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Mind the gap: monetary policy and financial regulations for supporting green finance

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1 Introduction

Climate change has been recognised as one of the defining challenges the humankind faces in the 21st century. It is now recognized that the rise of global temperature to 2 °C requires a structural shift to bring the global economy from a high to a low-carbon path. On its way, the policy responses to climate change challenges have been predominantly fiscal. Accordingly, as the first line of defence against environmental externalities was recommended to opt for a carbon tax and cap-and-trade policies (see Stern and Stern, 2007; Krogstrup and Oman, 2019, among others).

The Paris agreement in 2015 braked this monotonicity in climate policy response sending a crucial message to the policymakers and the international community. It called to align financial flows with a pathway towards a low carbon economy (COP, 2016), using it as a major tool to meet climate targets. Indeed, besides traditional environmental themes (e.g., reduction of greenhouse gas emissions and climate change adaptation), the COP21 acknowledged the challenges related to the financing of a green transition. For the first time, central banks and financial supervisors have been called to contribute through “making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development” (COP, 2016, Article 2). In particular, it posed a question of how the central banks and financial regulators could align the finance sector with the sustainable transition roadmaps thus closing the “green finance gap”.

At the same time, there is increasing acknowledgement and shared awareness of climate change as a significant threat to monetary policy and financial stability, thus on macro and financial dynamics. On the monetary policy side, climate change can directly or indirectly affect a central bank’s ability to meet its price stability objectives posting both supply and demand shocks to the economy (Batten et al., 2020). Therefore, central banks are not immune to the risks posed by climate change. Thus, monetary authorities will need to identify the nature, persistence, and magnitude of the climate-induced shocks hitting the economy and prepare an adequate instrumental setup to address it (Coœuré, 2018). Instead, on the regulatory policy side, the climate-induced physical

damages and abrupt policy interventions are among the primary sources of financial imbalances with the potential systemic implication of financial stability (Hsiang et al., 2017; Semieniuk et al., 2021).

Despite the rising awareness of the adverse impact of climate-related risk on monetary policy and financial stability (Carney, 2015; NGFS, 2020), so far, few central banks and financial regulators have decided to take significant action to protect their balance sheets (D’Orazio and Popoyan, 2019a,b). One of the main reasons that create hurdle to facilitate meaningful policy change is the absence of green taxonomy resulting in a lack of access to better climate-risk data to assess its exposure (Bolton et al., 2020). Moreover, many central banks hesitate to commit to climate change aligning monetary policy instruments to avoid departure from the “market neutrality” principle (Cochrane, 2020). On the financial regulation side instead, there are no internationally agreed-upon regulatory schemes to withstand the potential losses caused to the financial sector (D’Orazio and Popoyan, 2019b).

Since the Paris agreement signed in 2015, there is clear evidence that monetary authorities worldwide, either in their monetary stability or supervisory responsibilities, started to consider the possibility of incorporating the policies mitigating the climate-related financial risks to their operational radar. However, policy commitment strongly differs across countries posing several fundamental research questions. What is the current level of commitment of monetary and financial supervisory authorities in aligning with green policy mandates? How green are the monetary and financial regulatory policies? How to make them “green” to favour the low carbon transition and contain the possible financial instability? What can be the consequences of such policies?

In this chapter, we shed light on the monetary policy and financial regulatory instruments that can be implemented and their possible effects on the low carbon transition path and on protecting the financial sector from climate related financial risks. Moreover, we provide a state-of-the-art in green monetary and financial regulatory tool usage and take a prospective look at its future development. The remainder of the chapter is organized as follows. Section 2 discusses central banks’ involvement in low carbon transition relying on their two main functions – monetary and supervisory, their role in tackling climate change and the state-of-the-art. Section 3, building on the previous section and the nowadays state of green finance, looks forward to the future. Finally, Section 4 concludes the discussion.

2 Central Banks and Climate change: Where are we now?

Until recently, climate policies have been predominantly thought in fiscal terms, mainly relying on such policy solutions as the carbon tax and cap-and-trade policies with little (if any) place for monetary policy. One reason for this is the mismatch of policy windows. If central banks operational objectives (mainly price stability) are short-term, climate change policies and effects, on the contrary, are about long-term horizons (Batten et al., 2016). This unilateral policy preference has changed with the Paris Agreement signed in 2015 requiring parties to limit global warming to well below 2°C above pre-industrial levels. Most central banks acknowledge that climate change is a significant threat to

monetary stability, consequently translating into adverse macro and financial dynamics. However, opinions vary on whether they should take action, and some are having a hard time accommodating their climate ambitions with their mandates (Krogstrup and Oman, 2019). Considering historical differences in central banks’ policy traditions and the evolution of institutions mandates worldwide (Goodhart et al., 2011), this may not be unexpected.

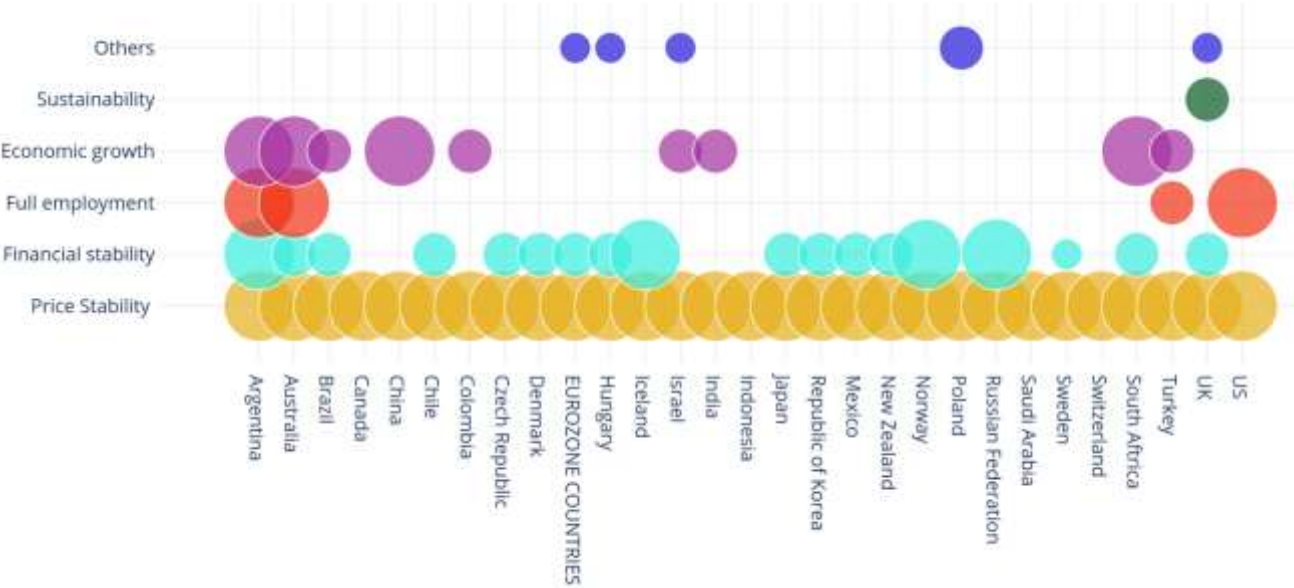


Figure 1: Structure of OECD and G20 central bank mandates

Source: Authors’ calculations based on IMF Central Banks Legislation Database double-checked with Central bank laws and statutes.

Figure 1, indicating the structure of OECD and G20 countries central bank mandates, shows a heterogeneity picture in terms of objectives. While the operational scope varies widely across central banks, what makes them alike is the price stability objective as a necessary component of the central banks’ institutional mandate. As the data speaks itself, sustainability is far from being an explicit mission statement by central banks. However, the most striking example comes from the UK where since March 3, 2021 the Bank of England (BoE) mandate was updated to explicitly promote “sustainable and balanced growth that is also environmentally sustainable and consistent with the transition to a net zero economy” (see BoE, 2021). The figure also tells that monetary authorities in advanced economies are assigned a narrower mandate than emerging economies’ experience. For example, in China, Brazil, Argentina, Turkey, having a broader monetary policy and frequently developmental objectives give them certain flexibility in their interpretations of the mandate. Accordingly, in these jurisdictions, green - financial instruments directed to canalization of credit flows to more environmentally friendly sectors have been employed as part of economy-wide sustainable development objectives.

The second most commonly used operational target is the financial stability objective. The financial crisis of 2007-2009 triggered an extensive transformation in monetary policymaking, reshaping central banks’ institutional role, governance, and mandate structures (Baker 2013; Quaglia

2013). As a result, in 2020, we have 62% of central banks in the G20 and OECD countries with financial stability as an integrative part of the mandate against 17% observed in 2000. This shift was mainly driven by high-income countries, which saw the role of economic stability in the hierarchical contest, keeping the primary focus on price stability (see Figure 1). In emerging economies, financial stability is either present at the same level as the price stability mandate or is *de facto* absent. However, as mandated to assure sustainable economic growth, the latter group of countries, due to its broad definition, assign central banks supervisory objectives to safeguard the financial system's stability to reach the final goal.

Relying on the insights provided by Figure 1, we will separate our analysis of the possible actions of central banks in managing climate-related risks based on their two principal objectives - monetary and financial stability. Although none of the above reported central banks has yet explicitly or implicitly included the management of climate-related risks in their operational objectives, an increasing amount of monetary authorities from advanced (e.g., the UK, France, Germany, among others) and emerging economies (such as Brazil, China, India) nowadays identify climate change as a significant threat to financial stability; even three years ago, hardly any made that claim. Ever since the climate-related risks became of utmost interest for central banks urging to create voluntary Central banks collaboration networks (e.g., NGFS created in December 2017 by Banque de France's initiative) and expert group (e.g., High-level expert group on sustainable finance established by European Commission in December 2016) to thoroughly incorporate climate-related financial risk to monetary policy actions.

2.1 Monetary policy and climate-related financial risks

Together with messages sent to the international community, the Paris Agreement has also been a whistle-blower for many central banks worldwide urging them to take action. Ever since many central banks started to take seriously the challenges posed by climate change acknowledging the climate-related risks could affect their ability to meet their principal operational mandate, the monetary stability thus posing both supply and demand shocks to the economy (McKibbin et al., 2017). In particular, extreme weather events, through the physical risk transmission channel, can result in supply-side shocks driving the shortage of commodities with consequent price volatility and erosion of productive capital stock hence slowing economic growth.¹ Losses induced by extreme climate events can also cause demand-side shocks, on one end, having negative wealth effect and follow-up reduction in private consumption, and on the other end, bring to adverse financial shock driven by high uncertainty, stranded assets, and financial loss. Thus, shocks mentioned above can, directly or indirectly, affect pre-cautionary saving, credit spreads, real interest rates, and financial instability, hence affecting inflationary pressures, for which monetary policy is responsible for (Bolton et al., 2020).

Moreover, while demand-side shocks with a current armoury of central bank tools are

¹ Note that the supply-side shocks can also arise through the transition from a high to a low-carbon economy.

manageable, the same is not true for supply-side shocks that pull output and inflation in opposite directions, thus inducing the trade-off between stabilising inflation and output fluctuations (see McKibbin et al., 2017; Coeuré, 2018).² Hence, being directly or indirectly exposed to climate-related risks that hinder monetary policy mandate achievement, the monetary authority is forced to identify the nature, magnitude persistence of climate-induced shocks, evaluate its impact, and prepare adequate instrumental toolkit to deal with it. However, as noted in Coeuré (2018) traditional policy instruments may be less effective at smoothing these shocks, to the extent that these are more or less permanent biophysical shocks, rather than transitory economic shocks. Accordingly, monetary policy line should rely on non-traditional measures to deal with these shocks.

The literature has pointed to several paths in which monetary policy could be a tool of (i) protection of the economy from green financial risks and (ii) support towards the green transition (for example see Krogstrup and Oman, 2019; Dafermos et al., 2020; Dafermos, 2021). We can split the green financial action among central banks and regulator between the “market fixing” (i.e., passive) and “market-shaping” (more active) approaches.³ Those approaches, first and foremost, highlight the necessity of adequate assessment of the climate risk impact on central banks’ collateral frameworks and asset portfolios (see Matikainen et al., 2017). The second line calls for a recalibration of asset purchase programs throughout eliminating high-carbon assets from central bank portfolios in favour of low-carbon assets (primarily known as “green quantitative easing (QE)”) supported by the idea of adjusting risk weights to reflect climate risks correctly (see Olovsson, 2018; Van Lerven and Ryan-Collins, 2017). All in all, it suggests central banks step beyond conventional monetary policy operations internalizing climate risks into central banks’ unconventional monetary policy practices, such as “green” quantitative easing, climate-aligned criteria in central bank collateral frameworks and portfolio management.

A restricted group of countries has already taken this route. However, we should note that this type of policies focuses more on financial risks rather than greening the central banks’ mandates as has been the case in the Bank of England. Since 2018, the Peoples Bank of China (PBoC) has revised and expanded the collateral list it accepts for medium-term lending. In particular, it was announced that PBoC accepts commercial banks’ green bonds, loans and asset-backed securities with a double-A rating and above as eligible collateral. Another country in the queue is Japan - the Bank of Japan since 2012 has been supporting lines of credit to green activities achieved through “Loan Support Programme”. The latter provides preferential liquidity at low interest to financial institutions lending to socially and environmentally beneficial projects. Other countries, such as Brazil, India and Indonesia, similarly to Japan, adopted credit allocation measures to priority and environmentally friendly sectors, such as green lending quotas and concessional loans.

After Christine Lagarde took a position of the president of ECB, EU also started to show its

² Few studies investigating the impact of climate-related shocks on inflation indicate that commodity prices tend to increase in the short term following natural disasters and weather extremes inducing upward pressure on the inflation rate (see Klomp, 2020; Heinen et al., 2019; Parker, 2018).

³ Literature purposes also other classifications of policy reactions to climate-related risks. For example, Baer et al. (2021) classify those policies depending on either different objectives the policy means to reach (i.e., prudential and promotional) or mechanisms (i.e., informational, incentive, or coercive).

ambitions in this field. In particular, defining climate change as “mission critical” for the ECB, its most significant suggestion includes adopting “green QE” programme. Disregarding the created agiotage, few works discuss the efficiency of green monetary policies. Dafermos et al. (2018), building on the DEFINE stock-flow-fund macro model (Dafermos et al. 2017), find that implementing a green QE programme can reduce climate-induced financial instability and restrict global warming. However, green QE is not by itself capable of preventing a substantial reduction in atmospheric temperature.

These proposals found very controversial reaction - while many central banks have been very enthusiastic about it (Financial Times, 2021), the academic world has criticized it heavily, considering that in both cases, these interventions are considered as a massive departure from one of the main principles of traditional monetary policymaking, namely “market neutrality” while responding to climate change-induced market failures (see Cochrane, 2020; Weidmann, 2019, among others). Moreover, several scholars (see Campiglio et al., 2018a; Olovsson, 2018; Dikau and Volz, 2018, among others) emphasise that incorporating sustainability goals to monetary policy’s operational radar is prone to overstressing its mandate and engendering its institutional independence. However, this criticism was met with conviction that the degree of discretion the many monetary authorities have in interpreting their mandates will smooth down the possible effects. Moreover, the current pandemic is already proof of mandate reinterpretations to sustain broad economic objective in coordination with fiscal authorities. Accordingly, a strong argument emerges in favour of coherent coordination between different policy wings for green transition rather than chasing “market neutrality” as the central postulate for monetary and financial regulatory policymaking on the way of green transition (see Barkawi and Zadek, 2021, among others).

2.2 Climate change and financial regulations: exploring the filed in between

The financial sector is frequently seen as key to enhance a “green structural change” via directing financial resources toward green investments to close the “green finance gap” (see Bolton et al., 2020, Dikau and Volz 2021). At the same time, climate-related risks and disorderly transition from a high to low carbon economy may hinder the financial system’s stability. Climate-induced physical damages and sharp policy interventions are among the primary sources of economic imbalances with the potential systemic implication of financial stability (see Diaz and Moore, 2017; Hsiang et al., 2017, among others). Accordingly, the literature classifies the risks posed by climate change to financial stability into two main categories, physical and transition risks. The former is associated with the economic cost of actual or expected extreme climate events that can provoke erosions and high volatility of physical and financial assets’ monetary value, thus increasing overall uncertainty in financial markets. Later instead is connected to a disorderly transition to a low carbon economy that could have a destabilizing effect on the financial system throughout sharp changes in public policy not anticipated by market participants (FSB, 2020).

Even if the mission is clear and risk are material, at the current state, the financial regulations are far from giving tangible results since in existing Basel III regulatory setup, climate-related financial risks are narrowly defined, and financial intermediaries are not explicitly required to assess the impact of climate-related risks on its exposures (Gros et al., 2016; D’Orazio and Popoyan, 2019b). It is also proved that financial regulatory frameworks contain an intrinsic “carbon bias” that creates barriers to aligning the finance sector with sustainable transition roadmaps (see Campiglio et al., 2018b, among others). Moreover, the Basel III requirements (in particular capital and liquidity) reinforces short-termism in financial markets (Haldane, 2011), hence hindering the capital mobilization aimed at green investment projects (see Spencer and Stevenson, 2013; Bhattacharya et al., 2015).

We believe that by “greening” the Basel III regulatory instruments (BCBS, 2017), including both lender and borrower side requirements, it is possible to retrieve the regulatory toolkit available to policymakers to address climate-related financial risks.⁴ These measures can be divided into 3 categories targeting banks’ capital, liquidity and credit limits, respectively. The capital management tools are the most discussed among the 3 categories mentioned above among both the policymaking and academic debates due to their potential to align the finance sector with sustainable transition targets. It mainly includes the minimum capital requirement with two applications for sustainable finance - Green Supporting Factor (GSF) and the Brown Penalising Factor (BPF) - together with countercyclical, conservation capital buffer and leverage requirement. According to the working mechanism of GSF, the banks will be allowed to apply a lower risk weight to low carbon assets, thus exerting less pressure on the intermediaries’ balance sheets, therefore directing their investments more towards finance climate-related projects. However, the proposal received considerable criticism considering that the looser regulatory capital requirement for green assets can underestimate possible real financial risks associated with those and thus threaten financial stability. The risk associated with GSF leads to BPF proposal, mainly from academic circles, requiring banks to conserve higher capital for carbon-intensive assets (Schoemaker and Van Tilburg, 2016; Thoma and Chenet, 2016; 2DII, 2018; D’Orazio and Popoyan, 2019b).

In the set of capital instruments, the leverage ratios, particularly those applied in sectoral bases, could be the easiest to implement to curb the financial sector’s exposure to carbon-intensive assets, thus addressing potential threats from a low-carbon transition. Instead, countercyclical capital buffer, even if essential to limit excessive credit growth to carbon-intensive assets, could be challenging to implement. This difficulty is mainly connected to the lack of data and information on the carbon-intensive credit cycle (Carney, 2019) and the absence of green taxonomy (NGFS, 2020) to distinguish between green (sustainable) and unsustainable assets.

Concerning liquidity regulations, following D’Orazio and Popoyan (2019b) three main instruments can be identified: Liquidity Coverage Ratios (LCR), Net Stable Funding Ratios (NSFR) and Reserve Requirements (RR). Empirical studies evidence the efficiency of LCRs and NSFR in managing liquidity crisis (Li et al., 2017; Papadamou et al., 2021). Still, they could hinder

⁴ Extensive analysis of the greened Basel III macro and macroprudential regulatory tools can be found in D’Orazio and Popoyan (2019b).

financial intermediaries' capacity to allocate capital to long-term climate-related assets. RR instead is one of the most used instruments by financial institutions actively involved in the green transition. Among those, Lebanon is a successful example of a country using the reserve requirement to support the low-carbon credits by lowering the RRs of commercial banks by 100-150% if the bank can provide a certificate of energy-saving potential of the financial project (BDL, 2010). Another example is PBoC, which uses differentiated RR regulatory policy tools to align the intermediaries portfolio to green growth objectives (Chang et al., 2019). In the case of "greened" RR, the level of obligatory reserves to hold against the attracted deposits depends on the bank's asset portfolio structure. Accordingly, the required reserves rate can be reduced in relation to green portfolio hence freeing financial resource to direct to green sectors.

The third category of regulatory tools is called either to limit or channel the financial flows to specific segments. It includes such widely used regulatory tools as minimum credit floors, maximum credit ceilings and large exposures limit. Volz (2017) already noticed that credit limits offer a very straightforward mechanism to channel investments to "green" projects. The maximum credit ceilings will structure the portfolios so limit certain carbon-intensive or polluting activities (sectors), while minimum credit floors would force the banks to allocate a certain fraction of their credit exposure portfolio to low-carbon sectors.

Climate-related stress tests and disclosure requirements hugely support the three groups of instruments mentioned above. Climate-related stress tests aim at testing the resilience of individual financial institutions and the financial system as a whole to hypothetical climate shocks (Battiston et al., 2017; NGFS, 2019). Climate-related stress tests produce valuable information about exposures of financial actors to climate-related risks (see Vermeulen et al., 2018). This information can be used to calibrate and evaluate climate-related macroprudential tools. Finally, disclosure requirements of the physical, liability and transition risks associated with climate change are also relevant to develop a credible green financial system and avoid a so-called "green washing" (TCFD, 2018).

One could ask what the state of art usage of green financial regulatory tools is. The increasing awareness about climate-related financial risks both in the policy and academic debates (see Dietz et al., 2016; Campiglio et al., 2018a; Dafermos et al., 2018; Dafermos and Nikolaidi, 2021; Carney, 2018; Nieto, 2019) pushes for the integration of those risks under the prudential regulations radar and shifting the policy agenda from whether financial regulators should act on the climate crisis to what measures they should take.

After the famous speech of the Governor of the Bank of England, Mark Carney (Carney, 2015), in the European Union (EU), a new wave of discussion started with the creation of the Task-force on Climate-related Financial Disclosures (TCFD, 2017) advocated by the Financial Stability Board, and the High-Level Expert Group by the European Commission. These initiatives and further steps towards creating the Network for Greening the Financial System (NGFS) provide evidence about intensified political debates and actions taking on from 2015 (Carney 2015; NGFS 2017; HLEG 2018) that could provide effective guidance for building capacity and understanding of risks in the field on green prudential policy tools. However, direct policy actions towards managing

climate-related financial risks, at least in developed economies, mainly meet the “all talk, no walk” approach relying only on discussions about financial regulatory tool adoptions. In fact, trusting the updated data collected by D’Orazio and Popoyan (2019a) on country-level diffusion of green prudential instruments listed above, Southern and East Asian regions (particularly China, India, Pakistan, Bangladesh, Vietnam, and Indonesia) appear as the forefront adopters of mandatory financial regulations. Other examples of successful application of green financial regulations are in Nigeria and Brazil, for which mandatory and voluntary regulations are adopted. Instead, such countries as France, Mexico, Turkey and others (marked with yellow in Figure 2) opted for the voluntary requirement.

What is the reason for such heterogeneity? All in all, as one can note from Figure 2, low-income countries and emerging economies are more involved in pursuing policies to green the banking sector than developed countries. This can be connected to 3 main factors. First, as noted in at the beginning of Section 2, central banks in emerging and low-income countries have a larger spectrum of goals and more flexibility in defining the policy periphery than high-income countries. Second, low-income countries are more exposed to climate change; therefore, they must shape timely and effective responses. The third reason could be connected to the lack of data to identify and assess climate-related risks. The latter builds a burden towards creating common taxonomy to facilitate more consistent and targeted green finance policies and investment. The creation of taxonomies could empower financial regulators to develop green credit allocation policies to encourage the banking sector to lend directly to environmentally friendly sectors. Such an approach could comprise credit quotes in the form of either credit ceilings for minimum lending requirements to green sectors or, conversely, credit ceilings that limit loans to carbon-intensive industries. Another critical concern that, so far, slows down the process of incorporation of climate-related risks to financial intermediaries risk radar is in an already “carbon-biased” financial system; if not correctly addressed, it can compromise the financial system’s safety and soundness (D’Orazio and Popoyan, 2019b).

Considering the instruments defined in Subsection 2.2 and data provided by D’Orazio and Popoyan (2019a), we observe no usage of green capital instruments. Instead, as expected, lending limits are more widely adopted and mainly on mandatory bases in countries as Bangladesh, Brazil, China, India, Indonesia, Nigeria, South Korea, and Vietnam and are voluntary in Japan. What concerns the climate-related stress test, it has been effectively conducted on a mandatory basis only in China. However, few central bankers and regulators, namely, the Bank of Canada and the macroprudential authorities in China, France, Netherlands and the UK, have started to consider integrating physical and transition risks in their stress testing scenarios (BoE-PRA, 2019; BdF-ACPR, 2019).

The French supervisor conducted a voluntary stress-test exercise in July 2020 to identify vulnerabilities in addressing climate-financial risks (Allen et al., 2020). A similar schedule was adopted by De Nederlandsche Bank (Vermeulen et al., 2019), while the Bank of England plans to perform the stress test in June 2021 (BoE-PRA, 2019). The European Central Bank (ECB) plans to conduct a supervisory stress test, including climate-related risks, in 2022.

Lastly, climate risk assessment and disclosure requirements in applications gather much interest, perhaps because of the necessity to have enough data to acknowledge the problem and later to

react. Relying on D’Orazio and Popoyan (2019a) they are implemented as a mandatory requirement in India, Indonesia, Nigeria, Indonesia, and Pakistan, South Korea, Vietnam, whereas they are voluntary in Colombia, Ecuador, France, Japan, Kenya, Mexico, Mongolia, Morocco, Nepal, Peru, South Africa, and Turkey. Argentina, Canada, Denmark, Laos, Sweden, Switzerland, and the United Kingdom are currently discussing the possibility of implementing them.

As evidenced by D’Orazio and Popoyan (2020), frequently “green financial mandate” is delivered by the central banks (47% per cent of all active cases) throughout their financial regulatory functions. The 11% of countries active in green financial regulations store the contribution in green transition in the hands of separate financial regulators. However, it is essential to highlight that central banks and financial regulators are frequently not alone carrying the burden of green objectives. We observe that the leading authorities collaborating with central banks in greening the financial sector (21% per cent of active cases) are bank associations in Cambodia and Mongolia, capital market authorities in India and Morocco, regulatory authorities in China and Finland, and Government in Denmark and Italy. In the rest of the active cases, the responsible authority is either a banks’ association (Ecuador, Luxemburg, Mexico, South Africa, and Turkey) or a separated prudential regulatory body (Australia, Chile, Indonesia, Norway and Peru). Resting two authorities active in the green finance debate is the government (Argentina, Sweden and the US) and the Ministry of Environment (in the case of Colombia, South Korea and Switzerland). All in all, the figure highlights the dominant role of central banks (either in the role of the regulator or not) and independent financial regulators in delivering the green finance mandate.

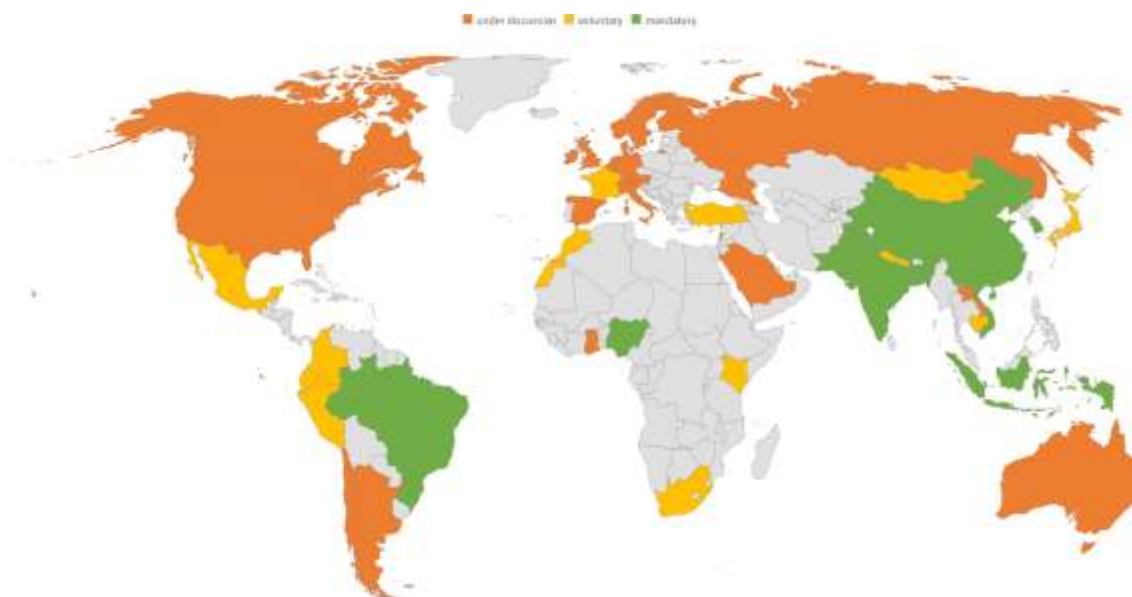


Figure 2: The adoption of green prudential requirements; year: 2020

Source: Authors’ calculations based on publicly available information and D’Orazio and Popoyan (2019a).

3 The future of green finance: a look forward

Although monetary authorities have recently demonstrated greater interest and engagement in climate-related issues, only a few central banks have decided on considerable climate action. Here two essential aspects need to be considered. Central banks are unelected delegates, and their actions are tightened to their operational mandates (Masciandaro and Romelli, 2015). Therefore, many central banks possess significant institutional and operational independence compared to other policy entities. However, they are required to exercise those powers following “market neutrality” (Vonessen et al., 2020). Henceforth, guiding financial flows to low-carbon activities without having an explicit mandate could endanger the credibility and independence of the monetary authorities (Cochrane, 2020). This explains why some perceive intervention by central banks for long-term sustainability issues with a degree of diffidence and as a “second-best” intervention instead of other policy actions such as taxation and fiscal policy. In this, a critical question arises of how monetary authorities and financial regulators could get out of this institutional deadlock.

Secondly, the operational scope to support the climate agenda varies widely across central banks, with sustainability far from being a universally explicit mission statement (see Figure 1). Some monetary and prudential authorities have relatively narrow interpretations of their mandate to address climate issues. For instance, in 2015, Bank of England Governor Carney’s call for central bankers to engage in a policy area outside their traditional charter was met with accusations of “mission creep” (Financial Times, 2019). Other central banks (such as PBoC, Central Bank of Brazil, Central Bank of Argentina) possess relatively broader policy remits to support green finance measures and climate policy.

This evidence brings a green monetary policy “dilemma” to the attention of policymakers and researchers. On the one hand, there is an urgency for central banks to contribute to keeping global warming below 2°C by closing the green finance gap and maintaining financial stability (i.e., macroprudential objective). On the other hand, the dilemma is concerned with preserving the central bank’s mandate and independence while “leaning against climate-related risks” (Campiglio et al., 2018a; Schoenmaker and Van Tilburg, 2016; de Galhau et al., 2019). Additionally, conflicts between the joint conduct of green monetary policy and prudential policy tools are possible due to intertwined transmission mechanisms (D’Orazio and Popoyan, 2020).

In fact, the goals and toolkits of green prudential regulation and monetary policy differ substantially (Svensson, 2018). Whereas the former focuses on green financial stability, i.e., reducing systemic risks posed by climate change, decarbonizing banks’ balance sheets, favouring the flow of funds to green sectors, and on the choice of the green tools (Lamperti et al., 2019), the latter relies, in the majority of the cases, on the policy rate to ensure price stability. However, since their field of influence passes through the financial system, they are characterized by an intertwined transmission mechanism (Barnea et al., 2015; Brunnermeier and Sannikov, 2014).

Moreover, considering that one policy is shaping the playground of the other, their respective impact should be taken into consideration in their implementation. Thus, the existence of climate-related financial risks, together with the need to scale up green finance, call for the development of a “synthesis” between monetary and green prudential policymaking. The latter boils down to Tinbergen’s well-known principle according to which “for each policy objective, at least one policy instrument is needed” (Tinbergen, 1939, 1952).

Relying on Tinbergen’s “*n objectives - n tools*” formula, incorporating green financial goals in the central bank’s price stability mandate could, on the one hand, endanger the principle itself and, on the other hand, bring to an over-stretching of the mandate making it too broad and less explicit, thus undermining the authority’s independence (Cochrane, 2020). However, as noted by D’Orazio and Popoyan (2020), if the green prudential regulation treated as a composite part of a more general prudential policy, the “leaning against the climate-related risk” function can be fulfilled without violating the Tinbergen principle. In particular, looking at the mappings of central banks financial regulatory governance models in Figure 3 we can see that governance model where the financial regulations are given either to a separate authority (i.e. separate model) or to a separate committee (i.e. committee model) guided by central banks and the most spread ones. Moreover, putting together Figures 2 and 3, one can note that the countries that have adopted tools to align the financial sector to sustainable objectives mainly belong to separate models (D’Orazio and Popoyan, 2020). While this arrangement safeguards the Tinbergen Principal, it will require a greater level of coordination between the monetary and the prudential authority since the “distribution” of the green prudential regulation among several authorities may hamper the decision-making reduce accountability and increase the risk of an inaction bias.

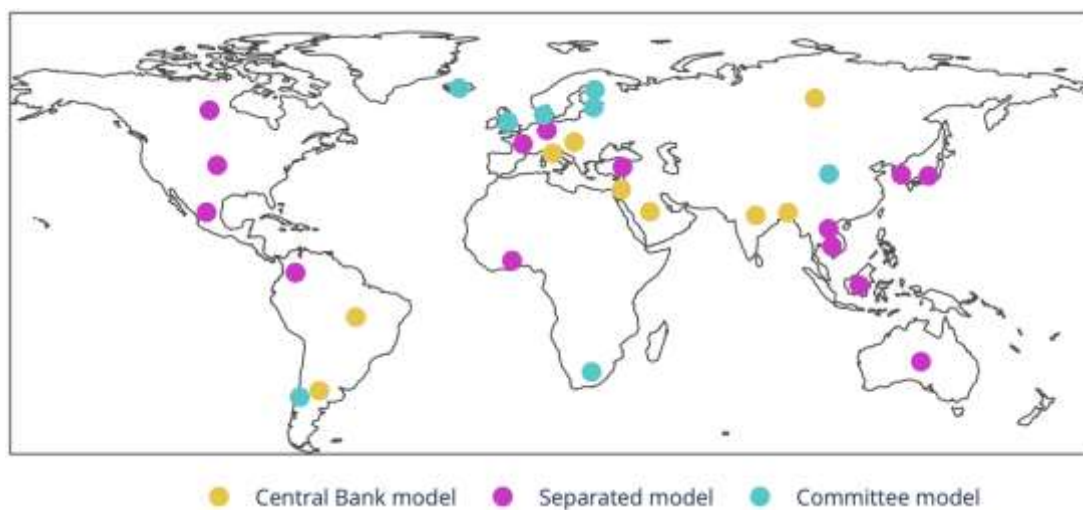


Figure 3: Central bank financial regulatory governance models in the active countries. Source: Authors’ calculations based on IMF Central Banks Legislation Database double-checked with Central bank laws and statutes.

Proceeding with analysis and putting together the obtained results of green financial policy adoptions with the structure of central banks mandates (see Figure 1), we can see that monetary authorities that have no financial stability in their structural mandates or have it “at the bottom” of the hierarchy frequently chose the separated models. Alternatively, monetary authorities with implicit financial stability mandate chose models with greater central bank participation, i.e., central bank or committee models. Accordingly, among active countries in the green finance debate, the most common central bank governance setups in the presence of climate-related financial policy are the separated models.

4 Conclusions

The last five years have seen increasing consideration from scholars, policy analysts, and practitioners on central banks' role and their policy responses in dealing with climate change challenge. While the debate on the urgency of interventions by central banks and financial regulatory authorities levitates, the central banks moving in this direction has been rising; however, the overall number is still limited. Despite the mounting knowledge and advance made in quantifying the adverse impact of climate-related risk on price and financial stability, there are no internationally agreed-upon regulatory schemes to withstand the potential losses caused to the financial sector.

The chapter seeks to provide a state-of-the-art analysis of the current debate on the involvement of central banks and financial regulators in green debate and their contribution in aligning the finance sector with sustainable transition roadmaps. It summarises the possible tools available to central banks and macroprudential authorities and their consecutive usage. We study how the central bank has adopted its structures to cope with climate uncertainty. Additionally, we identify the conflict areas between the joint conduct of green monetary and financial policies and propose how to solve them.

For the sake of analysis, a critical distinction must be introduced between the two responsibilities that central banks undertake in most countries: the implementation and conduct of monetary policy and the supervision, regulation, and oversight of financial institutions' activities. Furthermore, the literature has pointed to paths in which monetary policy could support the green transition through market-shaping approaches. However, as our analysis demonstrates, the central banks are leaning towards market-fixing instruments that are called to incentivise financial market participants to internalise the inherent mispricing of assets. In fact, according to a recent survey conducted by OMFIF (2020), most central banks are worried about the usage of market-shaping tools. They are concerned that those tools could have distortionary, unintended consequences while applied to the current myopic state where the climate-related financial risks are neatly measured. In particular, the central banks that responded to the survey identify two significant obstacles to the incorporation of climate risks into supervisory practice: (1) missing green taxonomy (Carney, 2019) and (2) lack of climate risk data. Similar conclusions were reached by the NGFS survey of 26 central banks from 51 countries (NGFS, 2020) and highlight the need for consistent, comparable, and reliable climate risk data. In the shadow of these drawbacks, only a small set of central banks have implemented far-reaching climate risk mitigation policies. So far, only a few countries proceeded in this path, with only the BoE taking an active step towards a green transition. The PBoC since 2018 expanded eligible collateral, including green assets for lending; the Bank of Japan since 2012 has been supporting lines of credit to green activities, while recently, the ECB is showing increasing interest in relevant policies, pointing in the direction of "green quantitative easing".

There is a critical issue in the debate of central banks being involved in the battle against climate change in the quality of monetary authority that explains their lesser effective involvement. As highlighted by Cochrane (2020) and Tooze (2020) it will have grave implications of central banks independence and maintenance of market neutrality due to the possible overstretching of its

mandate. Accordingly, most central banks see their contribution to green debate through their financial regulatory and oversight function, considering that most of them have adopted financial stability in their institutional mandates in the aftermath of a financial crisis. As we discussed above, most of the effectively adopted green finance tools are of financial regulation and macroprudential nature. We can also notice that developing and emerging economies are more active in their effective adoption than the developed world. Moreover, in many cases, this green mandate is jointly to deliver by multiple agencies.

However, we also point out that joint conduct of green financial regulatory and monetary policies are prone to conflicts because of existing intertwined transmission mechanisms. We highlight that the conflict can be less pronounced in a specific policy arrangement than the others respecting Tinbergen's principle. We found that in the governance structures where the prudential mandate is not imbedded in monetary one, but rather is separate either in terms of delegated authority out of central banks roof or in a separate committee with central banks' participation can allow avoiding the conflicts, but will require higher coordination efforts. Our study emphasises that even if these arrangements are already prevailing in the world map after the post-crisis arrangements and could embrace climate-related risk management schemes, further research is needed on the advantages and disadvantages of the climate-related financial instruments and green monetary policy options, taking into account the country-specific characteristics.

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