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Banking in Times of Climate Change: Next Steps for UK's Financial Regulators

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Declaration

I hereby certify that this policy report, which is 10,936 words in length, has been composed by me, that it is the record of work carried out by me, and that it has not been submitted in any previous application for a degree.

This project was conducted by me at the University of St Andrews from May 2022 to August 2022 towards fulfilment of the requirements of the University of St Andrews for the degree of MSc Sustainable Development under the supervision of Dr Antje Brown.

Emilia Noa Sensenbrenner

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Abstract

The transition to net zero greenhouse gas emissions by 2050 requires a step change in bank lending behaviour. This policy report contributes to the wider sustainable development debate by investigating the next steps UK's financial regulators need to take to tackle climate change via the banking sector. An in-depth analysis of various policy options shows that the current market-based approach is likely to be ineffective and more proactive and market-shaping policy tools are warranted. Therefore, the reconsideration of credit guidance policy tools is recommended. While more research is needed to establish the feasibility and effectiveness of these policies, they would clearly necessitate a paradigm shift in banking regulators' currently dominant narrative.

Contents

1. Introduction

Climate Change and the Banking Sector

Climate change is one of the greatest challenges, if not the greatest challenge, for humanity nowadays. The Intergovernmental Panel on Climate Change (IPCC)[1] has warned of the potentially disastrous consequences of human activities for the Earth's climate, and hence the flourishing of humanity itself, for decades already (IPCC, 2021; IPCC, 1992). Yet, policymakers are taking this issue seriously only since a few years. The Paris Agreement adopted in 2015, where 196 parties set the goal of limiting global warming to well below 2°C above pre-industrial levels, is the first legally binding global climate change agreement (UNFCCC, 2022). To achieve this, governments around the world are urged to reduce greenhouse gas emissions (hereinafter "emissions") to *net zero*[2] by 2050 (IEA, 2022). However, despite the ambitious commitments that have been made in recent years, policy efforts to achieve the transition to *net zero* are still deemed to be insufficient (IEA, 2022; IPCC, 2022).

This is particularly the case for the financial sector. Although the Paris Agreement recognises the importance of aligning financial flows with its overarching goal (UNFCCC, 2022), the most recent assessment report of the IPCC (2022, p. 17) notes that progress towards this is slow. Financial flows towards high-emission activities, which are heavily dependent on fossil fuels, remain greater than those aimed at mitigating and adapting to climate change ("low-emission activities") (IPCC, 2022, p. 17). This stands in sharp contrast to the International Energy Agency's (IEA) recommendation to stop financing new fossil fuel projects beyond 2021 (IEA, 2022, p. 11).

While public finance plays an important role in accelerating the transition to *net zero*, private finance is expected to stem the majority of the required investments for meeting the goal of the Paris Agreement (IEA, 2022, p. 12). This puts banks in the spotlight of current climate change conferences, given that they are dominating credit provision and creation in many countries, most notably in Europe (Alexander and Fisher, 2019, p. 2; United Nations Climate Change, n.d.). Bank lending is considered to be particularly

[1] A list of abbreviations can be found in Appendix 1.
[2] A summary of the definitions of key terms highlighted in italics can be found in Appendix 2.

important because banks decide where to allocate credit and serve as the primary source of external finance for companies in most countries (Alexander and Fisher, 2019). Hence, in their role as financial intermediaries for the real economy, banks play a prominent role in financing the transition to *net zero* (Alexander and Fisher, 2019).

The Role of Banking Regulators in Tackling Climate Change

Generally, the role of banking regulators is to ensure the stability of the banking system and consequently the economy (Alexander and Fisher, 2020). In most countries, the government mandates the national central bank with this task. Central banks are largely technocratic institutions whose leaders are unelected and which are usually independent from the government (Alexander and Fisher, 2020, p. 52). As such, they are bound to operate within their legal remits when delivering their mandates and discharing their supervisory responsibilities (Alexander and Fisher, 2020, p. 52). Remarkably, in the same year in which governments worldwide signed the Paris Agreement, a landmark speech was held by the then Governor of the Bank of England (BoE), the central bank of the United Kingdom (UK) (Carney, 2015). Taking into account the mandate of central banks, Carney (2015) warned that climate change can disrupt the banking sector. Similar to the business and the political cycle, Carney (2015, p. 2) argued that the horizon of central banks is too short to take into account the impacts of climate change in the future – an observation that is now widely known as the "tragedy of the horizon".

Since then, a debate has unfolded about the role of banking regulation in tackling climate change. While there appears to be a consensus that banking regulators play a role in the transition to *net zero*, it is unclear to what extent and how they can ensure that private finance supports the Paris Agreement (e.g., Feyen et al., 2020; Alexander and Fisher, 2019). To date, the desired step change in bank lending behaviour has not occurred (IPCC, 2022; Chenet et al., 2021; Ryan-Collins, 2019).

Research Question and Outline of the Policy Report

This policy report focuses on banking regulation in the UK. In 2019, the UK government became the first national government of a high-income country that committed to a legally binding target of *net zero* emissions by 2050 (GOV.UK, 2019). Moreover, the efforts of banking regulators in the UK to address climate change since Carney's (2015) speech are

considered to be among the most advanced (Feridun and Güngör, 2020, p. 6). However, although the UK is regarded as a leading country for climate policy with substantial financial support for the transition *net zero*, no country seems to be doing enough to meet the goal of the Paris Agreement (IPCC, 2022; Burck et al., 2021). Hence, the research question this policy report seeks to answer is the following:

What steps do financial regulators in the UK need to take to tackle climate change via the banking sector?[3]

By focusing on the main driver of climate change – emissions caused by human activities (IPCC, 2021) – this policy report aims to contribute to a better understanding of how progress in this narrow but crucial component of sustainable development could be achieved. The next section explains the analytical approach used to address the research question and describes the research process and data sources. The third section provides an overview of climate change-related banking regulation with a focus on the UK. This includes an explanation of the historical context of climate change-related banking regulation in the UK as well as an outline of the current regulatory landscape. Finally, this section highlights the limitations of the current policy approach to climate change-related banking regulation. The fourth section explores the various policy options that have been suggested by policy researchers to address climate change in banking regulation. Based on this, policy recommendations for banking regulators in the UK are provided to bring about the alignment of private finance with the goal of the Paris Agreement. The conclusion summarises the policy report, outlines the limitations of the policy recommendations, and provides recommendations for further research.

[3] Terms like "financial institution" or "financial regulation" usually refer to both banks and insurance companies. However, as the focus is exclusively on banks, these terms should be interpreted as only concerning banks throughout the policy report.

2. Data Analysis and Sources

This section outlines how the data used in the remainder of the policy report was analysed. First, the analytical approach of the research is explained. Second, the research process is described. Third, the sources of data and types of documents considered are specified.

Analytical Approach

The exploratory nature of the research question implies the need to employ a qualitative research approach. As climate change impacts human societies and economies in unpredictable and non-linear ways, it is impossible to conduct quantitative research using past data in order to provide recommendations for future banking regulation. The use of a qualitative research approach is also justified by the complexity of the topic as well as the fact that relatively little is known about climate-change related banking regulation to date (Elliott and Timulak, 2005, p. 149). Given the limited scope of the policy report, secondary research is considered to be most feasible to address the research question (Rodriguez, 2021).

The research paradigm can best be described as interpretive (Rodriguez, 2021; Bhattacherjee, 2012). As encouraged by Elliott and Timulak (2005, p. 147) for descriptive-interpretive qualitative research, an individual mix of methods is used instead of sticking to one specific research method under a particular "brand name". This implies that the researcher can adapt the collection and analysis of data in a way that is deemed to be most appropriate for addressing the research question (Elliott and Timulak, 2005, p. 148). While this approach allows for great flexibility, it also involves a degree of interpretation by the researcher. As this is influenced by the researcher's positionality, the detailed outline of the research process and the overview of data sources in the two next sub-sections aim to increase transparency about how the data was analysed.

Research Process

The research process started with the formulation of the research question. Afterwards, a draft outline was created for the policy report, which centred around six topic areas that were considered to be crucial for addressing the research question. Next, sub-research questions were defined for each topic area in order to guide the further research process

and to ensure that all collected data would be focused on answering the overarching research question. The subsequent data collection strategy was open-ended and allowed for a flexible inquiry of the literature (Elliott and Timulak, 2005).

The literature repository was captured in an Excel spreadsheet, which was sorted according to author(s), title, and topic areas (see Appendix 3). Methodological literature that did not relate to the content of the research question was indicated differently (see Appendix 3). The reading progress was then tracked in the Excel spreadsheet, while notes were taken in a separate document. The initial repository was broadened throughout the research process using the snowball method, meaning that references to literature that seemed to be relevant for answering the research question would be added to the repository. After each reading, a subjective ranking from 1 (highly relevant) to 5 (not directly relevant) was assigned to the literature in order to indicate its relevance to the research question (see Appendix 3). This ranking was used later on to ensure that the most relevant literature was included in the final policy report.

Data Sources

For the initial literature repository, data was sourced primarily through key word searches in online libraries such as the University of St Andrews' online library, Scopus, and Web of Science. Key words included terms such as "climate change and banking regulation", "green prudential regulation", "sustainable financial policy", or different combinations of these words and similar words. The types of documents gathered from these sources were mainly academic and research papers.

As mentioned in the previous section, the initial literature repository was broadened with additional literature throughout the research process. In addition to academic and research papers, this also included some grey literature such as policy reviews and journalistic outputs. The sources of data were also widened to web-based search engines and specific organisations' websites (e.g., the BoE's website).

3. Overview: Climate Change-Related Banking Regulation

This section gives an overview of climate change-related banking regulation in order to provide context for the fourth section of this policy report, which directly addresses the research question. First, this section explains the historical context of climate change-related banking regulation in the UK. This includes a description of the institutional structure of banking regulation in the UK, followed by an outline of how climate change emerged as an issue on the agenda of banking regulators. Second, the current regulatory landscape is outlined. While the focus is on banking regulation in the UK, some references are made to other countries and especially the European Union (EU). Third, the main limitations of the current approach to climate change-related banking regulation are highlighted.

Historical Context

Institutional Structure of Banking Regulation in the UK

The institutional structure and preferences of banking regulation in the UK have undergone fundamental changes in the past three decades and were shaped most significantly by the global financial crisis in 2007-08 (hereinafter "crisis"). Prior to the crisis, banking regulation in the UK was characterised by financial deregulation and market liberalisation (James and Quaglia, 2020). Banking regulation was the primary responsibility of the BoE and the Financial Services Authority (FSA), both of which were assigned operational independence in 1997 (James and Quaglia, 2020, p. 39). The BoE managed only *monetary policy*, which relates to all activities of a central bank to keep *inflation* at a certain level (BoE, 2022a; James and Quaglia, 2020). The FSA oversaw financial policy and was responsible for the supervision of banks (James and Quaglia, 2020). It focused only on the supervision of individual banks (so-called *micro-prudential supervision*), which was thought to be sufficient for ensuring the stability of the overall financial system in the early 2000s (James and Quaglia, 2020).

The crisis, at the heart of which stood banks, prompted structural reforms in banking regulation. To restore *financial stability* and to protect taxpayers from future bank failures, elected officials intervened directly in banking regulation (James and Quaglia, 2020, p. 52). The UK government abolished the FSA, as its failure to address the

interconnectedness between banks was perceived to have caused the crisis (James and Quaglia, 2020, p. 52). The responsibility for *micro-prudential supervision* of banks has since been moved to a new entity within the BoE, the Prudential Regulation Authority (PRA), while the responsibility to ensure the stability of the financial system as a whole has been assigned to the newly created Financial Policy Committee (FPC) (Beck et al., 2022; James and Quaglia, 2020). *Financial stability* is now defined as a "safe and sound" financial system, where people have trust in financial institutions and markets (BoE, 2022b). To ensure *financial stability*, the FPC takes a systemic view on the banking sector and employs so-called *macro-prudential supervision* (James and Quaglia, 2020). *Macro-prudential supervision* aims to identify, monitor, and reduce *systemic risks*, which comprise all risks that threaten *financial stability* (Beck et al., 2022; BoE, 2022c; James and Quaglia, 2020). These can include, for example, the risk of a cyber-attack or geopolitical risks (BoE, 2022c).

A consequence of the crisis has therefore been a widening of the BoE's mandate. While the BoE's Monetary Policy Committee (MPC) remains responsible for maintaining *price stability* (i.e., keeping *inflation* at a certain level), the BoE – through the PRA and FPC – is now also tasked to ensure *financial stability* (Beck et al., 2022). In addition to the two primary objectives of *price* and *financial stability*, the BoE also has a secondary objective of supporting the economic policy of the UK government (Beck et al., 2022, p. 4). This is communicated annually through a letter from the Chancellor to the Governor of the BoE, providing remit and recommendations to the MPC and the FPC (GOV.UK, 2022).

All in all, the UK is home to one of the toughest banking regimes in the world (James and Quaglia, 2020). Nonetheless, domestic banking regulation is strongly influenced by international regulatory standards as well as political developments. For example, UK banking regulation closely adheres to the standards set by the Basel Committee on Banking Supervision (BCBS) (James and Quaglia, 2020; BIS, n.d.). This is an international regulatory forum whose members comprise central banks and prudential supervisors from 28 jurisdictions, including the BoE (BIS, 2022). In response to the crisis, the BCBS developed the Basel III framework, which is an international standard for banking regulation that predetermines many of the policy tools aimed at reducing *systemic risks* (James and Quaglia, 2020). Banking regulation in the UK is also affected by political developments. The Brexit referendum, which led to the departure of the UK

from the EU in 2020, causes significant uncertainty about the future direction of banking regulation (James and Quaglia, 2020). While the desire for regulatory autonomy by elected officials and financial regulators has been achieved, it remains unclear whether regulatory preferences for banks will become more or less stringent in the future (Institute for Government, 2021; James and Quaglia, 2020).

Climate Change as a Rising Issue on the Agenda of Banking Regulators

Although the banking industry voiced concern about climate change before the crisis already, the topic received little attention from banking regulators prior to 2015 (Bowman, 2010). This changed abruptly when the then Governor of the BoE first discussed the "tragedy of the horizon", which relates to the observation that the time horizon used by central banks' *financial* and *monetary policy* is too short to take into account the potential long-term impacts of climate change (Carney, 2015, p. 2). Carney (2015) argued that climate change poses a risk to *financial stability*, and therefore needs to be addressed by central banks. Because central banks at the time did not perceive climate change to fall within their remit, Mackintosh (2019, p. 28) argues that Carney's (2015) speech indicates the first signal of a possible paradigm shift in central banks' dominant narrative.

Carney's (2015) speech unleashed a wave of research and initiated the founding of various international fora to figure out the impact of climate change on the banking system, and vice versa. For example, Aglietta and Espagne (2016) asserted that climate change should be considered as a *systemic risk* to the banking sector, given that it exhibits all characteristics that are normally attributed to *systemic risks*. One of them is that climate change presents a potentially broad shock to the banking system that simultaneously affects multiple institutions (Aglietta and Espagne, 2016, p. 8). Research by the BoE looked more closely into the different ways in which climate change poses a risk to the banking sector. Two types of climate change-related financial risks (short: climate risks) are considered to be particularly relevant for central banks. The first type are physical risks, which arise from the physical impact of climate change on human and natural systems, for example through extreme weather events and rising sea levels (BoE, 2017; Batten et al., 2016). The second type are transition risks, which result from the transition to a low-emission economy, for example through changes in climate policy or technology

(BoE, 2017; Batten et al., 2016). As visualised in Figure 1, both types of risks are considered to be relevant to the banking sector as they affect the firms that banks lend to as well as the assets that banks own (BoE, 2017). Ultimately, they are considered to impact *financial stability* (BoE, 2017).

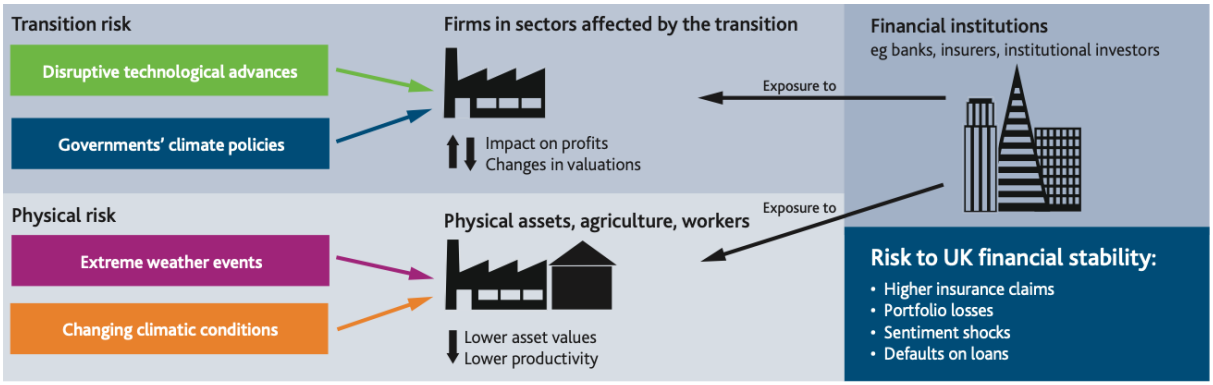

Figure 1

Primary channels for climate-related financial risks (BoE, 2017, p. 100)

Next to these early research efforts, the BoE also became one of eight founding members of the Network for Greening the Financial System (NGFS) in 2017 (Mackintosh, 2019, p. 28). The NGFS seeks to define and promote best practices for central banks to address climate change (Mackintosh, 2019, p. 29). By the end of 2021, membership of the NGFS increased to 105 members and 16 observers, who combined cover more than 85% of global emissions (NGFS, 2022). According to Mackintosh (2019, p. 29), the rapid growth in NGFS membership signifies a consensus leap in central banks' narrative.

Nonetheless, while banking regulators increasingly acknowledge the implications that climate change has for *financial stability*, central banks such as the BoE and the European Central Bank (ECB) contend that the primary responsibility to address climate change rests with governments (Grünewald, 2021; Cœuré, 2018; Batten et al., 2016; Carney, 2015). So far, these central banks have not announced any changes to their *financial* or *monetary policy* in an effort to tackle climate change (Feridun and Güngör, 2020, p. 10). The next sub-section outlines the current efforts they are undertaking instead.

Current Regulatory Landscape

Climate Change-Related Banking Regulation in the UK

The BoE's current efforts are focused on embedding climate risks in its supervisory approach rather than changing its *financial* or *monetary policy*. In 2019, the PRA, in its role as the *micro-prudential supervisor* of banks in the UK, was the first banking regulator worldwide to set out supervisory expectations for banks regarding their management of climate risks (PRA, 2021). These expectations are centred around four areas. First, banks are expected to consider climate risks in their governance arrangements, for example by defining clear roles and responsibilities for the board of the bank to manage these risks (PRA, 2019). Second, the PRA (2019) expects banks to incorporate climate risks in their risk management of other financial risks. This means that banks are expected to figure out how climate change might impact for example credit risk, which is the risk that a borrower is unable to repay their loan (PRA, 2021). Third, banks are expected to conduct scenario analyses, meaning that they should try to model different ways in which climate change might impact their business (PRA, 2019). These assessments are expected to inform banks' business strategies (PRA, 2019). Fourth, the PRA (2019) expects banks to publicly disclose the climate risks they are facing and to explain how they are dealing with them. The implementation of these expectations will be actively supervised as of the end of 2022 (PRA, 2021).

The main policy tool of the PRA are however not supervisory expectations, but capital requirements (PRA, 2021). These are explained in more detail in the fourth section. Here, it should be mentioned that although the PRA (2021) recognises that climate risks are systemic, it does not consider capital requirements to be adequate for addressing the causes of climate change. However, this opinion of the PRA (2021) is not final, and it plans to set out its view on the use of capital requirements for addressing climate risks at the end of 2022. The PRA (2021, p. 30) also acknowledges two gaps in its current regulatory framework: a "capability gap", which relates to the difficulty of estimating climate risks due to a lack of data, and a "regime gap", which is due to the fact that methodologies used to calculate capital requirements rely on past data and are therefore unable to account for future climate risks.

Although no changes to the existing regulatory framework have been undertaken by the BoE to date, it is important to take note of the two most recent letters of remit and recommendations for the FPC (HM Treasury, 2022; HM Treasury, 2021). The Chancellor emphasises that "the (FPC) should (…) regard risks from climate change as relevant to its primary objective", which is *financial stability* (HM Treasury, 2021, p. 6). Moreover, the BoE should consider climate change as part of its secondary objective to support the government's economic policy goal of achieving "environmentally sustainable and resilient growth" (HM Treasury, 2021, p. 8). In response to this, the BoE launched the Climate Biennial Exploratory Scenario (CBES), which explored how climate change impacts the UK's banking sector as a whole (BoE, 2022d; BoE, 2021a). The results were published in May 2022 (BoE, 2022d). While the BoE (2022d) recognises that early action on reducing emissions would be most effective in tackling climate change, a main conclusion of the CBES is that the responsibility for action rests with the UK government and the banking industry itself.

Climate Change-Related Banking Regulation in Other Countries

Banking regulators worldwide differ in terms of whether – and to what extent – they address climate risks in their regulatory and supervisory frameworks (FSB, 2020, p. 6). According to the BCBS (2020, p. 1), a majority of its members considers it appropriate to consider climate risks in their existing regulatory and supervisory frameworks (for a map of all members and observers of the BCBS, see Appendix 4). A distinction can be made between climate change-related banking regulation in high-income countries and lower-income countries. Here, the line is drawn using the World Bank's (2022) country classification based on gross national income per capita. The mandates of central banks in lower-income countries are usually broader and more explicitly aimed at supporting governments' development objectives (Campiglio et al., 2018, p. 466). Because of these broader mandates, some central banks in lower-income countries are already actively encouraging bank lending to low-emission activities (Campiglio et al., 2018, p. 464). In contrast, the mandates of central banks in high-income countries, such as the UK, are narrowly focused on *price* and *financial stability* (Campiglio et al. 2018, p. 466). Due to this, these central banks tend to avoid interfering with market dynamics or government policies (Campiglio et al., 2018, p. 466). As high-income countries are responsible for 38% of global emissions, while being home to only 16% of the world's

population (Ritchie, 2018), this policy report focuses primarily on the policy options available to banking regulators in high-income countries.

Among high-income countries, banking regulators in the UK were initially considered to have acted much faster than their peers in addressing climate change (Feridun and Güngör, 2020, p. 6). However, the EU is catching up quickly. In 2018, it launched the Action Plan on Sustainable Finance, which lays out an ambitious plan for banking regulators to address climate change in their regulatory framework (Busch et al., 2021, p. 21). Based on this, the ECB defined supervisory expectations and conducts supervisory reviews in the EU, similar to the PRA's supervisory expectations and the recently published CBES (Busch et al., 2021, p. 47). By mid-2025, the European Banking Authority – the EU's equivalent to the PRA – plans to set out its views on how to integrate climate risks in capital requirements (Busch et al., 2021, p. 47). This is similar to the PRA's (2021) plan to do the same by the end of 2022. Furthermore, the European Commission enforced two key regulations to accelerate the Action Plan on Sustainable Finance (Busch et al., 2021, pp. 22-23). The Taxonomy Regulation specifies which economic activities can be classified as environmentally sustainable (Busch et al., 2021; Lovisolo, 2021). The Sustainable Finance Disclosure Regulation increases transparency about the environmental sustainability of financial products, based on the definitions of the Taxonomy Regulation (Busch et al., 2021; Lovisolo, 2021). A common definition for environmental sustainability and increased transparency in financial markets are considered to be fundamental for the incorporation of climate risks in capital requirements (Riso, 2021; Mackintosh, 2019). A similar taxonomy regulation and disclosure requirements are still being developed in the UK (Green Finance Initiative, 2022; Pickard and Hook, 2022).

This overview of the current regulatory landscape shows that high-income countries are focused on raising banks' awareness about climate risks and improving the understanding of banking regulators about the impact of climate change on *financial stability* (Grünewald, 2021). So far, no central bank has incorporated climate change in its *financial* or *monetary policy* (Feridun and Güngör, 2020, p. 10). The next sub-section highlights the limitations of the current approach to climate change-related banking regulation.

Limitations of Current Climate-Change Related Banking Regulation

Treating Climate Change as a Market Failure

As the previous sub-section shows, current efforts of banking regulators to address climate change are not directly interfering with the market (i.e., the banking sector) and can therefore be described as market-based (Chenet et al., 2021; Ryan-Collins, 2019). In essence, climate change is viewed as a market failure, whereby banks fail to account for the environmental costs of the economic activities they finance (Ryan-Collins, 2019, p. 1). By increasing transparency and setting out supervisory expectations for banks to incorporate climate risks in their business strategy and risk management, banking regulators attempt to fix this market failure. The underlying assumption of this approach is that climate risks are calculable and that once banks quantify them, this will lead to a step change in bank lending behaviour (Chenet et al., 2021; Ryan-Collins, 2019). However, to date, this step change has not occurred (IPCC, 2022; Chenet et al., 2021; Ryan-Collins, 2019).

There is a growing literature warning of the impossibility of calculating climate risks, which is due to the sheer complexity and interconnections between climate change and human systems (e.g., Chenet et al., 2021; Grünewald, 2021; Le Quang and Scialom, 2021; Bolton et al., 2020; Ryan-Collins, 2019). The reliance on a market-based policy approach, coupled with the impossibility of calculating climate risks, is argued to lead to an "inaction bias" among banking regulators (Grünewald, 2021, p. 235; Le Quang and Scialom, 2021, p. 5). By waiting for a substantial improvement of data availability and for a better analytical understanding of climate risks, banking regulators are claimed to delay the action necessary to effectively address climate change (Grünewald, 2021, p. 246; Le Quang and Scialom, 2021, p. 6). Even international initiatives specifically aimed at "greening the financial system" are criticized of suffering from this inaction bias by focusing on issues around market transparency and taxonomy (Grünewald, 2021, p. 246; Mackintosh, 2019, p. 39).

Given that there is certainty that climate change, if left unaddressed, has disastrous consequences for humanity (IPCC, 2021), there is a growing consensus that alternative approaches to banking regulation are required to tackle climate change. More specifically, banking regulators are advised to break with their current market-based approach and to

employ a precautionary approach to banking regulation instead (Chenet et al., 2021; Le Quang and Scialom, 2021; Riso, 2021; Ryan-Collins, 2019). Such an approach would be based on the precautionary principle, which promotes preventative policies that protect the environment in light of uncertainty (Chenet et al., 2021, p. 2). As banks are unable to account for climate risks themselves, a move towards a more qualitative, "market-shaping" approach to banking regulation seems to be warranted (Chenet et al., 2021; Le Quang and Scialom, 2021; Riso, 2021; Krogstrup and Oman, 2019; Ryan-Collins, 2019). However, before exploring policy options that are in line with this precautionary approach in the next section, it is important to understand whether this approach would fall within the remit of banking regulators.

Narrow Views on Central Bank Mandates

As explained earlier, the primary objective of the BoE's mandate is to maintain *price* and *financial stability* in the UK (Beck et al., 2022). Alexander and Fisher (2019, p. 11) consider this to be a prerequisite for tackling climate change, because *price* and *financial stability* enable governments to focus on long-term policies (such as climate policy). Based on the same reasoning, Bolton et al. (2020, p. 47) deduce that any measures aimed to address climate change beyond the current market-based approach would overburden central banks' mandates. However, this line of reasoning misses two important points. First, as argued by Le Quang and Scialom (2021, p. 9), going beyond the current market-based approach may be necessary to ensure *price* and *financial stability* in the future. Second, most central banks' mandates were defined before climate change has been recognized as a major societal issue (Dikau and Volz, 2021, p. 2). In fact, despite some critics accusing central banks of over-stepping their mandates (e.g., Crow and Binham, 2018), it can be observed that central banks interpret their mandates much more freely than their formal mandate might suggest (Dikau and Volz, 2021, p. 14; BCBS, 2020). The BoE is a noteworthy example of this: Although no explicit mention of climate change is made in its formal mandate, it considers climate change to be directly relevant to its primary objective (BoE, 2021a; Dikau and Volz, 2021). Hence, even within existing formal mandates, it can be argued that central banks are responsible for addressing climate change in their regulatory framework (Dikau and Volz, 2021; Riso, 2021).

Another common argument against central banks intervening with the market to tackle climate change is that this is the responsibility of the government. This policy report does not challenge that fiscal tools are first in line and central for addressing climate change. However, it is important to note that unlike central banks, governments are subject to the lobbying power of the fossil fuel industry, which puts them under pressure not to regulate high-emission sectors (Chenet et al., 2021, p. 9; Ryan-Collins, 2019, p. 6). It is also evident that so far, government policy has failed to implement effective climate policy (IPCC, 2022; Bolton et al., 2020). Hence, even though conceptually government policy is the first-best option to tackle climate change, a mix of coordinated policies may be necessary to achieve the transition to *net zero* (Grünewald, 2021; Bolton et al., 2020; Krogstrup and Oman, 2019).

There is widespread agreement that the transition to *net zero* requires both a relative change in the price of fossil fuels and large-scale investments to lower the emissions of existing infrastructure and human activities (IEA, 2022; Krogstrup and Oman, 2019). According to Grünewald (2021) and Krogstrup and Oman (2019), the sheer complexity of this task calls for the coordination of governments' and central banks' policies. While more research is needed to figure out the most effective policy mix for climate change mitigation, the next section focuses on the policy options available to banking regulators.

4. Policy Options and Recommendations

To answer the research question, this section explores the various policy options that have been suggested in academia and policy reviews to address climate change in banking regulation. In one way or another, they aim to either reduce bank lending to high-emission activities (also referred to as "brown" loans) or to increase bank lending to activities that aim to reduce emissions (also called "green" loans). All of them are in line with the precautionary policy approach explained in the previous section (e.g., Chenet et al., 2021). First, adjustments to the Basel III framework are explored. The Basel III framework is split into three pillars, which are examined individually. Additionally, the Basel III framework prescribes liquidity requirements, which are analysed separately. Second, policy options that could be employed by national central banks – outside of the Basel III framework – are investigated. Based on these two sub-sections, the third sub-section provides policy recommendations for UK banking regulators to ensure the alignment of private finance with the goal of the Paris Agreement.

Addressing Climate Change in the International Regulatory Framework for Banks

Pillar I of the Basel III Framework

Pillar I of the Basel III framework sets out minimum capital requirements that all banks regulated by members of the BCBS are expected to hold (BIS, n.d.). In other words, Pillar I prescribes the minimum amount of capital (i.e., financial instruments that can be sold easily and quickly) a bank must hold in relation to the loans it provides to corporations, households, and individuals (BIS, n.d.). Minimum capital requirements are risk-based: the riskier a bank's loan book (the sum of all loans it provides), the more capital it is required to hold (BIS, n.d.). Additionally, Pillar I prescribes a non-risk-based leverage ratio (BIS, n.d.). Based on the size of a bank's loan book, but independent of how risky it is, this determines the minimum amount of capital a bank needs to hold at all times (BIS, n.d.).

Various measures to incorporate climate change considerations into the existing requirements of Pillar I have been proposed. A description of these measures along with their advantages and disadvantages can be found in Appendix 5. While some measures have more merit than others, they all face shortcomings that are difficult to overcome for

banking regulators in the UK. First, Pillar I requirements are determined by the BCBS and leave no room for supervisory discretion, meaning that UK banking regulators would not be able to implement any of these measures independently (NGFS, 2020). Nonetheless, UK banking regulators can influence Pillar I standards through their membership in the BCBS (NGFS, 2020). Second, all proposed measures require the implementation of a taxonomy that clearly defines what constitutes a "green" or a "brown" loan (Riso, 2021; Alexander and Fisher, 2019; D'Orazio and Popoyan, 2019). This does not yet exist in the UK and does not fall within the remit of banking regulators (Green Finance Initiative, 2022). Third, while it impossible to test the effectiveness of the proposed measures, it is believed that they would have to be calibrated at high levels to have the desired impact, which in turn could negatively influence *financial stability* (D'Orazio, 2021, p. 1374; Alexander and Fisher, 2019, pp. 4-5). Therefore, these measures might run counter to the primary objective of the BoE's mandate. All in all, it does not seem feasible for UK banking regulators to introduce any of these measures in the near future.

Pillar II of the Basel III Framework

Pillar II is complementary to Pillar I and allows national banking regulators to set higher capital requirements for individual banks (so-called capital add-ons) based on their own supervisory judgment (Alexander and Fisher, 2020, p. 66). While Pillar I requirements are largely aimed at reducing *systemic risks*, capital add-ons imposed by Pillar II normally only address risks that individual banks face (Alexander and Fisher, 2020, p. 66). National banking regulators determine capital add-ons by reviewing banks' governance and risk management frameworks (BIS, n.d.). In the UK, the PRA (2021) is responsible for setting Pillar II requirements.

As the previous section shows, the PRA set out supervisory expectations for banks regarding climate change in 2019 and will actively supervise the implementation of these expectations as of the end of 2022 (PRA, 2021; PRA, 2019). Theoretically, this enables the PRA to impose capital add-ons if it considers a bank to not monitor and manage climate risks adequately (Bolton et al., 2020, p. 52). However, this approach is inherently flawed. All Pillar II requirements rely on the quantification of climate risks, which is deemed to be impossible (e.g., Chenet et al., 2021; Grünewald, 2021; Le Quang and

Scialom, 2021; Bolton et al., 2020; Ryan-Collins, 2019). Furthermore, capital add-ons are imposed on individual banks based on the individual risks they face, while climate change is widely acknowledged to be a *systemic risk* (PRA, 2021; Aglietta and Espagne, 2016). Finally, effectively incorporating climate change considerations in Pillar II requirements would also rely on the implementation of a taxonomy for "green" and "brown" loans in the UK (D'Orazio, 2021). In sum, adjustments to Pillar II requirements currently do not appear to be sufficient for tackling climate change.

Pillar III of the Basel III Framework

Pillar III sets out disclosure requirements for banks (BIS, n.d.). In terms of incorporating climate change, Pillar III was in fact the first to be addressed by both banking regulators and the banking industry itself (D'Orazio and Popoyan, 2019). This work has largely been driven by the Task Force on Climate-Related Disclosures (TCFD), which is an industry-led task force that was created in 2015 (Busch et al., 2021, p. 26). Although it only provides a voluntary framework for climate change-related disclosures, its work is closely monitored and supported by banking regulators – including the BoE (2022d).

However, disclosure requirements by themselves are a market-based policy tool. Currently, improved disclosure about climate change metrics (such as banks' total emissions) is believed to improve banks' assessment of climate risks, which in turn is presumed to lead to a change in banks' lending behaviour (Grünewald, 2021, p. 242; Bolton et al., 2020, p. 22). As argued earlier, this is unlikely to be the case. While increased disclosure is certainly useful in gaining a better understanding about the impact of climate change on banks, this approach has so far not incentivised banks to align their lending with the goal of the Paris Agreement (IPCC, 2022; Chenet et al., 2021; Ryan-Collins, 2019). Regardless of that, the UK government currently seems to be delaying the enforcement of climate change-related disclosures (Pickard and Hook, 2022). Consequently, Pillar III is not considered to be an effective approach for UK's banking regulators to tackle climate change via the banking sector.

Liquidity Requirements

Apart from the three Pillars discussed above, the Basel III framework also sets out liquidity requirements (BIS, n.d.). Liquidity requirements were introduced in response to the crisis and aim to ensure that banks hold enough liquid assets (i.e., cash and other

financial instruments that can be easily converted to cash), independent of how much they lend out or how risky the loan book is (BIS, n.d.). By ensuring that banks do not lend out too much of the money[4] that is deposited with them to long-term, risky projects, liquidity requirements aim to protect banks in times of a bank run (when all depositors of a bank try to withdraw all their money at once) (BIS, n.d.). Long-term, risky projects are usually illiquid, meaning that they cannot easily and quickly be converted to cash again.

While the aim of liquidity requirements is to ensure *financial stability*, they have also been criticised for preventing banks from lending to "green" projects, which tend to be illiquid (D'Orazio, 2021, p. 1375; Grünewald, 2021, p. 243; D'Orazio and Popoyan, 2019, p. 27). D'Orazio (2021, pp. 1375-1376) and D'Orazio and Popoyan (2019, p. 31) propose to adjust liquidity requirements in a way that would reduce liquidity requirements for "green" loans, while at the same time increasing them for "brown" loans. While such adjusted liquidity requirements would be relatively easy to implement, they would again depend on the implementation of a taxonomy for "green" and "brown" loans in the UK (D'Orazio, 2021). Hence, the adjustment of liquidity requirements currently does not appear to be feasible for banking regulators in the UK.

Alternative Policy Options for National Central Banks

"Green" Quantitative Easing

In contrast to *financial stability*, for which policy tools are largely determined by the Basel III framework, ensuring *price stability* in the UK is the sole responsibility of the BoE (2022a). This is done through *monetary policy*, whereby the BoE (2022a) aims to influence the amount of money circulating in the UK's economy in such a way that *inflation* stands at 2% year on year. Before the crisis, the BoE influenced the amount of money in the UK's economy with one "conventional" monetary policy tool (Campiglio et al., 2018, p. 465). However, the crisis showed that this tool is effective only when *inflation* is above 0% (BoE, 2022a). Since the crisis led to low levels of *inflation*, the BoE has been employing an "unconventional" monetary policy tool: quantitative easing (Campiglio et al., 2018, p. 465). Quantitative easing involves the purchase of large amounts corporate bonds from banks (i.e., the loans that banks provide to companies)

[4] "Money" includes both cash and electronically held money (bank deposits).

(BoE, 2022a). By buying these corporate bonds in exchange for money, central banks provide banks with more money to use for lending again, which can then increase the total amount of money – and *inflation* – in the economy (BoE, 2022a).

While quantitative easing is considered to have been successful in bringing *inflation* back to the target, it has been accused of being biased towards high-emission sectors (Chenet et al., 2021; Grünewald, 2021; Campiglio et al., 2018; Monnin, 2018). More precisely, central banks – including the BoE – are considered to have purchased corporate bonds primarily from high-emission sectors, thereby disproportionately supporting these sectors and promoting a "carbon lock-in" of the economy (Chenet et al., 2021, p. 8; Campiglio et al., 2018, p. 465). To counteract this bias, it has been suggested that central banks could reflect climate change considerations in their quantitative easing programmes (Le Quang and Scialom, 2021; Krogstrup and Oman, 2019; Campiglio et al., 2018; Monnin, 2018).

The BoE (2021b) announced that it would apply "green" criteria to its quantitative easing purchase decisions as of November 2021 (Shankleman, 2022). Given the large size of the BoE's quantitative easing programme (shown in Figure 2), this was considered to be a promising step towards aligning the BoE's *monetary policy* with the goal of the Paris Agreement (Shankleman, 2022).

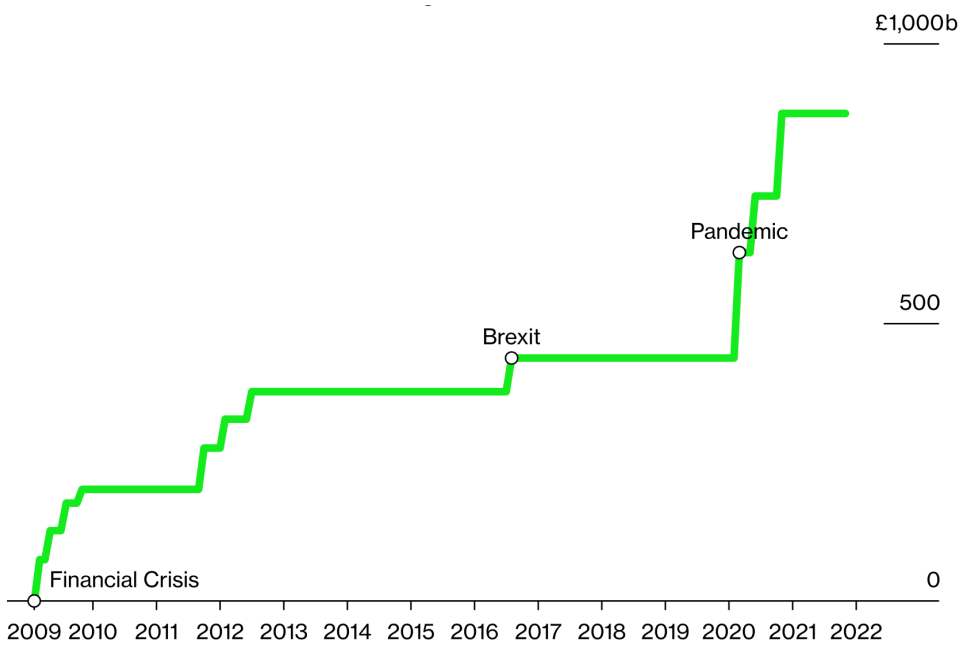

Figure 2

BoE's bond purchase target (as of November 2021, this includes corporate bonds worth £20 billion) (BoE, 2022e; Shankleman, 2022)

However, an early study on the BoE's "green" quantitative easing programme argues that it lacks ambition (Dafermos et al., 2022). The "green" criteria are deemed to be insufficient to substantively reduce the underlying emissions of the quantitative easing programme (Dafermos et al., 2022). Paradoxically, Dafermos et al. (2022) find that the BoE may in some cases even give preferential treatment to high-emission companies compared to low-emission companies. To significantly reduce emissions in the BoE's quantitative easing programme, Dafermos et al. (2022) propose more stringent purchase criteria that would categorically exclude high-emission companies from the programme.

While this would be an appropriate next step, the BoE is currently shifting away from its "unconventional" monetary policy tool. Due to the rapidly rising rate of *inflation* in the UK, the BoE will not increase its corporate bond purchases in the foreseeable future and has been prompted to return to its "conventional" monetary policy tool (BoE, 2022a; Shankleman, 2022). Hence, the current economic condition in the UK renders "green" quantitative easing an inaccessible policy option for the BoE at the moment.

Climate Change Considerations in Collateral Frameworks

The "conventional" monetary policy tool refers to the bank rate that the BoE determines (BoE, 2022a; Čáp et al., 2020). The bank rate is the interest rate that banks are charged for borrowing money from the BoE (2022a). Banks can borrow money from the BoE to meet their short-term liquidity needs, for example if they are temporarily faced with more deposit withdrawals than they have liquid assets (i.e., cash) available (BoE, 2022a). By setting the bank rate, the BoE can therefore influence the overall amount of money in the economy: if it increases the bank rate, borrowing money from the BoE becomes more expensive for banks, which reduces the total amount of money in the economy and lowers *inflation* (BoE, 2022a). Provided that *inflation* is above 0%, the opposite effect occurs when the BoE decreases the bank rate (BoE, 2022a). As indicated above, the BoE has recently increased the bank rate to counteract rising *inflation* in the UK (BoE, 2022a; Shankleman, 2022).

If a bank wants to borrow money from the BoE, it needs to pledge collateral (BoE, 2022f; Čáp et al., 2020). If a bank is unable to repay the loan, this collateral protects the BoE from incurring financial losses (BoE, 2022f). Therefore, collateral needs to consist of financial instruments that are of high quality for the BoE to be able to sell or keep it in

case a bank defaults on its loan (BoE, 2022f). These financial instruments include, among others, corporate bonds and mortgages (BoE, 2022f). It has been suggested that collateral frameworks could take into account climate change considerations (Le Quang and Scialom, 2021, p. 8; Alexander and Fisher, 2020, pp. 56-57; Bolton et al., 2020, p. 54; Dikau et al., 2020, p. 8). For example, the BoE could favour collateral that is connected to low emissions (e.g., corporate bonds from low-emission companies) and penalise collateral that is connected to high emissions (Le Quang and Scialom, 2021, p. 8; Dikau et al., 2020, p. 8). According to Le Quang and Scialom (2021, p. 8), such a collateral policy could encourage banks to reallocate their lending to borrowers with lower emissions. However, this policy option would also depend on the implementation of a taxonomy for "green" and "brown" loans in the UK. Moreover, collateral policy is considered to be a relatively technical issue (Alexander and Fisher, 2020, p. 56), implying that it cannot easily be modified and potentially is not the most straightforward policy option to tackle climate change via the banking sector.

Central Bank Portfolio Management

When employing "conventional" or "unconventional" monetary policy tools, the BoE essentially uses its own funds (i.e., the money it creates) to either lend out money to banks or to purchase corporate bonds from banks. Apart from its own funds, the BoE manages two additional portfolios of financial instruments. First, it holds foreign currency reserves, which it can use to influence the foreign exchange rate of the pound sterling in order to maintain *price stability* in the UK (BoE, 2021c). Second, it manages the pension fund savings of the BoE's staff (BoE, 2021d). While the first portfolio consists only of foreign currency reserves, the second one is invested in many different financial instruments (BoE, 2021c; BoE, 2021d). Regarding the latter, Bolton et al. (2020, p. 53) suggest that central banks could incorporate climate change considerations in their portfolio management. By becoming more transparent about their own portfolio management, Bolton et al. (2020, p. 54) and Grünewald (2021, p. 254) argue that central banks (i.e., the BoE) could lead by example and incentivise the wider banking sector to take into account climate change considerations.

However, this is unlikely to bring about the desired step change in bank lending behaviour for two reasons. First, the pension fund's size is negligible compared to the amount of money involved in the BoE's *monetary policy*. While the quantitative easing programme alone includes purchases of corporate bonds worth £20 billion (BoE, 2022e), the £4.7 billion managed by the pension fund (BoE, 2021d) are insufficient to send a strong signal to the banking sector. Second, this approach would also rely on the market-based assumption that banks would change their lending behaviour because the BoE aligns its own pension fund's portfolio with the goal of the Paris Agreement. Altogether, the suggestions by Bolton et al. (2020, p. 54) and Grünewald (2021, p. 254) are considered to be ineffective in tackling climate change.

Credit Guidance Policy Tools

All policy options explored until now aim to incorporate climate change considerations into the existing policy toolkit of the BoE. In addition to the rapidly growing literature in this field, there is also a small strand of literature that examines central bank policy tools that have long been abandoned in high-income countries. More specifically, some authors suggest that central banks could make use of credit guidance policies again, through which they could actively influence the allocation of bank lending (Chenet et al., 2021, p. 8; Grünewald, 2021, p. 244; Le Quang and Scialom, 2021, pp. 7-8; D'Orazio and Popoyan, 2019, pp. 32-33; Ryan-Collins, 2019, p. 6; Bezemer et al., 2018). According to Bezemer et al. (2018, p. 27), reintroducing credit guidance policies may be necessary to "ensure sufficient finance for major economic challenges, such as the transition to a low-(emission) economy".

Credit guidance policies can take various forms, but the ones that are discussed most widely are maximum credit ceilings and minimum credit floors (Grünewald, 2021, p. 244; Le Quang and Scialom, 2021, pp. 7-8; D'Orazio and Popoyan, 2019, pp. 32-33). This would be a straightforward mechanism in which a maximum credit ceiling determines the maximum amount of lending a bank can provide to "brown" activities and a minimum credit floor prescribes the minimum amount a bank must lend to "green" activities (Grünewald, 2021, p. 244; D'Orazio and Popoyan, 2019, pp. 32-33). The advantage of this approach is that it is not risk-based, meaning that banks would not need to quantify climate risks before deciding whether they should change their lending behaviour.

In contrast to the previously discussed measures, which are only indirectly influencing bank lending behaviour, credit guidance policies would be a "market-shaping" policy approach that directly determines the activities that banks lend to (Ryan-Collins, 2019; Bezemer et al., 2018). Given that the current contribution of private finance falls short of the required investment levels needed to meet the goal of the Paris Agreement, this policy option appears to be the only one that is impactful enough to bring about the desired step change in bank lending behaviour.

Clearly, such a drastic policy option does not come without several complications. First, actively intervening with the market is currently not common practice for central banks. Indeed, credit guidance policies would require close cooperation between central banks and governments to ensure that central banks act in line with the economic objectives of governments (Chenet et al., 2021, p. 8; Ryan-Collins, 2019, p. 6). Second, the impact of these policies on the primary objectives of central banks, i.e., *price* and *financial stability*, is unclear. At the time of writing, research on this appears to be limited. Third, credit guidance policies would also require the implementation of a taxonomy for "brown" and "green" loans in the UK. Again, this is still underway and the responsibility rests with the UK government (Green Finance Initiative, 2022). All in all, more research is needed to establish whether credit guidance policies would be a feasible and effective policy approach for UK banking regulators. Nonetheless, out of all the policy options discussed, this one appears to be the most straightforward in addressing the challenge that climate change poses to central banks.

Policy Recommendations for Banking Regulators in the UK

The exploration of policy options in the previous two sub-sections shows that there are several ways in which UK banking regulators could address climate change. While some of these options are already being implemented by the BoE and the PRA, others have not yet found their way into policy discussions. So far, the approach taken by UK banking regulators appears to be insufficient in bringing about a step change in bank lending behaviour. Hence, the overall recommendation for UK banking regulators is to explore "market-shaping" policy options that actively influence the direction of bank lending (Chenet et al., 2021; Le Quang and Scialom, 2021; Riso, 2021; Krogstrup and Oman, 2019; Ryan-Collins, 2019). Figure 3 illustrates the policy recommendations made below.

In terms of *financial policy*, the BoE is bound to the Basel III framework. Pushing for the consideration of climate change in existing Pillar I requirements is likely to be burdensome and time consuming. Nevertheless, given that they influence all members of the BCBS, banking regulators in the UK should advocate for further exploration of the policy measures proposed in Appendix 5. Regarding Pillar II requirements, the PRA is going to be the first *micro-prudential supervisor* in a high-income country that expects banks to implement its climate change-related expectations as of the end of 2022. Limitations aside, this provides the PRA with an opportunity to continue leading by example, for instance by imposing capital add-ons on banks that are heavily exposed to high-emission activities. In terms of Pillar III requirements, the BoE should continue backing the efforts of the TCFD and, if possible, press for the enforcement of climate change-related disclosures in the UK. With respect to liquidity requirements, the BoE is advised to address the short-termism they currently cause.

Regarding *monetary policy*, both policy tools employed by the BoE should incorporate climate change considerations. If the "unconventional" quantitative easing programme is going to be activated again, it should introduce more stringent "green" criteria for purchasing corporate bonds (Dafermos et al., 2022). The currently employed "conventional" bank rate should be coupled with a collateral framework that incentivises banks to change their lending behaviour. However, given that *monetary policy* has the narrow goal of ensuring a specific *inflation* rate in the UK, it is unlikely that these adjustments would drive the transition to *net zero*. Put differently, the alignment of the BoE's *monetary policy* with the goal of the Paris Agreement is a necessary piece of the puzzle, but it should not be viewed as sufficient to achieve *net zero* emissions in the UK. Similarly, incorporating climate change considerations into the pension fund's portfolio management should not be the primary focus of the BoE's efforts.

Instead, a move away from disclosure-focused and risk-based policy tools and towards a precautionary policy approach is advised. Rather than waiting for banks to quantify the climate risks they face themselves, the BoE should acknowledge that climate change is too large of a challenge for banks to address individually. If a step change in bank lending behaviour is desired, the BoE needs to take a proactive policy approach that intervenes and "shapes" the market (e.g., Chenet et al., 2021). The only policy approach that appears to fulfil these criteria are credit guidance policies.

Credit guidance policies would require close collaboration between the BoE and the UK government. As a first step, the UK government would need to implement a "green" and a "brown" taxonomy, using the expertise of the BoE and climate scientists to categorise different economic activities. While this would also benefit the implementation of previously discussed policy options, the taxonomy should be used to determine maximum credit ceilings and minimum credit floors for each type of activity in a next step. Here, it would be important to ensure that they are aligned with the government's climate policy. Given that credit guidance policies have long been abandoned in high-income countries, further research is necessary to assess their feasibility and effectiveness in driving the transition to *net zero*. This is also needed to demonstrate to the wider public that the reintroduction of credit guidance policies would benefit the UK in the long run (Chenet et al., 2021, p. 10).

It can easily be argued that this approach would harm the competitiveness and size of the banking sector in the UK. Clearly, credit guidance policies might decrease the profitability of banks and may cause economic disruption. Some banks might even leave the UK to benefit from looser regulation elsewhere. At the time of writing, it is also unclear whether credit guidance policies would interfere with the primary objectives of the BoE's mandate. However, the question that UK banking regulators should be asking themselves is whether a large and competitive banking sector is more important than living with the consequences of climate change. Credit guidance policies should not be measured by their ability to increase the efficiency of the banking sector, but by their effectiveness in aligning private finance with the goal of the Paris Agreement (Bezemer et al., 2018, p. 13). Hence, to complete the paradigm shift in central banks' narrative, the BoE should not only recognise that climate change presents a risk to *financial stability*, but also that market logic alone is unable to solve it (Mackintosh, 2019; Le Quang and Scialom, 2021, p. 9).

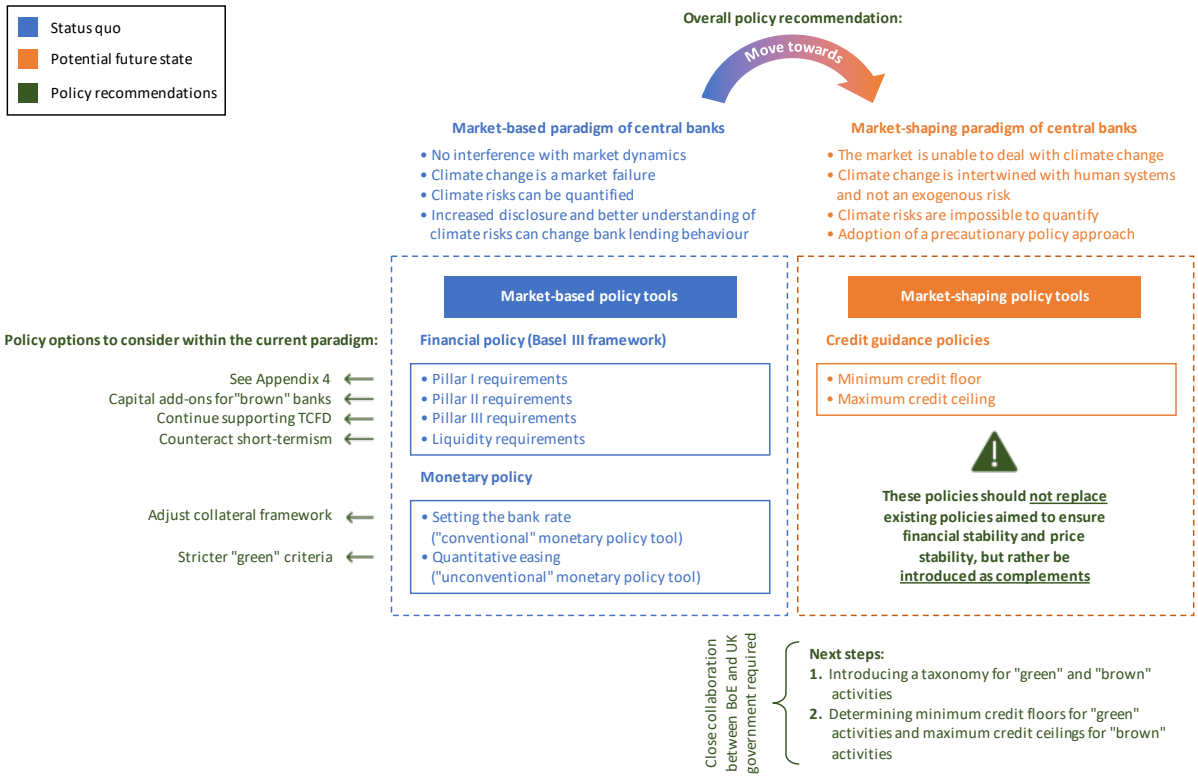

Figure 3

Summary and visual presentation of policy recommendations

5. Conclusions

Policy Report Conclusions

While this policy report was written, the UK issued its first ever Red Extreme heat warning as it expected temperatures of up to 40°C (WMO, 2022). Extreme heat warnings like this are estimated to be "(ten) times more likely in the current climate than under a natural climate unaffected by human influence" (WMO, 2022). Time is running out for policymakers to mitigate climate change. Given that private finance is expected to stem the majority of the required investments for meeting the goal of the Paris Agreement (IEA, 2022, p. 12), this policy report sought to figure out the next steps for financial regulators in the UK to tackle climate change via the banking sector. A narrow focus on emission reduction was deliberately chosen to provide a better understanding about how the main driver of climate change could be addressed in banking regulation. An appropriate next step would be to relate this detailed analysis to the wider sustainable development debate.

Clearly, the primary responsibility for mitigating and adapting to climate change rests with the UK government and fiscal tools are the first-best option to drive the transition to *net zero* (Grünewald, 2021, p. 250; Krogstrup and Oman, 2019). However, if the government fails to take effective action, the consequences of climate change will worsen (BoE, 2022d; Grünewald, 2021, pp. 230-231). As the consequences of inaction are likely to outweigh the costs of a second-best policy approach, this policy report advocates for a precautionary policy approach in UK banking regulation (Chenet et al., 2021; Grünewald, 2021, pp. 247-249). Instead of waiting for the government to act or trying to quantify climate risks, the BoE is advised to break with its current market-based policy approach and to explore proactive, "market-shaping" policy tools (Chenet et al., 2021; Le Quang and Scialom, 2021; Riso, 2021; Krogstrup and Oman, 2019; Ryan-Collins, 2019). The exploration of different policy options shows that incorporating climate change considerations in existing policy tools is difficult and unlikely to be effective. Therefore, the BoE is recommended to explore the feasibility of credit guidance policies, which would actively influence the activities that banks lend to.

Ultimately, climate change needs to be addressed by governments worldwide. However, a lack of internationally coordinated action should not deter the UK government and the BoE from experimenting with new policy approaches and mixes (Chenet et al., 2021, p. 10). As Chenet et al. (2021, p. 10) emphasize: "(…) with the most successful approaches hopefully emerging and being adopted (by) other countries, (…) leadership (is needed) from a at least a few jurisdictions." The EU has already enforced a Taxonomy Regulation which defines the economic activities that can be classified as environmentally sustainable (Busch et al., 2021; Lovisolo, 2021). Given that a taxonomy for both "green" and "brown" economic activities is a prerequisite for credit guidance policies, the UK government should follow suit as soon as possible. With their newfound autonomy as a result of Brexit, banking regulators in the UK could use this to continue to lead by example and to adopt a market-shaping regulatory paradigm (PRA, 2021). Whether such ambitious and unusual policy approaches are being considered will be seen when the PRA sets out its view on the use of capital requirements for addressing climate risks at the end of 2022 (PRA, 2021).

Limitations

The recommendations made in this policy report face several limitations that warrant caution. First, credit guidance policies have long been abandoned by central banks in high-income countries for various reasons (for an overview, see Bezemer et al., 2018). Undoubtedly, they would require strong political and public support to be reconsidered in the UK (Chenet et al., 2021, p. 10). Second, the literature considered in this policy report is qualitative and the recommendations do not rely on empirical findings. Given that there is no precedent of banking regulators in high-income countries addressing climate change effectively, it is impossible to evaluate the feasibility and effectiveness of the proposed measures. By reviewing the findings and opinions of researchers from a broad range of disciplines, this policy report aimed to take into account as many viewpoints as possible to provide informed recommendations to the UK's banking regulators. Third, this policy report has a narrow focus on reducing emissions in the UK and does not consider the impact that a market-shaping policy approach of central banks might have on the wider economy and society. *Financial* and *monetary policy* are known to influence income inequality and the distribution of wealth within countries (e.g.,

Koedijk et al., 2018). Therefore, it would be crucial to assess not only whether credit guidance policies are effective in driving the transition to *net zero*, but also how they should be formulated to ensure a socially just transition. Fourth and finally, there are factors outside of the realm of banking regulators that also need to be revised if private finance is to be aligned with the goal of the Paris Agreement. Not only is it the responsibility of the UK government to enforce a "green" and a "brown" taxonomy, but various researchers have also pointed out the need to redefine bank accounting (e.g., Le Quang and Scialom, 2021, p. 6). Once again, this highlights the need for a mix of coordinated policies to achieve the transition to *net zero*.

Recommendations for Further Research

There is clearly a need to conduct further research to determine whether the proposed policy recommendations are feasible for UK banking regulators. Currently, research on credit guidance policies is limited and their effectiveness in reducing emissions in the UK is unclear. It should also be analysed whether these policies would run counter to the BoE's mandate. In addition to more specific research about credit guidance policies, more research is needed to establish the most effective policy mix for climate change mitigation. This should consider how the UK government and banking regulators could work together more closely without jeopardizing the independence of the BoE. However, any research that is conducted to gain a better understanding of these topics also needs to take into account the urgency for policymakers to act (Chenet et al., 2021, p. 11). In times of climate change, banking regulators may need to sail uncharted waters (Bolton et al., 2020, p. 1).

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Appendix 1: List of Abbreviations

Abbreviation	Definition
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
BoE	Bank of England
CBES	Climate Biennial Exploratory Scenario
ECB	European Central Bank
EU	European Union
FPC	Financial Policy Committee
FSA	Financial Services Authority
FSB	Financial Stability Board
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
MPC	Monetary Policy Committee
NGFS	Network for Greening the Financial System
PRA	Prudential Regulation Authority
TCFD	Task Force on Climate-Related Disclosures
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
WMO	World Meteorological Organization

Appendix 2: Definitions of Key Terms

Term	**Definition**
Net zero	The term *net zero* refers to the reduction of global greenhouse gas emissions to net zero by 2050. Achieving this would be consistent with the goal of the Paris Agreement to limit the long-term increase in average global temperatures to well below 2° Celsius above pre-industrial levels (IEA, 2022; UNFCCC, 2022).
Micro-prudential supervision	Supervision and prudential regulation of all risks (financial and non-financial) that affect individual banks (BoE, 2022b).
Macro-prudential supervision	Supervision (i.e., identification, monitoring, and reduction) of *systemic risks* that affect the banking sector as a whole (BoE, 2022b).
Financial policy	Umbrella term for the policy tools used for *micro-* and *macro-prudential supervision*.
Monetary policy	All activities of a central bank aimed at regulating the total amount of money in the economy. Ultimately, monetary policy intends to ensure *price stability* (BoE, 2022a).
Financial stability	A "safe and sound" financial system, where people have trust in financial institutions and markets (BoE, 2022b).
Price stability	Price stability refers to a stable *inflation* rate year on year. This is ensured through *monetary policy* (BoE, 2022a).
Inflation	Inflation indicates how much the prices of goods and services are going up over time (BoE, 2022a).
Systemic risks	All risks that threaten *financial stability* (i.e., the banking sector as a whole). These can include, for example, the risk of a cyber-attack or geopolitical risks (BoE, 2022c).

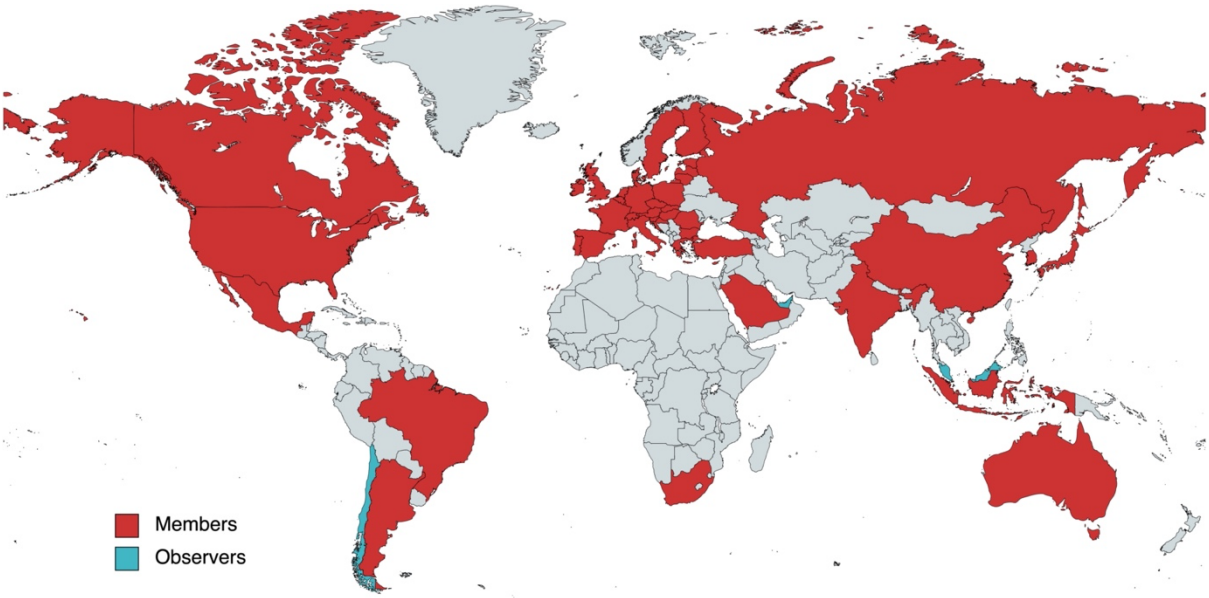
Appendix 3: Literature Repository

No.	Topic	Questions to consider when reading
1	**Introduction** - Relevance of banks to sustainable development	• What is the background to the research question? ('locate' my work within the research context) • Why are banks relevant to the promotion of sustainable development?
2	**Historical context** - Climate change related financial policy in the UK	• Definition of sustainable development? • What is the role of financial regulators (and financial policy)? • How has climate change emerged and developed as a policy concern over time (up until now)? • Since when is climate change a concern in UK financial policy? • Which institutions / financial regulators are concerned with climate change? • How does the UK's policy framework relate to the EU's?
3	**Current regulatory landscape** - Focus on the UK, with references to EU	• Which financial regulators in the UK are concerned with climate change? • What policy work is currently being undertaken? • Are there any binding regulatory requirements? • What is expected in the near future? • How do the UK's efforts relate to financial regulators worldwide?
4	**Limitations of current policy approach in the UK**	• What are the limitations of previous literature / the current policy approach that my study will address? • In other words, what is the research gap?
5	**Policy suggestions to bring about shift in behaviour of UK banks**	• Which policy tools are being suggested for financial regulators? • How effective could they be? • What are the pros and cons of each of these tools?
6	**Conclusion** - Wider contextualisation of my findings and future research needs	

1 = highly relevant
5 = not directly relevant

Author(s)	Title	Topic(s)	Notes taken?	Relevance (1-5)
Busch et al. (2021)	**Book: Sustainable Finance in Europe**			
	Chapter 2: The European Commission's Sustainable Finance Action Plan and Other International Initiatives	2, 3	Yes	2
	Chapter 7: Climate Change as a Systemic Risk in Finance: Are Macroprudential Authorities Up to the Task?	3, 4, 5	Yes	1
	Chapter 8: Climate Change as a Threat to Financial Stability: Can Solutions to This Problem Accelerate the Transition to a Low-Carbon Economy? A Critical Review of Policy and Market-Based Approaches	2, 3	Yes	1
	Chapter 9: Which Role for the Prudential Supervision of Banks in Sustainable Finance?	2, 3, 4, 5	Yes	1
Bolton et al. (2020)	The green swan - Central banking and financial stability in the age of climate change	4, 5	Yes	1
Carney (2015)	Breaking the Tragedy of the Horizon - Climate Change and Financial Stability	1, 2, 4	Yes	1
Carattini et al. (2021)	Climate policy, financial frictions, and transition risk	4	Yes	4
Chenet et al. (2021)	Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy	5	Yes	1
D'Orazio (2021)	Towards a post-pandemic policy framework to manage climate-related financial risks and resilience	5	Yes	1
D'Orazio, P. and Popoyan, L. (2019)	Fostering green investments and tackling climate-related financial risks: Which role for macroprudential policies?	5	Yes	1
Dikau and Volz (2021)	Central bank mandates, sustainability objectives and the promotion of green finance	2	Yes	2
Gray (2022)	Doing research in the real world, Chapter 7: Research Design: Qualitative Methods	Methodology	Yes	5
Dunz et al. (2020)	Climate Transition Risk, Climate Sentiments, and Financial Stability in a Stock-Flow Consistent Model	5	Yes	5
Le Quang and Scialom (2021)	Better safe than sorry: Macroprudential policy, Covid 19 and climate change	4, 5	Yes	1
Monasterolo, I. (2020)	Climate Change and the Financial System	5	Yes	5
Prudential Regulation Authority (2021)	Climate Change Adaptation Report 2021: Climate-related financial risk management and the role of capital requirements	3	Yes	1
Bank of England (2022)	Results of the 2021 Climate Biennial Exploratory Scenario (CBES)	3	Yes	2
Ryan-Collins (2019)	Beyond voluntary disclosure: why a 'market-shaping' approach to financial regulation is needed to meet the challenge of climate change	4, 5	Yes	1
Schoenmaker and van Tilburg (2016)	What role for financial supervisors in addressing environmental risks?	1	Yes	4
Batten et al. (2016)	Let's talk about the weather: the impact of climate change on central banks	1, 2	Yes	2
Battiston et al. (2017)	A climate stress-test of the financial system	1	Yes	5
Bowman (2010)	The role of the banking industry in facilitating climate change mitigation and the transition to a low-carbon global economy	1, 2	Yes	3
Burck et al. (2021)	Climate Change Performance Index 2022	1	Yes	3
Campiglio et al. (2018)	Climate change challenges for central banks and financial regulators	2, 3, 5	Yes	1
Dietz et al. (2016)	'Climate value at risk' of global financial assets	1	Yes	4
Feridun and Güngör (2020)	Climate-Related Prudential Risks in the Banking Sector: A Review of the Emerging Regulatory and Supervisory Practices	3	Yes	1
Feyen et al. (2020)	Macro-Financial Aspects of Climate Change	1	Yes	4
Furrer et al. (2012)	Much Ado About Nothing? How Banks Respond to Climate Change	1	Yes	5
Mackintosh, S.P.M. (2019)	Climate Change and Central Banking	2	Yes	1
Dikau et al. (2020)	A Toolbox for Sustainable Crisis Response Measures for Central Banks and Supervisors	5	Yes	1
Network for Greening the Financial System (2020a)	Guide for Supervisors - Integrating climate-related and environmental risks into prudential supervision	5	Yes	1
Financial Stability Board (2020)	Stocktake of Financial Authorities' Experience in Including Physical and Transition Climate Risks as Part of Their Financial Stability Monitoring	3	Yes	3
Network for Greening the Financial System (2020b)	The Macroeconomic and Financial Stability Impacts of Climate Change - Research Priorities	6	Yes	5
Alexander and Fisher (2020)	Central Banking and Climate Change	1, 2, 5	Yes	1
Krogstrup and Oman (2019)	Macroeconomic and Financial Policies for Climate Change Mitigation: A Review of the Literature	5	Yes	1
Coeuré (2018)	Monetary policy and climate change	2	Yes	1
Lastra and Alexander (2020)	The ECB Mandate: Perspectives on Sustainability and Solidarity	2, 3	Yes	5
Koedijk et al. (2018)	Monetary policy, macroprudential regulation and inequality: An introduction to the special section	4	Yes	4
Battiston and Monasterolo (2019)	How could the ECB's monetary policy support the sustainable finance transition?	3, 4	Yes	5
Monnin (2018)	Central Banks and the Transition to a Low-Carbon Economy	5	Yes	2
Mauderer (2020)	Central banks have a part to play in the fight against climate change	1, 3	Yes	5
Aglietta and Espagne (2016)	Climate and Finance Systemic Risks, more than an Analogy? The Climate Fragility Hypothesis	2	Yes	2
Alexander and Fisher (2019)	Banking Regulation and Sustainability	1, 2, 5	Yes	1
Campiglio (2016)	Beyond carbon pricing: The role of banking and monetary policy in financing the transition to a low-carbon economy	1	Yes	5
Bank for International Settlements (2020)	Climate-related financial risks: a survey on current initiatives	3	Yes	2
HM Treasury (2022)	Recommendations for the Financial Policy Committee: April 2022	3	Yes	1
HM Treasury (2021)	Remit and recommendations for the Financial Policy Committee: Budget 2021	3	Yes	1
Beck et al. (2022)	Macro-financial policy in an international financial centre: the United Kingdom experience since the global financial crisis	2	Yes	3
James and Quaglia (2020)	**Book: The UK and Multi-level Financial Regulation: From Post-crisis Reform to Brexit**	2		
	Chapter 1: Introduction	2	Yes	2
	Chapter 3: Setting the Multi-Level Context	2	Yes	2
	Chapter 4: In Search of Stability Bank Capital and Liquidity Requirements	2	Yes	3
	Chapter 9: Brexit and the Future UK-EU Relationship	2	Yes	2
	Chapter 10: Conclusion: The Futures of UK Financial Regulation	2	Yes	2
Howarth and Quaglia (2017)	Brexit and the Single European Financial Market	2	Yes	5
James and Quaglia (2022)	Rule maker or rule taker? Brexit, finance and UK regulatory autonomy	2	Yes	4
Elliott and Timulak (2005)	Descriptive and interpretive approaches to qualitative research	Methodology	Yes	1
Kelly and Cordeiro (2020)	Three principles of pragmatism for research on organizational processes	Methodology	Yes	1
Climate Policy Initiative (2021)	Global Landscape of Climate Finance 2021	1	Yes	5
Bank of England (2017)	The Bank of England's response to climate change	2	Yes	1
NGFS (2022)	Annual report 2021	3	Yes	1
Institute for Government (2021)	https://www.instituteforgovernment.org.uk/explainers/future-relationship-financial-services	3	Yes	1
Rodriguez (2021)	Chapter 9: An interdisciplinary approach to secondary qualitative data analysis: what, why and how	Methodology	Yes	1
Bhattacherjee (2012)	Chapter 12: Interpretive Research	Methodology	Yes	1

Appendix 4: BCBS Members and Observers



Adapted from BIS (2022)

Appendix 5:

Climate Considerations in Pillar I Requirements

Measure	Description	Advantages	Disadvantages	References
Green supporting factor (GSF)	Minimum capital requirements prescribe the minimum amount of capital a bank has to hold in relation to the loans it provides to corporations, households, and individuals. Minimum capital requirements are risk-weighted, meaning that the more risky a bank's loan book (which is the sum of all loans it provides) is considered to be, the more capital it is required to hold. A GSF lowers the minimum capital requirement for "green" loans (i.e., loans aimed at reducing emissions), thereby making it more attractive for banks to finance them.	• "Green" projects (for example investments in renewable energy projects) tend to have longer maturities than "brown" projects, which by default makes them appear more risky in the current framework – a GSF would counteract this	• Requires the implementation of a taxonomy • Might lead to an underestimation of financial risk and a "green bubble", which would threaten financial stability • Depends on the quantification of climate risks (likely impossible) • Effectiveness is unknown • National banking regulators cannot determine Pillar I requirements	Alexander and Fisher (2019) D'Orazio and Popoyan (2019) Alexander and Fisher (2020) Feridun and Güngör (2020) NGFS (2020) Chenet et al. (2021) D'Orazio (2021) Grünewald (2021) Le Quang and Scialom (2021) Riso (2021) BIS (n.d.)
Brown penalising factor (BPF)	A BPF raises the minimum capital requirement for "brown" loans (i.e., loans for emission-intensive activities) in order to make financing these activities less profitable for banks.	• Limits banks' exposures to climate risks (transition and physical risks)	• Requires the implementation of a taxonomy • Depends on the quantification of climate risks (likely impossible) • Distributional imbalances: Might disproportionately impact low-income households that cannot afford low-emission alternatives • Effectiveness is unknown • National banking regulators cannot determine Pillar I requirements	Alexander and Fisher (2019) D'Orazio and Popoyan (2019) Feridun and Güngör (2020) NGFS (2020) Chenet et al. (2021) D'Orazio (2021) Grünewald (2021) Le Quang and Scialom (2021) PRA (2021) Riso (2021)
Countercyclical capital buffer along the "carbon-intensive" credit cycle	Generally, countercyclical capital buffers (CCyBs) are designed to counteract the build-up of systemic risks. They do so by requiring banks to put aside capital in times of economic growth (during which bank lending tends to be higher). This capital can be drawn down during economic recessions (when bank lending decreases). It has been suggested that this measure could take into account the emission intensity of bank lending: Banks that increase their lending to high-emission activities during times of economic growth would have to put aside more capital (which makes it less profitable for banks to lend these activities) and, vice versa, banks that increase their lending to low-emission activities would face lower capital requirements (which makes this type of lending more favourable).	• Treats climate risks as systemic risks • Limits banks' exposures to transition risks • Recognises that banks also pose a risk to the climate • Could smooth the transition to net zero emissions	• Requires the implementation of a taxonomy • Depends on the quantification of climate risks (likely impossible) • Effective calibration and timing of this measure are unclear • There is no "carbon cycle": carbon emissions have been constantly rising since the mid-20th century • National banking regulators cannot determine Pillar I requirements	D'Orazio and Popoyan (2019) NGFS (2020) Grünewald (2021) Le Quang and Scialom (2021)
Sectoral leverage ratio	Currently, the leverage ratio is applied to banks' entire loan book and prescribes the minimum amount of capital a bank needs to hold at all times, independent of how risky its loans are. A sectoral leverage ratio would distinguish between high-emission and low-emission sectors that a bank lends to. Banks that lend to more high-emission sectors (and therefore are more leveraged in these sectors), would have to put more capital aside than banks that lend to low-emission sectors. Given that this measure is not time sensitive, it is independent of the current economic state.	• Not a risk-based measure: Climate risks do not have to be quantified • Not time sensitive: Emission-intensive activities are always less favourable • Could contribute to the reorientation of financial flows from "brown" to "green" activities	• Requires the implementation of a taxonomy and disclosure requirements • Analysis of exposures at a sectoral level might underestimate the true level of emissions of individual counterparties • Effectiveness is unknown • National banking regulators cannot determine Pillar I requirements	D'Orazio and Popoyan (2019) NGFS (2020) D'Orazio (2021) Grünewald (2021) Le Quang and Scialom (2021) BIS (n.d.)
Systemic risk buffer	Some banks are designated as global systemically important financial institutions (SIFIs) based on a range of indicators, including their size, interconnectedness, substitutability, cross-border activity and complexity. This designation could also include the emission intensity of their lending. SIFIs are subject to capital surcharges and the systemic risk buffer, which require SIFIs to put aside more capital than banks that are not designated as SIFIs.	• Great flexibility of use: Rate is not capped, it can be applied at differentiated rates to all or some of the supervised banks, and it is not limited to domestic exposures only • Limits banks' exposures to transition risks	• Requires the implementation of a taxonomy • Does not apply to banks that are not designated as SIFIs • Effectiveness is unknown • National banking regulators cannot determine Pillar I requirements	NGFS (2020) Grünewald (2021) Le Quang and Scialom (2021)