change on Poverty*. Climate Change and Development Series. Washington, D.C.: World Bank.
- IPCC [Intergovernmental Panel on Climate Change] (2001) *TAR Climate Change 2001: Impacts, adaptation, and vulnerability*. Chapter 8: Insurance and Other Financial Services. <https://www.ipcc.ch/report/ar3/wg2/chapter-8-insurance-and-other-financial-services/>
- Jack W and Suri T (2014) *Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. American Economic Review* 104(1): 183-223.
- Jones E, and Knaack P (2019) *Global financial regulation: Shortcomings and reform options. Global Policy* 10(2): 193-206.
- Kling G, Volz U, Murinde V and Ayas S (2021) *The impact of climate vulnerability on firms' cost of capital and access to finance. World Development* 137: 105131.
- Knaack P (2022) *Leveraging Digital Financial Services to Advance Inclusive Green Finance Policies*. Kuala Lumpur: Alliance for Financial Inclusion. <https://www.afi-global.org/publications/leveraging-digital-financial-services-to-advance-inclusive-green-finance-policies/>
- Knaack P and Gruin J (2020) *From shadow banking to digital financial inclusion: China's rise and the politics of epistemic contestation within the financial stability board. Review of International Political Economy* 28(6): 1582-1606. <https://www.tandfonline.com/doi/abs/10.1080/09692290.2020.1772849>

- Knaack P and Volz U (2023) "Inclusive Green Finance. In Schoenmaker D and Volz U (eds) *Scaling Up Sustainable Finance and Investment in the Global South*. London: CEPR Press.  
<https://cepr.org/publications/books-and-reports/scaling-sustainable-finance-and-investment-global-south>
- Knaack P and Zetterli P (forthcoming) Climate risk and financial inclusion: A regulatory perspective on risks and opportunities. CGAP Discussion Note. Washington, D.C.: Consultative Group to Assist the Poor (CGAP).
- Ndung'u N (2021) A digital financial services revolution in Kenya: The M-Pesa case study. *African Economic Research Consortium*.  
[https://www.researchgate.net/publication/349548752\\_A\\_Digital\\_Financial\\_Services\\_Revolution\\_in\\_Kenya\\_The\\_M-Pesa\\_Case\\_Study](https://www.researchgate.net/publication/349548752_A_Digital_Financial_Services_Revolution_in_Kenya_The_M-Pesa_Case_Study)
- NGFS [Network for Greening the Financial System] (2019) A call for action: *Climate change as a source of financial risk*. Paris.  
[https://www.ngfs.net/sites/default/files/medias/documents/synthese\\_ngfs-2019\\_-\\_17042019\\_0.pdf](https://www.ngfs.net/sites/default/files/medias/documents/synthese_ngfs-2019_-_17042019_0.pdf)
- NGFS (2018) *First Progress Report*. Paris: Network of Central Banks and Financial Supervisors for Greening the Financial System.  
<https://www.ngfs.net/sites/default/files/medias/documents/818366-ngfs-first-progress-report-20181011.pdf>
- NGFS (2022). *Central banking and supervision in the biosphere: An agenda for action on biodiversity loss, financial risk and system stability*. Final Report of the NGFS-INSPIRE Study Group on Biodiversity and Financial Stability. Paris.  
[https://www.ngfs.net/sites/default/files/medias/documents/central\\_banking\\_and\\_supervision\\_in\\_the\\_biosphere.pdf](https://www.ngfs.net/sites/default/files/medias/documents/central_banking_and_supervision_in_the_biosphere.pdf)
- Nguyen D, Ongena S, Qi S and Sila V (2022) Climate change risk and the cost of mortgage credit. *Review of Finance* 26(6): 1509–1549.
- Nie O, Regelink M and Wang D (2023) Banking sector risk in the aftermath of climate change and environmental-related natural disasters. *Policy Research Working Paper No. 10326*. Washington, D.C.: World Bank Group.
- PIGGFC and RCGFD (2020) *Fintech Facilitates the Sustainable Development of Green Finance in China: Cases and Outlook*. Beijing: Paulson Institute Green Finance Center and the Research Center for Green Finance Development of Tsinghua University  
[www.paulsoninstitute.org/wp-content/uploads/2020/09/Fintech-report\\_Final1.pdf](http://www.paulsoninstitute.org/wp-content/uploads/2020/09/Fintech-report_Final1.pdf)
- Riley E (2018) Mobile money and risk sharing against village shocks. *Journal of Development Economics* 135: 43–58.
- Robins N, Dikau S and Volz U (2021) *Net-zero central banking: A new phase in greening the financial system*. London: London School of Economics and Political Science and SOAS, University of London.  
<https://doi.org/10.25501/SOAS.00034895>
- Staschen S and Meagher P (2018) *Basic Regulatory Enablers for Digital Financial Services*. Washington, D.C.: Consultative Group to Assist the Poor (CGAP).  
<https://www.cgap.org/research/publication/basic-regulatory-enablers-digital-financial-services>
- Suri T and Jack W (2016). The long-run poverty and gender impacts of mobile money *Science*. 354(6317): 1288–1292.
- TCFD [Task Force on Climate-related Financial Disclosures] (2017) *Recommendations of the TCFD*.  
<https://assets.bbhub.io/company/sites/60/2021/10/FINAL-2017-TCFD-Report.pdf>
- UNEP FI [United Nations Environment Programme Finance Initiative] (2002) Climate Change and the Financial Services Industry – Module 1: Threats and Opportunities.  
<https://www.unepfi.org/themes/climate-change/climate-change-and-the-financial-services-industry-module-1-threats-and-opportunities/>
- Volz U, Knaack P, Nyman J, Ramos L and Moling J (2020) *Inclusive Green Finance: From Concept to Practice*. Kuala Lumpur and London: Alliance for Financial Inclusion and SOAS, University of London.  
[https://eprints.soas.ac.uk/34540/1/AFI\\_IGF\\_SOAS\\_digital.pdf](https://eprints.soas.ac.uk/34540/1/AFI_IGF_SOAS_digital.pdf)
- World Bank (2022) Financial Inclusion. Web Page.  
<https://www.worldbank.org/en/topic/financialinclusion/overview>
- Zetterli P (forthcoming). *Climate resilience and financial inclusion*. Washington, D.C.: Consultative Group to Assist the Poor (CGAP).

## About the authors

**Ulrich Volz** is a Professor of Economics and Director of the Centre for Sustainable Finance at SOAS, University of London ; a Senior Research Fellow at the German Institute of Development and Sustainability (IDOS); and a Visiting Professor at the Grantham Research Institute on Climate Change and the Environment, LSE.

**Peter Knaack** is an Adjunct Professor at the School of International Service, American University; a Research Associate at the Center for Sustainable Finance at SOAS; and an Associate at the Council on Economic Policies.

## Acknowledgements

The authors would like to thank Peter Zetterli (CGAP), Majorie Chalwe-Mulenga (CGAP), Andrius Skarnulis (World Bank), and Pierre Monnin, Julia Bingler, Alexander Barkawi and Chiara Colesanti Senni (Council on Economic Policies) for their helpful comments on earlier drafts of this paper.

## Disclaimer

The findings, interpretations and conclusions expressed in this paper are entirely those of the authors. They do not necessarily represent the views of the International Bank for Reconstruction and Development, the World Bank and its affiliated organisations, or those of the executive directors of the World Bank or the governments they represent. Nor does the paper necessarily reflect the views of the series editors or the editors' host institutions.

## Briefing paper series editors

Dr Simon Dikau: [S.Dikau@lse.ac.uk](mailto:S.Dikau@lse.ac.uk)  
Professor Nick Robins: [N.V.Robins@lse.ac.uk](mailto:N.V.Robins@lse.ac.uk)  
Professor Ulrich Volz: [uv1@soas.ac.uk](mailto:uv1@soas.ac.uk)

Find out more about their work at [www.lse.ac.uk/granthaminstitute/research-areas/sustainable-public-and-private-finance/](http://www.lse.ac.uk/granthaminstitute/research-areas/sustainable-public-and-private-finance/) and [www.soas.ac.uk/centre-for-sustainable-finance/](http://www.soas.ac.uk/centre-for-sustainable-finance/).

## Editing and production

Georgina Kyriacou (Managing Editor), Natalie Pearson and Zoe Kay, with support from Sophie Scharlin-Petee.

## About INSPIRE

**The International Network for Sustainable Financial Policy Insights, Research, and Exchange (INSPIRE)** is a global research network and designated research stakeholder of the Network of Central Banks and Supervisors for Greening the Financial System (NGFS) in its work to manage climate risk and mobilise finance to support the transition to a sustainable economy. The INSPIRE secretariat is co-hosted by the Grantham Research Institute on Climate Change and the Environment and the ClimateWorks Foundation, and is guided by an Advisory Committee who provide domain expertise independently but in close interface with the work priorities of the NGFS. Philanthropic support for INSPIRE is provided by ClimateWorks Foundation. [www.inspiregreenfinance.org/](http://www.inspiregreenfinance.org/)