

GREEN CENTRAL BANKING: A NEW ROLE FOR THE CENTRAL BANKS IN THE FINANCIAL SYSTEM

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Abstract

The financial sector plays a key role in the transition to a more sustainable and low-carbon economy. Central banks as one of the major actors in the financial system, have the ability to influence the adoption of green finance and reduce risks associated with climate change. Green central banking aims to give central banks' operations, regulations, and goals a more sustainability-related thought. This paper uses a qualitative analysis method based on the existing literature. In addition to exploring the concept of "green central banking," which is just starting to gain traction, this study addresses potential central bank responsibilities and tasks in the field of sustainable finance. This study also emphasizes the difficulties and dangers of implementing green central banking, including the possible conflicts between financial stability and environmental goals. The article provides a comparative examination of the methods used by central banks as it looks at the state of green central banking in various parts of the world. Ultimately, this study promotes central banks to take an initiative-taking stance in the transition to a greener and more resilient financial system and believes that green central banking can be a critical tool for accomplishing sustainable development goals.

Keywords: *central banks, green finance, sustainable finance.*

I. INTRODUCTION

Green central banking is an emerging notion that seeks to integrate environmental and sustainability considerations into policies and operations of central banks in order to tackle climate change through financial sectors. The term "green transition" describes the transitions to a low-carbon, sustainable economy, that fundamentally alters how societies produce, consume, and live. It entails switches from fossil fuels to renewable energy sources, cutting greenhouse gas emissions, promoting the ideas of the circular economy, boosting energy efficiency, and putting sustainable land use methods into effect. Green transition aims to reduce environmental damage that leads to climate change while promoting social welfare and economic development. Central banks all around the globe are increasingly examining how to manage

these concerns within their mandates because of the increased awareness of the financial risks and opportunities linked to climate change. The idea of green central banking entails re-evaluation regarding how central banks might support a financial system that is more robust and sustainable while also increase their commitment to the low-carbon economy.

There are no written guidelines on the approach central banks should consider in tackling the climate change challenges by implementing the green central banking. The assessment of the financial system's vulnerability to climate-related financial risks can be largely aided by central banks. Risks related to the climate can be incorporated into monetary policy, financial supervision, and regulation by central banks. On the other hand, it is asserted that central banks are neither the primary agents in the global warming mitigation nor do they in charge of establishing climate policy, which means combating climate change is beyond their mandates.

The first central banks were established to finance the governments, especially for funding the wars. Central banks later developed functions inter alia lender of last resort, maintaining specie convertibility, managing the gold standard, and facilitating financial transactions. Central banks' mandates further extended beyond settling and facilitating payments. In the twentieth century, their responsibilities are also preserving price stability, full employment, and macroeconomic stability, especially since the global financial crisis.

Today, we are on the verge of a new era for central banking. Recent developments in green central banking and central bank digital currencies can change the course of central bank power and responsibility. This study discusses the challenges and opportunities for central banks in a world struggling with climate change and transitioning to a greener economy. This paper uses qualitative analysis of the existing literature on green central banking along with green finance and the changing responsibilities of central banks. This study addresses the following questions by synthesizing existing research to provide insights into the topic:

- Should central banks play a role in combating climate change as well as achieving green transformation and sustainable development goals?
- Should central banks play a leading role in this, or should they support the efforts of the government and/or other institutions within the framework of their own powers and responsibilities?
- The main task of central banks is to ensure price stability and, in some cases, financial stability. Should they engage in efforts to combat climate change, within the scope of their existing powers or armed with new specific powers?

For this purpose, in the next two chapters, we offer an overview of the evolution of the central banks' roles and responsibilities, then explain how a green transformation and green finance have come to the forefront of the world's agenda. In the following chapters, we elaborate on green central banking, its emergence and initial efforts for its development, major risks that the central banks need to tackle in this manner, and the discussions about central banks' role, and the authority given by their mandates.

The literature on green central banking mainly revolves around discussions about the role of central banks in tackling climate-related risks and whether this is consistent with their mandates. Volz examined the role of central banks in green financial systems and discusses the risks of overstressing central banks' mandates.¹ Dikau and Volz investigated how addressing climate-related risks and promoting mitigation and adaptation policies fit into central banks' mandates by analysing and comparing them to sustainability-related policies central banks have adopted in practice.² Ramos Muñoz et al. integrated interdisciplinary concepts from network theory, decision under uncertainty, and social norms with a comparative analysis of central banks' mandates and case law pertaining to central banks.³ The European Central Bank (ECB) examines how climate change may affect implementation of monetary policy in the Eurozone. It then analyses several alternative monetary policies that may be taken to address climate risks, and whether they are consistent with the ECB's mandates.⁴ Campiglio et al. highlighted the important discourse and explores a possible future direction for research and policy regarding the role of central banks and financial regulators in tackling climate-related financial risks.⁵

Many studies have focused on the assessment and management of financial risks related to climate change. Giuzio et al. explored the ways that climate change might impact financial stability and demonstrates how systemic risks from climate change can develop, particularly if markets are not properly

¹ Ulrich Volz, "On the Role of Central Banks in Enhancing Green Finance," 17/01. *The Inquiry into the Design of a Sustainable Financial System* (2017).

² Simon Dikau and Ulrich Volz, "Central Bank Mandates, Sustainability Objectives and the Promotion of Green Finance," *Ecological Economics* 184 (June 2021) <https://doi.org/10.1016/j.ecolecon.2021.107022>.

³ David Ramos Muñoz, Antonio Cabrales, and Ángel Sanchez, "Central Banks and Climate Change: Fit, Opportunity and Suitability in the Law and Beyond." *EBI Working Paper Series* 119 (2022), <https://ssrn.com/abstract=4054908>.

⁴ ECB, "Climate Change and Monetary Policy in the Euro Area," *Occasional Paper Series* 271 (2021), <https://doi.org/10.2866/101932>.

⁵ Emanuele Campiglio, Yannis Dafermos, Pierre Monnin, Josh Ryan-Collins, Guido Schotten, and Misa Tanaka, "Climate Change Challenges for Central Banks and Financial Regulators," *Nature Climate Change* 8, no. 6 (2018): 462–68, <https://doi.org/10.1038/s41558-018-0175-0>.

pricing those risks.⁶ Bolton et al. discussed some of the key issues that central banks, regulators, and supervisors must deal with because of climate change, along with possible solutions and suggested that it will be crucial to create and strengthen forward-looking risk assessment and regulations relating to climate change.⁷ The Basel Committee on Banking Supervision (BCBS) examines how financial risks related to climate change may materialize and affect the banking sector and demonstrated how the effects of physical and transition risks on the financial and economic markets can differ depending on region, industry, and the state of the financial and economic systems.⁸ BCBS provides a broad overview of the theoretical concerns surrounding methods for measuring the financial risk associated with climate change and finds climate-related financial hazards have distinctive characteristics that call for precise and anticipatory mitigation techniques.⁹ Dafermos explains the necessity of a systemic risk approach in the age of climate emergency and discusses the difficulties faced in promulgating a policy agenda aimed at reducing climate systemic risks and how these difficulties can be overcome.¹⁰

II. THE EVOLUTION OF CENTRAL BANKS' SUPERVISORY ROLE

It can be said that central banking, with a four-hundred-year history, has shown an evolutionary development in terms of the purposes for its establishment and the roles it has assumed. Their development was initially linked to financing government expenditures in wars and marketing a government's debt. Until the term central bank came into use in the late nineteenth century, they used to be known as "Banks of Issue."¹¹ The first two central banks, the Swedish Riksbank established in 1668 and the Bank of England established in 1694, were founded as joint stock companies to lend government funds and to

⁶ Margherita Giuzio, Dejan Krusec, Anouk Levels, Ana Sofia Melo, Katri Mikkonen, and Petya Radulova, "Climate Change and Financial Stability," *Financial Stability Review* (2019), https://www.ecb.europa.eu/pub/financial-stability/fsr/special/html/ecb.fsrart201905_1~47cf778cc1.en.html.

⁷ Patrick Bolton, Morgan Despres, Luiz Awazu Pereira da Silva, Romain Svartzman, and Frédéric Samama. 2020. "The Green Swan: Central Banking and Financial Stability in the Age of Climate Change," *Bank for International Settlements* (2020).

⁸ BCBS, "Climate-Related Risk Drivers and Their Transmission Channels," *Bank for International Settlements* (2021).

⁹ BCBS, "Climate-Related Financial Risks: Measurement Methodologies," *Bank for International Settlements* (2021).

¹⁰ Yannis Dafermos, "Climate Change, Central Banking and Financial Supervision: Beyond the Risk Exposure Approach," *SOAS Department of Economics Working Paper 243* (2021), <https://ideas.repec.org/s/soa/wpaper.html>.

¹¹ Michael D Bordo and Pierre L Siklos, "Central Banks: Evolution and Innovation in Historical Perspective," *NBER Working Paper Series 23847*. (2017): 1, <http://www.nber.org/papers/w23847>.

purchase government debt. Other European central banks were established following this fashion and stabilizing currencies, like the Banque de France.¹²

The first central banks, or so-called banks of issue, did not function as supervisors of other banks. However, the motivation for their establishment was fundamentally to provide financial benefits to the governments. Early central banks were established with goals related to centralizing what in some cases had become a rather scattershot system of note of issuance, managing and safeguarding the nation's gold reserves, and facilitating and improving the payments system. Having the privileged legal status as the government's banker and note issuer, the central banks evolved into a bankers' bank because of the consolidation of reserves inside the banking system. Ultimately, this led central banks to develop their ability of monetary management via historical experience.¹³

The first central banks were profit-seeking enterprises that were operated purely in the interest of their owners rather than the interests of the larger financial community. The Bank of England was the first to recognize the nascent role of saving other financial firms by acting as a lender of last resort during financial crisis and became the role model for modern central banks.¹⁴ A fiat money standard was made possible by the creation of central banks and the addition of a fiat component to the money stock. Both the public and private sectors were encouraged to try to lower the reserve ratios due to the fractional reserve system. The centralization of reserves among private banks promoted a natural monopoly and boost the profitability of note issuance, resulting in rent-seeking actions with that objective.¹⁵ The imposed role of central banks to act as lenders of last resort was an inevitable consequence of the private money creation based on fractional reserves and the introduction of the fiat element to the money supply.

The creation of central banking was also a result of governments' failure to sufficiently define and protect depositors' property rights, that is, to stop bankers from abusing their position as safekeepers of their depositors' money. This brought the necessity for bankers to call for the creation of a central bank that would function as a lender of last resort and ensure their survival in turbulent times. This created a symbiotic relationship between the interests of the state and its central bank and those of private bankers. Private bankers

¹² Michael D Bordo, "A Brief History of Central Banks." *Federal Reserve Bank of Cleveland, Economic Commentary*, (December 2007).

¹³ Charles Goodhart, *The Evolution of Central Banks* (The MIT Press, 1991), 5.

¹⁴ George Selgin, "Central Banks as Sources of Financial Instability," *Independent Review* 14, no. 4, (2010): 486.

¹⁵ Angela Redish, "Anchors Aweigh: The Transition from Commodity Money to Fiat Money in Western Economies," *The Canadian Journal of Economics* 26, no. 4, (1993): 783, <https://doi.org/10.2307/135820>.

were aware that without the support of an official institution to provide the necessary liquidity once an inevitable bank crisis hit, their entire business model would ultimately collapse.¹⁶

The first central banks were private and autonomous institutions. They were free to pick their own tools and policies, but they needed the government to keep their charters in place. Their objectives, however, were limited by the convertibility of gold. Most of these central banks were nationalized and lost their independence during the 20th century, leaving fiscal authorities to set their priorities.¹⁷ During the Free Banking Era in the US, there were private clearinghouses that developed a strategy that was successful in regaining public trust in the banking sector in times of financial panic. Clearinghouses had gone so far as to print their own money during panics in the latter part of the 19th century; this money was accepted by bank depositors and used as payment and collateral. Clearinghouses developed into the role of lender of last resort and the function of money creation. These were central banking duties that, in the US, were transferred to the Federal Reserve Bank (the Fed). The difference between the Fed and the clearinghouses is that today the Fed implements a national monetary policy that is intended to result in adequate economic growth and low inflation.¹⁸

Until 1914, central banks played a key role in managing the gold standard with macro responsibility relating to the trajectory of monetary conditions in the economy, as well as a micro function relating to the health and well-being of the (individual) members of the banking system. This management mostly involved attempts to balance the need to preserve the preferred metallic standard with consideration for the security and health of the financial system.¹⁹ After World War I, because of the change in the political economy of many nations including expanding voting rights, rising labour movements, and emerging limitations on immigration, central banks started to be concerned about employment, real activity, and price levels.²⁰ Over time, there have been considerable changes to what financial stability means. The term came to include acting as a lender of last resort to the banking system and the payments system in the eighteenth and nineteenth centuries to prevent or manage banking panics. The introduction of the real bills doctrine in the twentieth century changed the concept to ensure financial stability by urging the central

¹⁶ Jesus Huerta De Soto, *Money, Bank Credit, and Economic Cycles* (Auburn, Alabama: Ludwig von Mises Institute, 2006), 648.

¹⁷ Bordo, "A Brief History," 1.

¹⁸ Gary Gorton, "Private Clearinghouses and the Origins of Central Banking," *Federal Reserve Bank of Philadelphia Business Review*, (1984): 9.

¹⁹ Goodhart, *Evolution of Central Banks*, 6.

²⁰ Bordo, "A Brief History," *ibid*.

bank to prevent an asset price-boom since it would produce inflation, which would ultimately cause depression and deflation.²¹

Most central banks were simply seen as subservient to governments in the aftermath of the wave of nationalization or state domination over the central banks that occurred around the end of World War II. The constraints of monetary policy were overlooked as monetary policy was seen to be capable of achieving multiple objectives at once. Most probably, decision-makers did not realize that more careful consideration needed to be given to define and detail the correct objectives of monetary policy after the abandonment of the Gold Standard.²² Although destabilizing pressures on the Gold Standard and then the Bretton Woods system of pegged exchange rates caused the central banks to change and adjust their macroeconomic goals of monetary management, maintaining the stability of the financial system has always taken precedence. From the first central bank to the last one, a financial stability imperative, or an effort to reduce the frequency of financial crises, was the driving force behind the establishment of various central banks.²³ When the Fed adopted a more active stabilization strategy in the 1960s, it altered its priorities in this decade from focusing low inflation to reducing unemployment. The acceptance of Keynesian concepts and the belief in the Phillips curve trade-off between inflation and unemployment were two potential causes. The development of inflationary pressures from the late 1960s to the end of the 1970s was a result of the policy change. Although there is ongoing discussion over the reasons for the Great Inflation, many economists believe that the Fed's approach at this time was flawed. Central banks' independence has played a significant role in the development of central banking.²⁴

Thanks to the adoption of effective anti-inflation strategies, together with comparable steps taken by other nations later in the decade, the Great Inflation ended between 1979 and 1982. This supported a wave of legislative reforms that allowed the monetary authorities the power to implement their policies in accordance with their mission and served to reinforce the significance of central banks' independence. This was reversed during the global financial crisis of 2007–2009 as central banks were perceived as being less independent from the government and more eager to provide fiscal support.²⁵ This is especially true when the preferences of elected officials appeared to collide with those who manage monetary policy, the degree to which central banks

²¹ Bordo and Siklos, "Central Banks," 1.

²² Pierre L. Siklos, *The Changing Face of Central Banking* (New York: Cambridge University Press, 2002): 2.

²³ Bordo and Siklos, "Central Banks," 4.

²⁴ Bordo, "A Brief History," *ibid.*

²⁵ Bordo and Siklos, "Central Banks," 9.

have tended to be depicted as distinct entities from the rest of the government that cause substantial tension. The laws regulating central banks are equivalent to those controlling any other government entity in most developed countries. Legislation governing the central bank is rarely organic since it is not covered by a constitutional clause and is quite simple to change.²⁶

Central banking evolved at a time when local branch service delivery was a key part of offering financial services. However, today's technology enables the central banking system to wholesale directly to customers. Stronger guarantees were needed for the banking system due to multiple banking crises that threatened and occasionally caused greater economic damage. These crises drew governments to the supervision of the central bank and ultimately to acquire ownership while insisting on the prudential regulation on the banks.²⁷ Since the 1980s, financial market advances have significantly raised interest in the characteristics of high-frequency data. Central banks may now monitor and, if they wish, respond daily to events impacting financial markets thanks to advancements in technology that have sparked the search for greater arbitrage possibilities.²⁸ Today, central banks have a greater ability to gather data and information and manage risks while they continue to learn and adapt to the changing world.

III. GREEN TRANSFORMATION AND FINANCE

Green transformation is a process that embraces the concept of sustainable development and incorporates actions for environmental and natural resource conservation. Environmental challenges such as reducing greenhouse gas emissions, conserving natural resources, and ensuring a sustainable future are all part of the green transformation. The 2030 Agenda for Sustainable Development is part of the green transformation since one of its objectives is to protect our planet. All the UN member countries signed on to this transformative Agenda which embraces Sustainable Development Goals (SDGs) applicable to all countries.

The 2030 Agenda complements the Paris Agreement on Climate Change, which was unanimously approved by States parties to the UN Framework Convention on Climate Change (UNFCCC) in 2015, shortly after the SDGs were adopted. SDG 13 refers to the UNFCCC as the key international, intergovernmental platform for discussing the global response to climate

²⁶ Siklos, *The Changing Face*, 7.

²⁷ Gruen, Nick. 2014. "Central Banking for All: A Modest Proposal for Radical Change," *Nesta*, (2014): 15.

²⁸ Siklos, *The Changing Face*, 119.

change.²⁹ To avoid the worst effects of climate change and keep the earth liveable, global temperature increase must be limited to 1.5°C above pre-industrial levels. This implies a 45% reduction in global net anthropogenic emissions from 2010 levels by 2030, reaching net zero emissions by 2050.³⁰

In Paris in December 2015, the Paris Agreement was adopted by 196 parties at the twenty-first session of the Conference of the Parties (COP). The Paris Agreement is a legally binding international treaty on climate change to limit global warming preferably to 1.5°C compared to pre-industrial levels. Implementing the Paris Agreement necessitates economic and social transformation, with countries aiming to achieve global peaking of greenhouse gas emissions as soon as possible to establish a climate-neutral planet by 2050. Countries develop their plans for climate actions intended to cut their greenhouse gas emissions to meet the Paris Agreement's goals.

Under Article 6 of the Paris Agreement, parties are bound to promote sustainable development. A mechanism was established to mitigation of greenhouse gas emissions and support sustainable development under the authority and guidance of the COP. Two of the three long-term goals of the Agreement focus on the mitigation of and adaptation to climate change. The third focuses on the role of finance, recognizing the vital role that financial institutions (both public and private) that are envisioned in meeting the Paris Agreement's objectives.³¹

The European Union (EU) aims for green transition by following a set of policies that is called the European Green Deal. As a part of this, the EU climate law set a goal to reduce net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels. For this purpose, some measures have been introduced such as a carbon border adjustment mechanism, CO₂ emissions standards for cars and vans, and emissions trading for road transport and buildings, including not only EU member countries but also any country that is a trade partner of the EU.

Green finance is a term that refers to investments in promoting environmentally sustainable economic growth. There are many definitions for green finance with a reference to green growth. OECD defines green finance as the long-term investment and consistent funding for achieving economic growth while reducing pollution and greenhouse gas emissions, minimizing

²⁹ United Nations Sustainable Development Group (UNSDG), "Foundational Primer on the 2030 Agenda for Sustainable Development," UNSDG, (2019): 10.

³⁰ IPCC, "Summary for Policymakers," in *Global Warming of 1.5°C: IPCC Special Report on Impacts of Global Warming of 1.5°C above Pre-Industrial Levels in Context of Strengthening Response to Climate Change, Sustainable Development, and Efforts to Eradicate Poverty* (Cambridge: Cambridge University, 2022), 1-24.

³¹ Net-Zero Banking Alliance (NZBA). 2022. "NZBA Transition Finance Guide," *UN Environment Programme Finance Initiative*, (2022): 8.

waste, and improving the efficient use of natural resources. According to the International Development Finance Club, this refers to financial investments in sustainable development projects and initiatives, and policies for the development of a more sustainable economy.³²

There are some other terms such as climate finance, sustainable finance, and transition finance, which are associated with green finance. While green finance is used to describe the activities, sustainable finance is the broadest term, encompassing social, environmental, and economic aspects. Climate finance includes a subset of environmental characteristics, and green finance includes climate financing that also addresses other environmental objectives and risks but excludes social and economic aspects.³³ Climate finance is associated with the UNFCCC and refers to local, national, or international financing derived from public, private, and alternative sources to support climate change mitigation and adaptation efforts.³⁴

Sustainable finance is the process of taking environmental, social, and governance interests into account when making investment decisions, resulting in increased long-term investments in a sustainable economy. Investor willingness to make an environmental and social impact in addition to seeking economic returns on their investments has fuelled the growth of sustainable finance.³⁵ Transition finance is the term for financing that supports and facilitates the global transition to a net-zero carbon economy. It is related to the mobilization of the capital to where it is most needed to facilitate the transition, including supporting research and scaling of climate solutions, as well as financing carbon-intensive enterprises that are progressively converting to net zero but require further acceleration.³⁶

The 2030 Agenda promotes an investment agenda for which all available resources, both from the public and private sectors, national and international, must be mobilised and integrated by governments. The governments must then align these resources behind a sustainable development agenda. The distribution of investment will be crucial, along with a variety of partnerships to mobilise resources, including with corporations and philanthropies.³⁷ Governments and business entities are compelled by the demands of civil society to reallocate their financial resources to a more resilient and sustainable

³² United Nations Environment Programme (UNEP), “Definitions and Concepts: Background Note,” 16/13, *The Inquiry into the Design of a Sustainable Financial System*, (2016): 6.

³³ UNEP, “Definitions and Concepts,” 4.

³⁴ UNFCCC, “What Is Climate Finance?” *Introduction to Climate Finance*, 2022, accessed in February 2022, <https://unfccc.int/topics/introduction-to-climate-finance>.

³⁵ R. Boffo and R. Patalano, “ESG Investing: Practices, Progress and Challenges,” Paris: OECD, (2020).

³⁶ NZBA, “Transition Finance Guide,” 5.

³⁷ UNSDG, ““Foundational Primer,” 8.

economy. To fulfil jurisdictional goals, this may require government authorities to redefine or review their national or regional sustainability policies, as well as to implement regulatory reforms on disclosures, risk management, or the definition of sustainable activities.³⁸

The environmental dimension of ESG criteria includes climate change and environmental degradation. An organization's interactions with the environment are referred to as its environmental aspects, while these interactions' effects are referred to as its environmental impacts, which can have positive or negative influence. The projects backed by green finance and the businesses participating in these processes impact that are present across the whole finance cycle. To comprehend and manage the risks and opportunities connected with them in a way that is cost-effective, determining the monetary value is therefore crucial.³⁹ To identify, validate, and align investments with sustainable goals, some governments and market actors are adopting or creating methodologies, including market-led approaches, public-led initiatives, and developing tools. The number of strategies to match investments with sustainable objectives has increased over the past several years, particularly in areas like sustainable finance taxonomies, ESG rating methodologies, verification techniques, and portfolio alignment tools. Distinct regulatory frameworks, policy aims, and methodology preferences are typically reflected in different methods and the deployment of various tools. This proliferation can result in the increased transaction costs, lack of transparency, market fragmentation, and risks associated with greenwashing and SDG washing and greenwashing.⁴⁰

Investors have been drawn to growing green industrial areas including recycling, renewable energy, and energy efficiency due to the ethos of ethical and environmental investments as well as the prospect of substantial financial returns in a developing economic sector. As these green investors become more and more widespread, the number of tools and techniques available to define green and sustainable investment types and activities will grow and result in a complex and disorganized collection of proprietary standards.⁴¹ Investors must have access to trustworthy, comparable, and consistent sustainability-related data that is useful for them to properly incorporate sustainability concerns into their financial decision-making. A broader range of stakeholders in the financial sector insurers, asset managers, and ESG rating providers also require such information because the evaluation of sustainability-related risks and

³⁸ NZBA, "Transition Finance Guide," 11.

³⁹ International Organization for Standardization (ISO), "Green and Sustainable Finance," Geneva: ISO, (2022): 10.

⁴⁰ G20, "G20 Sustainable Finance Roadmap," G20, (2021): 6.

⁴¹ ISO, "Green and Sustainable Finance," 6.

possibilities may be improved by the widespread availability of high-quality, comparable data. This will improve risk management and financial stability and allow for more effective capital allocation.⁴²

To reach the net-zero emission target set by the Paris Agreement, the emissions generated by the real economy, particularly those financed by the private banking sector, must be rapidly decreased. To make this transition, several industries have already taken concrete steps, which must be supported by financial institutions. Banks should be ready to allocate their capital and their expertise to companies in such sectors following credible transition plans outlining the steps these companies are taking to “decarbonize,” even while society manages the phaseout of technologies inconsistent with a 1.5°C temperature outcome.⁴³ This is crucial for the financial sector as climate change is a threat to financial stability, posing financial risk for banks and investors. The reactions to significant climatic catastrophes in aggregate stock prices, bank equity prices, and insurance equity prices have typically been modest during the previous few decades, especially in countries with strong sovereign financial standing. However, given the significant uncertainty surrounding climate science estimates and the economic costs of anticipated disasters, pricing future climate risks is incredibly difficult.⁴⁴ This brings new dimensions for the central banks’ supervisory role in sustaining financial stability along with maintaining price stability.

IV. GREEN CENTRAL BANKING

Green Central Banking is a term used to identify how central banks implement monetary policy and support financial system activities based on environmental and social values. This strategy strives to guarantee that central banks uphold and respect their obligations in terms of the environment, society, and economic efficiency. The Network of Central Banks and Supervisors for Greening the Financial System (NGFS) was established by eight central banks and supervisors in December 2017 to strengthen the global response required to meet the goals of the Paris Agreement and the financial system’s capacity to manage risks and mobilize capital for green and low-carbon investments. As of October 2022, the NGFS consists of 121 members and 19 observers. BCBS established the Task Force on Climate-Related Financial Risks (TCFR) in 2019 to work on climate-related financial risks on behalf of BCBS to reveal

⁴² ISO, “Green and Sustainable Finance,” 8.

⁴³ NZBA, “Transition Finance Guide,” 2.

⁴⁴ International Monetary Fund (IMF), “Global Financial Stability Report: Markets in the Time of COVID-19.” Washington: DC, IMF, (2020): 88.

existing initiatives to reduce climate-related financial risks. These are initial efforts to reduce the cost of the green transition at the international level.

At the national level, several central banks and regulatory agencies in the Asia-Pacific region, such as the Central Bank of Bangladesh, The Reserve Bank of India, Bank Indonesia and Indonesia's Financial Service Authority (OJK), the Monetary Authority of Singapore, are either explicitly or implicitly promoting sustainable financing. These institutions also play a significant role in this effort by building capacity, establishing the legal framework, encouraging the use of green products and loans, and incorporating climate change concerns into their monetary and financial policy frameworks.⁴⁵ For instance, guidelines for accelerating green lending and the issuance of green bonds were released by the Chinese government, banking regulator, and central bank in 2012. The Guidelines for Establishing the Green Financial System, which were jointly released in 2016 by a few ministerial agencies, signalled the beginning of structural reforms intended to advance green finance in the nation.⁴⁶ In Indonesia, the largest banks and foreign banks, totalling about 55 banks, are required to submit annual action plans to OJK under the regulation on sustainable finance that was adopted by OJK in 2017.⁴⁷ The Indonesia Sustainable Finance Initiative (ISFI), which supports adoption of sustainable finance in Indonesia, was founded in June 2018 by eight Indonesian banks.⁴⁸

By affecting the cost of food and energy, climate change and environmental risks can have a dramatic effect on price stability. The experience of past financial crises has demonstrated the necessity for financial regulation and supervision to go beyond its conventional micro-prudential emphasis and to create macroprudential policy frameworks targeted at reducing systemic risk in the financial sector. There shouldn't be any argument over the fact that environmental risk, and risk related to climate change, represent a major systemic risk for the financial sector.⁴⁹ With the primary goal of pursuing price stability and, in some cases, financial stability, most central banks have a relatively narrow mandate which does not necessitate that central bank actively

⁴⁵ Aziz Durrani, Masyitah Rosmin, and Ulrich Volz, "The Role of Central Banks in Scaling up Sustainable Finance—What Do Monetary Authorities in the Asia-Pacific Region Think?" *Journal of Sustainable Finance and Investment* 10, no. 2, (2020): 93.

⁴⁶ Camille Macaire and Alain Naef, "Greening Monetary Policy: Evidence from the People's Bank of China," 812, Working Paper, (2021): 5.

⁴⁷ **Ratu Silfa Addiba** Nursahla, Nismara Paramayoga, Muhammad Anas Fadli, & Muhammad Pravest Hamidi, "Legal Aspects of the Central Bank's Green Finance Instruments in Indonesia: An Overview," *Journal of Central Banking Law and Institutions* 2, no. 1, (2023): 123-152, <https://doi.org/10.21098/jcli.v2i1.38>.

⁴⁸ Sustainable Banking Network (SBN), "Global Progress Report of the Sustainable Banking Network October 2019," Washington DC: IFC, (2019): 56.

⁴⁹ Volz, "Role of Central Banks," 9.

advance sustainability and green financing. Given that their mandates frequently encompass social and economic goals, central banks in many developing and emerging economies have been considerably more active in supporting green finance and sustainable development.⁵⁰

Central banks need to address sustainability challenges and environmental risks because of three essential arguments including the financial and macroeconomic risk argument, the market failure argument, and the argument of the role of central banks as credible and powerful actors.⁵¹ The central banks can assume an active or passive approach while responding the climate change. According to the risk exposure approach or the passive approach, central banks should respond passively to the climate crisis. The primary responsibility for the transition to a low-carbon economy lies with governments and is common among central banks in the Global North. Central banks, as before, simply need to measure climate risks and then incorporate those risks into their operations. According to the active approach or the systemic risk approach, central banks should analyse the climate risks, thus preventing climate-related systemic risk.⁵²

There are three types of financial sector risk associated with climate change, e.g., physical risk, transitional risk, and liability risk. Physical risks are operational risks that typically cause damage to the physical assets of financial institutions due to climate events, disruption of services and supply chain, weakening of customers' repayment capacity, and damage to collateral. Transition risks include the risks that the irregular transition to a low-carbon economy will create in terms of risk to financial stability, including weakening repayment capacity of customers, depreciation of assets and collateral, license cancellations, quota limitations and tax regulations, and changing preferences of consumers and investors. Liability risk explains that due to the intensity of physical risks attributable to climate change and environmental damages, the pricing capacity of insurance companies would also be affected, and they would have to meet more frequent and larger compensation amounts.

Physical risks are the risks to financial stability caused by sudden weather events including floods and hurricanes, and slowly progressing natural disasters such as drought and rising sea levels.⁵³ Increased food prices due to bad harvests is an example of a supply-side major shock caused by physical risks. From the demand side, weather-related factors including heat, flooding, and changes in weather patterns could compel people to move or migrate,

⁵⁰ Dikau and Volz, "Central Bank Mandates," 17.

⁵¹ Volz, "Role of Central Banks," *ibid.*

⁵² Didem Nur Topçu, "Yeşil Tahviller ve İklim Değişikliği İle Mücadelede Merkez Bankalarının Rolü," İstanbul: Türkiye Cumhuriyet Merkez Bankası (TCMB), (2022): 75.

⁵³ TCMB, "Finansal İstikrar Raporu Mayıs 2021," Ankara: Tcmb, (2021): 15.

reduce the value of their homes, which insurance and banks would not be able to fully offset, and lower people's purchasing power.⁵⁴ Such significant environmental changes could have an impact on the safety and soundness of financial institutions, as well as economic and financial stability, with evident potential implications for central banks.⁵⁵

Transition to a low-carbon economy and the need for mitigating climate change requires drastic policy action and cause societal changes which are the drivers of transition risk. Changes in public sector regulations, innovation, and changes in the affordability of current technology, as well as investor and consumer attitude in favour of a greener environment, can all lead to transition risk. For instance, carbon-intensive enterprises will be greatly impacted by new environmental regulations and adjustments to the carbon price, and their very survival may be in jeopardy.⁵⁶ In the process of adapting to policies aimed at combating climate change, these enterprises may face decreased profitability and market values due to the change in consumer and investor demands, disruptions in business processes, difficulties in generating income and loan repayments, and increased financing costs.⁵⁷

There is a significant risk due to worries that banks and the financial sector may not be aligned with the transition pathway towards a sustainable and net zero economy. This necessitates a prudential evaluation of risks resulting from misalignment and an appropriate calibration of prudential policy to mitigate them.⁵⁸ Through a combination of market-fixing and de-risking strategies, central banks and financial regulators have attempted to decarbonize the financial sector on the presumption that with enough disclosures, climate risk will be effectively priced into the market and market actors will rationally reallocate capital in response. This risk-based, market-driven approach for greening the financial industry has failed largely because funding for fossil fuels enterprises from the world's 60 major banks has surged to \$3.6 trillion since the Paris Agreement.⁵⁹

Climate change and mitigation policies have implications for the conduct of monetary policy on the one side by affecting the ability of central banks to deliver on their price stability and on the other where central banks, while staying within their mandate, can assist in reducing the risks connected with

⁵⁴ Muñoz, Cabrales, and Sanchez, "Central Banks and Climate Change," 11.

⁵⁵ Volz, "Role of Central Banks," 11.

⁵⁶ BCBS, "Climate-Related Risk Drivers," 7; Volz, "Role of Central Banks," 9.

⁵⁷ TCMB, "Finansal İstikrar Raporu," 15.

⁵⁸ Dikau and Volz, "Central Bank Mandates," 8.

⁵⁹ Nikki Eames, and David Barmes, "The Green Central Banking Scorecard 2022 Edition," London: Positive Money, (2022): 22.

climate change.⁶⁰ Climate risks may have an impact on the monetary policy transmission channels, which are the causal links connecting climate risk drivers to the financial risks faced by banks. Microeconomic transmission channels include the causal relationships through which climate risk drivers impact the individual counterparties of banks, possibly leading to climate-related financial risk to banks and to the financial system. The processes through which macroeconomic parameters are impacted by climate risk drivers and how they may have an influence on banks by having an impact on the economy are known as macroeconomic transmission channels.⁶¹

The techniques and data requirements for risk assessment that are now accessible need to be re-evaluated considering climate hazards. Current financial ties between businesses and/or investors may be broken because of shocks, while new ones simultaneously form. This alters how shocks spread across the network. Risks can only be properly assessed if the feedback loop between network structure and financial system stability is correctly understood.⁶² This gets much more difficult when it comes to scenario analysis and stress testing because each component must be connected consistently inside the same framework. The lack of a comprehensive collection of climate risk indicators and comparable, detailed, and consistent data for their computation is one of the major challenges in developing a framework for conducting stress tests on climate risks. As a result, methods for calculating climate risk rely significantly on estimates, assumptions, and expert opinion.⁶³

It is difficult to estimate future climate-related financial risks using previous data since they are likely to diverge from observed or observable patterns. Because there is a limited amount of historical data available for risk estimates or model calibration, quantifying climate-related financial risks includes uncertainty that might result in misestimating the risks. In addition to this, heterogeneities are important when choosing measurement strategies because each bank has a unique set of financial risks related to the climate in its portfolio, depending on the regions, markets, industries, political environments, and technological frontiers to which its clients and counterparties are exposed.⁶⁴ Exposure metrics frequently include factors or concerns linked to the climate along with financial risks. The emission-to-allowance gap and the loan-weighted emission intensity are two metrics that the ECB employs to measure climate-related vulnerability for transition risk. Due to the frequency

⁶⁰ ECB, "Climate Change," 109.

⁶¹ BCBS, "Climate-Related Risk Drivers," 8.

⁶² Muñoz, Cabrales, and Sanchez, "Central Banks and Climate Change," 51.

⁶³ European Banking Authority (EBA), "Mapping Climate Risk: Main Findings from the EU-Wide Pilot Exercise," EBA (2021): 9.

⁶⁴ BCBS, "Measurement Methodologies," 10.

of bank mortgage exposure to houses in flood-prone areas, the most often cited exposure indicators for physical risk were those related to floods. Risk metrics consider other factors, such as the economic and financial effects of climate-related hazards, in addition to exposure levels.⁶⁵

Through monetary, micro-, and macro-prudential policies, central banks can have an impact on investment decisions as well as the creation and allocation of credit toward green investments and away from environmentally harmful activities. Differentiated rediscount rates and capital or reserve requirements, which have an impact on the money multiplier and can be used to encourage green lending, are examples of traditional monetary policy tools that can be used to improve green investments.⁶⁶ To promote green investments, central banks can use promotional credit policies. Green lending quotas and concessional loans to priority and environmentally friendly sectors are two examples of credit allocation instruments.⁶⁷ Utilizing differentiated reserve requirements is another tool the central bank can employ to control credit allocation. In the past, it was common practice to encourage lending to specific sectors by implementing variable asset-based reserve requirements. Similarly, capital requirements can vary depending on the type of bank and how much it lends.⁶⁸

Because the Basel framework does not expressly take into consideration the higher risks associated with lending to carbon-intensive businesses, these gain from an implicit advantage. Supervisors may use brown-penalizing or green-supporting factors to capital requirement calculations to close this gap. A green bubble could develop if capital restrictions for bank loans to low-carbon industries are lowered because this could encourage increased risk-taking in those industries.⁶⁹ There are two different ways that central banks might use green collateral frameworks. According to the environmental risk exposure approach, collateral arrangements would be modified to reflect how exposed financial firms and central banks are to environmental risk. According to the environmental footprint approach, eligibility standards and haircuts focus on the ultimate environmental effects of financial assets.⁷⁰

⁶⁵ Financial Stability Board (FSB), “Climate Scenario Analysis by Jurisdictions: Initial Findings and Lessons,” FSB, (2022): 16.

⁶⁶ Volz, “Role of Central Banks,” 14.

⁶⁷ Paola D’Orazio, and Steffen Thole, “Climate-Related Financial Policy Index: A Composite Index to Compare the Engagement in Green Financial Policymaking at the Global Level,” *Ecological Indicators*, no. 141, (August 2022): 5.

⁶⁸ Volz, “Role of Central Banks,” 15.

⁶⁹ Durrani, Rosmin, and Volz, “Sustainable Finance,” 109.

⁷⁰ Eames, and Barmes, “Green Central Banking,” 17.

Central banks can take a reactive or proactive attitude and develop policies regarding climate-related risks and green transition. GHG accumulates, promises irreversible effects, makes risks asymmetrical, and supports a proactive approach as authorities decide whether and when to act. The decision of when to intervene should be affected by evaluating the costs and hazards of intervention against the costs and risks of doing nothing if climate change affects central bank objectives.⁷¹ Using the IMF's Central Bank Legislation Database, Dikau and Volz examined the mandates and goals of the central banks and found that only 12% of the 135 central banks have specific sustainability mandates, although 40% are mandated to support the government's policy agendas, which typically include sustainability objectives. Institutions should include physical and transition risks associated with climate change in their policy frameworks to protect macro-financial stability because these risks have the potential to directly undermine central banks' conventional core tasks.

The behaviours and expectations of financial markets are influenced by central bank actions and inactions. Markets can be shaped by central bank decisions, which can also have an impact on capital formation and the carbon trajectory of an economy.⁷² A central bank should set its stability goals, determine the road to achieving them, evaluate the legitimacy of governmental initiatives, and modify its tools as necessary to control the consequences of climate change on price stability, financial stability, and macroeconomic stability.⁷³ Climate risk management, along with green and climate-finance goals, must be incorporated into the daily activities of central banks and/or financial authorities. Only then will regulators and supervisors be able to execute effective checks and balances by gaining data and insights from reporting and monitoring.⁷⁴

V. CHALLENGES AND THE WAY FORWARD

Central banks, which were initially established to finance governments, later assumed the role of lender of last resort, took on responsibilities including managing reserves, maintaining price stability, and achieving macroeconomic targets, and are currently also responsible for ensuring financial stability. Due to the changing and increasing responsibilities and roles, it is considered that they have a responsibility that they cannot avoid in the green transformation and climate change.

⁷¹ Ramos Muñoz, Cabrales, and Sanchez, "Central Banks."

⁷² Dikau and Volz, "Central Bank Mandates," 18.

⁷³ Ramos Muñoz, Cabrales, and Sanchez, "Central Banks," 100.

⁷⁴ SBN, "Global Progress Report," 41.

The relevance of price stability as the primary goal is based on economic theory, but more specifically on central bankers' thinking, which was significantly influenced by the inflationary events of the 1980s and the relationship between price stability and central bank independence. Although the objectives of central banks vary among institutions and historical periods, the core principle of price stability and their peripheral mandates are compatible with climate change. Even though the central bank may not be the sole or most pertinent body with this mandate, climate change falls under the purview of a risk-based prudential supervisory mandate.⁷⁵ A central bank is typically a creation of the central government because the laws governing central banks have the same legal standing as any other government organization that is not shielded by a constitutional clause and are quite simple to change. A separate piece of legislation will control that authority and the level of coordination between the central bank and the supervisory authority if the central bank is not required to supervise banks or the financial sector in general.⁷⁶ For this reason, the central bank can't be independent of other public institutions and the guidance of the government in managing the green transformation process and combating climate change.

Although many G20 nations have committed to achieving net zero, central banks and financial authorities are still reluctant to act on environmental challenges in the absence of a clearer mandate.⁷⁷ With narrow mandates, central banks can only address climate-related risks within the framework of their core objectives. The narrow mandate prevents central banks from going further and actively promoting sustainability and green finance. In developing countries, central bank mandates are more extensive and include social, economic, and sometimes sustainability objectives.⁷⁸ Governments and central banks should collaborate to develop long-term measures to address risks to price and financial stability brought on by climate change.

The case for central banks to pursue sustainability objectives beyond their traditional core mandates of maintaining monetary and financial stability can be seen as an application of the theory of the second best, after the best solution which would be the removal of the market failure. Central banks may need to play a more active, market-correcting role if externalities result in commercial banks allocating credit in an environmentally undesirable way. The first market failure-correcting strategy would be a carbon price system that accounts for the social costs of carbon emissions, as this might deter or

⁷⁵ Ramos Muñoz, Cabrales, and Sanchez, "Central Banks," 8.

⁷⁶ Siklos, *The Changing Face*, 7.

⁷⁷ Eames, and Barmes, "Green Central Banking."

⁷⁸ Topçu, "Yeşil Tahviller," 91.

discourage environmentally harmful investment. The government may fall back on a second-best policy and mandate the central bank or financial supervisor to handle unfavourable environmental externalities using the resources at their disposal if first-best policies cannot be put into practice.⁷⁹ However, this second-best policy may bring the risks such as harming the market neutrality of the central banks and arising the question of accountability for the central bank.

According to the principle of market neutrality, central banks' open market operations should be neutral, represent the market, and not skew relative asset prices. However, adherence to the idea of market neutrality has allowed for a bias in favour of carbon-intensive sectors, as assessed by criteria like total employment, contribution to GDP, and amount of debt they issue.⁸⁰ Another risk of expanding the mandates of central banks would make central banks run into difficulties if they would be expected to accomplish too many goals with insufficient resources. If central banks were given responsibility for environmental goals, they would need powerful tools to accomplish these goals without sacrificing other goals.⁸¹

There is also a risk that institutions with little public accountability could be given too much authority. There has been general agreement that central banks should have institutional independence since the 1980s. The adoption of unorthodox monetary policies by central banks in the wake of the 2008 financial crisis has led to greater criticism of these institutions for making decisions that go beyond their mandate. At the same time, central banking cannot be reduced to a purely technical endeavour because monetary policy always has distributional implications. Increasing central bank accountability, for instance by tightening reporting requirements, is one potential solution to this problem.⁸² Another possible solution is to promote accountability through communication. Given the complexity of the subject and the fact that central banks do not often specialize in climate change, some uncertainty in public communication seems appropriate.⁸³

To promote climate-related risks disclosures, green lending, or to expand their holdings of green assets, central banks are developing programs related to green finance. As realistic, second-best options to encourage sustainable growth and green investment, several central banks in emerging and developing economies have turned to these measures. Allocating funds to or away from

⁷⁹ Volz, "Role of Central Banks," 20; Dikau and Volz, "Central Bank Mandates," *ibid.*

⁸⁰ Eames, and Barmes, "Green Central Banking," 23.

⁸¹ Volz, "Role of Central Banks," 18.

⁸² Volz, "Role of Central Banks," *ibid.*; Dikau and Volz, "Central Bank Mandates," 19.

⁸³ David M. Arseneau, Alejandro Drexler, and Osada Mitsuhiro, "Central Bank Communication about Climate Change," Finance and Economics Discussion Series 2022–031, Washington: DC (2022): 3.

specific industries and businesses implies favouring some areas of the economy over others, which would seem to be at odds with the current concept of independent central banks.⁸⁴ Such credit allocation may be the path of least resistance, but it may damage the credibility of central banks by casting doubt on their sincere belief that climate change is a systemic phenomenon that affects all issuers. It may also involve central banks in a microlevel funding allocation process that can lead to significant distortions and put them in danger of becoming too close to fiscal policy.⁸⁵

Another crucial point is that, while the historical responsibility for the climate crisis is in the countries of the Global North, it places a heavy burden on the countries of the Global South. Climate justice, which acknowledges that not all people are equally affected by global warming and that these effects overlap with structural global inequalities including race, wealth, and gender, is fundamentally based on historical emissions. Despite bearing the least responsibility, the poorest populations in the Global South are disproportionately affected by the effects of global warming.⁸⁶ Therefore, it is crucial to acknowledge that the central banks in the Global North need to implement more severe climate change mitigation measures.⁸⁷ Global North central banks can support climate adaptation investments in the Global South, for example by committing to buy government bonds from countries in financial difficulty.

Last but not the least, we cannot help but observe that the banking system is set up in a way that is much more akin to a socialist economy than a market economy. The development of banking legislation has always followed crises. Existing legislation has always been proven to be insufficient and lacking the required answers and solutions when emergencies have struck. Therefore, it has always been necessary to develop emergency solutions that, regardless of the context in which they were created, were incorporated into a new general legal framework at the end of each crisis. These frameworks have only lasted until the next shock, at which point a similar cycle has started.⁸⁸ Undoubtedly, green central banking suggests more market intervention and allocation of credit in a way that can cause market imperfections. Central planning is already widespread in the banking and credit sector of market economies, where the central bank, an autonomous monetary authority that serves as a true planning body for the financial system, is responsible for managing the entire banking

⁸⁴ Dikau and Volz, "Central Bank Mandates," 18.

⁸⁵ Ramos Muñoz, Cabrales, and Sanchez, "Central Banks," 97.

⁸⁶ Eames, and Barmes, "Green Central Banking," 26.

⁸⁷ Dafermos, "Climate Change," 14.

⁸⁸ Huerta De Soto, *Money, Bank Credit*, 673.

system. Therefore, as Huerta De Soto argues, we should expect to observe the same lack of coordination and inefficiency that characterizes socialism in these sectors.

VI. CONCLUDING REMARKS

Green central banking has emerged as a new paradigm in the financial world that recognizes the role of central banks in promoting sustainability and mitigating climate risks. Central banks are ideally situated to play a significant role in easing the transition to a more sustainable and resilient financial system. In addition to examining the idea of green central banking, this study also looked at the potential duties and functions of central banks in advancing sustainable finance. Green central banking is an emerging topic related to sustainable and green finance. This study relies on a review and analysis of the existing literature on green central banking, which consists of a limited number of studies and research. While the literature supports the idea of the active involvement of central banks in climate change and sustainability matters, future research can focus on exploring potential conflicts between the governments and central banks and the impacts of this interventionist approach on the free-market mechanism.

We have concluded that central banks could support environmentally friendly financial frameworks, incorporate climate risks into assessments of financial stability, and encourage sustainable lending practices. Yet, there are several obstacles to the adoption of green central banking, including apparent inconsistencies between environmental and financial stability goals. Therefore, it might be necessary to modify central banks' mandates and resources to include sustainability issues. However, the advantages of green central banking exceed these difficulties since it can result in a more resilient, equitable, and sustainable financial system that promotes the shift to a low-carbon economy.

We can provide some recommendations for central banks based on the analysis and conclusions presented in this study. To identify and reduce potential systemic risks, central banks can include climate-related risks and opportunities in financial stability assessments and stress tests. They can also create green financial frameworks that support sustainable finance, such as green bonds, green loans, and sustainable investments. Additionally, transparency and disclosure of environmental risks and opportunities in the operations and investment portfolios of financial institutions is vital for industry buy-in. To promote sustainable finance and reduce climate risks, central banks should collaborate with other financial authorities, governments, and stakeholders in a coordinated manner. In this manner, central banks can aid in laying the

foundation for a more resilient and sustainable financial system that aids in the shift to a low-carbon economy.

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