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Integrating Climate-related Risks into Banks' Capital Requirements

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Executive Summary

Climate change dynamics are on a trajectory of intensification which may require the use of new and notable measures. The Paris Agreement recognized the urgency of directing financial flows toward low carbon activities and climate-resilient development. However, the latest special Intergovernmental Panel on Climate Change (IPCC) report[1] stated that to limit global warming to 1.5oC, the financial resources directed to green activities are by far insufficient and investments on carbon intensive projects are still far too high. At the same time, climate-related risks continue to potentially endanger the stability of the financial sector and they are only marginally addressed by Basel III capital requirements.

This situation gave rise to the **discussion about using capital requirements to address both the climate investment gap and climate-related risks**. The debate has gained more attention in Europe with the mandate given early 2019 by the Commission to the European Banking Authority (EBA) to report on the possibility of introducing a prudential treatment in accordance with environmental and social objectives[2]. Stakeholders have taken part in this debate with strong and opposing views.

Different approaches and objectives

To date, the debate has been often confused due to a mixing up of different possible objectives and conditions for implementing such regulatory measures. It is therefore key when looking at integrating climate-related risks into capital requirements to distinguish between two different approaches:

- The **risk approach**, which seeks to increase banks' resilience to climate-related risks and thereby ensure financial stability. It is as well the approach that corresponds to primary objective of capital requirements;
- The **economic policy approach**, which aims to use capital requirements as a policy tool to channel financial flows towards a low-carbon economy.

Different possible regulatory instruments

There are very few examples of existing capital requirement adjustments to learn from in order to inform the debate. The most relevant one is the Small and Medium Enterprise (SME) supporting factor put in place in 2014 by the EU to support credit to SMEs; however, the outcomes of this measure are still unclear, inconclusive and debated.

In order to integrate climate-risks into capital requirements, several mechanisms have been so far put forward: a Green Supporting Factor (GSF), a Brown Penalizing Factor (BPF), the combination of a GSF and a BPF, an Environment-Risk Weighted Asset (ERWA) and a Green Weighting Factor which is the only one already implemented on a voluntary basis by Natixis, a French commercial bank. All of them have their advantages and disadvantages which differ according to the approach chosen.

All the reviewed instruments are not equally fit to meet each possible approach:

- Under the risk approach, using a Green Supporting Factor or a Brown Penalizing Factor alone would face a major weakness: the risk approach would require recalibrating the risk weight factors of all assets to fully integrate climate-risks in banks' balance sheet and not only part of them. In this respect, the combination of a GSF and a BPF – or any similar mechanism – would make a step in the right direction by covering all assets. However, it would still assume that the climate adjusted risk weight of green assets should be lower than their current risk weight whereas it is likely that they would remain constant at best.
- On the contrary, under the economic policy perspective, none of the reviewed instruments can be disregarded ex ante.

Different challenges for implementation

Moreover, specific challenges would need to be addressed before implementing any of these measures at a national level:

- Under **the risk approach**, the objective is to integrate climate-related risks to maintain financial stability. Therefore, it is key to **accurately measure the level of climate-risks associated to each asset**. This is still a major challenge because of the deep uncertainty nature of climate change and socio-economic measures associated – and as a result the lacking usefulness of historical data – and the short-term horizon of standard credit risk models compared to the medium-long term horizon of climate-related risks. In the absence of a sufficiently robust risk measure, there is no point in taking the risk approach.
- Under **the economic policy approach**, the objective is to channel more flows toward the low-carbon economy. The issue of accurately measuring climate-risks is no longer essential. The question is rather to find a metric which allows to differentiate among activities based on their

1 Global Warming of 1.5°C report
2 European Commission, "Adoption of the banking package: revised rules on capital requirements (CRR II/CRD V) and resolution (BRRD/SRM)".

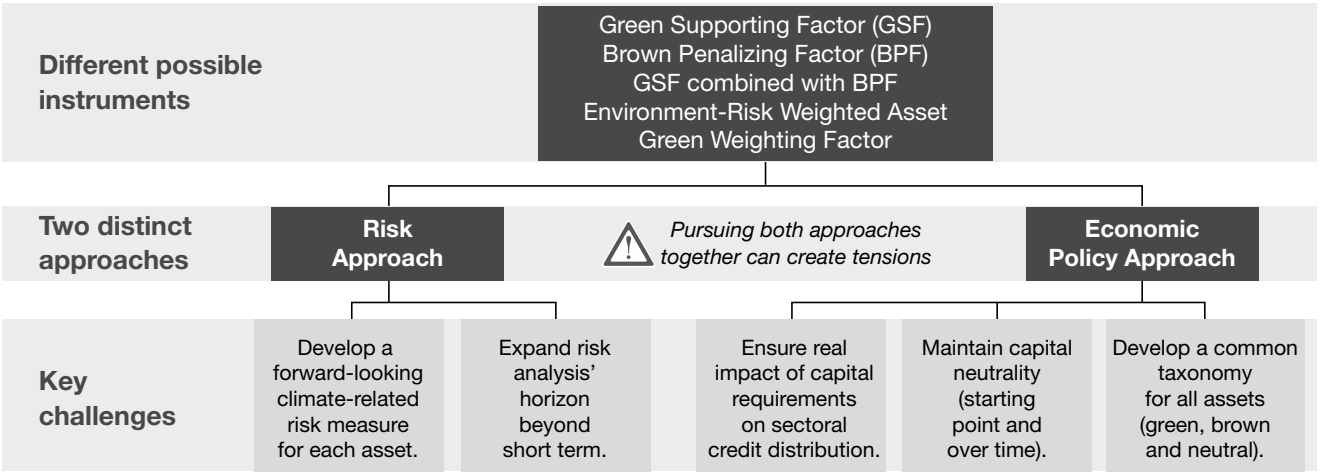
contribution to developing a low-carbon economy. In this situation, however, other challenges would still exist. The first one relates to the **effectiveness of adjusting banks' capital requirements to increase or reduce specific categories of credits.** Indeed, there is no clear empirical evidence supporting such effectiveness. The second challenge is to ensure this policy instrument would not endanger financial stability. To do so, it would be key to maintain banks' capital base in line with prudential requirements as measured today based on the lessons drawn from the recent global financial crisis. This raises the question of **how capital neutrality should be ensured** at the starting point, possibly through a micro adaptation of the mechanism, and whether it should be maintained over time which would entail rather complex mechanisms.

The paper stresses that **pursuing the risk and the economic policy objectives together can create tensions** in the design of the capital requirement adjustment for certain types of financings. It may be necessary to give preference to one objective, probably to the detriment of the other.

In addition, **a common taxonomy** would be helpful for the risk approach to screen the assets vis-à-vis their transition impact and would be a pre-condition to follow the policy tool approach. Depending on the instrument chosen, this taxonomy could be 'green' – as the European Union's (EU) taxonomy – or 'green and brown' as requested by regulators of the NGFS.

Finally, there are issues which will require further discussions. It would be important to clarify points such as the bias of methodologies, the capital neutrality in the long run and the lack of empirical evidence.

DIFFERENT INSTRUMENTS, APPROACHES AND CHALLENGES



Source: I4CE.

Introduction

In 2015, the Paris Agreement, signed collectively by 175 parties, already recognized in its Article 2.1c the necessity of establishing the consistency between public and private finance flows and the climate goals. In order to ensure support from countries for this approach, the think tank Overseas Development Institute (ODI) suggests four key sets of tools to operationalize Article 2.1c[3]: financial policies and regulations, fiscal policy and levers, public finance, and information instruments. The first group of tools, financial policies and regulations, seeks to influence financial actors' behavior through the constraint of the law to encourage and support the alignment of financial flows with the Paris Agreement.

This paper recognizes the different roles financial actors may have in addressing climate change. However, it focuses on the banking sector which can be a powerful player to achieve a sustainable economy as it provides significant volume of capital to economic agents, especially in emerging economies[4].

In the current financial and political framework, there is still insufficient financial resources to stimulate the development of green activities and not enough focus on de-scaling brown investments. Moreover, the precise impact of climate-related risks on banks might still be uncertain, but the existence of material financial risks related to climate change is no longer in doubt. The Network for Greening the Financial System (NGFS) considers that *"climate change may result in physical and transition risks that can have system-wide impacts on financial stability and might adversely affect macroeconomic conditions"*[5].

Given the gap of financial resources devoted to green activities, excessive finance to carbon intensive activities, and the potential impacts of climate-related risks on the financial system, the idea of incorporating climate-related risks into banks' capital requirements has emerged. The debate following this proposal was first a technical debate. But it became part of the political agenda when, in December 2017, the European Union Commission declared to be taking a deeper look into introducing a supporting factor to amend capital charges for banks to incentivize climate-friendly bank lending[6].

The pros and cons of integrating climate-related risks into banks' capital requirements have been vividly discussed. This debate has taken place among European banks, supervisors, NGOs and experts on several aspects: the objective of maintaining financial stability vs. supporting low-carbon activities, the degree of riskiness of green vs. brown activities, the effectiveness of the so-called Green Supporting Factor (GSF) vs. that of the so-called Brown Penalizing Factor (BPF) in order to shift the funding toward a low-carbon economy and guarantee banks' financial stability to mention a few. But overall, the debate has been rather confusing because the different possible objectives and conditions for implementing such regulatory measures have been mixed up.

The primary objective of the research carried out in this paper is to clarify the debate on integrating climate-related risks into banks' capital requirements. To do so, a key distinction will be made between the two different approaches that can be followed to consider this issue. On the one hand, there is a risk approach whose objective is to integrate a new source of risk in order to accurately measure credit risk and assumes that a risk differential between green and brown assets exists; on the other hand, there is an economic policy approach, aiming to foster the transition to a low carbon economy by shifting credit from brown to green activities. Against this background, the primary question is to review the proposed regulatory measures and to assess how they match the two possible objectives to be pursued. Another question is whether regulators could use prudential regulation to protect financial stability from climate-related risks and at the same time contribute to decarbonizing banks' portfolios to support the fight against climate change.

The paper will be organized as follows. Section 1 will present the rationale for using capital requirements. Section 2 will present the two possible approaches to be followed when adjusting capital requirements to integrate climate-related risks. Section 3 will review the lessons learned from other mechanisms of capital requirement adjustments and national frameworks and describe the different modalities of integration between climate-related risks and banks' capital requirements, highlighting the positive and negative points of each proposal. Section 4 will present the biggest challenges that regulators would face for integrating such regulatory measures depending on the approach followed (risk or economic policy). Section 5 will present remaining knowledge gaps on the issue as well as suggestions for future reflections on the matter. Finally, the main conclusions of the research will be provided.

3 Whitley et al., "Making finance consistent with climate goals".
4 The World Bank et Sustainable Banking Network, "Greening the Banking System: Experiences from the Sustainable Banking Network".
5 NGFS, "A call for action: Climate change as a source of financial risk".
6 Valdis Dombrovskis, "Greening finance for sustainable business: Speech by Vice-President for the Euro and Social Dialogue, Financial Stability and Financial Services Valdis Dombrovskis".

1. The rationale for using capital requirements

KEY MESSAGES

- **The idea of adjusting banks' capital requirements is linked to two objectives: incorporating climate-related risks in the assessment of banks' soundness and filling in the existing climate investment gap to support the low-carbon transition.**
- **The debate received more attention when in April 2019 the European Banking Authority received a Commission mandate to verify if a specific prudential regulation should be implemented for green assets to be in accordance with environmental and social objectives.**

1.1. Why modify bank's capital requirements?

First developed in the 80`s, the international prudential regulation for banks was severely criticized after the world financial crisis of 2007-2009. In response to the financial crisis and aiming to avoid future similar scenarios, the Basel Committee on Banking Supervision revised its minimum international standards (the Basel III Agreement). The revisions included a reform of the minimum level of regulatory capital for banks (Pilar I). Post-crisis, this minimum level was deemed insufficient for banks to ensure stability when under significant market stress[7]. Basel III then specified a more robust framework with a strengthened capital adequacy ratio to increase banks' resilience and address the flaws identified during the crisis[8]. This capital adequacy ratio should ensure that banks have the minimum capitalization level to deal with unexpected losses as the ones suffered by the banks in the financial crisis of 2007-09.

However, in spite of these recent revisions, climate-related risks are not yet incorporated in the risk-weighted assets of a bank. "The current Basel Capital Accord does not take explicit account of, and therefore only marginally addresses, these [environmental risks] issues"[9]. More specifically, the CISL report notes: "Pillar 1 […] does require banks to assess the impact of specific environmental risks on the bank's credit and operational risk exposures, but these are mainly transaction-specific risks […]"[10]. Besides not fully considering environmental risks, some authors even claim the Basel Agreement can be adverse to green financing. These authors point out that the Basel Agreement gives a more rigorous prudential treatment to long-term loans. This characteristic can then negatively impact the lending to green infrastructure projects which are highly important for the transition to a low-carbon economy but are by nature long-term projects[11].

However, there is no doubt that climate change is a new source of risks for banks. Climate-related risks can be divided in three main types of financial risks[12]: physical, transition and liability risks.

- Physical risks are the possible economic costs and financial losses related to the effects of the modification of the climate cycle (such as increase in average temperatures and changes in precipitation levels) and to the impacts of extreme climate change-related weather events (such as more severe and frequent storms, floods and droughts)[13]. Physical risks can decrease counterparts' cash flows (*e.g.* lower productivity, reduced sales, higher operational costs…) and/or devaluate counterparts' assets (*e.g.* direct damages on assets due to extreme weather events, write-offs of assets in risky locations…) which in turns will impact banks' assets and profitability[14].
- Transition risks are related to the impacts caused by the changes in the current socio-economic model to transform itself into a new low-carbon emissions model (these changes being driven by modifications in economic and environmental policies, changes in consumer preferences or development of new clean/ green technologies)[15]. Transition risks, as the physical risks, can negatively impact counterparts' cash flows and assets. For example, these risks can imply higher costs for adoption of climate friendly technologies and processes affecting the cash flows. In terms of assets' values, stricter energy policies to support the transition to a low-carbon economy will most likely generate a re-pricing of fossil fuel assets[16].
- Liability risks are related to a monetary compensation an enterprise might have to pay as a result of a judgement related to its contribution to climate change[17]. Given that this kind of risk is the least well analyzed to date, the discussion usually largely ignores this risk category. They will thus only be discussed marginally as part of this paper.

7 Bank for International Settlements, "Basel Committee on Banking Supervision: Explanatory note on the minimum capital requirements for market risk".
8 Härle et al., "Basel III and European banking: Its impact, how banks might respond, and the challenges of implementation".
9 CISL et UNEP FI, "Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?"
10 CISL et UNEP FI.
11 D'Orazio et Popoyan, "Fostering green investments and tackling climate-related financial risks".
12 Mark Carney, "Breaking the tragedy of the horizon-climate change and financial stability".
13 NGFS, "A call for action: Climate change as a source of financial risk".
14 Monnin, "Integrating Climate Risks into Credit Risk Assessment - Current Methodologies and the Case of Central Banks Corporate Bond Purchases".
15 Dépoues et al., "Towards an alternative approach in finance to climate risks: Taking uncertainties fully into account".
16 Monnin, "Integrating Climate Risks into Credit Risk Assessment - Current Methodologies and the Case of Central Banks Corporate Bond Purchases".
17 Finance for Tomorrow, "Climate risk in finance: concepts, methods & assessment tools".

In short, the financial impacts of climate-related risks could result in losses for banks and possible financial instability.

In 2015, the signature of the Paris Agreement ratified the urgency of increasing finance for mitigating climate change and adapting to its impacts. Nevertheless, climate financial flows are still insufficient, and it is necessary to beef up efforts from governments, regulators, development banks, and private investors to close this persistent investment gap. Approximately *"the investment required to achieve the low-carbon transition range from USD 1.6 trillion to USD 3.8 trillion annually between 2016 and 2050 (for supply-side energy system investments alone) while the Global Commission on Adaptation estimates adaptation costs of USD 180 billion annually from 2020 to 2030"*[18]. In France around 15-18 billion euros of additional investment per year by 2023 and 32-41 between 2024 and 2028 are needed to achieve its carbon neutrality goal[19]. Besides scaling up climate finance, the existing financial resources must be used in a more transformative way. Shifting credit flows from brown to green activities is another required major transformation towards the transition to a low carbon economy. For example, it is estimated that investments in oil and gas supply alone are still more than twice the amount of financial flows devoted to renewable energy[20].

The threat of climate-related risks to the financial stability together with the current investment gap to promote a transition to a low-carbon economy gave rise to the discussion of using capital requirements as a manner to tackle these issues[21].

1.2. The political agenda behind changing capital requirements

Banks are now becoming more aware of the importance of incorporating climate-related risks into their risk management systems. Yet no international regulation has emerged to support this movement. The decision of integrating climate change into the credit decision process and the risk management system is still dependent on national regulations. The NGFS recognizes that complying with the Paris' Agreement is primarily a responsibility of governments, but central banks and supervisors must also take leadership on this fight within their mandate. The recognition and treatment of climate-related risks which threaten the resilience of the financial system should not depend only on individual bank's decision[22].

In December 2017, the European Commissioner Valdis Dombrovskis stated in a speech the necessity for Europe to attract more green investments[23]. To unleash green financial flows, the European action plan aims to reach three main objectives: integrate sustainability factors in asset and institutional managers' decisions process; develop a system to classify investments/credits as being green and sustainable or not; and motivate European banks to provide green credits[24].

To achieve this third objective, the European Union Commission declared to be taking a deeper look into introducing a supporting factor to amend banks' capital charges to boost climate-friendly credits[25]. Valdis Dombrovskis stated that the Commission was considering the adoption of a Green Supporting Factor (GSF), as proposed by the European Parliament. He further suggested that a GSF could be modeled similarly to the SME and Infrastructure Supporting Factors and would be able to boost green investments by lowering capital requirements for certain climate-friendly investments[26].

In this context, the European Banking Federation also supported the idea of introducing a green supporting factor as an appropriate prudential treatment to incentivize the investments into the low-carbon transition[27]. At a national level, the French Banking Federation and the Italian Banking Association supported the initiative in favor of a Green Supporting Factor, as a way to strengthen their commitment to the energy transition[28].

The issue has recently received a renewed interest with the mandate given in April 2019 by the European Commission to the European Banking Authority (EBA) to report on the possibility of introducing a prudential treatment in accordance with the environmental and social objectives[29]. In particular, EBA will assess whether a specific prudential regulation should be implemented for green assets. After this assessment, European Institutions are expected to take a position on implementing or not a climate-factor to capital requirements. But the European Union might not wait so long before taking a final position on this issue.

18 Barbara Buchner et al., "Global Landscape of Climate Finance 2019".
19 Hainaut, Cochran, et Maxime Ledez, "The Landscape of domestic climate investment and finance flows".
20 IEA, "World Energy Investment 2019".
21 D'Orazio et Popoyan, "Fostering green investments and tackling climate-related financial risks".
22 NGFS, "A call for action : Climate change as a source of financial risk".
23 Valdis Dombrovskis, "Greening finance for sustainable business: Speech by Vice-President for the Euro and Social Dialogue, Financial Stability and Financial Services Valdis Dombrovskis".
24 Valdis Dombrovskis.
25 Valdis Dombrovskis.
26 Valdis Dombrovskis.
27 EBF, "Towards a Green Finance Framework".
28 Fédération Bancaire Française, "Green Supporting Factor".
29 European Commission, "Adoption of the banking package: revised rules on capital requirements (CRR II/CRD V) and resolution (BRRD/SRM)".

2. Two ways of looking at the debate

KEY MESSAGES

- **Depending on the objective pursued the appropriate approach is likely to differ.**
- **The risk approach seeks to guarantee banks' financial stability when exposed to unforeseen climate risks and the risk level of assets may not be clearly aligned with a "green/brown" taxonomy.**
- **The economic policy approach aims to orientate the market's financial flows towards a low carbon economy.**
- **Nevertheless, pursuing both objectives at the same time can create tensions on the design of the capital requirement adjustment tool.**

As seen above, adjusting capital requirements regulation according to climate-related risks can target two main objectives: ensure financial stability and increase banks' resilience to climate-related risks or be used as a policy tool to orientate the financial flows towards a low-carbon economy.

2.1. Risk Approach

When thinking about integrating climate-related risks into banks' capital requirements in order to ensure banks' financial stability, the central concern is how climate-related risks influence credit default risk. As already mentioned, current regulatory requirements do not take into account climate-related risks. However, there is a consensus in considering that climate change is an additional factor of credit risk which changes credit default rates and could then affect bank's financial stability. The risk-weight factor should then be recalibrated for all categories of assets considering climate-related risks. It goes without saying that both transition and physical risks should be integrated into capital requirements.

Two issues need to be considered. First, the introduction of a new source of risk should result, on average, in an increase of capital requirements. In theory, part of the assets (notably the "brown" ones) would potentially bear additional risks and therefore require additional capital. Another part of the assets would not bear additional risks in relation with climate change and should not require additional capital. It is unlikely that any asset would bear less risks after integrating climate-related risks than before. Overall, the introduction of climate-related risks should lead for each category of assets to increased or – at most – unchanged capital requirements compared to the current situation.

Second, the actual risk differentials need to be identified. Indeed, any risk differential between green and brown activities should be taken into consideration when determining climate-adjusted banks' capital requirements. This differential may result from likely lower transition risks of green assets because they are more likely to be aligned with the changes in the economy towards the low-carbon transition. Brown assets on the other hand will more likely attract higher transition risks. According to the Basel III framework, if assets are proven to be riskier than the current risk factor used to calculate their RWA, their capital requirement should be increased. In practice, assets should cover a range of shades from dark green to dark brown with different climate risk level associated. Therefore, the risk approach would require a new system of risk metrics to capture all these shades of risks.

However, the correlation between the "shade of green" of an asset and its underlying climate-related risk profile is likely to be complex. In relation to physical risks, it is easy to see how green and brown assets may be equally affected for example by extreme whether events, the decisive factors being their geographic location and the build-in resilience of the actual plant. In the case of transition risks, the correlation is not so clear cut since the actual risk profile also depends on other factors. For instance, the lack of commercially viable alternative products or the ability to hand down increased carbon related costs to the clients can reduce the overall risk of some brown assets, meaning that the higher transition risk of these assets will not be fully transferred to the financial institution[30]. Characteristics of the borrower, such as the level of revenues, are also external factors that can influence the overall risk profile, and more precisely the risk of default of an asset, regardless of its level of "greenness"[31].

Under this approach, the capital requirement mechanism is applied to protect the banking system from unexpected climate-related risks and systemic crises. Beyond the choice of which mechanism should be enforced (GSF, BPF, or other modalities) lies the issue of developing a risk metrics to overcome the uncertainty challenge when calculating climate-related risks. The integration of climate-related risks into capital requirements should only be done in a manner that will improve banks' solvency compared with the current situation. Again, this means that the integration of climate-related risks should be based on a solid assessment of the risk levels associated to different types of assets.

30 See for a more detailed discussion 2° Investing Initiative, 2015.
31 Benfratello, Schiantarelli, et Sembenelli, "Banks and innovation".

2.2. Economic Policy Approach

When the objective is to adjust capital requirements as an economic policy tool to allocate credit to specific sectors, the accurate level of climate-related risks is not a central concern anymore. This approach rather focuses on channeling credits to facilitate the transition towards a low carbon economy. The objective is to foster transition by introducing a financial incentive through the capital adequacy regulation without following a risk reasoning.

The "climate factor" used in this case to adjust Risk Weighted Assets should function as an economic instrument to increase the volume of green credits, or reduce financing to brown projects, or combine both to promote the shift of credits from brown to green activities. It would be expected to incentivize banks to gradually decarbonize their balance sheets and help them to comply with the Paris Agreement in the long run.

However, there is an important constraint: this economic policy approach should be pursued without affecting banks' capital and their financial soundness. Indeed, under this approach it is assumed that the current level of banks' capital is correct, and it is no meant to amend it.

This approach is not necessarily aligned with the risk stance, previously explained, and tensions might arise if one would try to follow them simultaneously. As an example, if a low carbon activity presents a certain level of credit risk based on the Basel III risk calculation, its climate adjusted risk factor should not be lower than the current one. However, from the policy perspective, the risk factor could be reduced to encourage green activities to receive more financing from banks. Integrating climate-related risks into capital requirements should then focus on achieving one of the two objectives. Arguably, pursuing the risk perspective should indirectly favor the transition; but it would more likely penalize the brown assets than support the green ones and in some instances the effect might even be counterproductive as it will be seen in Section 4.

Nevertheless, depending on the stance adopted, the prerequisites necessary to implement the mechanism will differ as explained more in details in Section 4 of this study.

3. Integrating Climate-related Risks into Capital Requirements

This section will first look at existing examples of regulatory instruments to inform the debate. It will then review the different regulatory instruments which have been so far proposed, starting with the polar ones before looking at more comprehensive instruments.

3.1. Lessons learned: examples of capital requirement adjustments and national regulatory frameworks

KEY MESSAGES

- **The examples of existing capital requirement adjustments to learn from are limited.**
- **The outcomes of the SME Supporting Factor are still unclear and there is not enough evidence as to whether it benefited or harmed the lending to SMEs.**
- **Many countries have adopted regulatory framework to incorporate climate and other environmental risks into the financial regulation. But overall, there is no example of national regulation relevant to this research.**

With the purpose of better understanding the effectiveness and difficulties of implementing a climate factor in banks' capital requirements, a review of the SME and Infrastructure Supporting Factors was conducted. In addition, a research on national frameworks with innovative green schemes was carried out to look for examples of similar mechanisms to the ones under study in this report.

3.1.1. Examples of capital requirement adjustments

Introduced by the European Union in 2014, the SME and Infrastructure Supporting Factors aimed to increase the volume of credits for both sectors, especially after the reduction of credits observed during the financial crisis of 2007-2009. The European Council and Parliament expected that with a reduction of 15-23,81% in capital charges for SMEs and 25% for infrastructure projects, banks' capability to support the real economy would increase[32].

Regarding the Infrastructure Supporting Factor, no result could be gathered for the banking sector as the formal legislation has not been enforced yet. Even if it has already been adopted by banks, it is anticipated that the Infrastructure Supporting Factor will only be fully enforced over a period of three years. Despite that, this supporting factor possesses a specific characteristic that could be of interest when implementing a climate adjustment factor. The 25% capital charge reduction will not be granted to any infrastructure project: a project will need to comply with a set of conditions to diminish its risk of default in order to benefit from the infrastructure supporting factor. For example, it is required that *"the source of repayment of the exposure shall be represented for at least two thirds of its amount by the income generated by the project being financed".* The conditions imposed by the regulation try also to enhance the predictability of cash flows and guarantee that this credit with a lower capital requirement is indeed financially sustainable[33]. Similar prerequisites to determine which green projects could be eligible for a capital charge relief could be integrated in designing a GSF or equivalent framework.

Concerning the SME Supporting Factor (SME SF), conclusions regarding its effectiveness are still unclear. The aim of such a supporting factor was to counterbalance the increased regulatory burden applied to banks after the international financial crisis, and to maintain access to finance for SMEs. Indeed, the SME SF is not a prudential measure as the main objective of its implementation was to avoid jeopardizing the lending to SMEs after the crisis[34]. Studies regarding the effectiveness of the SME SF are still limited and restricted to certain countries such as Spain, France and Germany. There is no clear indication that the adjustment factor benefited - or harmed - the lending to SMEs. Studies suggest that SMEs were exposed to the same constrains as large enterprises even after the adoption of the adjustment factor, and that the prudential tool did not necessarily boost the investments to the SME sector[35]. Other analyses also claim that the impact of the SME SF was heterogeneous and did not benefit equally to all classes of SMEs. Credit relief benefited mainly to enterprises in the sector which were by nature less risky, the medium-sized

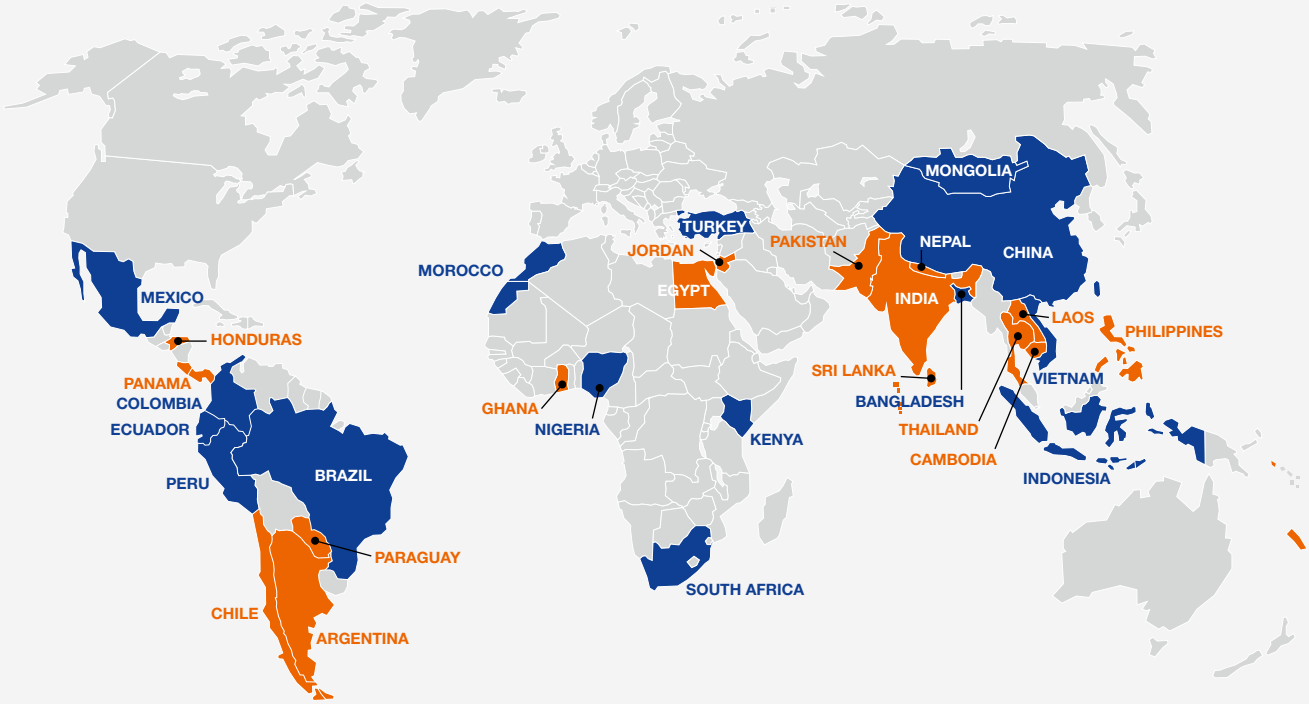
32 STAMEGNA Carla, "Amending capital requirements: The "CRD V package"".
33 STAMEGNA Carla.
34 EBA, "EBA Report on SMEs and SME supporting factor".
35 EBA.

firms, while micro and small enterprises continued to face the same difficulties as before to access finance[36]. A recent empirical study in France complements this point and says that risky firms (classified as ineligible exposures) remain too risky for banks and still face credit constrains even after the implementation of the SME SF.

However, this same study, based on Banque de France's data, observed that after two years of implementation, the SME SF has increased bank lending to targeted SMEs by 8-10%[37]. Therefore, with these limited data and analytical studies it is premature to draw any general conclusions as to whether the SME SF has served in the past years its purpose or not, or if it might in the future.

FIGURE 1

SUSTAINABLE BANKING GUIDELINES AND REGULATION INITIATIVE



■ **Existing guidance:** Bangladesh, Brazil, China, Colombia, Ecuador, Indonesia, Kenya, Mexico, Mongolia, Morocco, Nigeria, Peru, South Africa, Turkey, Vietnam.
■ **In dialogue:** Argentina, Cambodia, Chile, Egypt, Ghana, Honduras, India, Jordan, Laos, Nepal, Pakistan, Panama, Paraguay, Philippines, Sri Lanka, Thailand.

Source: The World Bank and Sustainable Banking Network

BANGLADESH: The Bangladesh Bank issued the Environmental Risk Management Guidelines in 2011 and the updated Guidelines on ESRM in 2017.

BRAZIL: The Central Bank of Brazil issued a Resolution on Social and Environmental Responsability for FIs ine 2014.

CHINA: The China Banking Regulatory Commission issued the Green Credit Guidelines in 2012 and the Green Credit Statistics System and KPIs in 2014.

COLOMBIA: Colombian Banking Association launched the Colombia Green Protocol in 202 and the Guideline on E&S Risk Management in 2016.

ECUADOR: The Banking Association of Ecuador launched the Sustainable Finance Protocol in 2016.

INDONESIA: The Indonesia Financial Services Authority (OJK) launched the Roadmap for Sustainable Finance in 2014.

KENYA: Kenya Bankers Association launched the Sustainable Finance Initiative Guiding Principles in 2015.

MEXICO: Mexican Banking Association launched the Sustainability Protocol in 2016.

MONGOLIA: Mongolia Bankers Association launched the Mongolian Sustainable Finance Principles (MSFP) in 2014. The Central Bank of Mongolia then issued a Directive requesting banks to report the MSFI implementation from 2016.

MOROCCO: The Central Bank of Morocco launched the Roadmap for Aligning the Moroccan Financial Sector with Sustainable Developments in 2016.

NIGERIA: The Central Bank of Nigeria issued the Nigerian Sustainable Banking Principles in 2012.

PERU: The Superintendency of Banking, Insurance and Private Pension Fund Administrators of Peru (SBS) launched the Regulation for Social and Environmental Risk Management in 2015.

SOUTH AFRICA: Banking Association South Africa launched voluntary Principles on E&S Risk Management in 2014.

TURKEY: Banks Association of Turkey launched voluntary Sustainability Guidelines in 2014.

VIETNAM: The State Bank of Vietnam issued the Directive on Promoting Green Credit and Managing Environmental and Social Risk in Lending Activities in 2015.

36 Mayordomo et Rodríguez-Moreno, "Did the bank capital relief induced by the supporting factor enhance SME lending?"
37 Dietsch, Fraisse, et Lé, "Lower Bank Capital Requirements as a Policy Tool to Support Credit to SMEs: Evidence from a Policy Experiment".

3.1.2. National Frameworks

The awareness regarding the importance of climate and other environmental risks for the financial sector has been increasing in past years. For this reason, central banks of various countries adopted measures in order to incorporate these risks into the financial regulation. **Figure 1**[38] shows different initiatives taken by the Sustainable Banking Network member countries up to 2016. These initiatives are diversified and include orientation guidelines towards a greener economy, implementation of environmental risk management systems, sustainable banking principles and others. The examples of the Chinese Green Credit Guidelines, the Green Banking Guidelines of Bangladesh Bank and the Netherlands Green Funds Scheme were looked at during the research carried out for this paper.

But despite the number of countries implementing measures to promote a sustainable development in their banking systems, no example of national regulation linking climate-related risks and capital requirements could be found.

3.2. Two polar instruments: supporting the green or discouraging the brown?

KEY MESSAGES

- **Under the risk approach using a GSF or a BPF alone would be questionable as this approach requires a recalibration of the risk weight factors of all assets to fully integrate climate-risks.**
- **The Green Supporting Factor relieves capital requirements for climate-friendly projects, making them more profitable and trying to close the green finance gap. But the limited empirical evidence regarding the lower risk of green assets augments the fear of inadequately reducing bank's capital and possibly creating systematic financial instability.**
- **The Brown Penalizing Factor could reduce credits to brown activities and help banks to bear losses from the materialization of climate-related risks. However, the tool might cause a negative distributional effect and can jeopardize the greening of key actors of the economy. The possible loopholes to avoid stricter capital rules could also reduce the effectiveness of the BPF.**

The decision to use a Green Supporting Factor or a Brown Penalizing Factor could only be made based on a single approach: the economic policy. Since the risk approach should aim at integrating climate-related risks in all assets and reflect the risk differential among assets, the application of a climate factor only to a single category of assets (green or brown) would not be consistent with the risk perspective. Nevertheless, the GSF or BPF could be used as a policy instrument and help direct financial flows from brown to green activities. Benefits and cons of GSF and BPF will be presented in this section.

3.2.1. The Green Supporting Factor

The idea behind the GSF, according to Commissioner Valdis Dombrovskis, is to reduce the capital adequacy ratio for projects classified as green according to the European taxonomy. In other words, a factor would be applied to lower the risk weight of green assets, reducing the capital requirement of these assets and consequently the overall capital adequacy ratio (CAR) of the bank. It is expected that banks would more easily finance climate-friendly projects, which would become more profitable with the lower capital requirement[39]. The factor could be applied in the capital requirement of a bank as shown for example in the simplified equation below, where α corresponds to the risk-weight of an asset:

$$\text{Bank's CAR (GSF)} = \frac{\text{Bank's total capital}}{\alpha \times \text{Brown Loans} + (\alpha - \text{GSF}) \times \text{Green Loans}} \geqslant \text{Capital Requirement}^{40}$$

The introduction of a GSF is justified by its supporters firstly by the need of new measures to help overcome the current green finance gap. They believe that it would enable banks to align more with climate objectives in financing more green projects. Five different studies estimated that the cost of capital for green projects is expected to drop by 5-25 basis points in average with the introduction of a GSF

38 The World Bank et Sustainable Banking Network, "Greening the Banking System: Experiences from the Sustainable Banking Network".
39 D'Orazio et Popoyan, "Fostering green investments and tackling climate-related financial risks".
40 D'Orazio et Popoyan.

in the range of 15%-25%, resulting in a rising profitability of these assets. A 15%-25% risk-weight reduction is equal to 1.05-1.75% decrease in the capital requirement itself[41].

Moreover, the theory of green assets having a lower risk of default is brought forward by its supporters to sustain the introduction of a GSF. Under this theory, even though green credits may also be vulnerable to transition climate-related risks, the disappearance of green activities is less likely than the disappearance of brown activities. Simply put, in a completed transition to a low-carbon economy all brown activities will necessarily have to be substituted by climate-friendly activities and progressively disappear while most green activities will thrive in the new low-carbon economy. In summary, the transition risks of green loans and investments would be lower since the probability of them not being aligned with the transition towards a low-carbon economy is far smaller[42].

- Under the risk perspective, this argument would only be valid if the climate adjusted risk factor associated with green assets was lower than the current risk factor used now in the RWA. As already mentioned, this situation is very unlikely: there is no reason why taking into account climate-related risks would decrease the level of existing risks as measured by the current Basel framework; at best, the impact would be neutral.
- Under the economic policy perspective, the argument could support the introduction of a GSF which would then include in the CAR calculation the positive value of green projects[43].

On the other hand, the GSF has been criticized and opponents of the idea warn it should be considered with caution. The first argument against a GSF is the very limited amount of empirical evidence that proves green activities to be indeed less risky than brown. The study conducted in the United States that supports such a theory is focused only on the reduction of the default risk for a specific type of green loan: energy efficiency mortgages[44]. Another study conducted in China shows that within 21 banks of the country, green loans have a non-performing loan ratio of 1.32 percentage point lower on average than other loans. Yet, other researchers believe this difference is related to the sample characteristics of the study[45]. Empirical data exist but they are still restricted to a few cases and limited to a country or a sector. Therefore, additional information is urgently needed to avoid any statistical bias.

In addition, one could even argue that some green assets are riskier than the average. Indeed, as the transition pathway to a low-carbon economy is highly unpredictable, it is hard to predict which green technologies will prevail; so, using a GSF could put at risk bank's financial stability.

Moreover, the negative impact of a GSF on bank's capital is put forward by the opponents of this measure because it would reduce bank's resilience to shock. Some experts consider that banks are already undercapitalized, that means current capital requirements might not be sufficient for banks to absorb unexpected risks[46]. If so, a GSF would then reduce even more their ability to cope with unforeseen risks. In this situation, the GSF could augment the probability of instability for several banks at the same time, putting at risk the whole system and pressuring governments to intervene again as it has already happened in the past crisis.

According to a study done by the European Banking Authority[47], the SME SF is estimated to save €11,7 billion in capital in European banks. While it is not demonstrated that the GSF would have the same material impact, this example gives a rough idea of the potential impact on banks' capital. Proponents of a GSF say its impact would concentrate on real estate lending and corporate loans. However due to the low interests currently applied to corporates, the natural low risk of real estate loans, and the benefit of capital relief under securitization regulations for residential mortgages, a modification on capital requirement is not expected to have a significant impact.[48] Moreover, critics claim there is no guarantee the capital saving of the GSF measure would result in an increase of green lending. Using the GSF as an economic policy tool would not be assured to result in supporting the transition to a low carbon economy. And even if green lending were to increase, there is no guarantee that brown lending would suffer any reduction if a GSF is applied alone. If brown investments continue to increase as well, as still observed today in several countries, the level of "greenness" of banks' portfolios would be maintained even with the use of a climate supporting factor.

Last, the reduction of capital requirements for green assets could eventually create a "green bubble" in the market. That means projects without real economic value or proper evaluation of their risks might end up being approved only because of the capital relief.[49] This bubble could lead to the development of greenwashing, where any project with a minimum environmental or climate benefit would try and attract the capital requirement bonus. With time the

41 2° Investing Initiative, "The Green Supporting Factor: Quantifying the impact on European banks and green finance".
42 The real situation is more complex: some green activities appeared to be quite risky in the past as it is generally the case for innovation. In addition, it would be necessary to take into consideration the risk profile of some green assets over time (highly volatile in the short term but more profitable in the longer term).
43 High-level expert group on sustainable finance, "Financing a sustainable European Economy".
44 IMT et UNC, "Home Energy Efficiency and Mortgage Risks".
45 NGFS, "A call for action : Climate change as a source of financial risk".
46 Arnoud Boot et Dirk Schoenmaker, "Climate change adds to risk for banks, but EU lending proposals will do more harm than good | Bruegel".
47 EBA, "EBA Report on SMEs and SME supporting factor".
48 Frank Van Lerven et Dr Josh Ryan-Collins, "Adjusting banks' capital requirements in line with sustainable finance objectives".
49 Abdeldjellil, Alain Grandjean, et Mireille Martini, "Régulation financière et urgence climatique : Pour des normes prudentielles et comptables plus vertes".

mechanism would be discredited by the market for not bringing sufficient economic or environmental value. The green bubble could also generate an imbalance between the supply and demand curves. With the fast increase of finance for green projects, consumers might not be ready to absorb all the supply, creating a surplus in the market.

3.2.2. The Brown Penalizing Factor

In response to the GSF, the idea of introducing instead a Brown Penalizing Factor (BPF) has been put forward by others. The mechanism of the BPF is very similar to the GSF and it would be included as a component in the calculation of the risk-weight assets of brown loans. Instead of diminishing the risk-weight of some assets and consequently the total capital adequacy ratio (CAR) of the bank, the BPF would be added up to the current risk-weight and increase the RWAs of this class of loans as shown by the example of the simplified equation below.

$$\text{Bank's CAR (BPF)} = \frac{\text{Bank's total capital}}{(\alpha + \text{BPF}) \times \text{Brown Loans} + \alpha \times \text{Green Loans}} \geqslant \text{Capital Requirement}$$ [50]

Those in favor of the BPF state that it could help banks bear losses from the possible materialization of climate-related risks. The assumption is that brown assets are exposed to higher transition risks than other assets since they are not aligned with the transition to the low-carbon economy. A BPF would allow banks to have an adequate capital basis to absorb unexpected losses caused for example by a possible carbon bubble or the repricing of stranded assets [51]. This would be a justification to increase their RWAs and at the same time discourage investments in brown activities that contribute to climate change. With the introduction of a BPF, the banking sector is expected to be more in line with the objective of restricting climate change under 1,5°C without compromising its financial stability. Obviously, such a crowding-out effect assumes that the BPF would be high enough. This aspect is developed later in this chapter.

Proponents of the BPF consider climate risks are underestimated and mispriced. Hence, the BPF would correct a market failure while not interfering with the capital framework of banks [52]. Requiring additional capital for brown activities would reflect their higher level of risk and guarantee that prudential regulation is being used according to the risk-based perspective. Regulators in favor of the BPF also believe that its implementation could be easier than implementing a GSF. In their view it is simpler to agree on the activities that contribute the most to climate change.

However, the BPF has also attracted several criticisms. First, from a political acceptability perspective the adoption of a BPF could be challenging. As the name implies, it punishes brown activities, so reaching a political consensus to adopt a methodology that penalizes major economic sectors would not be an easy task. Indeed, a BPF could have a distributional effect not only in certain sectors of the economy but could also differently impact households depending on their income level. Low income households who cannot afford environmentally friendly options could be penalized. On the business side, SMEs could be more impacted than large corporates, major employer industries such as the automotive industry could also suffer a substantial impact, and the penalization of strategically important goods like cement can affect the economy. All these examples make the acceptance of a punishing factor like the BPF more difficult.

Second, by penalizing a certain group of assets, the measure is not considered to be forward looking concerning the transition to a low-carbon economy. Bankers and others argue that it would very likely penalize the non-financial corporates which are engaged in a strategy to shift their business from mostly brown activities toward greener activities exactly the same way than corporates which are not making real transformative efforts. This could be very detrimental as it is key to support and accompany the transformation of corporates towards a low-carbon economy rather than penalizing them.

Third, the BPF would not stimulate the financial system to invest in technologies and ideas that will contribute to mitigate climate change impacts or increase resilience to it. Indeed, even if a reduction in credit to brown activities is obtained, a BPF would not necessarily support green credits which are needed to finance the transition to a low carbon economy but also benefit to any other type of climate neutral activities.

Fourth, a study based on interviews with regulators evidenced that higher capital requirements are likely to have a marginal influence on bank lending [53]. In other words, a BPF would not necessarily decrease significantly the volume of lending to brown activities if banks are enough capitalized to comply with the prudential requirements. The already mentioned study from 2°-Investing Initiative shows that overall the impact of a BPF between 15-25% would be an aggregate lending reduction of around 0.1-0.45%. This estimated decrease is the average overall impact in economy and may not be related only to brown activities. According to the study, as the volume of high carbon assets in the market is larger than that of green assets, the overall impact of a BPF might be higher than the impact of a GSF [54].

Finally, the introduction of a BPF may also shift the financing of brown activities from banks to other actors of the market

50 D'Orazio et Popoyan, "Fostering green investments and tackling climate-related financial risks".
51 D'Orazio et Popoyan.
52 2° Investing Initiative, "The Green Supporting Factor: Quantifying the impact on European banks and green finance".
53 CISL & UNEP FI, "Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?"
54 2° Investing Initiative, "The Green Supporting Factor: Quantifying the impact on European banks and green finance".

that are not subject to the same regulation ("shadow banking"). Banks could also escape the additional capital requirement through securitization (whereby, brown assets would be sold to non-financial actors) or by raising more capital in the market to continue to finance brown activities.

This situation, even if sustaining the resilience of banks, would maintain the overall level of brown activities that contribute to climate change. In essence, it is unclear if the BPF could be an effective economic policy tool to discourage non-environmental-friendly activities.

3.3. Three comprehensive instruments: accelerating the funding from brown to green

KEY MESSAGES

- **The combination of the GSF and BPF aims to overcome the weaknesses of each instrument taken separately, particularly the impact on banks' soundness. However, some potential difficulties remain especially regarding the debated impact on the transformation of corporates towards a low carbon economy.**
- **The Green Weighting Factor is an innovative and voluntary tool implemented by Natixis that correlates the analytical capital allocation to the degree of sustainability of each financial transaction. All bank's financial transactions are subjected to a specific adjustment of their risk-weight factor based on an internal environmental color rating methodology.**

Beyond the GSF and the BPF, other alternatives have been proposed with a more comprehensive approach. As for the GSF and BPF, pros and cons are presented in this section.

3.3.1. Combining the GSF and the BPF

As shown above, the idea of a GSF or a BPF is still controversial. For this reason, a third option is also considered which implies the combination of both factors to adjust banks' capital requirements. The combination would create at the same time a bonus and a penalty factor, with the aim of shifting credit allocation from brown to green activities.

From a risk perspective, this combined factor would make more sense than each taken separately if risk differentiation exists between brown and green activities. Capital requirements should in this case be readjusted for both groups to properly reflect the risk of the underlying exposures. The combination of the two factors would simply be superimposed to the current calculation of capital requirement for all assets instead of substituting the current methodology only for a part of them. However, the combination would still be short from a true risk approach which should recalibrate all risk weights to integrate climate-related risks (instead of using two adjustment factors) and would not assume that the risk level of green assets are lower than the level measured under the current regulatory framework.

From an economic policy perspective, the expected outcome is that together the GSF and BPF could better support the transition to a low-carbon economy (by shifting the credits from brown to green activities) and as the same time preserve banks' resilience (by compensating the capital relief on green credits with the capital increase on brown ones)[55].

However, all the obstacles mentioned for the GSF and BPF taken separately would not be solved when combined. In particular, in the absence of international rules, the possible loopholes to avoid stricter capital rules would remain: securitization, shadow banking, and finance for carbon intensive companies from outside banks. From the risk perspective, these escape solutions would not improve the overall financial stability level of the financial sector, even if individual bank's resilience improves. If analyzing the combination of a GSF and BPF from a policy perspective, the loopholes to get around capital rules would deteriorate the effectiveness of the instrument. Under both approaches, there would remain the high concern regarding the likely penalization of corporates undertaking their transformation as mentioned in the BPF case. In addition, global reduction in regulatory capital required for green assets is not assured to be equal to the increase for brown activities. In this case, the possible imbalance would not allow the mechanism to be capital neutral (*i.e.* to maintain the level of banks' capital as it is under the current regulatory framework).

3.3.2. Environment-risk weighted asset

In the context of this debate, the idea of incorporating environmental impacts into the calculation of risk-weighted assets has emerged. *"In practice, a bank's assets would be first multiplied using the present prudential regulation weight and then multiplied by a pollution coefficient that*

55 Abdeldjellil, Alain Grandjean, et Mireille Martini, "Régulation financière et urgence climatique : Pour des normes prudentielles et comptables plus vertes".

represents a correction for the environmental impact, thus determining an environment-risk weighted asset (ERWA)"[56]. The pollution coefficient applied to the current RWA would vary from 0.5 to 1.5 where values under 1 are only assigned to activities that produce zero or positive environmental impact. The new EWRA would then calibrate the capital requirement of assets taking into account their pollution externalities, resulting in a better management of the polluting activities. In summary, the EWRA functions as a policy tool to orient the allocation of capital from more polluting to less polluting activities.

However, the EWRA's calibration needs to be done carefully due to the complexity of the global value chains of production. Without granular data it is not possible to separate the impacts of each stage of the production chain by country, and consequently the calibration of the EWRA at the national level can be miscalculated. Another concern regarding the use of this mechanism is that it can overburden banks, so its implementation should be done gradually to lead to an orderly transition in the bank's portfolios towards less polluting assets.

3.3.3. Green Weighting Factor

Developed by Natixis, a bank part of BPCE group, the Green Weighting Factor (GWF) is an in-house mechanism which incorporates in essence the idea of combining the benefits of both the GSF and BPF. The GWF adjusts the analytical capital allocation to the degree of sustainability of each asset according to its climate and environmental impacts. The tool was created to monitor Natixis climate strategy and guarantee its alignment with the Paris agreement objectives; it is implemented since September 2019.

NATIXIS´ GWF METHODOLOGY

Two categories of credits are considered: dedicated-purpose credit – which is related to the financing of specific asset or project - and general-purpose credit – which is related to the funding provided to a client (corporate, sovereign, public actors).

Natixis rating methodology uses a 7-level scale.

- In the case of a dedicated-purpose credits, all project' s features feed an artificial intelligence system managed by Natixis staff. The system is based on decision trees and starts from an initial score related to the sector of the economy the asset/project is inserted in. This initial score also sets a minimum and maximum final color level for the transaction. Afterwards, other parameters are included in the questions of the decision trees to verify the possibility of additional environmental impacts (biodiversity, water, pollution and waste). The 46 decision trees provide different paths to achieve the final environmental score of the asset/project. All the questions in the paths are already framed, and the system is completely automatized.
- The scoring of the general-purpose credits follows a different methodology: the final grade is composed of the client's climate score (carbon footprint estimated automatically and analysis of the client's climate strategy) and the client's environmental impact score (based on Natixis´ sector analysis grid). The climate strategy analysis is not automatized; it is carried out by experts who verify the client's commitment to become greener and follow over time their transition to a low-carbon economy.
- For both groups, the final score is not necessarily static, and revisions are done periodically, especially for credits considered as highly risky according to the GWF.

The Green Weighting Factor gives a negative (up to 24%) or positive (up to 50%) adjustment of weighted assets to financial deals according to their environmental color rating. The environmental rating corresponds to a seven-level color scale from dark brown (transactions with negative impact), passing through grey (transactions with neutral or limited impact) to dark green (transactions with a positive impact). This adjustment is done to deals in all sectors Natixis works with: transport, infrastructure, real estate, energy, natural resources, waste and public sector.

56 Esposito, Mastromatteo, et Molocchi, "Environment – risk-weighted assets".

Initially the tool had two simultaneous objectives: i) incentivize green credits in Natixis' portfolio to reduce the bank's environmental impact and ii) integrate the climate transition risk into the bank's risk assessment of lending transactions. But during the development of the methodology, a tension has appeared between these two objectives. When analyzing some cases, it appeared that following both objectives was incompatible. First, the analysis of trade-finance activities brought to the discussion a time horizon constraint. For instance, when analyzing oil trade -which is a very short-term activity-, no transition risk is entailed from a risk perspective; but from the environmental impact perspective, its funding has a very negative effect on environment and climate. Second, loan's collateral can also create a divergence between the two objectives. From a risk perspective, the collateral of the activity being financed may not be exposed to transition risks, but that doesn't imply the underlying activity will not have negative environmental impacts.

Even being considered by Natixis as a simple tool with not much space for interpretation, the implementation of the GWF was not simple and required some material adjustments. The main difficulties in this process were the modifications of the 17 IT systems impacted, the change in the internal culture to get acceptance of the methodology, and the time spent to develop the methodology itself and revise written procedures Moreover, some new adaptations might be needed in the future. Once the European Green Taxonomy is released and depending on its final outcomes, Natixis could potentially make some adjustments to its environmental/climate credit classification (it is fair to add that such type of implementation difficulties would probably be faced when implementing any of the instruments reviewed in this paper).

The GWF is a voluntary framework which has no impact on the calculation of the prudential capital requirements. Still, it was initially calibrated to be capital neutral, *i.e.* to guarantee that Natixis' analytical capital remains similar to the capital required by the banking regulation. At first Natixis is applying a reduction by up to 50% in RWAs of green deals while brown activities can have their RWAs increased by up to 24%[57]. Capital neutrality is ensured given the current portfolio's structure: today 70% of Natixis' balance sheet (portion of the portfolio to which a color rating was already determined) is composed of 38% of brown activities, 43% of green activities and 19% are neutral. The calibration of the RWAs adjustment factor guarantees that the reduction in the capital required for the 43% of green activities doesn't exceed the increase in capital required for the 38% of brown loans[58]. This allows Natixis's analytical capital to remain stable and identical to its prudential capital at least at the starting point. Of course, Natixis expects that the percentage of green activities in its portfolio will augment at some point. When this occurs the green weighting factor will generate a difference between Natixis' analytical capital and regulatory capital. At this moment, a new adjustment regarding the portfolio's new structure may need to be made to address this capital gap should Natixis be willing to maintain the capital neutrality of the GWF over time.

The GWF is an interesting pioneer tool. However, its actual effectiveness is not yet clear. Natixis expects its portfolio to become greener, but at what pace this will happen remains an open question.

57 Natixis, "Natixis rolls out its Green Weighting Factor and becomes the first bank to actively manage its balance sheet's climate impact".
58 Natixis.

FIGURE 2

ADVANTAGES AND DISADVANTAGES OF EACH INTEGRATING TOOL

Green Supporting Factor

- Incentivize banks to grant credit to green activities.

- Decrease bank's capital base vis-a-vis current regulatory requirement;
- No empirical evidence on the risk level of green credits;
- No evidence on the impact regarding green lending increase;
- Possible development of a green bubble.

Brown Penalizing Factor

- Strengthen banks' capital base to help them overcome unexpected losses coming from brown activities;
- Help correct market failure of mispricing climate risks.

- Not forward looking as it may jeopardize transformation of corporates from brown to green business;
- Difficult political acceptance;
- Decrease in brown lending not surely linked to less brown activities (shadow banking);
- Possible levers to escape the increase of capital requirements.

GSF combined with BPF

- Covers both green and brown assets;
- Can help accelerate the shift from brown to green lending;
- Maintain banks'capital base at their current level under certain conditions.

- Not forward looking as it may jeopardize transformation of corporates from brown to green business;
- No garantee that the capital relief for green assets will be compensated by the increase on brown activities so to maintain capital neutrality;
- Possible levers to escape the increase of capital requirements.

Environment-risk Weighted Asset

- Designed as a policy instrument to reduce polluting activities.

- No guarantee that capital neutrality will be maintained;
- Difficult to calibrate because of the global production chain;
- Cannot be used for the risk perspective as currently designed.

Green Weighting Factor

- Designed to accelerate the greening of the bank's portfolio;
- Designed to ensure capital neutrality at the starting point.

- When tensions surfaced between the 2 initial objectives priority was given to incentivise green credits over the integration of climate risks;
- No guarantee that capital neutrality will be maintained over time;
- No evidence on the impact regarding green lending increase or brown lending decrease.

Source: I4CE

4. Design and Operational Challenges

KEY MESSAGES

- **Challenges to implement a tool that integrates climate-related risks into banks' capital requirements depend on the goal pursued: maintain banks' financial stability (risk approach) or support the transition of the economy (economic policy approach).**
- **Overall there are five main challenges: developing a common, transparent, comparable and non-binary taxonomy; creating operational and accurate climate-related risk assessment even with climate-related risks' deep uncertainty; expanding risk analysis' horizon beyond short term; maintaining capital neutrality in the micro level, in the starting point and overtime; and ensuring the effectiveness of adjusting banks' capital requirements.**

As previously mentioned, when it comes to integrating climate-related risks into banks' capital requirements there are two main approaches that can be pursued. The first is the risk approach to guarantee banks' financial stability and so preserve their solvency. This stance is risk-based, and the capital requirement adjustment aims to protect the banking system from unexpected climate-related risks and systemic crises. The second approach, economic policy, seeks to orientate financial flows towards investments on green activities instead of brown, so to serve as an accelerator of the low-carbon transition. This would aim to incentivize banks to gradually decarbonize their balance sheets and help them to comply with the targets of the Paris Agreement in the long run. Depending on which of these two stances is favored, the challenges to design and implement an integration tool might vary.

4.1. Common Taxonomy

However, regardless of the approach adopted, the development of a common taxonomy is a helpful circumstance. A taxonomy determines minimum standards to precisely classify activities according to their environmental impacts. Therefore, a taxonomy can be considered as a pre-condition for using banks' capital requirements as a policy tool.

But one could argue that taxonomy is not a risk management tool and so it would not be necessary to have one in the risk approach for calibrating risk weighting adjustments. Still, in the EU Plan, the Commission has mandated EBA to check that the future taxonomy could be used for adjusting capital requirement and for stress tests. The taxonomy is not meant to look at activities from a risk perspective but rather from an impact perspective according to the asset's contribution to environmental objectives. However, even if the exposure of the assets to climate-related risks is not calculated, activities failing to meet the thresholds of the taxonomy to be considered green have a higher probability to face transition and liability risks, besides a likely reputational risk in the future. Although other factors can also impact the overall risk profile of the asset (*e.g.* the availability of commercially viable alternative products or the ability to hand down increased carbon related costs to the clients), the climate-related risks of brown activities are still more likely to be higher. Therefore, it would make sense to use the taxonomy as a contribution to regulators' works for assessing the level of climate-risks of each type of assets. In this sense, taxonomy can be considered as a useful tool for the risk approach.

Taxonomy' s minimum standards allow financial institutions to precisely classify their assets according to their environmental impacts. The taxonomy also sets the basis for banks to assess the level of "greenness" of their current portfolio before, during and after the use of a supporting factor or other similar tool and could then be a type of monitoring and evaluation system of the effectiveness of the instrument. Moreover, a common taxonomy can limit "greenwashing", a phenomenon especially related to the GSF, by preventing "green marketing" to overstate the real environmental benefits of an asset[59]. Finally, a taxonomy, if appropriately designed, can be a helpful tool to manage a potential green bubble that can arise from the implementation of some integration tools. A green bubble, as already mentioned before in the paper, creates a pressure that would lead investors to finance any project that has a minimum intrinsic environmental value only due to the decrease in the overall price of the asset related to the capital relief.

The common taxonomy should however comply with certain minimum requirements to be a useful mechanism which helps to overcome some of the challenges to design and implement an integration tool. First, in most cases, it needs to be more than binary. It should set a definition and categorization not only of green assets but also for brown assets, that negatively contribute to climate-change (including lock-in effects), and assets which can be considered as neutral. The NGFS supports the development of a taxonomy of economic activities that contribute to the low-carbon economy transition ("green taxonomy") but also of activities that are more exposed to climate-related risks ("brown taxonomy")[60]. Mark Carney said " mainstreaming sustainable investing will require a richer taxonomy – 50 shades of green"[61]. In other

59 EBF, "Towards a Green Finance Framework".
60 NGFS, "A call for action: Climate change as a source of financial risk".
61 Carney, "Remarks given during the UN Secretary General's Climate Action Summit 2019".

words, activities should be classified in accordance with the level of their contribution to the ecological transition.

Second, transparency is a key factor for the effective development of a taxonomy, hence the participation of a diversified group of stakeholders in its design is highly important to ensure it does not favor any sector of the economy[62]. The categorization of financial products must also be simple and continuously adjusted, as it will not only be used by environmental experts, and green activities will frequently change, with new technological advancements or innovations[63].

Last, a universal taxonomy should set descriptions and standards that allow clear and fair comparisons of financial products by all market participants[64]. To anticipate upcoming regulations, some banks have already developed their internal taxonomy. This is certainly a valuable initiative, but it does not provide clarity and comparability to the entire financial sector and can be sometimes considered as biased, especially regarding sensitive classifications such as nuclear energy, natural gas or large hydropower projects. These types of assets might generate plural opinions when developing a taxonomy as to whether they can be considered as green financial products.

4.2. Approach 1: Risk – Climate-related risk assessment

If the objective of adjusting banks' capital requirements is to accurately reflect the risks generated by climate change, regulators and banks still need to overcome the difficulty of quantifying those risks. Awareness of climate-related risks has increased but calculating climate-related risks is still a challenge because of the deep uncertainty[65] (see box) nature of climate change and the limitations of standard credit risk models. Deep uncertainty[66] makes the use past data (which are lacking anyway) irrelevant to build probabilities. Instead, estimating climate-related risks requires models with a forward-looking approach. However, with the uncertainty issue these models rely on several hypothesis and assumptions that can highly influence the results. For instance, depending on the physical and economic relationships adopted or on the feedback loops presumed the outcomes of the models can considerably vary[67].

The capacity to identify and analyze climate change impacts on the banking sector assets has improved with the development of new models and higher availability of data. Notwithstanding, today banks' risk valuation tools still depend on probabilistic data to be calibrated. That means climate-related risks' assessments are still approximated, as are climate impacts on the performance and financial return of assets. The existence of a negative climate-change impact on the economy is widely recognized but adjusting the probability of default (PD) and the loss-given default (LGD) of various assets to consider climate-related risks is still a substantial challenge. Consequently, the doubt arises as whether banks' standard risk assessment models are the appropriate tools to evaluate climate-related risks.

CLIMATE-RELATED RISKS AND THE RADICAL UNCERTAINTY

Climate Change risks are associated with three sources of uncertainty:

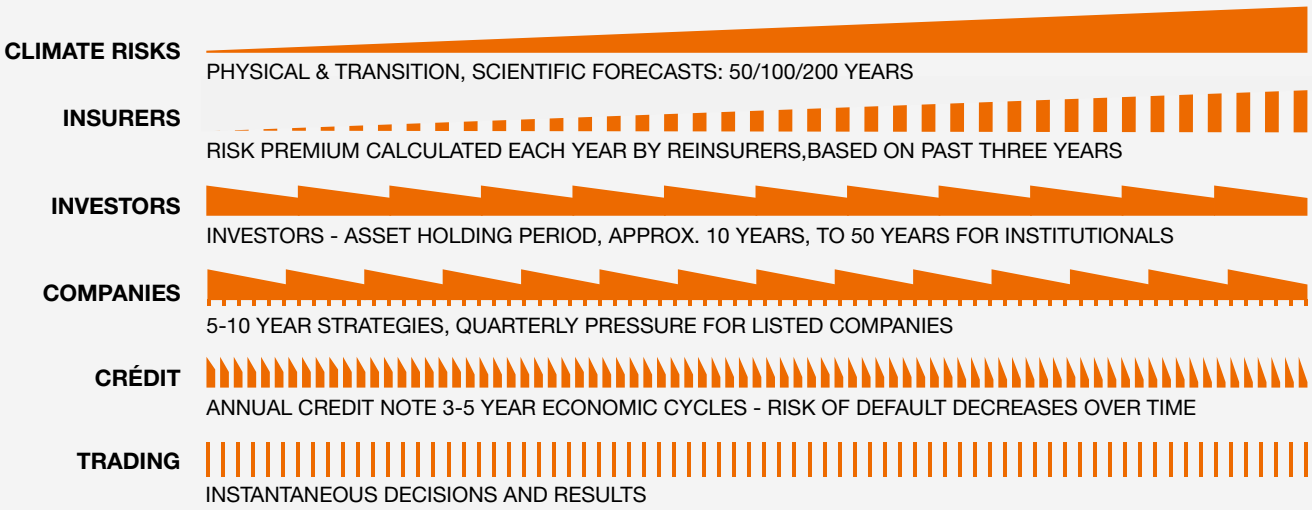
1. Socio-economic: it is not possible to determine when and how the decarbonization of the economy will occur or how the GHG emissions will evolve.
2. Scientific: climate system is highly complex, and models only simplify the reality of the ecosystem interactions.
3. Climate natural variability: the climate system has a non-linear and non-deterministic natural intrinsic characteristic that turns it into an unpredictable system.

Moreover, notably in the case of large banks, even if the barrier of deep uncertainty to quantify climate-related risks was overpassed, their risk management systems, used also as source of information to calculate the bank's RWAs, would not be able to integrate those risks. The major constraint large banks would face is the mismatch regarding the risk analysis horizon. Climate-related risks are expected to materialize in the medium and long run while financial risks are generally analyzed according to a short and medium period scenario[68]. Small banks face a similar difficulty when using the standard method established by Basel III. To calculate their RWAs, they use risk-weight factors calibrated with PDs and LGDs measured through the business cycle horizon (5-8 years) which is medium term. So, the RWAs cannot by definition address longer term risks such as climate related risks. **Figure 3** shows the lag between the horizons considered by scientists when analyzing climate-related risks and those generally used by financial and economic players to assess the risks of their activities.

62 EBF, "Towards a Green Finance Framework".
63 European Investment Bank, "The need for a common language in Green Finance: Towards a standard-neutral taxonomy for the environmental use of proceeds".
64 European Investment Bank.
65 Frank Knight defined in 1921 the difference between risk and uncertainty: "The practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience), while in the case of uncertainty that is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique".
66 Dépoues et al., "Towards an alternative approach in finance to climate risks: Taking uncertainties fully into account".
67 Monnin, "Integrating Climate Risks into Credit Risk Assessment - Current Methodologies and the Case of Central Banks Corporate Bond Purchases".
68 Sevillano et González, "The risk of climate change for financial markets and institutions: challenges, measures adopted and international initiatives".

FIGURE 3

DISTINCT RISK HORIZONS



*Source: Finance for Tomorrow**

* Finance for Tomorrow, "Climate risk in finance: concepts, methods & assessment tools".

4.3. Approach 2: Economic Policy – Capital neutrality and capital requirement impact

From the economic policy perspective, the objective of adjusting banks' capital requirements is to accelerate the financing of the transition to a low carbon economy and unleash green finance. In such a situation, the exact measure of climate-related risks is no longer a concern.

Accordingly, calibrating the climate factor to adjust risk weights could be based on other parameters more relevant for the economic policy perspective such as for instance environmental impacts, analysis of climate strategies and environmental impact as applied by Natixis or a transition score as already done by Credit Agricole (see **box**).

However, it would be of the utmost importance that such a policy does not threaten banks' financial stability. Consequently, the climate factor used to adjust capital requirements should be calibrated in a way that the decrease in capital requirements for green activities is balanced by the increase for brown activities. The ways of calculating the adjusting factor can vary but capital neutrality should be assured.

4.3.1. Capital neutrality

This issue of capital neutrality raises two difficulties. The first one is how to ensure capital neutrality at the starting point since banks have different structures of portfolios. As explained before, the proper calibration of the climate factor to ensure capital neutrality depends on the structure of each bank's portfolio, or in other words, on the percentage of the balance sheet associated with green, brown and neutral credits. If only a single climate factor was applied to all banks, similar to the SME supporting factor, it would not be able to maintain the capital base for each individual

CRÉDIT AGRICOLE: DEVELOPING A TRANSITION SCORING

The bank Credit Agricole (CA) developed an internal methodology to green its portfolio. Today all new application for getting credit from the institution pass through an environmental analysis to be graded. First the credit is classified as green or not according to the internal taxonomy. Subsequently, a transition risk score is assigned, which evaluates the preparedness of the clients to cope with energy-related challenges. The transition risk score is calculated using the three following variables:

1. The economic sector and geographical location of the credit (method P9XA);
2. The Intended Nationally Determined Contribution of the geographical and economic sector normalized to the level of decarbonization of the economy per year;
3. Energy transition score provided by Vigeo to compare with the average grade of the sector;

CA considers that a credit with an overall positive transition score is better aligned with the transition to a low carbon economy. Those credits would then represent a better opportunity of investment for the bank due to possible lower transition risks.

bank. Capital neutrality could not be achieved only through calibration at the macro level; a micro adaptation for each bank within a common framework would likely be necessary to consider portfolio particularities as it will be further explained in Section 5-Next Steps.

The second issue is whether capital neutrality should be maintained overtime, following credit dynamics and the changing structure of banks' portfolios between green and brown assets. In this case, regulators and banks would have also to be prepared to frequently assess the calibration of the factor to guarantee capital neutrality in operational terms. Should the overall capital requirements decrease due to a rapid greening of the portfolio of one specific bank, it would be necessary to envision measures such as an extra capital buffer to be applied, which would impact the bank's balance sheet and profitability. If no measure is applied and overall capital is insufficient when compared to the current Basel's RWAs, this bank might be vulnerable to unforeseen risks. In the case of a crisis, as observed in 2008, the bank would not be sufficiently capitalized if the relief of capital for green assets is not balanced with the increase of capital for the brown part of the portfolio. What's more, if initially a bank is undercapitalized, then an integration tool that reduces capital requirement should not be utilized.

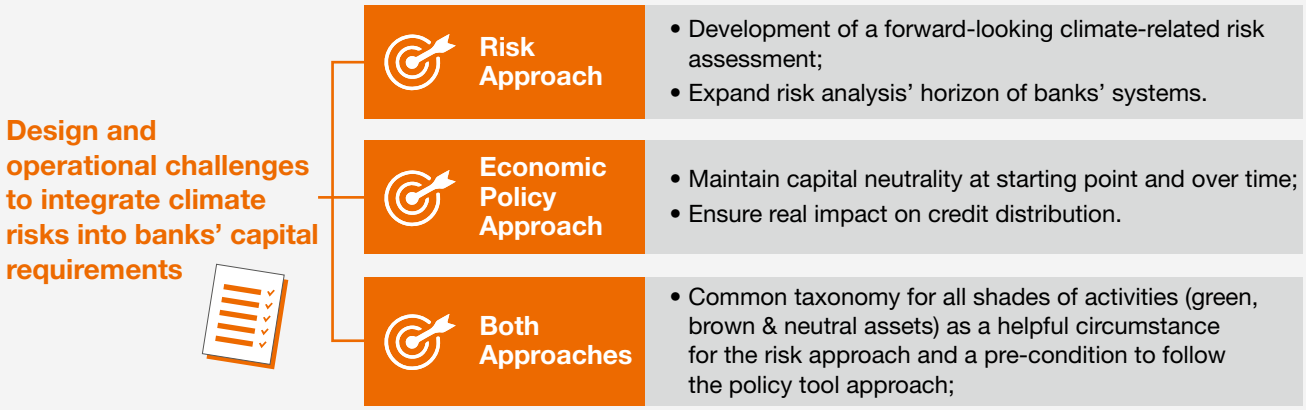
4.3.2. Capital requirement impact

Beyond capital neutrality, there is the question of the real impact of capital requirements on credit distribution. There is no evidence for instance to address the concern that any capital relief would in reality benefit mainly to credits that are already considered less risky by banks due to other factors besides their "greenness". That means there is no evidence so far of the efficiency of the RWA adjustment in terms of channeling more credits to green activities. The extent to which the change in capital requirements would increase green credits and/or reduce brown credits is uncertain.

Another point to take into consideration regarding the question of capital requirement potential effectiveness as policy instrument is whether the adopted tool would help to tackle the most pressing financing gap for transition. For example, one may argue that the integration modalities discussed in this paper would not encourage the banking system to invest in green innovation; then this category of credits, which is highly important to promote low-carbon transition, would continue to be jeopardized in the market. The higher risks of new green products and technologies and their lower capacity to be used as collateral are obstacles for banks to finance the green innovation sector[69]. This fundamental problem cannot be addressed by a climate factor, but probably needs other approaches that are more focused on reducing the risk taken by private actors via some form of public guarantees. In other words, from a policy approach perspective, a country facing an investment gap in innovation will most likely not benefit much from the proposed adjustments in capital requirements. It is also unknown if a climate supporting factor would encourage investments that tackle other environmental problems or if the additional credits would be mainly centered around addressing climate change.

FIGURE 4

IMMEDIATE CHALLENGES TO INTEGRATE CLIMATE-RELATED RISKS INTO BANKS' CAPITAL REQUIREMENTS



Source: I4CE

69 Benfratello, Schiantarelli, et Sembenelli, "Banks and innovation".

5. Next Steps

KEY MESSAGES

- **There are still grey areas which need to be further discussed and studied. Examples are the difficulty in segregating climate-related risks from other financial risks, maintenance of capital neutrality after implementation of the integration mechanism, and lack of information and empirical evidence.**
- **Temporality and the development of a monitoring and evaluation system would be interesting points to discuss in the near future.**

Even if one assumes the willingness to adopt a climate factor, some topics still need to be further discussed. Though some methodologies have already been developed to integrate climate-related risks into capital requirements, some grey areas still exist when debating about this topic. It would be important to discuss and clarify points such as the bias of methodologies, the capital neutrality in the long run and the lack of empirical evidence, in order to avoid future constraints. At the same time, other ideas will only be addressed in the future when the necessity comes, such as the case of the implementation of a monitoring and evaluating system or the temporality of use of the tool.

5.1. Knowledge Gaps

Even if the challenges, exposed in Section 4, for the design and implementation of integration mechanisms were satisfied, some concerns would still exist.

First, as mentioned earlier in this note, climate-related risks are extremely difficult to quantify. Studies have been done on this subject and clearly explain why this measurement is not as straight-forward as for other financial risks; therefore, the question of the difference of level of default risk between green and brown assets is still inconclusive. Indeed, the improvement of climate-related risk assessment tools still does not guarantee the statistical reliability of correlations between climate-related risks and credit default. It is always very hard to completely segregate the causes for credit default and the situation is no different when thinking about climate-related risks. Even if a risk differential was proven between green and brown activities, other characteristics of the borrower could affect the default probability[70]. For example, if energy efficiency or renewable energy loans are obtained by people with superior revenues, the risk of default will most likely be lower as their repayment capacity is higher. This implies that the credit is not less risky just because it is environmental-friendly: the financial level of the borrowers has also a high influence. Another hypothesis is that, while in theory there may be a logical link between the greenness of an asset and its riskiness, in practice there may be other factors that influence whether the risk potential of a brown asset is actually transferred to the financial institution or not. Further in-depth analysis of where risk factors emerge (*i.e.* what are the transmission channels of transition risk) and how they are transferred across the value chain as well as across the chain of financial intermediaries, could help elucidate the issue.

Secondly, in the case where the climate factor would be used as an economic policy tool, it would be important to maintain banks' level of capital. As credit dynamics may change quickly over time, guaranteeing that banks' own funds will remain at the level required by prudential regulation might not be feasible in operational terms. In that case: should extra capital buffers be required by regulators? Could other measures or tools be adapted to prevent or to compensate the reduction in banks' own funds? Answers for these questions have not yet been found and they should be brought to the table before the issues occur on real situation after any adjustment of the prudential regulation.

Third, as already discussed in Section 4, there is still a considerable knowledge gap in terms of information availability regarding the efficiency of capital requirements' adjustments on the effective credit distribution.

Lastly, it is important to think about the flexibility of a climate factor to adjust the capital regulation which should not be static and similar for all banks. A micro adjustment at the bank level within a common prudential regulation framework could be necessary to reflect the banks' changing portfolio structure between green and brown activities and also the particularities of the sectors they work with. Such a micro calibration could also help prevent banks from jeopardizing the funding of corporates which are progressively greening their brown activities.

5.2. Points for future reflection

As the debate of integrating climate change into banks capital requirements is still open and opinions are very divided, some ideas are premature to be discussed at this point. Nevertheless, it might be considered as a good practice to reflect about them in advance.

One point is the temporality of use of such a tool. According to the interviews conducted, experts see the tool as a measure to be taken for the middle and long term. A possibility would

70 NGFS, "A call for action : Climate change as a source of financial risk".

be to revise its calibration with a certain frequency, as for example every two years as the transition to a low carbon economy progresses. However, the exact timeline for this review is arduous for regulators to determine, as economy transition will depend on development of new technologies, on policies adopted and on change of consumers' behavior. According to the experts interviewed to draft this paper a short-term adoption would not be recommended, as it could generate a bubble effect. Moreover, from a political perspective it could also create a sensitive situation for politicians who supported the implementation of the climate factor, which requires a large adaptation on banks' systems, to remove the instrument in a short period of time. A short-term factor could also send a wrong signal when it ends, as it could be interpreted as the fact that the transition does no longer matter.

Last, as there is no clear evidence that the outcome of integrating climate-related risk into banks' capital requirements would have a positive impact, putting in place a monitoring and evaluation (M&E) system could help improving its efficiency based on reliable data. A M&E system could not only help with a possible revision of calibration of the factor but could also assess the effectiveness of the measure and its positive environmental impact. Inspiration for the design could be gathered from the system put in place by the Chinese government. It is focused on key performance indicators for banks that cover three main areas: green products, green risk assessment, and green operations[71].

71 Frankfurt School et UNEP, "Delivering the green economy through financial policy".

Conclusion

The recognition of the potential system-wide impacts of climate-related risks combined with the investment gap of the low-carbon transition (insufficient financing dedicated to green activities and too many resources allocated to brown assets) require immediate action. In this context, using prudential regulation, and more specifically banks' capital requirements has been discussed as an alternative solution to address the problem. The integration of climate-risks into banks' capital requirements could be a complementary mechanism to other economic and fiscal policy tools.

The debate regarding the integration of climate-related risk into capital requirements has taken place among various stakeholders who defended strong and opposing views. But the debate has been rather confusing so far because objectives, instruments and conditions have been mixed up.

This paper' s objective is to clarify the debate in distinguishing very clearly the two possible objectives that can be followed when integrating climate-related risks into banks' capital requirements. Indeed, such mechanism can follow two different approaches. The risk approach aims to ensure banks' financial stability by integrating a new source of credit risks in the calculation of banks' capital requirement. The second approach aims to use the adjustment of banks' capital requirements as an economic policy tool to allocate the financial flows towards a low carbon economy.

Using this analytical perspective, several points have been highlighted in the paper:

First, the examples of integration features presented demonstrate that the discussion goes beyond a simple decision between using a Green Supporting Factor or a Brown Penalizing Factor. Other proposals have been developed by the market to design tools that benefit climate-friendly activities while discouraging carbon intensive credits. All these proposed instruments possess advantages and disadvantages that should be carefully analyzed before any decision making.

Second, all the reviewed instruments are not equally fit to meet each approach. When following the risk approach, using a Green Supporting Factor or a Brown Penalizing Factor alone would be very questionable. Indeed, the risk approach would require recalibrating the risk weight factors of all assets to fully integrate climate-risks. There would be no point in reassessing the level of risks of only some assets and not all. In this respect, the combination of a GSF and a BPF – or any similar mechanism – would make a step in the right direction as such a combination would cover all assets, be they green or brown. However, it would still make the highly debatable assumption that the adjusted risk weight of green assets should be lower than their current risk weight: on the contrary, from a pure risk based perspective, it is likely that the adjusted risk weight of green assets should remain constant at best, depending on their shade of green. On the contrary, if the economic policy perspective is privileged, none of the reviewed instruments can be disregarded from the start.

Third, it is crucial to keep in mind that depending on the approach pursued different challenges need to be overcome before adopting an integration tool.

- In the case of the risk approach, a risk assessment framework capable of quantifying climate-related risks and compatible with banks' systems needs to be developed. For the time being, given the deep uncertainty brought by climate change, the lack of forward looking data and the discrepancy between the horizon of standard risk assessment models and that of climate-related risks, designing a reliable method to measure climate-related risk is still a huge challenge.
- Regarding the economic policy approach, assessing climate-related risks is no longer a concern as other metrics could be used. However, this approach would face other challenges. The first one relates to the effectiveness of adjusting capital requirements to accelerate or slow down the granting of specific categories of credit. Indeed, there is no clear empirical evidence supporting such effectiveness. The second one is this policy instrument should not conflict with the primary objective of prudential regulation, *i.e.* financial stability. As capital requirements have been increased after the recent global financial crisis, it would be very questionable to jeopardize the efforts made in the last decade to reinforce banks' resilience. Maintaining the capital neutrality of this policy instrument would then be a key challenge. This raises the question as how capital neutrality should be ensured at the starting point, possibly through a micro adaptation of the mechanism, and whether it should be maintained over time which would entail rather complex mechanisms.

Fourth, the research stresses that pursuing the risk and the economic policy objectives all together can create tensions in the design of the capital requirement adjustment for certain types of financial transactions. One could think that one objective needs to be privileged, probably to the detriment of the other.

Fifth, a common taxonomy, if appropriately designed, appears to be a helpful circumstance for the risk approach to screen the assets vis-à-vis their transition impact and would be a pre-condition to follow the policy tool approach. Depending on the instrument chosen, this taxonomy could be a green taxonomy – as the European Union's (EU) taxonomy – or a green and brown taxonomy as requested by regulators of the NGFS.

Finally, some questions remain without answers and should be further explored in the next years. For instance, the level of risks of green assets compared to that of brown assets or the real impact of the integration tools already implemented by individual banks.

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