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BANK REGULATORY CAPITAL & CLIMATE-RELATED RISKS.

di Luca MENEHINI*.

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Maggio

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Abstract

The paper explores the links between the bank regulatory capital requirements framework and climate-related risks. On the one hand, the issue is surveyed in light of the debate underpinning “green” capital requirements through a risk-based approach, using both microprudential and macroprudential analysis. On the other hand, the paper further analyzes whether capital regulation should be employed as a climate policy tool. Finally, in light of previous determinations, the European and US frameworks are compared.

Il presente contributo esamina il rapporto tra il capitale regolamentare bancario e i rischi climatici. Da un lato, il tema è trattato analizzando i profili di rischio che contraddistinguono il dibattito inerente ai cosiddetti requisiti di capitale “green”, utilizzando sia l’analisi microprudenziale sia quella macroprudenziale. Dall’altro, l’articolo si interroga se sia opportuno usare la regolamentazione del capitale come uno strumento di policy climatica. In conclusione, il presente contributo analizza e confronta il quadro giuridico europeo e americano.

Bank regulatory capital & climate-related risks.

SUMMARY: 1. Introduction - 2. Bank capital requirements: a primer - 3. The impact of climate-related risks on bank capital - 3.1. Climate stress testing - 4. Green capital requirements - 4.1. The microprudential risk-based approach - 4.2. The macroprudential risk-based approach - 4.3. Greening TLAC - 4.4. The climate policy approach - 5. The European framework - 6. The US framework - 7. Conclusion.

1. Introduction.

There is mounting consensus that climate change poses material risks to banks and to the financial system. To this end, policymakers, academics and financial regulators on both sides of the Atlantic have been discussing whether some of the existing financial and regulatory toolbox may be reshaped to face the consequences of the climate emergency and support the transition towards a low-carbon economy. The debate surrounding the deployment of capital regulation has arguably been at the top of the agenda.

While the main objective of capital regulation is to ensure the soundness and stability of credit institutions, the idea to adjust regulatory capital to address climate risks and to induce sustainable lending is exerting increasing support. However, we think much intellectual confusion is characterizing the debate around green capital requirements. Implementing a climate-adjusted capital regime raises important technical questions, both from an empirical and a policy standpoint. Our approach to examining the issue moves in two steps. First, we analyze whether bank capital requirements should be adjusted to address climate-related financial risks and how such calibration could look like. Second, we investigate whether a climate-informed capital regime would be an appropriate policy tool to channel financing towards more sustainable economic activities and curtail lending to carbon intensive industries.

The paper first provides a brief overview of bank capital requirements and analyzes how climate-related risks might in fact impact bank capital, and whether stress testing could prove useful to remediate some methodological challenges. Then, we survey the debate underpinning green capital requirements under a risk-based approach - through the lenses of both microprudential and macroprudential analysis. We further analyze whether capital

regulation should be employed as a climate policy tool. Finally, in light of previous determinations, we compare the European and US frameworks.

2. Bank capital requirements: a primer.

The paper only seeks to offer a critical assessment of the debate surrounding so-called “green” capital requirements, and does not purport to address neither the history nor the rules underpinning capital regulation or the business of banking. However, for reference, the stage is set by recapping some key features and vocabulary of the capital adequacy regime.

Bank capital requirements are arguably the key financial regulatory tool to ensure that banks are equipped with a cushion to cover unexpected losses and declines in asset values during times of economic stress, thus preserving the safety and soundness of the financial system.¹ In the most general terms, the regulatory rationale for imposing minimum capital levels is to ultimately avoid failures and to shield the bank’s viability by reducing incentives for incurring excessive risks, limiting leverage growth and controlling moral hazard.² In theory, if a bank shelves adequate cushions of capital it should be equipped to absorb unexpected losses and declines in asset values, ultimately benefitting both bank depositors and taxpayers.³ From a regulatory standpoint, capital regulation leverages the composition of a bank balance sheet. Thus, banking institutions are required to fund certain assets with shareholder equity rather than exclusively relying on cheaper sources of financing, such as debt.⁴

The paper analyzes the issue of capital through a jurisdictionally agnostic approach (unless otherwise stated), but for ease of understanding we shall discuss capital requirements by referring to the rules adopted under the auspices of the Basel Committee on Banking

¹ See, *inter alia*, H. SCOTT, *Interconnectedness and Contagion. Financial Panics and the Crisis of 2008*, 2014, p. 122, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2178475; J. ARMOUR, D. AWREY, P. DAVIES, L. ENRIQUES, J. N. GORDON, C. MAYER, J. PAINE, *Principles of Financial Regulation*, Oxford University Press, 2016, pp. 277 ff.; M. S. BARR, H. W. JACKSON, M. E. TAHYAR, *Financial Regulation: Law and Policy*, Foundation Press, 2021, pp. 325 ff.; R. S. CARNELL, J. R. MACEY, G. P. MILLER, P. CONTI-BROWN, *The Law of Financial Institutions*, Aspen Publishing, 2021, pp. 203 ff.

² *Ibidem*.

³ *Ibidem*.

⁴ BANK POLICY INSTITUTE, *Basel Finalization: the History and Implications for Capital Regulation. Part I: Introduction*, January 2023, p. 2, <https://bpi.com/basel-primer-series-introduction/>.

Supervision (BCBS) at the Bank for International Settlement (BIS) - the global standard setter of bank capital regulation.⁵ In a nutshell, the Basel regime operates under a three pillars structure: Pillar I defines minimum regulatory capital requirements, Pillar II adds a supervisory review system (for banking supervisors to evaluate banks' risk assessment best practices) and Pillar III aims to ensure transparency and market discipline by disclosing capital adequacy.⁶

Under the Basel Accord framework, banks must hold a minimum threshold of shareholder equity capital that is proportionate to the nature and scale of their risks and is calculated as a percentage of a bank's risk-weighted assets (RWAs).⁷ The risk-weighting mechanism essentially reflects the perceived riskiness of a certain asset classes.⁸ Three main risk buckets are considered under the Basel rules: credit risk, market risk, and operational risk. Mandatory capital levels are expressed as a function of such risks on the balance sheet, and are determined by applying a multiplier to each type of exposure according to their tailored risk sensitivity.⁹ Therefore - intuitively - banks must set aside higher levels of capital when their balance sheet is exposed to riskier assets and/or borrowers. Against this backdrop, a ratio must be calculated by dividing the available capital (numerator) by the RWAs (denominator).¹⁰

To calculate an optimal level of capital, banks employ probabilistic financial models such as the value-at-risk (VAR) framework or Expected Shortfall. The underlying functionality of these models is to numerically quantify the risk of a bank's portfolio by

⁵ The BCBS was established in 1974. As of 2019, its membership base comprised 45 members representing 28 jurisdictions. Members include central banks and bank supervisors across the worlds. See M. Barr, G. P. Miller, *Global Administrative Law: the View from Basel*, *The European Journal of International Law*, vol. 17(1), 2006, pp. 15 ff, <https://academic.oup.com/ejil/article/17/1/15/410997>.

⁶ For an overview of the Basel III regulatory framework, see BASEL COMMITTEE ON BANKING SUPERVISION, *Basel III: a Global Regulatory Framework for More Resilient Banks and Banking Systems*, 2011, <https://www.bis.org/publ/bcbs189.htm> and also compare the newly consolidated Basel framework at https://www.bis.org/basel_framework/.

⁷ For a detailed overview on how to calculate RWAs for credit, market and operational risks see https://www.bis.org/basel_framework/chapter/RBC/20.htm?inforce=20230101&published=20201126.

⁸ IBIDEM. For instance, let's use an example taken from P. WOOD, *Law and Practice of International Finance*, Sweet and Maxwell, 2008, p. 410. When a bank grants a loan, the formula is [capital requirement] x [outstanding amount of the loan] x [risk weight]. If the loan amount is \$100 to a borrower to which a 100% risk weight is applied, the bank must set aside an equity capital layer of \$8. If the risk weight is instead 50%, then only \$4 of capital must be set aside and so on.

⁹ BANK POLICY INSTITUTE, *Basel Finalization: the History and Implications for Capital Regulation*. Part I: Introduction, p. 3.

¹⁰ IBIDEM.

estimating the distribution of potential losses above a given threshold, with a certain degree of probability, over a given time period (usually one year).¹¹ This allows to determine the level of capital that would theoretically allow the bank to remain solvent over that period, should expected or unexpected losses materialize in the projected timeframe.¹² Furthermore, under Basel, risk-sensitivity to credit risk exposures can be calculated under two frameworks: the standardized approach made available by the BCBS and the Internal Rating-Based (IRB) approach that allow banks to develop internal models to calculate individually their risk-weights, subject to an output floor pegged to the standard calculations to ensure capital equivalency.¹³

Under Pillar I, which requires banks to set aside regulatory capital for credit, market and operational risks, different types of capital may be qualitatively identified, depending on the type of instruments that can be encompassed in the calculation. The minimum ratio composed of Common Equity Tier 1 (CET1) capital consists only of shareholder equity and undistributed profits, whereas Additional Tier 1 (AT1) and Tier 2 (AT2) capital can also include non-cumulative preference shares and certain hybrid subordinated debt.¹⁴ Further to this mandatory threshold, bank capital is complemented by buffers, i.e. additional capital cushions.¹⁵

For reference, the current Basel rules force banks to hold a total mandatory capital adequacy ratio of at least 8% of the risk-weighted value of their assets.¹⁶ This consists of a minimum of 4.5% CET1 (and provided that CET1 + AT1 is at least 6%), while additional levels of capital are required either under AT2, or in the form of buffer capital requirements. The buffers include: (i) the capital conservation buffer (2.5% of RWAs), meant to avoid

¹¹ For an overview, see <https://www.bis.org/cgfs/conf/mar02p.pdf>.

¹² In addition, other risk modelling components that banks need to include in their calculations are the probability of default (likelihood that a borrower defaults over a given time horizon), the exposure at default (exposure likely to be lost in case of default) and loss given default (amount to be lost when the borrower defaults on her loan). See https://www.ecb.europa.eu/pub/pdf/fsr/art/ecb.fsrart200412_04.en.pdf.

¹³ For an overview of the two approaches, see BANK POLICY INSTITUTE, *Basel Finalization: the History and Implications for Capital Regulation. Part I: Introduction* and compare the online resources made available by the BCBS at https://www.bis.org/basel_framework/.

¹⁴ J. ARMOUR, D. AWREY, P. DAVIES, L. ENRIQUES, J. N. GORDON, C. MAYER, J. PAINE, *Principles of Financial Regulation*, Oxford, Oxford University Press, 2016, p. 305. Subordinated debt is sometimes treated as capital, although from an accounting perspective it is still debt. Preferred shares give some sort of preferred treatment to holders, for instance in liquidation and/or in dividends distribution.

¹⁵ BANK POLICY INSTITUTE, *Basel Finalization: the History and Implications for Capital Regulation. Part I: Introduction*, p. 4.

¹⁶ See https://www.bis.org/basel_framework/.

capital squeezes during loss-generating periods of stress; (ii) the countercyclical capital buffer, ranging from 0% to 2.5% of RWAs, intended to mitigate procyclicality resulting from fluctuations in the credit growth cycle; (iii) as applicable, a capital surcharge for global systemically important banks, the G-SIBs ratio (ranging from 1% to 3.5% of RWAs), designed to discount the systemic risk posed by the largest financial institutions.¹⁷ Additional bank-specific capital can be imposed under Pillar II to meet supervisory expectations. On average, the largest banks in Europe and in the US hold a total (Pillar I + Pillar II) of 13% to 15% of RWAs.¹⁸ Banks are also subject to a non-risk-based capital requirement, the leverage ratio, a backstop measure intended to prevent an unrestrained use of leverage.¹⁹ The leverage ratio is not based on risk weights, but rather functions as an absolute limit on the indebtedness and is set at 3% of total exposures (i.e. Tier 1 capital divided by on- and off-balance sheet's exposures)²⁰. However, in the further course of this paper, we will consider only risk-based capital requirements.

The complexity underpinning capital regulation are exacerbated by the different implementation strategies adopted by EU and US legislative and regulatory authorities. We find the below snapshot prepared by Oliver Wyman for the European Banking Federation a helpful tool in summarizing the abovementioned capital components, as well as outlining how regulatory capital looks like across the Atlantic:²¹

¹⁷ See <https://www.bis.org/bcbs/basel3.htm>. G-SIBs need also to meet further total loss-absorbing capacity (TLAC) requirements. In the US, the capital buffer framework was recently simplified by introducing a single stress test capital buffer (SCB) in lieu of the capital conservation buffer and Pillar II instruments that characterize the EU framework, see the press release of the Federal Reserve Board announcing the SCB at <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20220804a.htm>.

¹⁸ For reference, see the aggregated results of the ECB SREP 2021 at <https://www.bankingsupervision.europa.eu/banking/srep/2022/html/ssm.srepaggregateresults2022.en.html> and BANK POLICY INSTITUTE, *Basel Finalization: the History and Implications for Capital Regulation*. Part I: Introduction, p. 8.

¹⁹ https://www.bis.org/basel_framework/standard/LEV.htm.

²⁰ IBIDEM.

²¹ O. WUENSCH, K. TRUEMLER, L. RUBIRA, *The EU Banking Regulatory Framework and Its Impact On Banks*, Oliver Wyman [report commissioned by the European Banking Federation], January 2023, p. 26, <https://www.oliverwyman.com/our-expertise/insights/2023/jan/the-eu-banking-regulatory-framework-and-its-impact-on-banks-and-the-economy.html>.

Comparison of European and American capital requirements	
EU CAPITAL REQUIREMENTS	US EQUIVALENT
Pillar 1 capital requirements: Generic 4.5% minimum capital requirement according to Basel III standards.	Minimum CET1 capital ratio: Generic 4.5% minimum capital requirement according to Basel III standards.
Countercyclical capital buffer (CCyB): Designed to counter procyclicality in the financial system, consisting of a domestic CCyB element (determined per country) and an institution-specific element (currently slightly above 0%).	Countercyclical capital buffer (CCyB): System-wide buffer, currently set at 0%.
Capital conservation buffer (CCoB): Additional capital buffer set to 2.5% in line with Basel III guidance, under the logic that it is set to avoid breaches of minimum capital requirements during periods of stress when losses are incurred.	Stress capital buffer requirement: Determined by considering entity-specific ST results and applying a floor of 2.5% in line with the standard capital conservation buffer established by Basel III.
Pillar 2 requirement and guidance: Additional bank-specific capital requirements and guidance based on individual risk levels (guidance is non-binding, however in practice it establishes the minimum expectations of supervisors and entities are unlikely to breach it).	
Systemic buffers: The systemic buffers cover the systemic risk (SyRB), the G-SIB and the O-SIB buffers. <ul style="list-style-type: none"> • Systemic risk buffer (SyRB): To address systemic risks not covered by other buffers, determined at sector-level or institution-level, or even per subset of exposure. • G-SIB or O-SIB buffer: Entity-specific buffer requirement set for banks identified as G-SIB or O-SIB. Required buffer amount is determined based on set of indicators measuring systemic importance. The G-SIB buffer is calculated according to Basel assessment (corresponding to US method 1). 	G-SIB surcharge: Applies to G-SIB institutions. Determined as the maximum of the method 1 score (based on Basel assessment of systemic importance) and method 2 score, which also considers an entity's use of short-term wholesale funding. Method 2 has historically resulted in higher values. The difference compared to European G-SIBs is explained by the size and complexity of US G-SIBs, and the use of method 2.
<div> <div></div> Similar level <div></div> Higher level <div></div> Lower level </div>	

3. The impact of climate-related risks on bank capital.

In order to assess whether the capital requirements regime should be adjusted to take climate risks into account, it is pivotal to first understand how climate change might impact bank capital, and thus qualify and quantify the interaction between climate-related risks and a bank's balance sheet. As such, we shall examine the issue through a risk-based approach.

Central banks, regulators, policymakers and financial institutions across the world seem to generally acknowledge that climate risk is ultimately financial risk, and thus that climate change may have repercussions on global financial stability and may become a

triggering factor for the next global financial crisis.²² The Network for Greening the Financial System (NGFS) - an international group comprising central banks and financial regulators - has emphatically stated that “climate-related risks are a source of financial risk [...]”.²³ Mark Carney’s “tragedy of the horizon” adage has become the epitome of the growing consensus over the systemic nature of the climate crisis.²⁴ Indeed, banks and other financial institutions exacerbate the links between climate change and financial stability by funneling lending and underwriting efforts towards carbon intensive industries, while at the same time their balance sheets are directly exposed to assets’ stranding and depreciation resulting from climate-related events.²⁵

²² See *inter alia* E. CAMPIGLIO, Y. DAFERMOS, P. MONNIN, J. RYAN COLLINS, G. SCHOTTEN, M. TANAKA, *Nature Climate Change* Vol. 8, pp. 462 ff., 2018, for an overview of interventions by central banks and financial regulators in the environmental space and CARBON TRACKER INITIATIVE, *Wasted Capital and Stranded Assets*, 19 April 2013, <https://carbontracker.org/reports/unburnable-carbon-wasted-capital-and-stranded-assets/> claiming a \$6 trillion carbon bubble might occur in the next decade. The work of the European Central Bank in this area is also impressive, see for instance the Guide on Climate-Related and Environmental Risks published in 2020 to set supervisory expectations relating to risk management and disclosure

<https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr201127~5642b6e68d.en.html>. Several private market actors have also clearly expressed to consider ESG and sustainability in general in their financial decision-making. A notable example is BlackRock, see <https://www.blackrock.com/corporate/literature/publication/blk-sustainability-mission-statement-web.pdf>. See also L. LAYBOURN-LANGTON, L. RANKIN, D. BAXTER, *This is a Crisis: Facing up to the Age of Environmental Breakdown*, Institute for Public Policy Research, February 2019, <https://www.ippr.org/files/2019-11/this-is-a-crisis-feb19.pdf> for a description of potential destabilizations occurring due to the environmental breakdown and its implications. Graham Steele uses the highly evocative “Climate Lehman Moment” to describe the similarities between what happened during the 2008 financial crisis and what could happen in the future as a result of the impacts of climate change into the financial system, see G. STEELE, *Confronting the “Climate Lehman Moment”: the Case for Macroprudential Climate Regulation*, *Cornell Journal of Law and Public Policy* Vol. 30, pp. 109 ff, 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3542840

²³ NETWORK FOR GREENING THE FINANCIAL SYSTEM, *A Call for Action: Climate Change as a source of financial risk*, April 2019, https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf.

²⁴ See M. CARNEY, *Breaking the Tragedy of the Horizon. Climate Change and Financial Stability*, Speech at the Lloyd’s of London, 29 September 2015, <https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability.pdf?la=en&hash=7C67E785651862457D99511147C7424FF5EA0C1A>.

²⁵ FINANCE WATCH, *A Silver Bullet Against Green Swans. Incorporating Climate-related Financial Risk into Bank and Insurance Prudential Rules*, November 2021, p. 4, <https://www.finance-watch.org/publication/report-a-silver-bullet-against-green-swans-incorporating-climate-risk-into-prudential-rules/>. As an example, as reported by the Center for American Progress (quoting a study conducted by the Rainforest Action Network https://www.ran.org/wpcontent/uploads/2019/03/Banking_on_Climate_Change_2019_vFINAL1.pdf) the six largest banks in the US committed \$700 billion in fossil fuel financing in the period spanning from 2016 to 2018, while the biggest players in the insurance market held around \$530 billion in fossil fuel investments, see G. GELZINIS, G. STEELE, *Climate Change Threatens the Stability of the Financial System*, Center for American Progress, November 2019, <https://www.americanprogress.org/article/climate-change->

In light of the above, several prominent regulators across the world endeavored to qualify and quantify the correlation between climate change and the financial system. For our purposes, we are interested in surveying the work conducted in this regard in order to portray a comprehensive overview of how climate change may ultimately impact bank capital.

At the international level, the BCBS examined how climate-related risks impact the banking system and how such impact should be measured.²⁶ In a nutshell, the BCBS found that while a number of important challenges in terms of crystallizing risk measurement methodologies exist, climate factors can in fact be captured into the same, traditional financial risk categories that are used in the Basel framework to calculate appropriate levels of capital, such as credit, market, operational, liquidity or reputational risks.²⁷ However, to translate the effects of climate change into financial risks the BCBS uses two additional formulations - the climate risk drivers - to conceptualize the changes that impact banks and economic systems. These climate-related risk drivers can be grouped either under physical or transition risks.²⁸

On the one hand, the BCBS defines “physical risks” as the economic costs and financial losses resulting from either (i) the increasing severity and frequency of acute climate change-related weather events (e.g., heatwaves, floods and wildfires); (ii) chronic, longer-term gradual shifts of the climate (e.g., rising average temperatures and ocean acidification) or (iii) indirect effects of climate change such as loss of ecosystem services or economy-wide disruptions (e.g., desertification and water shortage).²⁹ For instance, physical risk exposures could materialize through impacts on a bank’s credit portfolio of mortgages for properties located in areas subject to potential floods, or through damages caused by wildfires on crops

[threatens-stability-financial-system/](#). Gelzinis and Steele also note that from 2016 to 2018 the US experience 45 natural disasters that each caused losses greater than \$1 billion.

²⁶ See BASEL COMMITTEE ON BANKING SUPERVISION, *Climate-related Risk Drivers and their Transmission Channels*, April 2021, <https://www.bis.org/press/p210414.htm>, and BASEL COMMITTEE ON BANKING SUPERVISION, *Climate-related financial risks – measurement methodologies*, April 2021, <https://www.bis.org/press/p210414.htm>.

²⁷ See *IBIDEM*.

²⁸ BASEL COMMITTEE ON BANKING SUPERVISION, *Climate-related Risk Drivers and their Transmission Channels*, p. 5.

²⁹ See BASEL COMMITTEE ON BANKING SUPERVISION, *Climate-related Risk Drivers and their Transmission Channels*, and BASEL COMMITTEE ON BANKING SUPERVISION, *Climate-Related Financial Risks – Measurement Methodologies*, April 2021,

and buildings, negatively altering borrower's ability to repay their loans.³⁰ Rising sea levels could potentially wipe out trillions of dollars of assets and impair loan books as borrowers default.³¹ These types of losses to the banking system could be then exacerbated by an endogenous response from the insurance industry, should it chooses to stop underwriting loan risks in those geographical areas or other industries mostly exposed to physical risks.³² Other examples of indirect effects include lower housing prices and increased poverty rates, which in turn could undermine banks' business operations.³³

On the other hand, "transition risks" are defined by the BCBS as the risks related to the process of adjustment towards a low-carbon economy and more generally towards less carbon-intensive modes of production, including policy, litigation, reputational and technological risks.³⁴ Transition risks could destabilize the financial system when banks lend to corporations that have carbon-sensitive assets at risk of becoming stranded, as they could for instance suffer from unanticipated write-downs and devaluations driven by the imposition of government climate policy.³⁵ A number of important industries could be affected under this risk driver category, including utilities, transportation, oil & gas, and energy. Innovations in climate science and technological advancements need to be internalized in a timely manner by financial firms to avoid business disruptions. Should the transition happen drastically, an increase in carbon prices sparked by investors' environmental preferences or policy enforcement would likely result in procyclicality of losses, turning into what has been dubbed the "climate Minsky moment", characterized by a

³⁰ G. STEELE, Confronting the "Climate Lehman Moment": the Case for Macroprudential Climate Regulation, p. 115; PRUDENTIAL REGULATION AUTHORITY, Climate-related Financial Risk Management and the Role of Capital Requirements. Climate Change Adaptation Report 2021, October 2021, p. 10, <https://www.bankofengland.co.uk/prudential-regulation/publication/2021/october/climate-change-adaptation-report-2021>. Estimates quoted by Gelzinis and Steele calculate private investor losses due to physical risk to be potentially between \$4.2 trillion and \$13.8 trillion globally, see G. GELZINIS, G. STEELE, Climate Change Threatens the Stability of the Financial System.

³¹ P. SCHROEDER, Climate Change Risks Will Affect U.S. Bank Capital in Long-Run, Reuters, 2 June 2021, <https://www.reuters.com/business/finance/climate-change-risks-will-affect-us-bank-capital-long-run-official-2021-06-02/>.

³² G. GELZINIS, G. STEELE, Climate Change Threatens the Stability of the Financial System.

³³ IBIDEM.

³⁴ BASEL COMMITTEE ON BANKING SUPERVISION, Climate-related risk drivers and their transmission channels, April 2021, <https://www.bis.org/press/p210414.htm>, and BASEL COMMITTEE ON BANKING SUPERVISION, Climate-related financial risks – measurement methodologies, April 2021, <https://www.bis.org/press/p210414.htm>.

³⁵ PRUDENTIAL REGULATION AUTHORITY, Climate-related Financial Risk Management and the Role of Capital Requirements. Climate Change Adaptation Report 2021, p. 10.

fire-sale liquidation of the revaluated assets, price shocks, bank runs, and financial instability.³⁶

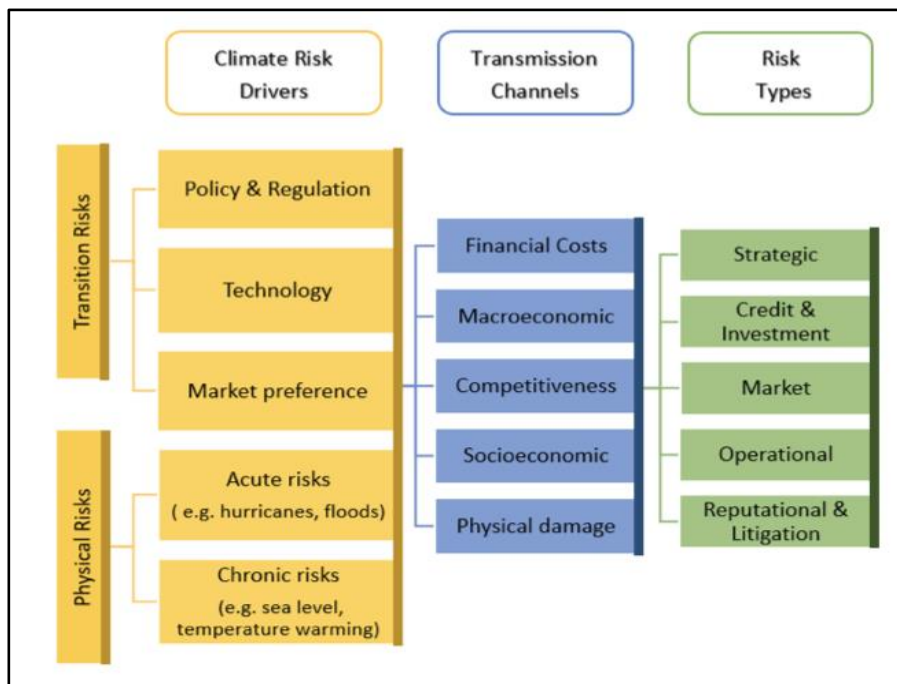
When combined, these risks can give rise to “green swans” - echoing Nassim Taleb’s proverbial “black swans” - i.e. tail risks generating from disruptive and systemic climate catastrophes that are rare and unexpected, but are characterized by a high degree of uncertainty as to the exact extent of their materialization, and that are later rationalized as predictable to begin with.³⁷ The threats posed by these risks to financial stability and their potential cross-border amplification mechanisms have also been acknowledged by the main competent authorities globally, including the Financial Stability Board, the European Central Bank and the Financial Stability Oversight Council (including several of its members, such as the Securities and Exchange Commission, the Commodity Futures Trading Commission, and the Federal Reserve Board).³⁸ The below chart provides a useful snapshot of the abovementioned traits of physical and transition risks and their transmission channels to the bank capital framework.³⁹

³⁶ G. GELZINIS, G. STEELE, Climate Change Threatens the Stability of the Financial System. The expression quoted by Gelzinis and Steele is from Mark Carney, who used it in a speech at the International Climate Risk Conference for Supervisors in 2018. A Minsky moment is essentially a market collapse resulting from aggressive speculation that follows an unsustainable bulk markets.

³⁷ FINANCE WATCH, A Silver Bullet Against Green Swans. Incorporating Climate-related Financial Risk Into Bank and Insurance Prudential Rules, November 2021, p. 7, <https://www.finance-watch.org/publication/report-a-silver-bullet-against-green-swans-incorporating-climate-risk-into-prudential-rules/>. See J. KRAAIJENBRINK, What are Green Swans and Why They Matter, 29 March 2022, Forbes, <https://www.forbes.com/sites/jeroenkraaijenbrink/2022/03/29/what-are-green-swans-and-why-they-matter/?sh=73201e69936d>.

³⁸ See FINANCIAL STABILITY BOARD, The Implications of Climate Change for Financial Stability, 23 November 2020, <https://www.fsb.org/2020/11/the-implications-of-climate-change-for-financial-stability/>; Also compare the results of the 2022 climate thematic review conducted by the ECB, EUROPEAN CENTRAL BANK, Walking the talk. Banks Gearing Up to Manage Risks from Climate Change and Environmental Degradation, November 2022, <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.thematicreviewcerreport112022~2eb322a79c.en.pdf?c59ddfc36c950805785e5f3112dda4cb>. The work conducted by the FSOC is summarized in FINANCIAL STABILITY OVERSIGHT COUNCIL, Report on Climate-related Financial Risk, 2021, <https://home.treasury.gov/system/files/261/FSOC-Climate-Report.pdf>. The SEC, CFTC and the Fed have all established dedicated working groups to address the impacts of climate risk into their respective field of supervisory actions, see <https://www.federalreserve.gov/newsevents/speech/brainard20210323a.htm>, (Fed) <https://www.cftc.gov/sites/default/files/2020-09/9-9-20%20Report%20of%20the%20Subcommittee%20on%20Climate-Related%20Market%20Risk%20-%20Managing%20Climate%20Risk%20in%20the%20U.S.%20Financial%20System%20for%20posting.pdf> (CFTC) and <https://www.sec.gov/news/press-release/2022-46> (SEC).

³⁹ D. BELTRAN, H. BENSEN, A. KVIEN, E. MCDEVITT, M. SANZ, P. UYSAL, What are Large Global Banks Doing about Climate Change? International Finance Discussion Papers 1368, Board of Governors of the Federal Reserve



Regardless of their intensity and despite their uncertainty of outcomes, physical and transitions risks have the power to severely impact the balance sheet and erode bank capital. As such, they have microprudential and macroprudential implications for credit institutions and the financial system as whole. However, to reach a definitive answer to what these implications might actually be, we would need to know more than we currently do. Preliminary research conducted at the Federal Reserve Board can helps us understand how capital losses could be distributed in the VaR formulation used to compute RWAs as a result of climate-driven events - both physical and transition-related (the assumption of this model is a scenario without transition efforts where climate change impacts the economy abruptly).⁴⁰

In theory, under climate stress, bank loss-generation can occur in three different ways.⁴¹ First, physical and transition risks could deplete capital through an increase in the distribution of average losses (resulting in a higher mean); second, climate change could

System, January 2023, p. 11, <https://www.federalreserve.gov/econres/ifdp/what-are-large-global-banks-doing-about-climate-change.htm>.

⁴⁰ See M. HOLSCHER, D. IGNELL, M. LEWIS, K. STIROH, Climate Change and the Role of Regulatory Capital: a Stylized Framework for Policy Assessment, Finance and Economics Discussion Series 2022-068, <https://doi.org/10.17016/FEDS.2022.068>.

⁴¹ IBIDEM, pp. 14 ff.

increase the frequency and distribution of losses, without changing their average (i.e. a higher variance leads to more volatility in terms of frequency and severity); third, expected losses could increase due to impacts resulting from variations associated with both a higher mean and a higher variance.⁴² These different climate impact dynamics would naturally translate into different policy responses in terms of loss provisioning, risk-based pricing and desirable capital levels. However, these findings are not per se very enlightening. It is yet unclear from an empirical standpoint how climate change will in fact impact the banking system, nor it is obvious whether any correlation assumption between the business cycle and idiosyncratic or systemic climate losses can lead to accurate predictions in the loss-generating process.⁴³ In addition, each component of the regulatory capital framework toolkit would be subjected differently to climate-related impacts, as summarized below:⁴⁴

	Policy Objective	Assumptions Needed for a Climate-Related Impact
Minimum	Ensures firm remains viable, with certain level of confidence	Increased unexpected losses for the bank as a whole
Capital Conservation Buffer	Cover stress losses to reduce probability that firm breaches the minimum	Increased stress losses for the bank as a whole
Countercyclical Capital Buffer	Protect against cyclical changes when risks are elevated	Changes in cyclical properties of bank losses
GSIB Buffer	Lower the probability of default (PD) to offset higher loss given default (LGD) for systemically important firms	Higher LGD of distress or failure of a GSIB
Risk-Weighted Assets	Reflect relative risk across asset classes	Changes in relative riskiness of specific assets

Against this backdrop, the most important finding we can draw from our analysis is that climate risk modelling and its associated impact on capital cannot be calculated under the typical statistical models used in banking regulation. Such conclusion is generally well-acknowledged across the board.⁴⁵ This is because evolving climate risks do not lend

⁴² IBIDEM.

⁴³ IBIDEM, p. 17.

⁴⁴ IBIDEM, p. 18

⁴⁵ See FINANCIAL STABILITY BOARD & NGFS, Climate Scenario Analysis by Jurisdictions, 15 November 2022, <https://www.fsb.org/wp-content/uploads/P151122.pdf>.

themselves to be captured into the standard distribution profile, as their probability of occurrence and severity increase asymmetrically over time.⁴⁶ Traditional risk modelling pivoted on historical data - the kind mostly used to discount for risks in the financial sector - cannot be applied to climate-driven risks which are both inherently a forward-looking phenomenon and take a longer time span to materialize.⁴⁷

Most importantly, the greatest level of uncertainty pertains to the non-linear ties and feedback loops associated with transition risks resulting from unforeseen governmental climate policy implementation, both domestic and internationally.⁴⁸ Even if competent authorities and financial institutions can agree on a set of likely accurate measurement toolkit for physical risks, the transition to a low carbon economy will be necessarily characterized by a range of competing legislative actions. For these reasons, in the next section we endeavor to understand a different approach to the assessment of the climate change impacts to the bank capital framework, the stress testing exercises.

3.1. Climate stress testing.

Bank stress tests are simulations conducted by supervisors to assess the resiliency of a bank's balance sheet under hypothetical adverse market scenarios.⁴⁹ In a nutshell, the purpose is to generate forward-looking quantitative and qualitative information for assessing the risk

⁴⁶ B. GENEST, *Climate Risk in the Banking Industry. The Challenges to 2050*, Chappuis Halder & CO, 31 May 2022, <https://chappuishalder.com/insights/finance-risk-compliance/climate-risk-in-the-banking-industry-the-challenges-to-2050/>.

⁴⁷ FINANCE WATCH, *A Silver Bullet Against Green Swans. Incorporating Climate-related Financial Risk into Bank and Insurance Prudential Rules*, p. 7.

⁴⁸ See BANK OF ENGLAND, *Report on Climate-related Risks and the Regulatory Capital Frameworks*, March 2023, <https://www.bankofengland.co.uk/prudential-regulation/publication/2023/report-on-climate-related-risks-and-the-regulatory-capital-frameworks>.

⁴⁹ See BASEL COMMITTEE ON BANKING SUPERVISION, *Stress Testing Principles*, October 2018, <https://www.bis.org/bcbs/publ/d450.pdf>. For an overview of stress testing in Europe see <https://www.bankingsupervision.europa.eu/banking/tasks/stresstests/html/index.en.html> and <https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing>. In the European Union, the European Banking Authority runs a bi-annual EU-wide stress test in cooperation with the European Systemic Risk Board and the European Central Bank. Additional stress tests can be also conducted as part of the comprehensive assessment of the financial health of bank or for macroprudential purposes, while thematic stress tests can be run to measure the resilience of a financial institution against a specific kind of shock. Compare the US framework at <https://www.federalreserve.gov/supervisionreg/dfa-stress-tests-2022.htm>. The Federal Reserve conducts a Dodd-Frank Act Stress Test (DFAST) and the Comprehensive Capital Analysis and Review (CCAR), whose key difference relates to the size of the institutions that are subject the analysis.

profile of banks, their tolerance to cope with financial and economic shocks, and whether they are sufficiently capitalized.⁵⁰ Statistical models are employed to calculate losses to regulatory capital under macroeconomic stress over a given time-horizon.⁵¹ The results of stress tests then strategically feed into the formulation of bank capital requirements.

Climate stress testing is centered around the concept of scenario analysis, which is meant to represent hypothetical future developments of physical and transition risks on banks' assets. Climate scenario analysis is distinct from existing bank stress tests and poses several methodological challenges. To guide supervisory intervention across the world, the NGFS has framed some principles for effective climate stress testing.⁵² Specifically, the NGFS has focused on developing climate scenarios that can estimate in a credible manner the potential losses arising from extreme weather events and chronic climate changes on the economy at large.⁵³ Generally, the assumptions envisage either an orderly transition (assuming immediate action is taken to reduce greenhouse gas emissions), a disorderly transition (where limited and delayed reduction is achieved) and a "hot house world" scenario (assuming climate goals are not met).⁵⁴ Then, the supervisors might either perform the analysis themselves or ask the banks to participate in the stress test.⁵⁵

Against this backdrop, several central banks and supervisors have been endorsing the work done at the NGFS and conducted experimental climate stress tests to fine-tune their methodology and data availability. In Europe, the European Central Bank conducted an economy-wide (macro) climate stress in 2021 to measure the impact of climate change on four million firms worldwide and 1600 banks in the Eurozone under three different climate scenarios.⁵⁶ In 2022, the ECB also conducted a (micro) climate risk stress test on the banks falling under its direct supervision in order to help enhance data granularity and best

⁵⁰ R. S. CARNELL, J. R. MACEY, G. P. MILLER, P. CONTI-BROWN, *The Law of Financial Institutions*, pp. 238-239.

⁵¹ See F. COVAS, *Challenges in Stress Testing and Climate Change*, Bank Policy Institute, September 2020, <https://bpi.com/challenges-in-stress-testing-and-climate-change/>.

⁵² NGFS, *Guide to Climate Scenario Analysis*, June 2020, https://www.ngfs.net/sites/default/files/medias/documents/ngfs_guide_scenario_analysis_final.pdf.

⁵³ See NGFS, *Climate Scenarios for Central Banks and Supervisors*, June 2022, <https://www.ngfs.net/en/ngfs-climate-scenarios-central-banks-and-supervisors-september-2022>.

⁵⁴ IBIDEM.

⁵⁵ IBIDEM.

⁵⁶ See EUROPEAN CENTRAL BANK, *ECB Economy-wide Climate Stress Test*, September 2021, <https://www.ecb.europa.eu/pub/pdf/scpops/ecb.op281~05a7735b1c.en.pdf>.

practices.⁵⁷ In 2021, the Bank of England conducted a Biennial Exploratory Scenario to measure the resiliency of the UK financial system to physical and transition risks associated with different climate pathways.⁵⁸ In 2023, the Federal Reserve will conduct a pilot exercise - albeit with no capital consequences - to probe the effects of climate-related risks on six of the largest US banks.⁵⁹ US banks will have to forecast the severity of physical impacts on their residential and commercial real estate portfolio (e.g. the impacts of a hurricane in the Northeast part of the country) and consider the effects of the transition on corporate loans.⁶⁰ These supervisory tools slightly differ in their objectives and scenario analyses, but are generally understood to be learning exercises to gauge the challenges posed by climate risk to banks' business models.

The differences in scope, however, hamper the comparability of results across jurisdictions. While one may intuitively infer that physical risks and transition policies could in fact be concentrated in some geographies or asset classes, the tail risks and spillover effects have a non-linear impact on financial stability.⁶¹ Specifically, climate adaptation measures - not only those undertaken by financial institutions - might add significant costs associated with upgrades in the risk management infrastructure and give rise to unquantifiable externalities.⁶²

Conducting a new type of climate-informed stress tests generates better informed estimates about the impact of climate-related risks to bank capital, but there are yet many obstacles in designing coherent tools. While existing stress tests are not perfect, climate stress testing is - at the time of writing - characterized by a far larger degree of uncertainty. As we have argued before, the link between and among climate change, bank capital and the financial system is difficult to predict and so would be mapping the one between macro-

⁵⁷ See the communication sent to the CEOs of the institutions covered by the ECB Climate Risk Stress Test https://www.bankingsupervision.europa.eu/press/letterstobanks/shared/pdf/2021/ssm.2021_letter_on_participation_in_the_2022_ECB_climate_risk_stress_test~48b409406e.en.pdf. The Bank of France and the Netherlands Banks also have conducted similar exercises..

⁵⁸ See <https://www.bankofengland.co.uk/stress-testing/2021/key-elements-2021-biennial-exploratory-scenario-financial-risks-climate-change>.

⁵⁹ See <https://www.americanbanker.com/news/fed-sets-parameters-for-pilot-climate-stress-test> and https://www.newyorkfed.org/medialibrary/media/research/staff_reports/sr977.pdf.

⁶⁰ See the press release at <https://www.federalreserve.gov/newsevents/pressreleases/other20230117a.htm>.

⁶¹ This is acknowledged by the FSB and the NGFS, see FINANCIAL STABILITY BOARD & NGFS, Climate Scenario Analysis by Jurisdictions.

⁶² IBIDEM.

financial variables and climate.⁶³ Data gaps and modelling seem to constitute the hardest burden and proxies must be used to make projections. Climate science modelling is also arguably opaque.⁶⁴

There are limited historical data measuring the correlation between losses and impacts on profits and revenues associated with climate-related risks.⁶⁵ Thus, it is challenging to collect material inputs to develop plausible scenarios. In addition, climate stress testing requires a different time planning horizon, to be stretched over the span of 30 to 50 years.⁶⁶ Modelling the dynamics of second-round effects - i.e. endogenous changes of financial variables and economic actors from the estimated predictions when the hypothetical scenario unfolds - is equally complex and pervaded by uncertain correlations.⁶⁷ One could easily think about the challenges in qualifying and quantifying climate policy reforms and their impact on both individual banks and the financial system. And there is also limited assurance as to the validity of predictions, given the lack of a large enough stall of previous losses to establish a plausible bank behavior over that time horizon.⁶⁸

As a result, as long as climate science cannot be more accurately embedded into financial models, climate stress testing should be further researched and perfected, but the results should probably not be translated into quantitative micro- or macroprudential policy actions, including setting regulatory capital levels.⁶⁹

⁶³ F. COVAS, Challenges in Stress Testing and Climate Change.

⁶⁴ L. ANDERSON, F. COVAS, Climate Risk and Bank Capital Requirements, Bank Policy Institute, 13 May 2021, p. 2, <https://bpi.com/climate-risk-and-bank-capital-requirements/>.

⁶⁵ F. COVAS, Challenges in Stress Testing and Climate Change.

⁶⁶ IBIDEM.

⁶⁷ L. ANDERSON, F. COVAS, Climate Risk and Bank Capital Requirements, p. 2.

⁶⁸ IBIDEM. As a reference, the US supervisory stress tests are conducted on a nine quarters planning time horizon, whereas in the EU it is usually three years.

⁶⁹ IBIDEM. Also see <https://www.fsb.org/2022/11/current-climate-scenario-analysis-exercises-may-understate-climate-exposures-and-vulnerabilities-warn-fsb-and-ngfs/>. For instance, an official source at the ECB acknowledged this limitation and stated that “we did not come up yet with quantitative capital requirements, but that will come eventually” <https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/what-us-banks-and-their-supervisors-can-learn-from-europe-s-climate-stress-tests-72517451>. The BCBS also recognizes that “climate stress tests are not currently used for quantitative regulatory requirements” but rather that the objectives are “to acquire knowledge, help to build capability in financial firms, gather information and assess bank’s strategic outlook”, see P. BAUDINO, J.-P. SVRONOS, Stress-Testing Banks for Climate Change. A Comparison of Practices, BIS FSI Insight, July 2021, <https://www.bis.org/fsi/publ/insights34.htm>.

4. Green capital requirements.

Much of the scholarship to date concerning green capital requirements has been focused on determining whether policymakers and regulators have the legal authority to use capital regulation as a climate policy tool or whether bank capital should be used to foster green investments. However, we first wish to address the more substantive question of how in fact would regulatory capital be designed, should the much debated “greening” become a reality.

Under the classic approach to prudential regulation, be it microprudential or macroprudential, the rationale for adjusting regulatory capital should first and foremost be based on risk management considerations. The goal should be to make banks more resilient to climate-related risks and systemic climate crises, thus ensuring the safety and soundness of individual firms and financial stability at large.⁷⁰ Yet, at the time of writing, there is no widespread consensus on whether microprudential and/or macroprudential regulatory capital - in its role as loss-absorber - should be adjusted to reflect climate-related risks. Even more intellectual confusion arises from the debate surrounding the use of capital as a climate policy tool to channel sustainable financing and curtail lending to carbon-intensive industries.

Below, we approach understanding the two issues separately as we think that they pose two distinct regulatory problems, the former to be solved merely from a risk-based approach - both from a microprudential and macroprudential standpoint - and the latter lending itself to a wider array of intellectual ramblings, including subjective policy considerations. The first three paragraphs seek to explore pros and cons of adjusting regulatory capital to reflect to some extent climate-related risks. Ultimately, as we will explain, this exercise will be a highly technical one, subject to policymakers’ and financial supervisors’ willingness to consider climate change as a standalone risk driver. In the fourth subsection, we will investigate whether calibrations to bank capital requirements should be pursued as a mean to achieve climate and environmental policy goals.

⁷⁰ M. BERENGUER, M. CARDONA, J. EVAIN, Integrating Climate-related Risks into Banks’ Capital Requirements, Institute for Climate Economics, March 2020, p. 2, <https://www.i4ce.org/en/publication/integrating-climate-related-risks-into-banks-capital-requirements/>.

4.1. The microprudential risk-based approach.

Let's consider the issue at hand under the lenses of microprudential regulation. From an economic standpoint, recalibration of the existing risk-weighting could be justified on the basis that either climate risks are mispriced and/or climate-related risks amount to elevated, non-diversifiable concentration risks.⁷¹ In both cases, higher capital requirements should discount the additional layer of risk associated with climate change.

Under the former hypothesis, adjusting capital levels would merely signify a necessary correction for the mispricing of the underlying climate risks and could be addressed by the introduction of a “green supporting factor”.⁷² In other words, climate-adjusted capital requirements would be employed to fix a market failure and to facilitate capital intermediation.⁷³ However, while there is plenty of evidence that climate change poses some risks, there does not seem to be enough empirical evidence showing that these risks are in fact mispriced.⁷⁴ As such, adjusting capital requirements on this basis does not seem justifiable.

Under the latter theoretical assumption, such green supporting factor could be embedded into risk-weighting formulas if there is evidence of climate-related concentration risk, i.e. that the assets in banks' balance sheets are more correlated and simultaneously exposed to potential losses resulting from environmentally-driven events.⁷⁵ If that is the case, on the one hand climate capital add-ons would be imposed where such concentration is manifest, and on the other hand reduction of capital levels would reward banks that pursue

⁷¹ 2DEGREES INVESTING INITIATIVE, The Green Supporting Factor. Quantifying the Impact on European Banks and Green Finance, April 2028, pp. 6-7, <https://2degrees-investing.org/resource/the-green-supporting-factor-quantifying-the-impact-on-european-banks-and-green-finance/>.

⁷² IBIDEM.

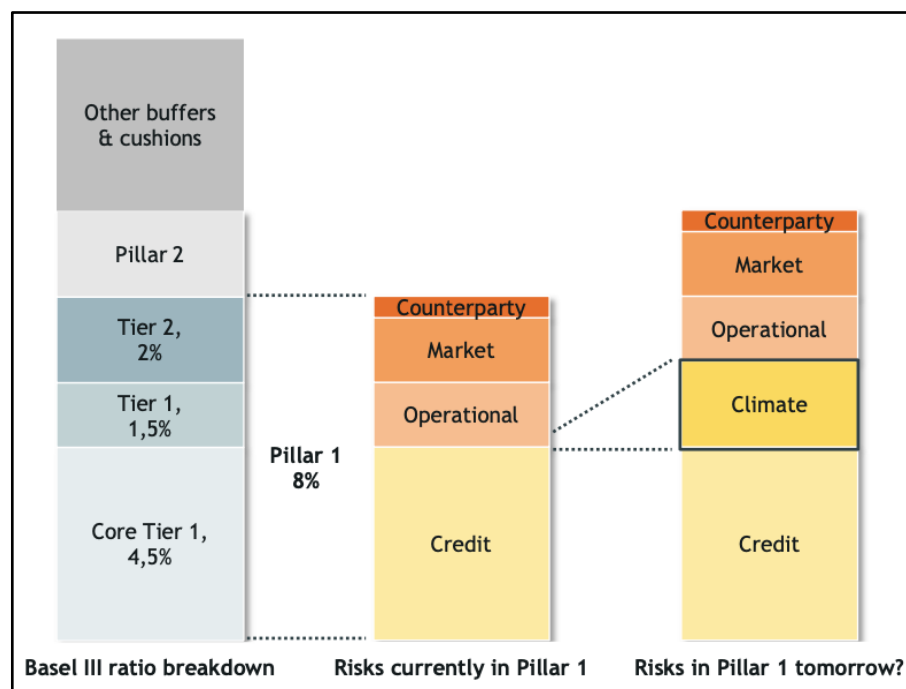
⁷³ IBIDEM

⁷⁴ IBIDEM. See *inter alia* a study conducted by the Federal Reserve Bank of Richmond at https://www.richmondfed.org/publications/research/economic_brief/2021/eb_21-41 and also <https://www.cascades.eu/publication/climate-risk-mispricing-why-better-assessments-matter-in-financing-for-development/>.

⁷⁵ IBIDEM. Similarly, to internalize the pollution risk of a borrower, some authors have suggested to change the RWAs calculations and introduce so-called environment risk-weighted assets. A bank's assets would be multiplied using the existing RWAs at first, and then multiplied again by a pollution coefficient representing the correction for the environmental risks. See L. ESPOSITO, G. MASTROMATTEO, A. MOLOCCHI, Can Prudential Regulation Help the Transition to a Green Economy, Duke University Blog, 2019, <https://sites.duke.edu/thefinregblog/2019/02/22/can-prudential-regulation-help-the-transition-to-a-green-economy/>.

diversification strategies to address their concentrated physical and transition risks.⁷⁶ The advantage of the second hypothesis is that capital add-ons could be implemented on a non-asset-specific basis, whereas using capital to correct mispricing need more accurate methodological assumptions before performing the necessary recalibration. But even if the above assumptions might have some basis in reality, how would regulatory capital materially be adjusted to discount for climate risk?

To answer this fundamental question, it has been suggested that it would be possible to restructure Pillar I to include a novel climate risk category. This could be achieved by either amending the minimum capital ratio (Core Tier 1 capital) and/or the buffer capital requirements (Tier 1 and Tier 2 capital) - i.e. the capital conservation and the countercyclical buffers. Practically speaking, risk models used to calculate Pillar I capital should be re-designed to capture climate risks at the microprudential level. The following is a visual snapshot of the hypothetical composition of a new Pillar I structure:⁷⁷



⁷⁶ IBIDEM.

⁷⁷ B. GENEST, 7 Proposals to Integrate Climate Risk into Capital Requirements, Chappuis Halder & CO, 15 September 2020, <https://chappuishalder.com/insights/finance-risk-compliance/7-proposals-to-integrate-climate-risk-into-capital-requirements/>.

Intuitively, the introduction of a new risk category should - on average - lead to an increase of capital levels, but then the challenge lies in identifying the actual risk differentials.⁷⁸ In other words, embedding a new climate risk bucket into Pillar I would require a determination of the underlying climate risk level of different asset classes and a contextual assessment of the “greenness” (or “brownness”) of said assets, and everything else in between the two extremes.⁷⁹

To address what Mark Carney has exemplified as the “shades of green” issue, a solution would be to design a capital ratio based on asset color - i.e. one that would vary progressively according to the degree of greenness or brownness of the funded exposure.⁸⁰ However, this would require the adoption of an uniform rating of assets or a commonly accepted sustainable taxonomy, potentially endorsed by the BCBS and supported across the board by all jurisdictions, to avoid regulatory arbitrage and a “race to the bottom” scenario.⁸¹ Another challenge lies in accurately isolating the climate component for each of the risk buckets and account for a climate risk capital charge on the RWAs calculation, and also consider the climate effects on credit risk levels, for instance by increasing the Probability of Default or the Loss Given Default metrics.⁸² The following diagram outlines how such ratio could be calculated:⁸³

⁷⁸ M. BERENGUER, M. CARDONA, J. EVAIN, Integrating Climate-related Risks into Banks Capital Requirements, p.7.

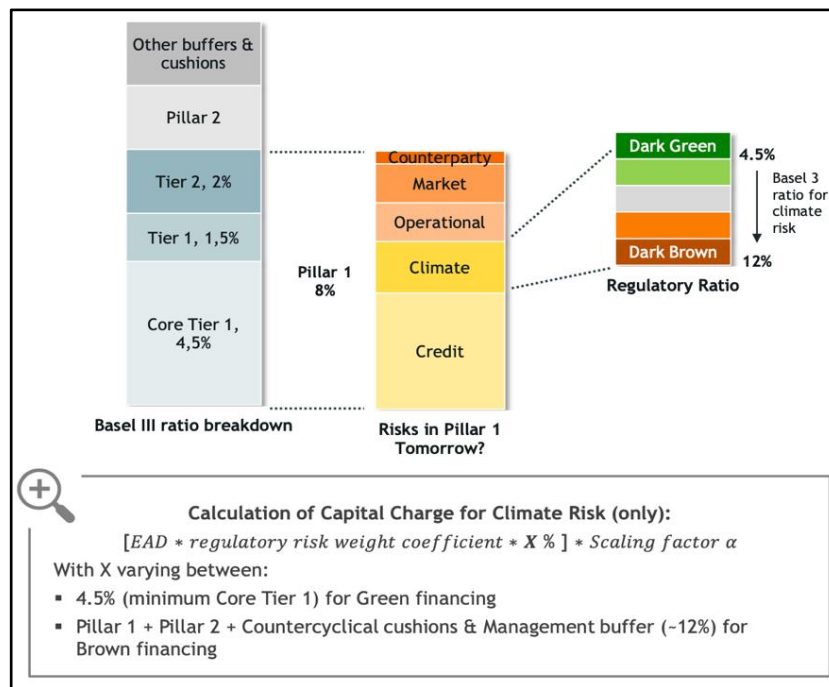
⁷⁹ IBIDEM.

⁸⁰ B. GENEST, 7 Proposals to Integrate Climate Risk into Capital Requirements.

⁸¹ For instance, the EU has adopted a Green Taxonomy exactly to address this issue, but other jurisdictions are following suit, see T. EHLERS, D. GAO, F. PACKER, A Taxonomy of Sustainable Finance Taxonomies, BIS Papers No 118, October 2021, <https://www.bis.org/publ/bppdf/bispap118.htm>.

⁸² B. GENEST, 7 Proposals to Integrate Climate Risk into Capital Requirements.

⁸³ IBIDEM.

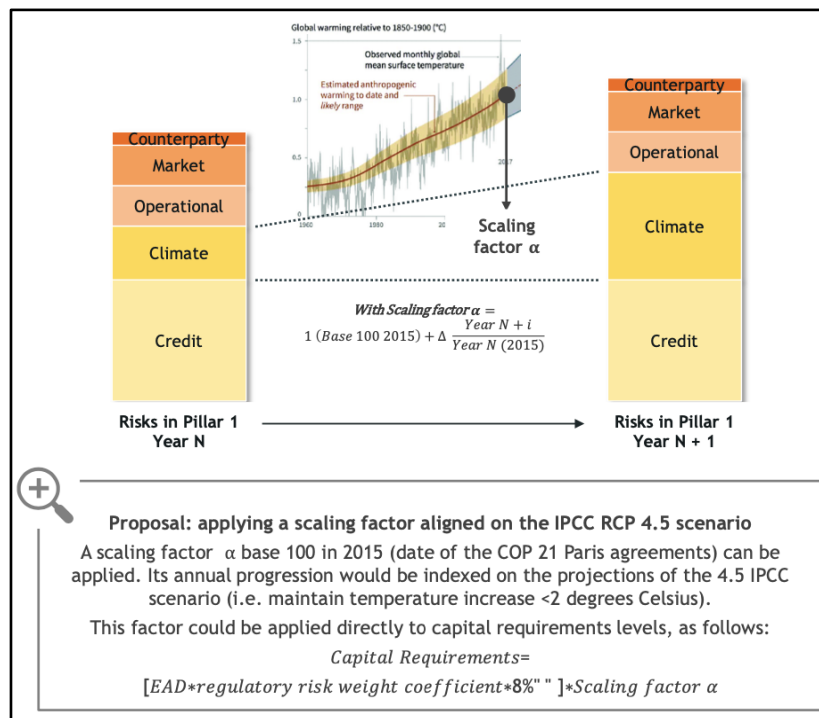


While calculating the impact of physical risks might reveal more straightforward - because assets are on average equally affected by extreme weather events in a given geographic location - the correlation between an asset and the associated transition risks is less obvious, because numerous other factors need to be computed.⁸⁴ For instance, a transition plan might not be yet commercially feasible for a given asset class, and it is inherently difficult to predict the actual effects of forward-looking environmental policies. One way to address the above would be the following: capital charges associated with transition risks could be integrated over time by applying a scaling factor aligned with an internationally agreed climate scenario analysis.⁸⁵ For example, the below proposal suggests generating a scaling factor that can be applied directly to capital levels by indexing the annual progression to the climate scenarios developed by the Intergovernmental Panel on Climate Change (IPCC). Thus, the capital charge would increase simultaneously with the projected cumulative increase of Co2 emissions. The following is a visual snapshot of such proposal:⁸⁶

⁸⁴ M. BERENGUER, M. CARDONA, J. EVAIN, Integrating climate-related risks into banks capital requirements, p. 7.

⁸⁵ B. GENEST, 7 Proposals to Integrate Climate Risk into Capital Requirements.

⁸⁶ IBIDEM.



Part of the literature has been emphasizing that since the current capital rules do not address material environmental risks, banks might be in fact undercapitalized and might lack adequate loss-mitigating tools to face acute impacts of environmental risks.⁸⁷ The case for heightened capital requirements assumes that physical and transition risks do translate into a standalone microprudential and/or macroprudential risk bucket that should mitigate varying degrees of credit, market, liquidity reputational and operational risks that impact banks' balance sheets, and that could trigger endogenous or exogenous losses capable of disrupting the financial system.⁸⁸

In contrast to the above argument, we make the point that climate-related financial risks might already be largely captured under the existing capital framework, albeit not explicitly through a standalone risk-weighted category. Physical and transition risks are arguably contributing to exacerbate all sorts of banking risks, in that they potentially increase

⁸⁷ See G. GELZINIS, Addressing Climate-related Financial Risk Through Bank Capital Requirements, Center for American Progress, May 2021, <https://www.google.com/search?client=safari&rls=en&q=Addressing+Climate-Related+Financial+Risk+Through+Bank+Capital+Requirements&ie=UTF-8&oe=UTF-8>.

⁸⁸ IBIDEM.

loan defaults and thus alter the existing credit default rates, and also impact market, corporate and sovereign risk categories.⁸⁹

But if we all agree that climate-related risk is indeed financial risk - and the proponents of green capital requirements evidently cannot dispute this point - then the next natural conclusion is that credit rating agencies should already factor it automatically in their methodologies when determining ratings (which determine RWAs and thus capital requirements), shedding doubts on why additional green capital would be an optimal regulatory strategy. In other words, we tend to conclude that climate-related risks should already be priced into the bank capital framework. To support our conclusion, it has been rightfully argued that “the existing global regime for prudential regulation - the Basel rules - already has sufficient provisions to enable supervisory authorities to assess whether banks are managing sustainability risks properly”.⁹⁰

We also concur with those observing that any microprudential adjustment would face a pivotal methodological challenge, in that it is very hard to capture physical and transition risks into banks’ assets at the micro level.⁹¹ As we have already noted, quantification of environmental risks would require extensive data requirements and selection of accurate climate scenarios, posing a potentially insurmountable implementation barrier.⁹² From a risk-based point of view, the introduction of a green supporting factor might have adverse financial effects by causing banks to underestimate their exposures to certain asset classes. We will better elaborate on this point below as it also fundamentally relates to the introduction of green capital requirements as a climate policy tool. For the time being, we further point to two major issues arising with an increase in risk-based capital requirements.

⁸⁹ M. BERENGUER, M. CARDONA, J. EVAIN, Integrating Climate-related Risks into Banks Capital Requirements, p. 7. See also UNEP Finance Initiative & CISL, Stability & Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?, 2014, p. 15, <https://www.unepfi.org/industries/banking/stability-sustainability-in-banking-reform-are-environmental-risks-missing-in-basel-iii-2/>, noting that under Basel III, for example, banks already need to factor into their credit and operational risk exposures certain borrower-related, transaction specific environmental risks

⁹⁰ A. KERN, P. G. FISHER Banking Regulation and Sustainability, p. 2, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3299351

⁹¹ Y. DAFERMOS, M. NIKOLAIDI, Greening Capital Requirements, INSPIRE Sustainable Central Banking Toolbox Policy Briefing Paper 8, October 2022, p. 5, <https://www.lse.ac.uk/granthaminstitute/publication/greening-capital-requirements/>.

⁹² IBIDEM.

First, higher capital levels could to some extent reduce a bank's willingness or capability to lend, because they increase funding costs for banks and borrowing costs for clients, at least in the short run.⁹³ Intuitively, more regulatory capital would numerically translate into a constraint of the credit supply. Let's recall that capital requirements represent inherently a trade-off between financial stability and the costs associated with a reduction in lending.⁹⁴ Empirical data gathered from a pool of banks that were required to incorporate environmental risks into the capital adequacy framework suggest that these measures may paradoxically steer lending away from those sectors most exposed to climate.⁹⁵

Secondly, if certain financing activities are to become more equity-intensive - and thus more expensive - they could simply end up being channeled outside the banking system itself. It is not unrealistic to assume that the funding gap could be then filled by non-bank financial institutions, such as hedge funds and private equity firms, thereby simply shifting climate risk to a mostly unregulated portion of the financial system.⁹⁶ That is, borrowers would tap the capital markets rather than bank funding to procure financing. One could object that supervisors could then solve this by following the risks into the shadow banking sector, mitigating this unintended consequence.⁹⁷ But we still argue that higher capital requirements would simply end punishing already well-capitalized institutions, with no guarantee of a successful course of regulatory action should climate risks end up concentrating in the private equity or hedge fund industries.⁹⁸

Notwithstanding the foregoing analysis, far-reaching proposals have been advanced by some industry groups. For instance, Finance Watch suggested that exposures to assets

⁹³ See *inter alia* R. GROPP, T. MOSK, S. ONGENA, C. WIX, Bank Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment, SAFE Working Paper No. 156, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2877771; P. D'ERASMO, Are Higher Capital Requirements Worth it?, https://www.philadelphiafed.org/-/media/frbp/assets/economy/articles/economic-insights/2018/q2/eiq218-capital_requirements.pdf.

⁹⁴ L. ANDERSON, F. COVAS, Climate Risk and Bank Capital Requirements, p. 1.

⁹⁵ See F. MIGUEL LIRIANO, A. PEDRAZA MORALES, C. RUIZ ORTEGA, Climate Change Regulations: Bank Lending and Real Effects, World Bank Policy Research Working Paper, December 2022, <https://documents1.worldbank.org/curated/en/099439412272229612/pdf/IDU04c8901a60c3dc04fb60a008036d83009b76f.pdf>. The study was conducted on a sample of large Brazilian banks that were required to embed climate risks into their internal risk management frameworks..

⁹⁶ G. GELZINIS, Addressing Climate-related Financial Risk Through Bank Capital Requirements, p. 29.

⁹⁷ *IBIDEM*.

⁹⁸ For some of the challenges related to shadow banking regulation, see A. METRICK, Can We Reduce Risk from the Shadow Banking System, Yale Insights, 12 April 2022, <https://insights.som.yale.edu/insights/can-we-reduce-risk-from-the-shadow-banking-system>.

associated with exploration, expansion and exploitation of new fossil fuel reserve should be entirely equity funded.⁹⁹ Similarly, the Center for American Progress has suggested that risk weights for fossil fuel assets should be increased via a transition risk-related capital adjustment in order to finance such activities with more loss-absorbing equity capital, calibrated on variables such as the extent to which a borrower generates revenue from the fossil fuel-related activity, the transition risk profiles associated with the specific industry (e.g. oil, coal and gas), and the length of the exposures - since the latter increase in magnitude over time.¹⁰⁰

In reality, it seems more plausible that climate risks will initially be capitalized through temporary capital increases under Pillar II measures, rather than recalibration of Pillar I regulatory capital.¹⁰¹ This makes the most sense since it can be argued that banks themselves are best placed to assess their own risks, at least as long as common methodologies to measure climate-related financial risks are implemented on an industry-wide basis. As noted by the Financial Stability Board, by setting supervisory expectations under the Pillar 2 umbrella, banks would be forced to evaluate their capital and the extent to which it is adequate to cover losses arising from material climate risks.¹⁰² These own risk assessments would then feed into their Internal Capital Adequacy Assessment Process (ICAAP), and would be scored by supervisors through the Supervisory Review and Evaluation Process (SREP). The BCBS also formally recognized this approach as the currently preferred one by codifying that “banks should identify and quantify climate-related financial risks and incorporate those assessed as material over relevant time horizons into their internal and liquidity adequacy assessment process, including their stress testing programmes”.¹⁰³ A

⁹⁹ FINANCE WATCH, *A Silver Bullet Against Green Swans. Incorporating climate-related Financial Risk into Bank and Insurance Prudential Rules*, p. 19.

¹⁰⁰ See G. GELZINIS, *Addressing Climate-related Financial Risk through Bank Capital Requirements*, p. 9 ff. As explained in the paper, a loan to a company that derives 80% of its revenue from fossil fuel-related business should receive a higher risk weight than a company that only derives 30% of its revenue from such activities. This approach according to Gelzinis should best address financial losses that arise in the process of decarbonizing and transitioning the economy and shield the system against the costs arising from stranded assets.

¹⁰¹ Examples of jurisdictions that rely on Pillar II approaches include the EU, the UK, China and Brazil.

¹⁰² FINANCIAL STABILITY BOARD, *Supervisory and regulatory approaches to climate-related risks. Final report*, 13 October 2022, p. 48, <https://www.fsb.org/2022/10/supervisory-and-regulatory-approaches-to-climate-related-risks-final-report/>.

¹⁰³ BASEL COMMITTEE ON BANKING SUPERVISION, *Principles for the Effective Management and Supervision of Climate-related Financial Risks*, June 2022, <https://www.bis.org/bcbs/publ/d532.pdf>. The quote is principle 5.

description of a Pillar II regulatory strategy, however, lies outside the scope of this analysis and will not be addressed here.

4.2. The macroprudential risk-based approach.

In the previous part, we mostly analyzed the developing of risk-based, climate-informed capital through a microprudential perspective, where the focus was on the safety and soundness of individual institutions. But climate risk is prone to systemic features, which require a macroprudential regulatory approach.¹⁰⁴ Systemic climate-related risks could easily spread between vulnerable counterparties and asset classes, across regions and economic clusters.¹⁰⁵ Climate catastrophes could affect financial stability at the macro level through, *inter alia*, increase in leverage, liquidity and maturity mismatches, and credit risk concentrations.¹⁰⁶ Using bank capital requirements as a macroprudential tool would not be a novel feature of a climate-driven regulatory framework. For instance, the countercyclical capital buffer and the G-SIB capital surcharge are widely understood as macroprudential tools.¹⁰⁷

Borrowing a categorization advanced in the literature, green capital requirements could be incorporated into the capital adequacy framework under either a “weak” or “strong” macroprudential approach.¹⁰⁸ Under the former approach - risk-based in nature - bank exposures should be measured with regard to the features of groups of asset classes (e.g. all assets of carbon-intensive sectors, assets exposed to water stress etc.), rather than considering the traditional micro-characteristics of assets.¹⁰⁹ Under the latter approach, capital

¹⁰⁴ See S. GRÜNWALD, Climate Change as a Systemic Risk: Are Macroprudential Authorities Up to the Task?, European Banking Institute Working Paper No. 62, April 2020, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3580222. For an overview of macroprudential supervision, see <https://www.esrb.europa.eu/pub/pdf/wp/esrbwp2.en.pdf>.

¹⁰⁵ See G. STEELE, Confronting the “Climate Lehman Moment”: the Case for Macroprudential Climate Regulation and K. YILLA, N. LIANG, What are Macroprudential Tools?, Brookings, February 2020, <https://www.brookings.edu/blog/up-front/2020/02/11/what-are-macroprudential-tools/> for a quick summary of what macroprudential means as opposed to microprudential.

¹⁰⁶ IBIDEM. See also P. HIBIERT, A Case for Climate-related Macroprudential Policy, CEPR, September 2022, <https://cepr.org/voxeu/columns/case-climate-related-macroprudential-policy>.

¹⁰⁷ See https://www.esrb.europa.eu/national_policy/ccb/html/index.en.html.

¹⁰⁸ Y. DAFERMOS, M. NIKOLAIDI, Greening Capital Requirements, INSPIRE Sustainable Central Banking Toolbox Policy Briefing Paper 8, October 2022, p. 5, <https://www.lse.ac.uk/granthaminstitute/publication/greening-capital-requirements/>.

¹⁰⁹ Ibidem.

adjustments should instead incentivize the transition and bolster financial resilience to climate risk.¹¹⁰ This “strong” approach - which we shall discuss further below as we frame it as a climate policy tool - aims to reallocate bank financing in order address physical and transition risks through calibration of macro-financial feedback loops and double materiality.¹¹¹ In other words, the capital adjustment should not only reflect how the bank is exposed to sectoral or geographical environmental risks, but also how the bank’s financing patterns can feed into climate-related risks via feedback loops.¹¹²

Several proposals have been formulated outlining how the “weak” approach could in fact be implemented in practice. To best mitigate the financial externalities generated by banks through shocks correlations and portfolio overlaps, some have in fact suggested that regulators should implement a macroprudential climate risk contribution capital surcharge.¹¹³ The capital surcharge should be calibrated to a score reflecting the total greenhouse gas emissions in order to have banks bear the cost of their carbon financing footprint on the financial system as a whole, therefore bolstering the overall resilience to systemic risk.¹¹⁴ This proposal conceptually mirrors the existing G-SIB capital surcharge. Others have advocated for the introduction of climate systemic risk buffers, through which banks would be required to hold capital in proportion of their individual exposure to group of assets impacted by climate risks.¹¹⁵ Professors Paola D’Orazio and Lilit Popoyan, in a widely cited piece of research, have suggested to introduce a carbon-intensive countercyclical buffer to increase the capital base during periods of carbon-intensive growth.¹¹⁶ The buffer add-on would mitigate and possibly prevent excessive credit growth and leverage in carbon-intensive markets, ensuring financial stability.¹¹⁷ To do so, they suggest calculating a carbon intensive credit-to-GDP ratio (a measure of excess credit) based on the breakdown of a bank’s private

¹¹⁰ IBIDEM, p. 6

¹¹¹ IBIDEM. The legal concept of double materiality takes into account not only the environmental footprint on the firm’s business, but also the firm’s impact on the environment and the society at large.

¹¹² IBIDEM.

¹¹³ G. GELZINIS, Addressing Climate-related Financial Risk through Bank Capital Requirements, p. 12.

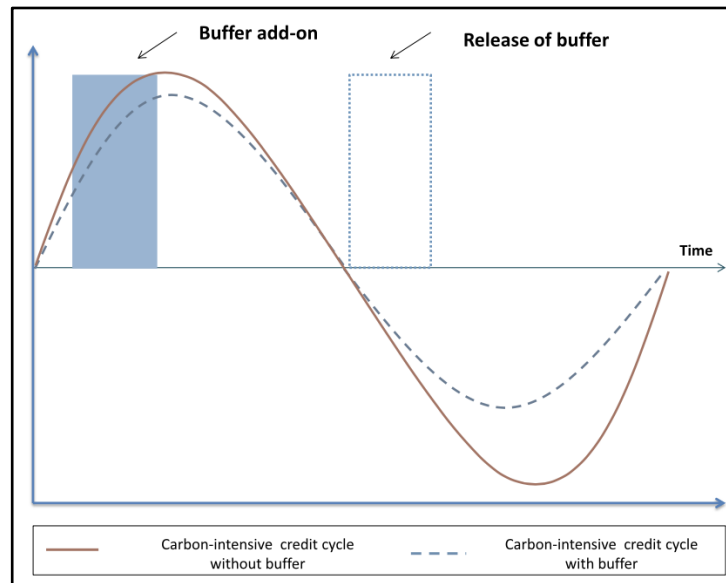
¹¹⁴ IBIDEM.

¹¹⁵ See P. MONNIN, Systemic Risk Buffers – the Missing Piece in the Prudential Response to Climate Risks, Council on Economic Policies, June 2021, <https://www.cepweb.org/wp-content/uploads/2021/06/Monnin-2021.-Climate-systemic-risk-buffer-for-Europe-Final.pdf>. Also see <https://greencentralbanking.com/2022/11/09/macprudential-framework-climate-systemic-risk/>.

¹¹⁶ P. D’ORAZIO, L. POPOYAN, Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?, 160 Ecological Economics, 2019, p. 15, <https://www.sciencedirect.com/science/article/pii/S0921800918309601>

¹¹⁷ IBIDEM.

sector exposures and portfolio composition.¹¹⁸ However, this tool can only be effective if activated before the credit cycle turns downwards.¹¹⁹ The following snapshot provides an interesting visual representation of the buffer mechanism over the carbon-intensive credit cycle:¹²⁰



The same authors also introduced the concept of a sectoral leverage ratio - to serve as a backstop to risk-based capital requirements - that would require banks to hold Tier 1 capital in higher quantities than their carbon-intensive assets value, in order to mitigate overleveraging.¹²¹

However, macroprudential tools could in fact not best capture climate risks and be inconsistent in their risk-absorbing role. For instance, one could argue that when grouping asset classes within a given region, banks with different models and exposures could end up discounting higher buffers than required in light of their real exposure to physical risks.¹²² Similarly, higher capital levels could lure banks to reduce their exposure to those assets that are mostly vulnerable to climate change, and thus need the most financing to withstand the

¹¹⁸ *IBIDEM*. The credit-to-GDP ratio has been used by the Bank for International Settlements, see https://www.bis.org/statistics/c_gaps.htm.

¹¹⁹ S. GRÜNWARD, *Climate Change as a Systemic Risk: Are Macroprudential Authorities Up to the Task?*, p. 9.

¹²⁰ P. D'ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?*, p. 31

¹²¹ P. D'ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?*, p. 16.

¹²² Y. DAERMOS, M. NIKOLAIDI, *Greening Capital Requirements*, p. 6.

transition costs.¹²³ This second point will be crucial in the further course of our discussion. But most importantly, any green macroprudential policy action comes with great uncertainty due to the abovementioned information gaps on the cross-sectoral dimension of climate risk and its distribution and aggregation in the financial system.¹²⁴

As we have previously noted, calibrating capital to account for any “green” risk, including “green” systemic risk, would require us to know more than we do now. Empirical evidence is scarce. Nevertheless, we concur with those who noted that implementing “weak” macroprudential tools, such as climate systemic risk buffers, would be easier than adjusting RWAs at the micro level, because supervisors could more confidently rely on group-level information.¹²⁵

4.3. Greening TLAC.

A risk-based analysis of green capital regulation should also provide a brief overview of a sometimes-neglected regulatory tool, the total loss-absorbing capacity (TLAC) requirement. In a nutshell, TLAC is yet another product of the global financial crisis aftermath, feeding into the capital regulation framework. The standard was first developed by the Financial Stability Board to ensure that failing G-SIBs would be equipped with sufficient-loss absorbing and recapitalization power in the midst of resolution procedures, without impairing financial stability nor resorting to government bailouts.¹²⁶ To this end, the largest banks are now required to hold certain financial instruments that can be easily written down or converted quickly to equity. Thus, TLAC-eligible instruments include common equity, subordinated debt and some categories of senior debt that are legally eligible for bail-in in the event of a resolution, as long as the liabilities are unsecured, have a maturity of at least one year and are not vulnerable to legal challenges.¹²⁷ As of January 2022, G-SIBs need to hold a TLAC amount equal to 18% of RWAs, or 6.75% of their leverage exposure.¹²⁸

¹²³ *IBIDEM*, p. 7.

¹²⁴ See S. GRÜNWALD, *Climate Change as a Systemic Risk: Are Macroprudential Authorities Up to the Task?*.

¹²⁵ Y. DAFERMOS, M. NIKOLAIDI, *Greening Capital Requirements*, p. 6.

¹²⁶ FINANCIAL STABILITY BOARD, *Total Loss-Absorbing Capacity (TLAC) Principles and Term Sheet*, 2015, <https://www.fsb.org/2015/11/total-loss-absorbing-capacity-tlac-principles-and-term-sheet/>

¹²⁷ See <https://www.risk.net/definition/total-loss-absorbing-capacity-tlac>.

¹²⁸ *IBIDEM*. Previously, the TLAC amount was 16% of RWAs or 6% of the leverage exposure.

The TLAC framework is a great example to betoken the strain between sustainability and risk management concerns. Under investors' pressure to fund the transition towards a carbon-neutral economy, credit institutions have begun issuing TLAC-eligible instruments in green formats to raise capital.¹²⁹ Green bonds currently lead this trend.¹³⁰ However, it is unclear whether prudential requirements for loss absorbency and sustainable features can in fact coexist.¹³¹ Yet, the issue has been under regulatory scrutiny in Europe.

On the one hand, the European Banking Authority has accordingly cautioned banks and investors that TLAC-eligible green bonds should be capable of fulfilling their loss-absorbing role in resolution.¹³² On the other hand, investors might question whether prudentially sound instruments can indeed meet a bank's sustainability targets.¹³³ Investors might in fact worry that the use of proceeds will not be entirely allocated to sustainable projects, as banks might encounter challenges in matching bond liabilities with their assets (e.g. tier 1 and tier 2 bonds allow for more lending compared to their face value, spawning leverage in the capital base).¹³⁴

For instance, perpetual or subordinated debt instruments embedding step-up coupons that are triggered should a bank fail to meet its sustainability targets could be disqualified from the capital base.¹³⁵ While the maturity of the green assets might not match the minimum duration of TLAC-eligible instruments, investors might also not fully grasp that loss-absorbing capacity extends to all bank activities (and not just to losses related to sustainable assets).¹³⁶ To mitigate these concerns, one could imagine issuing sustainability-linked bonds

¹²⁹ P. ALEXANDER, Green Bonds Risk Failing TLAC Test, Risk.net, 10 September 2021, <https://www.risk.net/regulation/7873266/green-bonds-risk-failing-tlac-test>.

¹³⁰ Green bonds are debt instruments where the use of proceeds is exclusively destined to finance or re-finance, in part or in full, new or existing eligible projects and which are aligned with some pretermitted green framework. For a prominent example, compare the Green Bond Principles issued by the International Capital Markets Association <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/green-bond-principles-gbp/>.

¹³¹ P. ALEXANDER, Green Bonds Risk Failing TLAC Test.

¹³² IBIDEM. See EUROPEAN BANKING AUTHORITY, Report on the Monitoring of Additional Tier 1 (AT1) Instruments of European Union (EU) Institutions, 24 June 2021, https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Reports/2021/10_15682/Report%20on%20the%20monitoring%20of%20Additional%20Tier%201%20instruments%20of%20EU%20institutions.pdf.

¹³³ IBIDEM.

¹³⁴ P. ALEXANDER, Green Bonds Risk Failing TLAC Test.

¹³⁵ IBIDEM.

¹³⁶ EUROPEAN BANKING AUTHORITY, Report on the Monitoring of Additional Tier 1 (AT1) Instruments of European Union (EU) Institutions, p. 31.

that embed a step-up coupon triggered if the bank does not meet key performance indicators tied against its sustainability outlook.¹³⁷ Such feature can help reassuring investors, but could create incentives for a bank to redeem the bond earlier if the key performance indicators is not to be achieved, thus jeopardizing the perpetual nature of TLAC capital eligibility.¹³⁸

It is thus unlikely that regulators would allow these instruments to count towards loss-absorption. A viable option to make TLAC greener and prudentially safe would rather be including a use-of-proceeds clause, so that the issuer must commit to allocate the funds in green assets.¹³⁹ Paired with adequate disclosures, this structure should not contradict the loss-absorbing features under TLAC.¹⁴⁰

The TLAC framework is extremely complex, and we did not seek to be exhaustive in describing its mechanisms. However, we wanted to make the point that greening any kind of regulatory capital instrument involves a number of legal and reputational challenges that put into question whether risk management and sustainability can successfully be reconciled. For a thing, an open question concerns the link between policy changes and TLAC-eligibility, should certain financial instruments face legal challenges pertaining to the nexus between their loss-absorbing capacity and their sustainability features. Next, we must move beyond a risk management approach and consider whether climate-adjusted capital requirements should be used as a policy tool to advance a sustainability-driven agenda.

4.4. The climate policy approach.

Adjustments to the capital regulation regime have also been proposed as a mean to promote broader climate policy objectives - namely addressing the climate investment gap - by favouring credit allocation to certain economic activities. Under the current rules, formal

¹³⁷ P. ALEXANDER, Green Bonds Risk Failing TLAC Test. A sustainability-linked bond financial performance depends on whether the issues achieves certain predefined key performance indicators that measures its commitment to future improvements in sustainability outcomes. For reference, see the principles developed by ICMA <https://www.icmagroup.org/sustainable-finance/the-principles-guidelines-and-handbooks/sustainability-linked-bond-principles-slbp/>.

¹³⁸ IBIDEM.

¹³⁹ IBIDEM.

¹⁴⁰ IBIDEM.

incentives for banks to invest in sustainable assets are not embedded in the regulatory capital framework, nor penalizing mechanisms exist when banks finance unsustainable targets.¹⁴¹

As mentioned above, one way to bridge the sustainable financing gap would be to introduce green differentiated capital requirements. The goal is to nudge banks into financing environmentally friendly assets by lowering capital levels for such investments.¹⁴² Essentially, certain green investments would receive a preferential risk weight, whereas brown assets would have to discount a capital-intensive treatment.¹⁴³ Such “green supporting factors” are intended to encourage green lending and ultimately foster green investments. Alternatively - and/or simultaneously - RWAs could be raised when banks finance carbon-intensive assets. This is achieved by increasing their marginal cost of financing through a “brown-penalizing factor”.¹⁴⁴

Economically, the outcome of this regulatory structure ultimately affects the bank’s ability to create credit.¹⁴⁵ Specifically, the goal is to leverage the non-neutral effects of capital requirements on bank lending.¹⁴⁶ If green lending is cheaper than “dirty” financing, banks should therefore extend more credit to green assets and increase the interest rates applied to dirty loans.¹⁴⁷ However, the above is not necessarily an accurate prediction of economic reality.

In theory, if more equity needs to be accounted for dirty loans, the balance sheet would tighten and the total number of loans that a bank can provide is reduced.¹⁴⁸ The question is

¹⁴¹ On the contrary, some authors have observed that the Basel regime effectively discourages the financing of long-term sustainable projects by requiring higher capital requirements for longer lending arrangements. See P. D’ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?* and also A. Kern, R. M. Lastra, *International Banking Regulation and Climate Change*, Queen Mary Law Research Paper no. 401, 2023, p. 26, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4290785.

¹⁴² Y. DAFERMOS, M. NIKOLAIDI, *Greening Capital Requirements*.

¹⁴³ *IBIDEM*.

¹⁴⁴ M. HOLSCHER, D. IGNELL, M. LEWIS, K. STIROH, *Climate Change and the Role of Regulatory Capital: a Stylized Framework for Policy Assessment*, p. 12.

¹⁴⁵ P. D’ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?*, p. 28.

¹⁴⁶ Y. DAFERMOS, M. NIKOLAIDI, *Greening Capital Requirements*, p. 3.

¹⁴⁷ *IBIDEM*, p. 6. Dafermos and Nikoladi explain in detail the effects of green capital requirement on credit availability and cost of borrowing. Specifically, climate-sensitive capital requirements can affect lending practices through the credit volume channel, the credit reallocation channel, the cost of borrowing channel and the differentiated interest rate channel. See pp. 8-9.

¹⁴⁸ M. OEHMKE, *Bank Capital Regulation and Climate Change*, ASC Insight, No. 3 November 2022, p 4, https://www.esrb.europa.eu/pub/asc/insights/shared/pdf/esrb.asc.insight_03_11_22~c72a4ae30d.en.pdf.

then which type of loans the bank will in fact stop financing. Financially speaking, it would make more sense for a bank to cut back on marginal loans ranking them by maximum Return on Equity (ROE) - i.e. cutting back on the ones that generate less profits.¹⁴⁹ But paradoxically these less profitable loans could as well end up encompassing sustainable loans to low-carbon intensive assets, rather than those for which capital requirements were increased.¹⁵⁰ *De facto*, as long as dirty investments remain profitable, financial institutions may still choose to keep funding them even at the cost of higher capital requirements.¹⁵¹ This conclusion is sustained by empirical evidence proving that the decision to finance a given project is mostly taken by considering other variables, such as the riskiness of the project, economic or political factors, rather than regulatory capital considerations.¹⁵²

Against this backdrop, we make the argument that changing capital levels to achieve environmental policy objectives is suboptimal. Capital regulation should remain solely risk-based. It has been rightfully argued that pursuing such a policy trajectory could undermine the link between regulatory capital and bank risk and also undermine transparency for investors and banks' stakeholders.¹⁵³ Besides, greening capital requirements for non-risk related purposes entail a legal challenge as this would presumably go beyond the mandate bestowed upon financial regulators.¹⁵⁴

But the biggest concern of applying a favorable capital treatment for green finance is that those exposure might end up crystallizing below the prudentially optimal level, thus compromising both financial stability and the prudential mandate assigned to supervisors.¹⁵⁵ In other words, it would be incorrect to assume that green assets are prudentially safer than brown assets.¹⁵⁶ If one contends that climate risk is material, then banks would rather need more capital, not less.¹⁵⁷ Looser regulatory capital can in fact underestimate the real financial

¹⁴⁹ IBIDEM.

¹⁵⁰ IBIDEM.

¹⁵¹ IBIDEM, p. 8.

¹⁵² A. KERN, R. M. LASTRA, *International Banking Regulation and Climate Change*, p. 26.

¹⁵³ M. HOLSCHER, D. IGNEILL, M. LEWIS, K. STIROH, *Climate Change and the Role of Regulatory Capital: a Stylized Framework for Policy Assessment*, p. 13.

¹⁵⁴ IBIDEM.

¹⁵⁵ M. OEHMKE, *Bank Capital Regulation and Climate Change*, pp. 8-9,

¹⁵⁶ P. D'ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?*, p. 29.

¹⁵⁷ See D. SCHOENMAKER, A. BOOT, *Climate Change Adds to Risk for Banks, but EU lending proposals will do more harm than good*, Bruegel, 16 January 2018, <https://www.bruegel.org/blog-post/climate-change-adds-risk-banks-eu-lending-proposals-will-do-more-harm-good>.

risks associated with green assets, therefore a green supporting factor only could be justified if implemented together with enhanced transparency tools, such a common taxonomy of sustainable assets and granular disclosure standards.¹⁵⁸

Even if capital requirements can be somehow calibrated to effectively mitigate climate-related risks, they are not the optimal strategy to address unpriced carbon externalities. That is, addressing the prudential risks arising from climate change does not equate with a reduction in emissions.¹⁵⁹ As evidenced in a study conducted by the UK Prudential Regulation Authority, adjusting regulatory capital should not be used as tool to address the causes of climate change nor should try affecting financing and investments decisions.¹⁶⁰ In order to be effective as a policy tool, capital ratios should be calibrated at very high levels (a non-commercially-viable option) and such course of action could produce unintended consequences, including an inaccurate depiction of the risk profile of certain assets.¹⁶¹ But as discussed above, it is yet unclear how to measure the risk differentials between green and brown assets.

Among the potential unintended consequences, we wish to highlight an issue pertaining to the realm of financial inclusion. The World Bank recently conducted a study warning that climate-related capital requirements may disproportionately affect smaller borrowers and lenders, who have an inherently adaptation disadvantage.¹⁶² One could hypothetically imagine the difficulties that low-income individuals living in climate-exposed areas (e.g. subject to floodings or hurricanes) could face in obtaining bank credit, if that loan would need to discount higher capital. The same reasoning applies to small firms based in the same geographical areas. The injustice is even more compelling when one realizes that in

¹⁵⁸ P. D'ORAZIO, L. POPOYAN, *Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?*, p. 29. The authors make the point that an alternative to remediate this concern would be to concurrently create a loan-loss reserve fund to absorb those risks not accounted for in regulatory capital.

¹⁵⁹ See M. OEHMKE, M. OPP, *Green Capital Requirements*, Swedish House of Finance Research Paper No. 22-16, 2022, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4040098.

¹⁶⁰ PRUDENTIAL REGULATION AUTHORITY, *Climate-related Financial Risk Management and the Role of Capital Requirements*. Climate Change Adaptation Report 2021, p. 28.

¹⁶¹ *IBIDEM*, p. 29.

¹⁶² D. CLARKE, *Systemic View Needed When Implementing Climate Regulation*, Says World Bank, *Green Central Banking*, 3 February 2023, https://greencentralbanking.com/2023/02/03/systemic-climate-regulation-world-bank/?utm_source=linkedin&utm_medium=social&utm_campaign=news and also See F. MIGUEL LIRIANO, A. PEDRAZA MORALES, C. RUIZ ORTEGA, *Climate Change Regulations: Bank Lending and Real Effects*.

many instances those most likely to suffer from climate shocks are also the ones least contributing to climate change, and yet they live in areas of the world that are most exposed to catastrophic climate events.

In order to reduce carbon emissions, the optimal strategy would rather be to directly reduce the profitability of carbon-intensive assets through taxation (e.g. the much debated global carbon tax).¹⁶³ This can be inferred from recognizing that green supporting factors and brown supporting factors have opposite marginal effects on credit allocation, even though both instruments decrease the relative profitability of granting a loan to a “dirty” industry sector.¹⁶⁴ In fact, in an influential piece of research, Professors Martin Oehmke and Marcus Opp have argued that penalizing dirty loans exposed to transition risks may even crowd out lending to clean firms, potentially hampering transition finance efforts.¹⁶⁵

If anything, climate-informed capital requirements could actually work if only a standalone “brown penalizing factor” is introduced, because higher RWAs for carbon-intensive loans would better address the growing systemic risk associated with potential losses associated with high-carbon assets.¹⁶⁶ The case for higher risk-weights only applied to fossil fuel assets rests on the idea that the transition to a low-carbon economy will happen indeed eventually, and that carbon intensive investment are thus more risky simply because at some point in time they won’t represent a viable source of revenue.¹⁶⁷

Further, assuming that green capital requirements would lead to the much-desired policy outcomes is subject to debate. In the European Union, a similar supporting factor was introduced in 2014 to facilitate credit provision to small and medium enterprises (SMEs).¹⁶⁸

¹⁶³ See M. OEHMKE, M. OPP, Green Capital Requirements.

¹⁶⁴ IBIDEM.

¹⁶⁵ IBIDEM.

¹⁶⁶ S. GRÜNEWALD, Climate Change as a Systemic Risk: Are Macroprudential Authorities Up to the Task?, p. 8. Also see <https://www.bruegel.org/blog-post/climate-change-adds-risk-banks-eu-lending-proposals-will-do-more-harm-good>.

¹⁶⁷ See Y. DAFERMOS, M. NIKOLAIDI, Greening Capital Requirements, p. 6 and S. MATIKAINEN, Green Doesn’t Mean Risk-Free: Why We Should Be Cautious about a Green Supporting Factor in the EU, LSE Grantham Research Institute on Climate Change and the Environment, 18 December 2017, <https://www.lse.ac.uk/GranthamInstitute/news/eu-green-supporting-factor-bank-risk/.m>. On this, also R. VAN TILBURG, S. GRÜNEWALD, D. SCHOENMAKER, A. BOOT, Climate Risks Are Real and Need to Become Part of the Bank Capital Regulation, VoxEU CEPR, 7 December 2022, <https://cepr.org/voxeu/columns/climate-risks-are-real-and-need-become-part-bank-capital-regulation>.

¹⁶⁸ See article 501 of the Capital Requirements Regulation (CRR): “Capital Requirements for Credit Exposures to SMEs shall be multiplied by the factor 0,7619.

It allowed banks to reduce the amount of capital for credit risk on exposures to SMEs.¹⁶⁹ Empirical evidence is ambiguous as to the merits of this reform, and while its outcome is still subject to much debate in the literature, it appears that the SMEs supporting factor did not significantly decreased borrowing costs for SMEs nor it increased in a meaningful way their access to bank finance.¹⁷⁰

Overall, exogenous policy tools like the green supporting factors and brown penalizing factors seems to fail to properly take into account optimal levels of capital intensity. Due to several challenges from a methodological standpoint, we find that it would be quite burdensome to devise both environmental considerations and financial risks associated with an investment into the risk-weighting process. Paradoxically, sustainable but risky investments could end up benefitting from a favorable capital treatment, whereas carbon-intensive investments needed as part of the climate transition toolkit would be hampered by extremely high capital levels.¹⁷¹ The introduction of “green supporting factors” could in fact induce banks to profit from regulatory arbitrage opportunities by engineering financing structures that artificially inflate green assets in order to lower capital.¹⁷² Besides, as long as investing carbon-intensive assets remain profitable, firms may simply choose to seek funding elsewhere, either by tapping the bond market or private equity investors.

Thus, we agree that prudential risk-based, data-driven considerations should be the only determining factors in setting capital levels, and that bank regulatory capital should not be used in lieu of climate policy to mitigate externalities associated with carbon-intensive assets.¹⁷³

¹⁶⁹ S. MAYORDOMO, M. RODRIGUEZ-MORENO, Did the Bank Capital Relief Induced by the Supporting Factor Enhance SME Lending?, *Journal of Financial Intermediation* Vol. 36, October 2018, p. 46, <https://reader.elsevier.com/reader/sd/pii/S1042957318300342?token=5F8A0D4B1BA803B5640318622AD1EE7E66617088956CBFF2BFDD3EB101727F28C96FCEFB8E7D61180ED05923394BF76A&originRegion=us-east-1&originCreation=20230307165240>.

¹⁷⁰ See S. MATIKAINEN, Green Doesn't Mean Risk-Free: Why We Should Be Cautious about a Green Supporting Factor in the EU.

¹⁷¹ PRUDENTIAL REGULATION AUTHORITY, Climate-related financial risk management and the role of capital requirements. Climate Change Adaptation Report 2021, p. 29.

¹⁷² IBIDEM.

¹⁷³ IBIDEM, p. 28.

5. The European framework.

The European Union has long been at the forefront of legislative innovation in the sustainable finance space.¹⁷⁴ Most notably, the European Green Deal ambitiously delineates an environmental strategy that aims to make the EU “the first climate-neutral continent” by zeroing net emissions of greenhouse gases by 2050.¹⁷⁵ A dense sustainable finance regulatory agenda has been thus designed in order to gather the financial community’s efforts into achieving climate neutrality and broader environmental-friendly targets.¹⁷⁶

Capital regulation has not been exempted from being scrutinized under the lens of the climate momentum. To frame a comprehensive strategy, the European Commission tasked a High-Level Expert Group (HLEG) - comprising senior experts from the civil society, academia and the finance sector - to issue a report on desirable sustainable finance policies.¹⁷⁷ When addressing the nexus between sustainability and the bank regulatory framework, the HLEG debated among other things the merits of lowering capital levels for green lending, recognizing that “a green supporting factor could give a strong policy signals to re-engage the banking sector in its lending function for the economy after years of tightening capital regulation”.¹⁷⁸ But it also made clear that “financial stability is a prerequisite for sustainability; to safeguard both, capital requirements must remain risk-based”.¹⁷⁹

First, the HLEG considered that for green capital requirements to be effective they must be based on a well-identified taxonomy of “green” and “brown” asset classes.¹⁸⁰ While the EU has indeed adopted a Green Taxonomy - essentially a “green” lexicon to define assets classes that are sustainable - we argue that the framework lacks a “50 shades of green”

¹⁷⁴ For an overview of the current and past EU workstreams on sustainable finance, the European Commission maintains a comprehensive list of all initiatives at https://finance.ec.europa.eu/sustainable-finance_en.

¹⁷⁵ See EU COMMISSION, Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal, 2019, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2019%3A640%3AFIN>.

¹⁷⁶ The most important initiatives include, *inter alia*, the adoption of a EU Green Taxonomy to define economic activities considered sustainable and several market-based disclosure mechanisms, such as the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSRD).

¹⁷⁷ HIGH-LEVEL EXPERT GROUP ON SUSTAINABLE FINANCE, Final Report, January 2018, https://finance.ec.europa.eu/system/files/2018-01/180131-sustainable-finance-final-report_en.pdf.

¹⁷⁸ IBIDEM, p. 68.

¹⁷⁹ IBIDEM.

¹⁸⁰ IBIDEM.

dimension, because it does not yet classify all types of assets to which differential capital requirements could be applied.¹⁸¹ But reforming regulatory capital would need to happen across all types of assets' exposures, thus requiring a certain degree of regulatory flexibility and an explicit categorization of transition finance within the applicable "green" lexicon. At the time of writing, these characteristics are arguably missing from the Taxonomy Regulation and its implementing acts.

Second, the HLEG confirmed that at this time there does not seem to be quantitative evidence that green investment pose a lower risk differential at the micro-level.¹⁸² The HLEG also admitted that existing proposals are not grounded in a proper risk assessment, but rather in desirable outcomes based on policy preferences.¹⁸³ Nevertheless, should green capital become a reality, the HLEG also warned that to avoid a green bubble and undercapitalization, a cap should be imposed to lower green capital requirements.¹⁸⁴ This is because, for instance, lower capital levels applied to green mortgages could lead to an increase of excessive leverage in the system, in light of the existing favorable risk-weighted treatment of these instruments under the Basel rules.¹⁸⁵

Overall, the HLEG concluded that absent evidence of observable and quantifiable differences in the risk outlook of green and brown assets, the best policy approach is to develop forward-looking scenario analyses and build risk assessments on future exposure of current assets, rather than implementing capital requirements reforms based on historical data.¹⁸⁶

¹⁸¹ The EU Taxonomy Regulation is Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020R0852>. The expression was coined by Mark Carney. Full speech available at <https://www.imf.org/external/pubs/ft/fandd/2019/12/a-new-sustainable-financial-system-to-stop-climate-change-carney.htm>. For reference, the HLEG recommended as a regulatory priority to establish a common sustainability taxonomy, to clarify investor duties to better embrace long-term horizon and sustainability preferences, to upgrade disclosure rules to make sustainability risks fully transparent, to adopt a retail strategy on sustainable finance, to develop Europe sustainability standards and labels, starting with green bonds, to include sustainability in the supervisory mandate of the European supervisors and extend the horizon of risk monitoring.

¹⁸² HIGH-LEVEL EXPERT GROUP ON SUSTAINABLE FINANCE, Final Report, p. 68.

¹⁸³ IBIDEM.

¹⁸⁴ IBIDEM, p. 69.

¹⁸⁵ IBIDEM.

¹⁸⁶ IBIDEM.

Despite the abovementioned technical premises, several prominent EU officials have expressed their support towards greening the capital requirements rules. EU Commission Vice-President for the Euro and Social Dialogue, Financial Stability and Financial Services Valdis Drombrovskis announced in 2017 that “to incentivize lending, [the EU Commission is] looking positively at the European Parliament’s proposal to amend capital charges for banks to boost green investments and loans by introducing a so-called green supporting factor”.¹⁸⁷ Frank Elderson - an Executive Board member at the ECB and the Vice-Chair of the Supervisory Board - recently stated that banks should manage their climate and environmental risks, *inter alia*, by “quantifying and holding capital”.¹⁸⁸ Elderson’s stance should not come as a surprise as the ECB appears to have already raised capital requirements under Pillar II and the Supervisory Review and Evaluation Process (SREP) for a small number of EU banks, in light of alleged weaknesses in their climate and environmental risk management processes.¹⁸⁹ This type of supervisory intervention is likely to soar in the near future. The ECB has expressed concerns over banks’ climate risk management practices and has anticipated that should environmental compliance expectations not be met “[...] enforcement action will be taken”.¹⁹⁰ Clearly, capital charges are a powerful weapon in the ECB’s arsenal.

On the other hand, the European Banking Authority (EBA) and its chairperson, José Manuel Campa, seem to currently oppose an ease of capital rules to incentive green lending. In Campa’s words, “[...] first is disclosure to understand what we are talking about; secondly we need an adequate measure of the risks; only then we can talk about the allocation of capital. We’re not going to get to a green economy if in the process we end up encouraging

¹⁸⁷ V. DOMBROVSKIS, Greening Finance for Sustainable Business, 12 December 2017, https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_17_5235.

¹⁸⁸ F. ELDERSON, Towards an Immersive Supervisory Approach to the Management of Climate-related and Environmental Risks in the Banking Sector, Speech at the industry outreach on the thematic review on climate-related and environmental risks in Frankfurt am Main, Germany, 18 February 2022, <https://www.bis.org/review/r220223e.htm>.

¹⁸⁹ See K. AZIZUDDIN, ECB Raises Bank Capital Requirements Over Climate Risks, Responsible Investor, 3 November 2022, <https://www.responsible-investor.com/ecb-raises-bank-capital-requirements-over-climate-risks/> and D. CLARKE, ECB Begins Applying Capital Charges to Climate Laggards, 8 November 2022, <https://greencentralbanking.com/2022/11/08/ecb-capital-requirements-climate-thematic-review/>.

¹⁹⁰ See F. ELDERSON, Banks Need to be Climate Change Proof, The ECB Blog, 2 November 2022, <https://www.ecb.europa.eu/press/blog/date/2022/html/ecb.blog221102~7599e5851e.en.html> and also <https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr221102~2f7070c567.en.html>.

banks to be insolvent, and get into another financial crisis”.¹⁹¹ In essence, while the risk assessment of climate-related risks is of utmost importance, solvency and profitability of the banking system remain EBA’s priorities. Such policy stance has been recently reiterated.¹⁹² In opining on the role of environmental risks and their impact on the prudential framework, the Authority expressed its preference for the risk-based approach and raised doubts over the introduction of a dedicated capital treatment of exposures under a non-risk-oriented green and/or brown supporting factor, expressing similar concerns raised in this paper.¹⁹³

Notwithstanding the foregoing, the issue continues to receive heightened scrutiny in the EU.¹⁹⁴ In January 2023, the European Parliament’s Economic Affairs Committee (ECON) voted against the introduction of tighter capital requirements for lending towards fossil fuel projects.¹⁹⁵ The vote addressed a proposed “one-for-one rule”, under which banks would have been required to hold one euro of their own capital for every euro invested in fossil fuel projects.¹⁹⁶ The original proposal formulated by Finance Watch - a European NGO advocating for financial regulatory reform - envisioned a new 150% risk weight to be applied to banks’ existing fossil fuel assets under Pillar I (requiring an estimated additional capital in the range of \$157 to 210.2 billion).¹⁹⁷ While the legislation needs now to undergo a

¹⁹¹ See J. VALERO, EU Banking Regulator: “No Green Economy if we Encourage Banks to be Insolvent, EURACTIV, 5 December 2019, <https://www.euractiv.com/section/energy-environment/interview/eu-banking-regulator-no-green-economy-if-we-encourage-banks-to-be-insolvent/>.

¹⁹² EUROPEAN BANKING AUTHORITY, The Role of Environmental Risks in the Prudential Framework. Discussion Paper, 2 May 2022, https://www.eba.europa.eu/sites/default/documents/files/document_library/Publications/Discussions/2022/Discussion%20paper%20on%20the%20role%20of%20environmental%20risk%20in%20the%20prudential%20framework/1031947/Discussion%20paper%20on%20the%20role%20of%20ESG%20risks%20in%20the%20prudential%20framework.pdf. The EBA concludes that “[...] a prudential risk-based perspective should underlie the assessment of the justification for modifying the prudential framework. Key conditions for assessing the justifications for modifying the prudential treatment are gathering the empirical evidence as to the risk differentials or specific risk profiles of exposures associated with environmental objectives / subject to environmental impacts, and evaluating whether any such risk differentials or specific risk profile can be captured by the existing rules”.

¹⁹³ IBIDEM.

¹⁹⁴ For instance, the Banking Package adopted by the EU Commission in 2021 does include some requirements for banks to identify and disclose certain ESG risks, see https://ec.europa.eu/commission/presscorner/detail/en/ip_21_5401.

¹⁹⁵ D. CLARKE, EU Lawmakers opt against one-for-one climate capital requirements, Green Central Banking, 25 January 2023, https://greencentralbanking.com/2023/01/25/econ-one-for-one-capital-requirements/?utm_source=linkedin&utm_medium=social&utm_campaign=news.

¹⁹⁶ IBIDEM.

¹⁹⁷ See G. FORD, J. SYMON, C. NICOL, L. DICALE, A Safer Transition for Fossil Banking. Quantifying the Additional Capital Needed to Reflect the Higher Risks of Fossil Fuel Exposures, Finance Watch, October 2022, <https://www.finance-watch.org/publication/a-safer-transition-for-fossil-banking/>.

vote by the full plenary of the European Parliament (and Member States are set to finalize an agreement by 2025), the ECON simultaneously asked the EBA to evaluate whether a prudential treatment of fossil fuel exposures should be implemented.¹⁹⁸

The ECB made clear that EU banks are expected to meet all climate-related supervisory expectations by the end of 2024.¹⁹⁹ Failure to do so might have capital consequences. But any green capital adjustment will be likely enforced under Pillar II powers, and thus would only influence credit institutions on a temporary and individual basis.²⁰⁰ At the time of writing, we simply note that there is not enough support in Europe to reform regulatory capital to account for neither green and/or brown supporting factors nor climate risk-based Pillar I adjustments.

6. The US framework.

The US stance on green capital regulation is - to put it mildly - far from being demarcated. While the discourse around climate change has been revived under the Biden administration, no official regulatory agenda has been set around bank regulation as a tool to inform climate policy. In a recent speech, Jerome Powell - the Chair of the Board of Governors of the Federal Reserve System - has stated what we consider to be an accurate summary of the overall US approach to climate finance regulation: “In my view, the Fed does have a narrow, but important responsibilities regarding climate-related financial risks. [...] The public reasonably expects supervisors to require that banks understand, and appropriately manage, their material risks, including the financial risks of climate change. But without explicit congressional legislation, it would be inappropriate for us to use our

¹⁹⁸ D. CLARKE, EU Lawmakers opt against one-for-one climate capital requirements.

¹⁹⁹ EUROPEAN CENTRAL BANK, ECB Sets Deadlines for Banks to Deal with Climate Risks, [Press Release], 2 November 2022, <https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr221102~2f7070c567.en.html>.

²⁰⁰ See the recent statements made by François Villeroy de Galhau, Governor of the Bank of France and Executive Board Member of the ECB, at the 7th annual sustainability week in London: [...] In addition, banks should be required to publish transitions plans to be assessed by supervisors: a misalignment with the climate policy target could be seen as an indication of material transition risk – leading potentially to a capital add-on. In any case, I would favour Pillar 2 capital add-ons, given the need to ensure availability and comparability of data on assets. And these add-ons should remain wholly risk-based rather than conceptually colour-based: let us be cautious about simplistic and binary green supporting factors, or brown penalising ones. <https://www.banque-france.fr/en/intervention/7th-annual-sustainability-week-europe-motion-climate-transition-snapshot-video-and-scenario-risks>.

monetary policy or supervisory tools to promote a greener economy or to achieve other climate-based goals. We are not, and we will not be, a “climate policymaker”.²⁰¹

In other words, as opposed to the European framework, these remarks suggest that any regulatory intervention would be strictly entangled with synchronous, climate-friendly political initiatives, which are arguably problematic in light of the stance generally taken by a significant share of the American political scene towards environmental, social and governance concerns.²⁰² In any event, the Federal Reserve, the Federal Deposit Insurance Corporation and the Comptroller of the Currency have all indicated that climate-informed capital requirements are not part of their regulatory agenda in the short and medium-term.²⁰³ But Michael Hsu, Acting Comptroller, has also stated that “US regulators will eventually have to factor climate change risks into bank capital rules, but it is still too soon to say when that would become necessary”.²⁰⁴

Nevertheless, the US ruling party is generally aware of the potential financial risks stemming from climate change. Most recently, Treasury Secretary Janet Yellen warned that climate shocks across the country could trigger asset value losses and severe harm to the US economy.²⁰⁵ Michael Barr, the Federal Reserve Vice Chair for Supervision, has made clear that a review of bank capital requirement and climate risk management are among his

²⁰¹ J. H. POWELL, Central Bank Independence and the Mandate-Evolving Views, Speech at the Symposium on Central Bank Independence, Sveriges Riksbank, 10 January 2023, <https://www.federalreserve.gov/newsevents/speech/powell20230110a.htm>.

²⁰² For reference, compare Florida Governor Ron DeSantis’ recent statements on ESG: “[...] ESG considerations will not be tolerated in here in Florida [...] Florida’s not going to subsidize the actions of a bunch of Leftist ideologues who hate America; we’re not going to let a bunch of rich people in. Manhattan or Europe to try to circumvent our democracy [...] we will continue to fight back against ESG agendas that put partisan ideology ahead of financial returns for Florida’s retirees”. <https://www.flgov.com/2023/01/17/governor-ron-desantis-further-prohibits-woke-esg-considerations-from-state-investments/>.

²⁰³ T. PHILLIPS, What are Climate-adjusted Capital Requirements, Green Central Banking, 21 February 2023, <https://greencentralbanking.com/2023/02/21/climate-adjusted-capital-requirements/>. For instance, see the following statement made by Kevin Stiroh, Executive Vice President at the Federal Reserve Bank of New York who cautioned that regulation and supervision should adopt the “risk management perspective, not a social engineering one” <https://www.bis.org/review/r191107a.htm>.

²⁰⁴ P. SCHROEDER, Climate Change Risks Will Affect US Bank Capital in Long-run, Reuters, 2 June 2021, <https://www.reuters.com/business/finance/climate-change-risks-will-affect-us-bank-capital-long-run-official-2021-06-02/>.

²⁰⁵ A. SHALAL, Yellen Warns Climate Change Could Trigger Asset Value Losses, Harming US Economy, Reuters, 7 March 2023, <https://www.reuters.com/world/us/yellen-warns-climate-change-could-trigger-asset-value-losses-harming-us-economy-2023-03-07/>.

priorities.²⁰⁶ The Financial Stability Oversight Council (FSOC) created a Climate-related Financial Risk Advisory Committee (CFRAC), while its members - including the SEC, the OCC and the Federal Reserve - have already conducted exploratory work to assess the impact of climate-related risk on institutions and activities falling within their regulatory mandate.²⁰⁷

However, climate-informed capital rules in the American regulatory framework would be in theory more technically difficult to implement. Under section 939A of the Dodd-Frank Wall Street Reform and Consumer Protection Act banks cannot rely on external credit ratings for determining their risk-weights to loan exposures.²⁰⁸

Instead, the US framework applies a flat risk-weight to corporate exposures, regardless of the climate risk associated with a given borrower.²⁰⁹ In addition, Section 171 of the Dodd-Frank Act - the “Collins Amendment” - effectively does not allow large banks to rely on their internal models (i.e. the IRB approach) to calculate risk-weights, but rather prescribes the standardized approach as a floor.²¹⁰ In practice, all large banks must compute their risk weights under the latter methodology, and are *de facto* barred to use the IRB calculations, which could actually best serve banks by allowing them to take into account climate-sensitivity if they so wished.²¹¹

In light of this, it has been argued that US regulatory capital is inherently unresponsive to climate-sensitive downgrades to borrowers that would otherwise have an impact on the minimum capital ratio.²¹² In other words, the argument we made above explaining how climate externalities should already be factored in credit rating simply is not applicable to US banks. It has been argued that this structure exposes American firms to higher climate risks, because borrowers who have a less sustainable outlook might be lured to tap the US banking

²⁰⁶ See P. SCHROEDER, US Fed is Reviewing Capital Rules, Plans 2023 Climate Tests – New Regulation Chief, Reuters, 7 September 2022, <https://www.reuters.com/markets/us/us-feds-new-supervision-chief-barr-lay-out-vision-wall-street-oversight-2022-09-07/>.

²⁰⁷ See <https://home.treasury.gov/news/press-releases/jy0987> and supra note 38.

²⁰⁸ See <https://www.federalreserve.gov/publications/other-reports/credit-ratings-report-201107.htm>.

²⁰⁹ *IBIDEM*.

²¹⁰ The Collins Amendment in fact mandates banks to meet the minimum capital ratio under the standardized approach if it is higher than that calculated under the internal ratings-based approach. *De facto*, this is always the case. For more details on the Collins Amendment, see <https://corpgov.law.harvard.edu/2010/07/08/collins-amendment-sets-minimum-capital-requirements/>

²¹¹ J. C. KRESS, Banking’s Climate Conundrum, American Business Law Journal Vol. 59(4), p. 710, <https://onlinelibrary.wiley.com/doi/epdf/10.1111/ablj.12217>.

²¹² *IBIDEM*.

market for cheaper funding (because their green performance is not relevant), thus creating concentration risks on US banks' balance sheets.²¹³ And even from a risk-based perspective, US banks could be at a disadvantage in absorbing losses.²¹⁴ To this end, Professor Jeremy Kress argues that US policymakers should either repeal section 939A to enhance the risk sensitivity of US capital requirements or integrate climate risks in the capital framework.²¹⁵

In opposition to the EU framework, in the US the debate also is keen on surveying the question of whether financial regulators do in fact have a mandate to implement climate sensitive risk-weighted capital. While this is not an issue we wish to address in this paper, it is worth noting that some have argued that while the Federal Reserve - in its guise of being the primary prudential regulator - could change its current rules to implement differentiated capital requirements, it should not do so.

For instance, Professor Christina Skinner contends that federal courts could end up reversing such rules if they are not reasonable and based on risk-based evidence.²¹⁶ As we have argued previously, this is exactly the case of climate-related risks, that cannot by definition be based on firm and unequivocal data inputs, but rather need to be measured on forward-looking, precautionary proxies.

Nevertheless, the lack of climate-sensitivity in US bank capital requirements might not be that concerning, if one is worried about loss-absorption capabilities. The US is on track to finalize Basel implementation and large American banks could even end up being overcapitalized, especially if compared to their European peers. US regulators generally "gold-plated" Basel standards and imposed higher and less-flexible minimum requirements.²¹⁷ As former Federal Reserve Board Vice Chair for Supervision Randy Quarles

²¹³ *IBIDEM*.

²¹⁴ *IBIDEM*, p. 711.

²¹⁵ *IBIDEM*, pp. 716 ff.

²¹⁶ C. SKINNER, Central Banks and Climate Change, *Vanderbilt Law Review* Vol. 74(5), 2021, p. 1336, <https://scholarship.law.vanderbilt.edu/cgi/viewcontent.cgi?article=4783&context=vlr>.

²¹⁷ See BANK POLICY INSTITUTE, Basel III Endgame and the Cost of Credit for American Business, 1 February 2022, <https://bpi.com/wp-content/uploads/2022/01/Basel-III-Endgame-and-the-Cost-of-Credit-for-American-Business.pdf#page=4>.

noted, the latest Basel reforms in the US could increase capital requirements by as much as 20% for largest US banks.²¹⁸

We note that it is safe to conclude that any Pillar I reform to implement green capital requirements in the US will not be happening soon. Whether US supervisors will follow suit on Pillar II add-ons, we think it will largely depend on the results of the upcoming pilot climate stress test and whether US banks will prove capable of handling physical and transitions risks.

7. Conclusion.

For our part, we have tried to highlight the complex nexus between bank regulatory capital and climate-related risks. In light of the arguments presented throughout this paper, we shall endeavor to summarize the main findings.

For a thing, we noted how from an empirical standpoint it is yet unclear how climate-related risks will in fact end up impacting bank capital. Challenges especially pertain to predicting the appropriate correlation between idiosyncratic or systemic climate losses and bank loss-generating processes. Climate-related risks do not lend themselves to be captured into the standard distribution profile, and thus traditional banking risk modelling pivoted on historical data is not a suitable metric to calculate green capital requirements. Climate stress testing is a promising regulatory tool, but informational data gaps and climate science modelling pose an implementation burden that is yet to be solved.

On the one hand, we then presented alternatives to restructure Pillar I to encompass climate risks, but concluded that climate externalities are likely already factored in the existing capital framework. We observed that any microprudential or macroprudential adjustment would face pivotal methodological challenges and we also noted that climate-informed capital requirements could produce a number of unintended consequences and impair credit allocation.

²¹⁸ See BANK POLICY INSTITUTE, Mitigate Potential Unnecessary Capital Requirement Increases, 2 February 2022, <https://bpi.com/basel-finalization-the-history-and-implications-for-capital-regulation-part-iii/>.

On the other hand, we argued that exogenous policy tools like green supporting factors and brown penalizing factors fail to properly take into account optimal levels of capital intensity and might crystallize balance sheets exposures below the prudentially desired level. Thus, employing capital regulation to achieve climate policy objectives is a suboptimal regulatory strategy, that could even produce negative social outcomes.

As a final remark, we must conclude that calculating bank regulatory capital should only be based on sound prudential risk-based considerations, and that capital adequacy should not be used in lieu of governmental climate policy to mitigate the externalities associated with carbon-intensive assets.