

Climate Change as a Systemic Risk

The Role of EU Macroprudential Regulation in Tackling Climate-Related Risks to the
Financial System

University of Helsinki

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Master's Thesis

17th May 2022

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Fakultet: Juridiska fakulteten

Utbildningsprogram: Magisterprogrammet i rättsvetenskap

Studieinriktning: Bank- och finansrätt

Författare: Liselotte Grönlund

Arbetets titel: Klimatförändringen som en systemrisk: makrotillsynsregleringens roll inom EU i bekämpningen av klimatrelaterade risker

Arbetets art: Juris magisteravhandling

Månad och år: Maj 2022

Sidantal: 77 + XXI

Nyckelord: Hållbar finansiering, makrotillsyn, klimatförändring, systemrisk, regleringsteori, EU rätt, finansiell stabilitet, klimatrelaterade finansiella risker, kapitaltäckningsregler

Handledare: Heikki Marjosola

Förvaringsställe: Helsingfors universitets bibliotek

Övriga uppgifter:

Sammandrag:

Det finns en växande medvetenhet bland beslutsfattare om att klimatförändringen ger upphov till så omfattande finansiella risker att de kollektivt utgör en systemrisk och ett hot mot den finansiella stabiliteten. Bankreglering och banktillsyn har därmed en viktig roll att spela i att förverkliga EU:s klimatförändringsmål och i att minska den systemrisk som klimatförändringen utgör.

Som en reaktion på lärdomarna från den senaste globala finanskrisen har makrotillsyn etablerat sig som en ny sorts finansiell reglering, vars mål är att förhindra överdrivet risktagande i det finansiella systemet och mildra dess effekter på den reala ekonomin. Även om det finns en växande debatt bland forskare och beslutsfattare om tillsynsmyndigheternas och bankernas roll i att identifiera och hantera klimatrisker, är diskussionen om hur makrotillsyn skulle kunna användas för att hantera systemrisker i samband med klimatförändringen fortfarande begränsad. Den Europeiska kommissionen har också erkänt behovet av att undersöka hur tillsynsreglering kan ta hänsyn till klimatförändringens finansiella risker i sin strategi för hållbar finansiering från år 2021. Denna magisteravhandling undersöker därmed egenskaperna av klimatrelaterade finansiella risker och diskuterar de alternativ som beslutsfattare inom makrotillsyn har för att integrera sådana risker i banktillsyn. Med hjälp av teorier om ekonomisk reglering ger avhandlingen därmed en översikt av diskussionen kring den ekonomiska grunden för och lämpligheten av att använda makrotillsynsreglering av banksektorn för att hantera klimatförändringen som en systemrisk.

Även om denna magisteravhandling i stort sett anser att användning av makrotillsynsreglering för att hantera klimatförändringsrisker är rättfärdigat, medför dess implementering flera utmaningar för tillsynsmyndigheter. Tillsynsmyndigheter kommer att ställas inför politiska val och speciellt EU:s lagstiftare kommer att behöva ta hänsyn till skillnader mellan de olika medlemsstaternas makroekonomiska målsättningar. Trots bristen på säkerhet gällande klimatförändringsriskernas exakta natur och tidpunkt och de politiska svårigheterna kring tillämpningen av makrotillsynsreglering, kan och bör finansiella tillsynsmyndigheter och banker aktivt stödja en smidig övergång till en ekonomi med låga koldioxidutsläpp och ta steg för att minimera skadorna för det finansiella systemet och ekonomin i framtiden.

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Abbreviations

Basel Committee	Basel Committee of Banking Supervision
BPF	Brown Penalizing Factor
Capital Requirements Directive IV, CRD IV	Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC [2013] OJ L 176/338
Capital Requirements Regulation, CRR	Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 [2013] OJ L 176/1
EBA	European Banking Authority
ECB	European Central Bank
EIOPA	European Insurance and Occupational Pensions Authority
ESFS	European System of Financial Supervision
ESG	Environmental, social, and governance
ESMA	European Securities Market Authority
ESRB	European Systemic Risk Board
ESRB Regulation	Regulation (EU) No 1092/2010 of the European Parliament and of the Council of 24 November 2010 on European Union Macro-Prudential Oversight of the Financial System and establishing a European Systemic Risk Board [2010] OJ L 311/1
Eurozone	Euro area member states
Financial Crisis	The 2008-09 Global Financial Crisis
GSF	Green Supporting Factor
IPCC	Intergovernmental Panel on Climate Change
NCA	National Competent Authority
NGFS	Network for Greening the Financial System
SIFI	Systemically important financial institution
SSM	Single Supervisory Mechanism

SSM Regulation

Council Regulation (EU) No 1024/2013 of 15 October 2013 conferring specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions [2013] OJ L 287/63

SREP

Supervisory Review and Evaluation Process

1. Introduction

1.1 Setting the Stage

Climate change is unequivocal and unprecedented. Beyond natural climate variability, it causes widespread, adverse impacts to ecosystems and people.¹ In 2015, the Paris Agreement set in motion a joint, global effort to limit global warming to 1.5°C above pre-industrial levels, which would significantly reduce or delay the impacts of climate change.² Yet, the world is still on track to already exceed this 1.5°C threshold by 2033 according to some estimates, with global temperatures to continue upwards from there.³ The European Union (“EU”) has been the global leader in the combat against climate change and has committed the EU to becoming climate neutral by 2050.⁴ The Commission recently held that to achieve the EU’s emissions-reduction targets in energy systems alone by 2030, the EU must fill an annual investment gap of EUR 350 billion.⁵

Banking regulation and supervision has a key role to play in the transition to a low-carbon economy.⁶ Leading banking authorities and regulators have started to assess how the banking sector (i) can support the transition to a low-carbon economy by targeting the sources of finance, but also (ii) sufficiently identify and manage climate risks within banking regulatory frameworks.⁷ The physical consequences of climate change cause unique risks to the financial system at large. At the same time, the transition to a sustainable economy in

¹ IPCC, ‘Summary for Policymakers. In: Climate Change 2022: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change’ (2022) Cambridge University Press 11ff.

² United Nations Framework Convention on Climate Change, Conference of the Parties, ‘Adoption of the Paris Agreement’ (12 December 2015) U.N. Doc. FCCC/CP/2015/L.9/Rev/1 (the “Paris Agreement”); United Nations Climate Change, ‘The Paris Agreement’ (2022) <<https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>> accessed 17 May 2022. In 2015, 196 contracting parties to the United Nations’ Framework Convention on Climate Change convened at the 21st Conference of the Parties in Paris in 2015 and signed a new international agreement on combating climate change and promoting sustainable development.

³ Copernicus Climate Change Service, ‘Global Temperature Trend Monitor’ <<https://cds.climate.copernicus.eu/cdsapp#!/software/app-c3s-global-temperature-trend-monitor?tab=app>> accessed 17 May 2022.

⁴ See, e.g., Commission, ‘The European Green Deal’ (Communication) COM (2019) 640 final.

⁵ Commission, ‘Strategy for Financing the Transition to a Sustainable Economy’ (Communication) COM (2021) 390 final (“2021 Sustainable Finance Strategy”).

⁶ For examples on discussions on climate change and banking regulation, see Kern Alexander, *Principles of Banking Regulation* (Cambridge University Press 2019); Seraina Grünewald, ‘Climate Change as a Systemic Risk – Are Macroprudential Authorities up to the Task?’ (2020) 62 European Banking Institute Working Paper Series; Jay Cullen, ‘After ‘HLEG’: EU Banks, Climate Change Abatement and the Precautionary Principle’ (2018) 20 Cambridge Yearbook of European Legal Studies 61.

⁷ See, e.g., NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (April 2019); ESRB, ‘Positively Green: Measuring Climate Change Risks to Financial Stability’ (2020). The recognition that banking supervision plays a key role in the transition to a low-carbon economy prompted the creation of the Network for Greening the Financial System (“NGFS”), an international group of central banks and financial supervisors focused on how financial policy needs to be adjusted to support the transition to a low-carbon economy.

itself entails risks for banks and financial stability that are systemic and might not be internalized by the market. It is thus widely accepted that climate change risks represent a major threat to financial stability, and, as such, financial policy supervision has an essential role to play in addressing them.⁸ The issue is particularly pertinent in the EU, where banks remain the largest source of financial capital, emphasizing the impact of lending policies on risk management.⁹

Despite broad agreement on the adverse impact of climate change risks on financial stability and the importance of targeting such risks, central banks and regulators largely seem to not have acted on such concerns.¹⁰ There are currently no global or EU prudential standards or regulations for the supervision of climate-related risks. Recent work has focused on analyzing the financial risks that arise from climate change.¹¹ The assessment of how macroprudential regulation could address the specific risks arising from climate change in the proliferation of systemic risk is still in its early stages, but has recently become a topic of debate.¹² Both the Basel Committee on Banking Supervision (the “Basel Committee”) and the European Banking Authority (the “EBA”) have launched initiatives to examine if and how climate change financial risks could be captured by prudential regulatory framework.¹³ Likewise, the Commission has recognized the need to examine how prudential

⁸ Ibid. See also Commission, Strategy for Financing the Transition to a Sustainable Economy (n 5).

⁹ ECB, ‘Financial Integration and Structure in the Euro Area’ (March 2020) 27. For example, the ECB finds that analyses on aggregate carbon emissions and financial structure reveal that “the carbon footprint of the economy shrinks faster in economies that receive relatively more of their funding from equity investors than from banks”. See also Cullen (n 10) 64.

¹⁰ Paola D’Orazio and Lilit Popoyan, ‘Fostering Green Investments and Tackling Climate-related Financial Risks: Which Role for Macroprudential Policies?’ (2019) 160 *Ecological Economics* 25, 26; Mélanie Chaves and others, ‘A Theoretical Case for Incorporating Climate Risk into the Prudential Framework’ (2021) ECB Macroprudential Bulletin, <https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/focus/2021/html/ecb.mpbu_focus202110_2.en.html> accessed 17 May 2022.

¹¹ See, e.g., Basel Committee, ‘Climate-related Risk Drivers and their Transmission Channels’ (April 2021) Bank for International Settlements; ECB/ESRB Project Team on Climate Risk Monitoring, ‘Climate-related Risk and Financial Stability’ (July 2021); Financial Stability Board, ‘The Implications of Climate Change for Financial Stability’ (November 2020).

¹² See, e.g., D’Orazio and Popoyan, (n 10) 25; Grünewald (n 6); Graham Steele, ‘Confronting the “Climate Lehman Moment”: the Case for Macroprudential Climate Regulation’ (2020) 30 *Cornell Journal of Law and Public Policy* 109; Emanuele Campiglio, ‘Beyond Carbon Pricing: The Role of Banking and Monetary Policy in Financing the Transition to a Low-Carbon Economy’ (2015) 121 *Ecological Economics* 220;

Kern Alexander, ‘Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?’ (2014) CISL & UNEP FI; ESRB, ‘Review of the EU Macroprudential Framework for the Banking Sector – March 2022’ (2022) ESRB Concept Note <<https://www.esrb.europa.eu/pub/pdf/reports/esrb.reviewmacropruframework.220331~65e86a81aa.en.pdf>> accessed 17 May 2022.

¹³ Bank for International Settlements, ‘Basel Committee Consults on Principles for the Effective Management and Supervision of climate-related Financial Risks’ (Press Release 16 November 2021) <<https://www.bis.org/press/p211116.htm>> accessed 17 May 2022. The Basel Committee

regulation could capture climate change financial risks in its 2021 Sustainable Finance Strategy.¹⁴ Accordingly, the Commission included a proposal to include climate-related risks in credit institutions' risk management systems and supervision in its proposals to amend the Capital Requirements Regulation (575/2013)¹⁵ (the "Capital Requirements Regulation" or "CRR") and the CRD IV Directive (2013/36/EU)¹⁶ (the "Capital Requirements Directive" or "CRD IV") (referred to altogether by the Commission as the "Banking Package 2021").¹⁷

Addressing climate change risks in the banking sector, however, is not easy. Climate change presents several complex challenges for traditional risk management techniques.¹⁸ Two underlying issues should be highlighted. Firstly, investments and risk assessments, both for financial institutions and regulators, are traditionally short-sighted. Secondly, the high level of uncertainty concerning the exact probabilities of climate change impact and quantities of financial harm stemming from climate change, as well as the long periods over which the risks will materialize, complicates consistent collective action.¹⁹ This is what

issued draft guidelines in November 2021 to improve management and supervision of climate-related financial risks, including prudential regulation, consisting of 18 principles, which are currently under progress. See also EBA, 'Action Plan on Sustainable Finance' (December 2019). Based on Article 501(c) CRR, the EBA has a mandate to assess by 2025 whether a dedicated prudential treatment of exposures related to assets or activities associated substantially with environmental and/or social objectives would be justified. The proposal in the Banking Package 2021 (See (n 17)) includes a proposal to move the deadline for the EBA's assessment to 2023.

¹⁴ Commission, Strategy for Financing the Transition to a Sustainable Economy (n 5). The 2021 Sustainable Finance Strategy calls for better integration of climate and environmental risks into the EU prudential framework and holds that the Commission will propose amendments to the prudential framework for banks to ensure ESG factors are consistently included in the risk management systems and supervision.

¹⁵ Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012 [2013] OJ L 176/1.

¹⁶ Directive 2013/36/EU of the European Parliament and of the Council of 26 June 2013 on access to the activity of credit institutions and the prudential supervision of credit institutions and investment firms, amending Directive 2002/87/EC and repealing Directives 2006/48/EC and 2006/49/EC [2013] OJ L 176/338.

¹⁷ Commission, 'Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 575/2013 as regards requirements for credit risk, credit valuation adjustment risk, operational risk, market risk and the output floor' COM (2021) 664 final, and Commission, 'Proposal for a Directive of the European Parliament and of the Council amending Directive 2013/36/EU as regards supervisory powers, sanctions, third-country branches, and environmental, social and governance risks, and amending Directive 2014/59/EU' COM (2021) 663 final.

¹⁸ For examples of discussion on this issue, see Hugues Chenet, Josh Ryan-Collins and Frank van Lerven, 'Finance, Climate-change and Radical Uncertainty: Towards a Precautionary Approach to Financial Policy' (2021) 183(106957) *Ecological Economics*, 1; Steele (n 12); Barnali Choudhury, 'Climate Change as Systemic Risk' (2021) 18 *Berkeley Business Law Journal* 52, 59; Hanna Alhström and David Monciardini, 'The Regulatory Dynamics of Sustainable Finance: Paradoxical Success and Limitations of EU Reforms' (2020) 177 *Journal of Business Ethics* 193, 195; Jay Cullen, Jukka Mähönen and Heidi Rapp Nilsen, 'Financing the Transition to Sustainability: SMART Reform Proposals' (2020) 10 *University of Oslo Faculty of Law Research Paper Series* 39-42.

¹⁹ Jay Cullen and Jukka Mähönen, 'Taming Unsustainable Finance - The Perils of Modern Risk Management' in Beate Sjøfjell and Christopher M. Bruner (eds), *The Cambridge Handbook of Corporate Law, Corporate Governance and Sustainability* (Cambridge University Press 2019) 103-104; Patrick Bolton and others, 'The Green Swan: Central Banking and Financial Stability in the Age of Climate Change' (January 2020) Bank for

Mark Carney, former governor of the Bank of England, characterized in his speech at Lloyd's of London in 2015 as the “*tragedy of the horizon*”: while the impacts of climate change will be felt over the long-term horizon, with large costs and civilizational impacts on future generations, the time horizon in which financial, economic, and political players plan and act is much shorter.²⁰ This dilemma further highlights the need to explore and assess the most appropriate regulatory steps to overcome the challenges in mitigating climate change risks and supporting the transition to a low-carbon economy.

1.2 Purpose and Research Questions

The purpose of this thesis is to focus on the role of EU macroprudential regulation in addressing climate change financial risks considering the objective of financial stability.

Financial stability as a policy goal, and hence the adoption of a macroeconomic perspective to financial regulation, have been at the center of EU financial regulatory reform in the aftermath of the Financial Crisis.²¹ Instead of regulating the soundness of individual institutions, the macroprudential approach to financial regulation focuses on the stability of the financial system as a whole by mitigating systemic risks.²² Macroprudential policy is still considered an innovation, and its scope and rationale are still evolving.²³ One of the main goals of this thesis is, therefore, to provide an overview of the objectives and tools of macroprudential regulation. This thesis will describe the EU's macroprudential regulatory framework, including both the supervisory authority arrangements and the instruments that Member States are empowered to use under either EU or national law.

The second central objective of this thesis is to understand the market failures that lead to climate change, and how they relate to the market failures underlying systemic risk. It will, therefore, examine what financial risks arise from climate change, and how they

International Settlements 4-8. For example, financial stability assessments, stress tests and other risk assessments usually have a time framework of three to five years.

²⁰ Mark Carney, ‘Breaking the Tragedy of the Horizon – Climate Change and Financial Stability’ (Speech at Lloyd's of London, 29 September 2015) <<https://www.bankofengland.co.uk/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability>> accessed 17 May 2022. The tragedy of the horizon (TOH) is a concept emphasized by the Governor of the Bank of England, Mark Carney, that has attracted a lot of attention in regulatory and policy circles.

²¹ See, e.g., Anna Gelpern and Adam J Levitin, ‘Considering Law and Macroeconomics’ (2020) 83 Law and Contemporary Problems i-x, for a discussion on the increased popularity of macroeconomic considerations in law scholarship following the Financial Crisis. Macroeconomic analysis of law has especially focused on financial regulation and financial stability and macroeconomic institutions.

²² John Armour and others, *Principles of Financial Regulation* (Oxford University Press 2016) 410.

²³ Steele (n 12) 109; Gianni de Nicolò, Giovanni Favara and Lev Ratnovski, ‘Externalities and Macroprudential Policy’ (2012) SDN/12/05 International Monetary Fund Staff Discussion Note 3.

interplay with the risk categories commonly addressed by macroprudential regulation. The use of banking regulation and macroprudential policies to target climate change risks has become a recent topic of debate.²⁴ This thesis will therefore aim to systematize and summarize the discussion and expound upon the arguments presented.

In sum, the ultimate focus of this thesis is to examine the legal and economic rationale for, and the appropriateness of, using macroprudential regulation to address climate change-driven financial risks. This entails a discussion encompassing both whether the existing regime is sufficient to enable banks in their macroeconomic role to manage sustainability risks appropriately, as well as the extent to which such policies are currently being implemented. Consequently, the principal research question is the following: *Should macroprudential regulation be used to address climate change financial risks?* To answer this dilemma, the following questions guide the research:

- What are the objectives and tools of macroprudential regulation?
- What financial risks arise from climate change, and can they be considered to collectively pose a systemic risk?
- Can macroprudential regulation be used to address climate change risks, and what are the challenges involved in doing so?

1.3 Methodology and Materials

To assess the appropriateness of the current macroprudential framework for climate change financial risks, the EU macroprudential regulatory framework must first be established.²⁵ The content of regulation is studied using the doctrinal legal research method, which interprets and systematizes the law and the principles, rules, and concepts governing a particular legal field.²⁶ This thesis will describe both the existing law and the Commission's proposal for legislative amendments in the Banking Package 2021.

Although the appropriateness of a specific instrument to address climate change could be analyzed from a number of angles, this thesis will approach the issue from the

²⁴ n 12.

²⁵ Jan M Smits, 'What is Legal Doctrine? On the Aims and Methods of Legal-dogmatic Research' (2015) 06 Maastricht European Private Law Institute Working Paper 16. The doctrinal description of the existing law is arguably always the necessary starting point to alternative approaches to legal research, such as economic analysis of the law.

²⁶ Smits (n 25) 4.

perspective of economic theories of regulation.²⁷ Two broad theoretical frameworks exist in economic theories of regulation to explain why governments regulate and the outcome of such regulation: the *public interest theories* and the *private interest theories* of regulation.

According to the public interest theories, regulators aim to pursue collective goals. A desired collective goal is generally described as the best possible allocation of resources for individual and collective goods.²⁸ The standard starting point is that the market is assumed to generate such allocative efficiency by itself.²⁹ In practice, however, various imperfections arise in the market, referred to as *market failures*, which prevent the efficient allocation of resources.³⁰ Consequently, public interest theories hold that regulation is *prima facie* justified when it corrects these market failures.³¹ Under a broader approach to the public interest theories, regulation can also be considered justified for correcting other undesirable market results that are unrelated to the traditional market failure rationale, such as social objectives (*e.g.*, distributional justice).³² In sum, the public interest theory of regulation assumes that regulators exclusively pursue goals in the public interest and have sufficient information and appropriate instruments to do so.³³

Skepticism towards the capacity of regulators to achieve public interest goals, and the recognition that regulation typically benefits particular groups, led to the creation of an alternative approach for explaining and examining regulation, the private interest theories of regulation. The theories stress the extent to which private interest groups are capable of using

²⁷ More specifically, this thesis focuses on so-called ‘interest’-based accounts on regulatory theory, as presented in, *e.g.*, Anthony I Ogus, *Regulation: Legal Form and Economic Theory* (Hart Publishing 1994) and Robert Baldwin, Martin Cave and Martin Lodge, *Understanding Regulation: Theory, Strategy, and Practice* (2nd edn, Oxford University Press 2011).

²⁸ Johan den Hertog, ‘Review of Economic Theories of Regulation’ (2010) 10-18 Tjalling C. Koopmans Research Institute Discussion Paper Series 5; Armour and others (n 22) 53. The efficient allocation of resources is often considered to include not only the efficient allocation between activities and individuals, but also temporally, meaning that resources should be allocated as efficiently as possible between different points of time, such as over years and generations. This is referred to as dynamic efficiency.

²⁹ Ogus (n 27) 23-28.

³⁰ *Ibid*; Armour and others (n 22) 52; den Hertog (n 28) 5. In other words, as described by Hertog, a market failure is a situation where scarce resources are not put to their highest valued uses, thus implying a discrepancy between the price or value of an additional unit of a good or service and its marginal cost or resource cost. Chapter 2 herein includes a closer examination of market failures relevant for the banking sector.

³¹ Ogus (n 27) 29ff. Regulation may not be considered necessary in situations where the market itself corrects market failures. Only when the market and private law mechanisms cannot provide for a solution (a so-called ‘private law failure’) is there a public interest for regulation. Even in such a case, regulatory intervention must be capable in correcting the market failure and in such a way that the costs of the regulatory intervention do not outweigh the benefits of correcting the market failure. See also den Hertog (n 28) 6.

³² Ogus (n 27) 46ff; Baldwin, Cave and Lodge (n 27) 22ff. Sometimes this dimension is called the pursuit of social efficiency.

³³ Baldwin, Cave and Lodge (n 27) 41-42.

the political and law-making processes to pursue private interests.³⁴ According to a prominent private interest theory, the ‘Chicago theory of government’ by George Stigler, the form and outcome of regulation can be predicted from the demands of interest groups, as politicians and regulators will respond to such interests in exchange for public support.³⁵ According to the theory, regulation will consequently not be directed at the correction of a market failure, but will instead serve the benefits of industry interests.³⁶ Many variations of private interest theories have been developed and, depending on which one is considered, the private interests that interfere with the regulatory process can be those of the industry actors, but also those of the private interests of politicians, bureaucrats, and other actors involved in the making and enforcing of regulation.³⁷

The public interest theories are generally described as rationalizing prospective regulation, while private interest theories are described as explaining existing regulation.³⁸ Both theories have been the subject of criticism, and neither is considered universally accurate.³⁹ A comprehensive review of regulation should thus include elements from both

³⁴ Ogus (n 27) 56-71. The background for the creation of private interest theories was the belief that regulatory authorities either did not succeed in achieving their aim (typically, the correction of a market failure) or did so inefficiently, *i.e.*, the regulatory intervention gave rise to costs exceeding the benefits which it generated or gave rise to misallocations in other sectors. Private interest theories of regulation are also largely based on the so-called ‘capture theory’ (a theory assuming that regulators are pressured, influenced, and bribed to protect private interests) and, in particular, on public choice theory, which looks at how individual preferences play a role in lawmaking and other procedures which are used for collective choice. Public choice theory centers around the notion that the individual involved in the regulatory or legislative process acts rationally to maximize their utility, just as the behavior of a market participant.

³⁵ George J Stigler, ‘The Theory of Economic Regulation’ (1971) 2 *The Bell Journal of Economics and Management Science* 3. The private interest theory developed by Stigler is also referred to as ‘the economic theory of regulation’. The central thesis, as formulated by Stigler, is that “as a rule, regulation is acquired by the industry and is designed and operated primarily for its benefit”.

³⁶ *Ibid*; Hertog (n 28) 22-28.

³⁷ Ogus (n 27) 56-63. Different variations of Stigler’s theory have been developed, as well as other distinct private interest theories, which also consider the private interests of, *e.g.*, bureaucrats and regulatory staff, in addition to those of legislators. See, for example, Sam Peltzman, ‘Towards a More General Theory of Regulation’ (1976) 19 *Journal of Law and Economics* 211-240. Peltzman expands on Stigler’s theory and argues that regulation will to some extent reflect social interests, such as those of consumer groups, but will be dominated by industry interests.

³⁸ Ogus (n 27) 71; Hertog (n 28) 4.

³⁹ Ogus (n 27) 75; Hertog (n 28) 28ff; Andrei Shleifer, ‘Understanding Regulation’ (2005) 11 *European Financial Management* 439, 440. As aptly summarized by Shleifer, the public interest theory has been the subject of criticism primarily in three ways (mostly by private interest theories, such as Stigler’s theory): (i) markets can correct most market failures without regulatory intervention, (ii) where the market itself cannot correct such failures, private law mechanisms can address conflicts and hence allocate resources efficiently, and (iii) even in cases where the market and private law cannot correct market failures, regulators are incapable of doing so, as they are incompetent and corrupt due to political motivations. On the other hand, private interest theories, such as the Chicago theory of government, have been criticized for, *e.g.*, being incomplete (*e.g.*, not considering the interaction between various actors in the regulatory process or adequately considering the motivation and behavior of political actors). Private interest theories also largely focus on findings of ineffectiveness of regulation, some of which have been partly invalidated by empirical research.

theories.⁴⁰ The analysis in this thesis will first focus on the justification of regulation under the public interest theories of regulation and then include elements of private interest-based accounts.

This thesis will utilize primary sources such as EU regulations and directives and certain references to international treaties. A substantial amount of the research will be based on official sources from different EU authorities, such as reports, impact assessments, proposals, and communications. Among the key sources will also be the official sources of the Basel Committee. Among the literature used, there will be a variety of books and articles focusing on principles of financial and banking regulation, economics, and climate change financial risks.

1.4 Delimitations, Key Terms, and Structure

This thesis looks at macroprudential regulation from a European perspective. This perspective is particularly salient because of recent developments in the field of sustainable finance in the EU and the Banking Package 2021 introduced by the Commission.⁴¹ Given the international origin of macroprudential regulation through the Basel Accords, however, the global perspective on macroprudential regulation and climate change financial risks is also considered.

Systemic risks to financial stability can arise from vulnerabilities in all parts of the financial system, including, *e.g.*, insurance, pension funds, and ‘shadow’ banking. As a result, macroprudential policy is a broad field and encompasses many fields of financial policy.⁴² This thesis will focus on macroprudential regulation in the context of banking regulation. For clarity, banking regulation means a “body of rules and standards established by regulatory authorities or self-regulatory bodies to limit or control the risk assumed by banks or other financial institutions”.⁴³ Further, given the limited scope of this thesis, it will discuss the allocation and structure of supervisory responsibility for macroprudential regulation in the EU only on a more general level. Thus, it will not focus on questions around the desirability and legitimacy of the current allocation of macroprudential regulatory and supervisory responsibility within the EU and between the EU and the Member States.⁴⁴ Lastly, the focus will be on financial risks related to climate change and not broader

⁴⁰ Ibid; Baldwin, Cave and Lodge (n 27) 65-66.

⁴¹ n 16 and n 17.

⁴² ESRB, ‘Flagship Report on Macro-prudential Policy in the Banking Sector’ (2014) 5.

⁴³ Alexander, *Principles of Banking Regulation* (n 6) 34.

⁴⁴ For a more detailed discussion on this, see, *e.g.*, Armour and others (n 22) Chapter 24 and 27.

environment-related risks (*i.e.*, environmental, social and governance (“ESG”) factors). A large part of the analysis will, however, generally carry over to broader sustainability topics.

This thesis is organized as follows. Chapter 2 describes the economic theory of banking and reviews the rationale for banking regulation and for regulating systemic risk. A particular focus will be on the key market failures that give rise to systemic risk. It then presents the background and theoretical foundations of macroprudential regulation.

Chapter 3 provides a more detailed overview of macroprudential regulation, focusing on the regulations in the EU. First, the regulatory architecture for macroprudential supervision in the EU is introduced, followed by a non-exhaustive review of macroprudential tools that Member States are empowered to use under either EU or national law.

Chapter 4 then explains the main sources of risks arising from climate change and how these drive traditional financial risks for the financial system. More specifically, as the reduction of systemic risk constitutes the central objective of macroprudential regulation, the chapter will discuss how climate change risks can be conceptualized as creating systemic risk.

Chapter 5 goes on to link the previous chapters and to discuss the appropriateness of applying EU macroprudential regulation to climate change systemic risk. It first examines the market failures underlying climate change systemic risk and why market-based mechanisms are not capable of addressing such market failures. It then discusses the suitability and pros and cons of applying the current macroprudential regulatory regime to climate change risks. Lastly, the chapter highlights the main implementation challenges related to addressing climate change risks by macroprudential regulation, considering the influence of political economy and private interests.

Chapter 6 summarizes the conclusions uncovered by the foregoing analyses.

2. Theoretical Foundations of Macroprudential Regulation

The most striking lesson of the Financial Crisis was the inadequacy of the prudential regulation in place. At the core of the subsequent reexamination of financial regulation has been the realization that financial stability is of critical importance to the functioning and wellbeing of the economy.⁴⁵ This resulted in various new measures, including the rise of a new type of approach to financial regulation - macroprudential regulation. This chapter will lay the foundations for the following chapters by first discussing the role of banks in society and the main economic rationales for banking regulation. It then focuses on the concept of systemic risk. Lastly, it describes the objectives and principles of macroprudential regulation.

2.1 Banking and Economic Theories

Banks play a central role in society by financing businesses and households, payment systems, and capital markets.⁴⁶ The traditional view is that banks are financial intermediaries with the main task of collecting deposits and providing loans and access to payment systems and other financial services for the economy.⁴⁷ Banks also play an important role in enabling risk-sharing in the economy.⁴⁸ Some larger banks play a broader role through the implementation of monetary policy, by providing credit and liquidity. Banks, therefore, contribute to an efficient allocation of resources and have an integral role in the redistributive process in the economy.⁴⁹ The importance of their role is demonstrated by the practice of governments providing safety nets to the banking business, by, for instance, providing deposit insurance or other forms of guarantees and by acting as lenders of last resort and providing short-term financing to banks in distress.⁵⁰

The core task of banks is to allocate credit through liquidity, maturity, and credit transformation.⁵¹ This process is what makes the banking business distinctive and of great

⁴⁵ de Nicolò, Favara and Ratnovski (n 23) 4.

⁴⁶ Alexander, *Principles of Banking Regulation* (n 6) 16.

⁴⁷ Ibid. See also, for example, the definition of a credit institution in art. 4.1(1)(a) CRR: “‘Credit institution’ is an undertaking the business of which is to take deposits or other repayable funds from the public and to grant credits for its own account...”

⁴⁸ Franklin Allen, Elena Carletti and Xian Gu, ‘The Roles of Banks in Financial Systems’ in Allen Berger, Philip Molyneux and John Wilson (eds), *The Oxford Handbook of Banking* (2nd edn, Oxford University Press 2015) 31-32.

⁴⁹ Alexander, *Principles of Banking Regulation* (n 6) 18.

⁵⁰ Ibid 34.

⁵¹ Armour and others (n 22) 277ff. Essentially, the basis for banks’ business model is to take on liabilities in the form of short-term debt from retail depositors and other liabilities and leveraging its own balance sheet, to

value to society, but also brings serious risks and potential social costs. Actual or perceived disruptions in a bank's solvency or liquidity can quickly affect its clients, other banks, and society at large.⁵² Loss of confidence by depositors or investors can lead to withdrawal of wholesale or retail funding (a so-called 'bank run'), potentially spilling over to other banks with connections to the distressed bank. Banking therefore inherently holds a liquidity risk, which is of public concern because of the role of banks as credit intermediaries and in the payment system.⁵³ Preventing such risks from materializing is, therefore, at the core of banking regulation.⁵⁴

Two market failures are considered the most pertinent in the banking business: *asymmetric information* and *negative externalities*.⁵⁵ Banks and other financial intermediaries are particularly prone to agency problems, which arise from asymmetric information. Agency problems usually arise from two main sources: (i) asymmetric information between the owners of assets (*principals*) and their managers (*agents*), and (ii) misaligned incentives between the principal and agent, that allow the agent to utilize the principal's assets opportunistically. A specific market failure arising from agency problems is *moral hazard*, which describes the phenomenon of agents maximizing their utility and pursuing self-interest to the detriment of the principal and others in situations where they do not bear the full costs or consequences of their actions.⁵⁶ Agency problems can arise between, *e.g.*, banks as agents and their shareholders or depositors and other creditors as principals.⁵⁷ A key example of moral hazard arises from the use of deposit insurance. Deposit insurance is a tool used by governments to stabilize financial systems in the event of bank failures. Governments guarantee to depositors that they will receive their funds even if their bank fails, thus reducing the risk of bank runs.⁵⁸ However, this practice may worsen the incentives of depositors to monitor bank risk strategy, as they know they will receive their insured funds even in the case of failure. The possibility of a government bailout in the event of an institutional insolvency (*e.g.*, as evidenced in the Financial Crisis) may also reduce the incentives of uninsured creditors to monitor the banks.⁵⁹ This creates moral hazard by

then grant longer-term loans for businesses and other long-term investments. In doing so, the bank turns short-term funding into longer-term loans (maturity transformation), liquid liabilities, such as short-notice debt, into less liquid loans (liquidity transformation), and low-risk liabilities into risky loans (credit transformation).

⁵² Sakari Wuolijoki and Mika Hemmo, *Pankkioikeus* (2nd edn, Talentum Media Oy 2013) 8.

⁵³ Alexander, *Principles of Banking Regulation* (n 6) 19

⁵⁴ Wuolijoki and Hemmo (n 52) 8.

⁵⁵ See Alexander, *Principles of Banking Regulation* (n 6) 35; Armour and others (n 22) 287.

⁵⁶ Alexander, *Principles of Banking Regulation* (n 6) 34-36.

⁵⁷ *Ibid* 36; Allen, Carletti and Gu (n 48) 41.

⁵⁸ Armour and others (n 22) 65.

⁵⁹ de Nicolò, Favara and Ratnovski (n 23) 6.

creating incentives for bank shareholders and management to grant risky loans and receive the profits from increased lending, as taxpayers will ultimately pay the price of a failure via, *e.g.*, a government bailout or depositor reimbursement under deposit insurance structures.⁶⁰

In general, the agency problem framework is used to analyze bank risk-taking and the incentives of management, shareholders, or creditors to engage in unobserved, opportunistic behavior, at the cost of economic efficiency and society. Banking regulation, therefore, aims to align incentives and ensure that adequate information is available to shareholders, creditors, and other stakeholders, to enhance the monitoring of financial institutions, balance the interests of societal stakeholder groups that are affected by bank risk-taking, and, ultimately, minimize the social costs arising from poor risk management.⁶¹

The second key market failure arises from what is known as *negative externalities*. Negative externalities are costs that arise from the actions of a person or an institution that affect third parties, for which that person or institution is not fully charged (and hence, not ‘internalized’).⁶² Such a situation may arise, for instance, when the interests of those who own and operate banks do not align with the interests of society at large. For example, because governments provide safety nets to the banking business, shareholders of banks only bear a small part of the overall loss to society should a failure arise. Consequently, shareholders may tolerate higher risks than what is desirable from society’s perspective.⁶³ In situations where such externalities cannot be negotiated or bargained between the different parties affected⁶⁴, the government may instead intervene and ‘internalize’ such externalities by setting taxes and subsidies which reflect the costs involved, or by regulating the activities of banks in such a way as to prevent them from creating damaging negative externalities.⁶⁵

A specific type of negative externalities arises with public goods, *i.e.*, commodities that bring shared benefits.⁶⁶ A public good is identifiable by its two elements: non-rivalry,

⁶⁰ Jonathan S Masur and Eric A Posner, ‘Should Regulation be Countercyclical?’ (2017) 34 *Yale Journal on Regulation* 857, 878.

⁶¹ Alexander, *Principles of Banking Regulation* (n 6) 35-37.

⁶² Baldwin, Cave and Lodge (n 27) 18; Ogus (n 27) 35. A classic example is an industrial company imposing costs on a neighboring landowner by polluting.

⁶³ Armour and others (n 22) 58.

⁶⁴ Ogus (n 27) 17; Ronald H. Coase, ‘The Problem of Social Cost’ (1960) 3 *The Journal of Law and Economics* 1-44. According to the theory created by Coase (the ‘Coase theorem’), an efficient allocation of resources can nevertheless be achieved by bargaining between the parties affected by externalities, assuming clear property rights and the absence of transaction costs.

⁶⁵ Ogus (n 27) 35ff; Armour and others (n 22) 58-59. On balance, banks also create positive externalities by, *e.g.*, contributing to liquidity of financial markets or by enabling risk-sharing.

⁶⁶ Nicholas Stern, *The Economics of Climate Change: The Stern Review* (Cambridge University Press 2007) 25. According to Stern, public goods are formally special cases of externalities, where the effects of the externalities are independent of the origin of the externalities.

meaning that one person's enjoyment of the public good does not reduce the amount available for others to enjoy, and non-exclusivity, meaning that those who invest in public goods cannot exclude (or it is too costly to exclude) others from benefitting from it. Because of these two elements, the market does not automatically provide the right quality or quantity of public goods; since persons can enjoy the benefits without paying for them (referred to as 'free-riding'), there are insufficient incentives to produce or invest in a public good. This leads to an under-production of such public goods, termed the *tragedy of the commons*.⁶⁷ Classic examples of public goods are local public parks and the provision of a nation's defense; an example of a public good in the financial sector is liquidity.⁶⁸ As discussed in Chapter 2.1, banks contribute to the liquidity of financial markets through liquidity transformation. Liquidity brings multiple benefits for all market participants, including lending and borrowing, appropriate pricing of assets and, hence, an efficient allocation of resources.⁶⁹ In addition, the high interconnectedness of financial markets has made financial stability an example of a global public good, thus constituting a potential source of market failure.⁷⁰ The enjoyment by one jurisdiction does not reduce the amount available in another jurisdiction, and jurisdictions that invest in financial stability cannot exclude other jurisdictions from benefitting from it. Some countries can, therefore, have incentives to under-invest in achieving financial stability and free ride on the investments made by other jurisdictions, which can lead to 'underproduction' of financial stability on a cross-border basis.⁷¹

2.2 The Concept of Systemic Risk

One of the many consequences of negative externalities and market failures arising from agency problems, such as moral hazard, is that they can lead to widespread financial instability through the creation of systemic financial risk.⁷² Systemic risk is broadly defined as a risk of disruption in the financial system that (i) affects many institutions, markets, and systems simultaneously and (ii) has the potential to have serious negative consequences on

⁶⁷ Ogus (n 27) 34; Stern (n 60) 25.

⁶⁸ Armour and others (n 23) 59.

⁶⁹ Ibid 277.

⁷⁰ Rosa Lastra, 'Systemic Risk and Macro-prudential Supervision' in Niamh Moloney, Eilís Ferran and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation* (Oxford University Press 2015) 313ff; Dirk Schoenmaker, 'The Financial Trilemma' (2011) 111 *Economics Letters* 57.

⁷¹ Lastra (n 70) 313ff.

⁷² Alexander, *Principles of Banking Regulation* (n 6) 39.

the real economy.⁷³ While no clear consensus has been reached on a framework for explaining the different causes of systemic risk, Mülbert summarizes the discussion in four steps⁷⁴:

- (i) an initial shock to one or several financial institutions, often resulting from exogenous developments outside the financial sector (such as a recession, a political event, or a natural disaster),
- (ii) the transmission of the initial shock to other financial firms,
- (iii) stress caused to other financial firms by the propagated shock, and
- (iv) further amplification because of second-round effects.

Systemic risk is, therefore, often discussed in the context of shock events (systemic risks being the factors that cause the initial shock). Traditionally, systemic risk was considered in the context of a failure of one or more financial institutions, which then causes adverse economic effects that spread across the financial system in a ‘domino effect’, or, alternatively, in the context of a loss of value or confidence, causing bank runs.⁷⁵

The Financial Crisis taught two important lessons in this regard. First, it demonstrated that the contagion of shock events is much more varied and complex due to the heightened complexity and interconnectedness of modern financial markets. Shock events can be triggered and transmitted without the failure of a financial institution, *e.g.*, from simultaneous imbalances in many financial institutions caused by correlated investment strategies.⁷⁶ For example, sudden asset liquidations by one or more institutions may lead to reduced market prices and reduce the value of such assets on the balance sheets of other institutions, causing further liquidations (a ‘liquidity spiral’) and new selling of

⁷³ Ibid. See, *e.g.*, the definition of the ESRB in art.2(c) of Regulation (EU) No 1092/2010 of the European Parliament and of the Council of 24 November 2010 on European Union macro-prudential oversight of the financial system and establishing a European Systemic Risk Board [2010] OJ L 311/1 (the “ESRB Regulation”).

⁷⁴ Peter O. Mülbert, ‘Managing Risk in the Financial System’ in Niamh Moloney, Eilís Ferran and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation* (Oxford University Press 2015) 382. See also Jakob de Haan, Sander Oosterloo and Dirk Schoenmaker, *European Financial Markets and Institutions* (Cambridge University Press 2009) 335.

⁷⁵ de Haan, Oosterloo and Schoenmaker (n 74) 338; Armour and others (n 23) 64ff. The ‘domino effect’ explanation of transmission of contagion is based on the idea that shocks spread because liabilities on the balance sheet of a failed financial institution are assets on the balance sheets of other financial institutions.

⁷⁶ Armour and others (n 23) 411. To clarify, the failure of multiple financial institutions was a central part of the Financial Crisis. However, the crisis was not triggered solely by the failure of a single financial institution, but it was the cause of multiple factors, and the crisis was highly contagious because of indirect linkages within the financial system.

underpriced assets (a so-called *fire sale*).⁷⁷ Fire sales can cause financial distress for multiple banks, and consequently, trigger a credit crunch with adverse consequences for the economy.⁷⁸ Even though fire sales and the related externalities typically take place during downturns, the risk is often built up in economic upswings.⁷⁹ The typical scenario is that financial institutions over-borrow, leading to excessive leverage and inflated asset prices, because the individual financial institutions do not internalize the negative externalities associated with socially excessive levels of debt and the effects that fire sales may have.⁸⁰ In sum, the high interconnectedness of the modern financial system thus amplifies contagion arising from shocks to one or multiple financial institutions, because of asset price movements and common exposures among banks. Such negative externalities arising from the interconnectedness of the financial system are especially strong with systemically important financial institutions.⁸¹ Second, while Mülbert's four steps discuss exogenous shocks, the recent financial crisis proved that systemic risks can also be caused by initial shocks that are endogenous, meaning that they arise from shocks within the financial system.⁸² Financial crises are not "acts of God or perfect storms", but may also arise from collective behavior of financial institutions and distortions in perceptions of risk.⁸³

Systemic financial risks are typical examples of negative externalities that private parties cannot internalize, and which regulation, therefore, needs to correct.⁸⁴ Addressing negative externalities, such as the social cost of systemic risk, is, therefore, considered desirable for financial regulation as the potential losses involved are difficult to predict and of extensive nature.⁸⁵

⁷⁷ de Nicolò, Favara and Ratnovski (n 23) 8-9; David Greenlaw and others, 'Stressed Out: Macroprudential Principles for Stress Testing' (2012) No. 12-08 Chicago Booth Paper, No 71 Working Paper 7.

⁷⁸ Ibid; See also Recommendation of the ESRB ESRB/2013/1 of 4 April 2013 on intermediate objectives and instruments of macro-prudential policy [2013] C 170/1, Annex. Credit crunches signify a "sudden tightening of the conditions required to obtain a loan, resulting in a reduction of the availability of credit to the non-financial sector". This reduces investment and employment and has adverse effects on the real economy.

⁷⁹ de Nicolò, Favara and Ratnovski (n 23) 8-9.

⁸⁰ Samuel G. Hanson, Anil K Kashyap, and Jeremy C. Stein, 'A Macroprudential Approach to Financial Regulation' (2011) 25(1) *Journal of Economic Perspectives* 3, 6. More specifically, the individual financial institution does not take into account that when it increases leverage, it simultaneously degrades the collateral value of assets it holds in common with another financial institution, since, in a crisis, the fire-selling of such assets by that institution will lower the liquidation value that the other institution can realize for the same assets.

⁸¹ de Nicolò, Favara and Ratnovski (n 23) 9-10.

⁸² Choudhury (n 18) 57.

⁸³ Claudio Borio, 'Implementing a Macroprudential Framework: Blending Boldness and Realism' (2011) 6 (1) *Capitalism and Society* 3.

⁸⁴ Armour and others (n 23) 59.

⁸⁵ Ibid 65.

2.3 Objectives and Tools of Banking Regulation

Banking regulation traditionally has three key objectives, which significantly overlapped before the Financial Crisis: financial stability, consumer and depositor protection, and market integrity.⁸⁶ Since the Financial Crisis, the focus at the international and EU level has been on financial stability and preventing new financial crises through prudential regulation and risk management.⁸⁷ Financial stability is defined as “a condition in which the financial system is capable of withstanding shocks and the unravelling of financial imbalances, thereby mitigating the likelihood of disruptions in the financial intermediation process which are severe enough to significantly impair the allocation of savings to profitable investment opportunities”.⁸⁸ The goal is not to eliminate risk-taking, but, rather, to require banks (and other financial market actors) to price their risk-taking efficiently and to control and limit the potential costs for society. After the Financial Crisis, banking regulation reforms have, in general, included higher consideration of societal stakeholders affected by excessive risk-taking.⁸⁹

Another theoretical underpinning of banking regulation is the so-called ‘too-big-to-fail’-problem, which refers to banks becoming so large or having such an important role in the financial system that a state simply cannot let the bank run into bankruptcy.⁹⁰ The insolvency of such banks, or systemically important financial institutions (“SIFIs”), would entail substantial damage to the economy at large. Governments have strong incentives to regulate the stability of systemically important financial institutions, since last-minute financial rescue requires the re-allocation of significant amounts of tax revenue.⁹¹ SIFIs can, thus, rely with a high degree of certainty on states intervening and preventing a failure, which has its drawbacks. Because of public support, the shareholders and management of a financial institution might not consider it necessary to manage risks as carefully, as they will not have to pay the entire price of failure. Correspondingly, clients and creditors of SIFIs do not need to closely consider or evaluate the creditworthiness of a SIFI. This is a classic example of a *moral hazard* – problem.⁹² Accordingly, a significant development in banking regulation, *e.g.*, in the Basel III reforms, has been the introduction of assessments on which

⁸⁶ Alexander, *Principles of Banking Regulation* (n 6) 33; Wuolijoki and Hemmo (n 52) 10.

⁸⁷ Alexander, *Principles of Banking Regulation* (n 6) 77ff.

⁸⁸ de Haan, Oosterloo and Schoenmaker (n 74) 337. See also European Central Bank, ‘Financial Stability Review’ (December 2006) 7.

⁸⁹ Alexander, *Principles of Banking Regulation* (n 6) 40ff.

⁹⁰ Lastra (n 70) 314. Discussions on banking regulation sometimes also include theories around institutions that are too-complex-to-fail and too-interconnected-to-fail.

⁹¹ Alexander, *Principles of Banking Regulation* (n 6) 40.

⁹² See Chapter 2.1. See also Wuolijoki and Hemmo (n 52) 10.

financial institutions are systemically important and the imposition of additional regulatory requirements and scrutiny to remedy the moral hazard problem.⁹³

In sum, the economic rationale for governments to exercise banking regulation is strongly linked to the important role of banks in society, systemic risk arising from market failures in the banking business, economic consequences of such systemic risks, as well as, although less discussed here, consumer protection.⁹⁴

The four most common tools of banking regulation are entry requirements, governance rules, prudential requirements, and resolution. Entry requirements relate to the structural features of institutions when they apply for banking licenses. Governance rules relate to the structures and processes of a bank. The focus in governance regulation has lately been on adequate risk management and managerial compensation. Prudential regulation governs banks' activities and requires them to hold appropriate levels of capital and liquidity. In particular, capital regulation has been the standard prudential mechanism for addressing risks linked to maturity transformation. The idea is that equity (*i.e.*, funding contributed by shareholders, either by purchasing shares from the bank, or by the retention of profits earned by the bank) should fund a minimum proportion of the current value of a bank's assets, to increase the chances of such bank being able to absorb losses, and thus decrease the risk of balance sheet insolvency.⁹⁵ The basis of such capital requirements is a system of asset risk-weighting – to clarify, the riskier the asset on a bank's balance sheet, the more capital a bank needs to fund it.⁹⁶ Furthermore, prudential regulation can be split into two domains, based on the objective pursued: prudential regulation promoting macroeconomic stability (macroprudential regulation), and prudential regulation aiming for micro-level safeguarding of stability or investor protection (microprudential regulation).⁹⁷ The following Chapter 2.3 will discuss this division more closely. Lastly, because of the negative externalities that can arise if a bank fails, special resolution procedures have been created for minimizing such

⁹³ Basel Committee, *Basel III: A global regulatory framework for more resilient banks and banking systems* (2010, Revised in June 2011) Bank for International Settlements. Following the financial crisis, the Basel Committee together with the FSB, produced proposals for measures to combat systemic risks in the future as part of Basel III. The Basel III reforms after the Financial Crisis developed a methodology to assess which banks are of global systemic importance based on the impact that a failure of a bank can have on the global financial system (so-called G-SIBs), and a framework to deal with them. See Basel Committee, 'High-level Summary of Basel III Reforms' (December 2017) Bank for International Settlements.

⁹⁴ Alexander, *Principles of Banking Regulation* (n 6) 44.

⁹⁵ Armour and others (n 23) 290. Liquidity requirements are, on the other hand, based on the idea that the higher the level of liquid assets the bank must hold (cash or assets that can easily be converted to cash), the easier it is to meet demands from depositors, which reduces the risk of unexpected withdrawals of deposits (bank runs).

⁹⁶ Armour and others (n 23) 299.

⁹⁷ Wuolijoki and Hemmo (n 52) 8.

costs. In particular, after the Financial Crisis, the focus has been on trying to create resolution mechanisms that would minimize the effects of failure of a systemically important financial institution and avoid a government bail-out based on tax revenue.⁹⁸

2.4 The Macroprudential Approach to Regulation

The best way to define the perimeters of macroprudential regulation is by examining its differences and similarities with microprudential regulation. Before the Financial Crisis, the general conception was that microprudential regulation was sufficient to ensure financial stability.⁹⁹ Traditional microprudential regulation aims to ensure the soundness of individual financial institutions.¹⁰⁰ The economic rationale for such regulation rests on correcting market failures that threaten economic efficiency at the level of the individual firm, such as standard negative externalities and moral hazard problems, examined in Chapter 3.1. In short, shareholders of leveraged financial institutions have incentives to engage in risky activities as they will receive potential profits but not bear the whole costs of failure, which will be borne by creditors. This risk-shifting is exacerbated for banks which have public safety nets. For this reason, microprudential regulations, most notably capital requirements, were introduced to limit such risks and force shareholders to bear a greater share of the costs of excessive risk-taking.¹⁰¹ Its primary objective is therefore investor protection.¹⁰²

The Financial Crisis, however, demonstrated the importance of regulating and protecting the financial system as a whole. Several factors led to the emergence of the crisis; the low cost of borrowing before the crisis, a search for ever-higher profits prevailing in the financial market, and, in particular, the use of complex approaches to manage financial risks through off-balance-sheet entities, such as the use of credit default swaps and securitization structures.¹⁰³ In combination with the globalization of finance, financial institutions were able to hedge and spread risk across geographies and different sectors. The securitization of mortgages and the sale of mortgage-backed securities reduced banks' incentives to screen their mortgage lending, contributing to over-borrowing.¹⁰⁴ When the credit quality of a large

⁹⁸ Armour and others (n 23) 288.

⁹⁹ Yener Altunbas, Mahir Binici and Leonardo Gambacorta, 'Macroprudential Policy and Bank Risk' (2018) 81 *Journal of International Money and Finance* 203.

¹⁰⁰ Armour and others (n 23) 409.

¹⁰¹ de Nicolò, Favara and Ratnovski (n 23) 6.

¹⁰² Alexander, *Principles of Banking Regulation* (n 6) 2.

¹⁰³ Jacques de Larosière and others, 'The High-Level Group on Financial Supervision in the EU - Report' (25 February 2009) 7-8.

¹⁰⁴ Armour and others (n 22) 409ff; Alexander, *Principles of Banking Regulation* (n 6) 48.

number of loans deteriorated, it triggered a rapid contagion of financial difficulties across financial markets globally. Financial regulation at the time included a key market failure, which created systemic risk and has since been referred to as a ‘composition fallacy’: what might be prudent behavior from the perspective of a single financial institution may be imprudent from the perspective of the financial system as a whole if a sizable contingency of institutions engage in similar behavior.¹⁰⁵ Therefore, in each of the factors leading up to the Financial Crisis, there were negative externalities that the markets and financial institutions failed to adequately assess and price. Solving the moral hazard problem for individual institutions, therefore, proved to not be sufficient to ensure the stability of the financial system.¹⁰⁶ Certain tools of microprudential regulation aimed at stabilizing individual institutions were furthermore at times capable of further destabilizing the financial system.¹⁰⁷ In sum, since the Financial Crisis, the consensus has been that the previous prudential framework had not been fit for purpose.¹⁰⁸ Consequently, regulators started developing tools to deal with system-wide financial risks to the macroeconomy through pre-emptive intervention – macroprudential regulation.¹⁰⁹

The macroprudential approach to financial regulation is still considered an innovation and its scope is not entirely clear.¹¹⁰ It is mostly defined based on its objectives and scope, constituting what may be best categorized as a perspective of regulatory and supervisory arrangements.¹¹¹ A widely accepted, broad definition of a macroprudential approach is that it is designed to: “identify and mitigate risks to systemic stability, in turn reducing the costs to the economy from a disruption in financial services that underpin the workings of financial markets”.¹¹² Such a system-wide perspective aims effectively to, *e.g.*, manage systemically important institutions, apply a macroeconomic perspective to bank supervision, anticipate emerging systemic risks, and consider the linkages and

¹⁰⁵ Lastra (n 70) 310. See also Chapter 2.2.

¹⁰⁶ de Nicolò, Favara and Ratnovski (n 23) 6.

¹⁰⁷ *Ibid* 7; Masur and Posner (n 60) 878. For example, capital requirements set independently of the business cycle may be a source of systemic risk: in the case of downturns, raising new capital to satisfy capital requirements is costly. Banks may therefore prefer to de-lever instead of increasing equity, which in aggregate, if done simultaneously by multiple banks, may cause a credit crunch and exacerbate the initial negative shock. For example: capital requirements that become binding following a negative shock to a bank’s assets can transform individual deleveraging into a system-wide credit crunch.

¹⁰⁸ Borio, ‘Implementing a Macroprudential Framework: Blending Boldness and Realism’ (n 83) 4; de Nicolò, Favara and Ratnovski (n 23), 4.

¹⁰⁹ Armour and others (n 22) 410.

¹¹⁰ Armour and others (n 22) 409.

¹¹¹ Borio, ‘Implementing a Macroprudential Framework: Blending Boldness and Realism’ (n 83) 2.

¹¹² Altunbas, Binici and Gambacorta (n 99) 204.

interdependencies across the financial system.¹¹³ Armour and others use the analogy between medicine and public health care to conceptually clarify the approach: macroprudential regulation is analogous to the protection of the population, whereas microprudential supervision is analogous to the saving of individual lives. Simply the good treatment of individuals does not necessarily amount to effective protection against the spread of disease. Similarly, ensuring the soundness of individual institutions is not sufficient to protect the stability of the financial system *as a whole*, which therefore requires its own approach.¹¹⁴ The measures, tools, and processes employed by financial regulators to achieve these objectives are thus called macroprudential policy.

While the idea of a macroprudential approach to regulation predates the Financial Crisis¹¹⁵, it only became a focal point of financial regulation after the events of the crisis proved its necessity.¹¹⁶ The focus is on preventing and mitigating the events that create negative externalities and can give rise to systemic risk, such as bank runs, fire sales and credit crunches.¹¹⁷ More specifically, a common approach has been to classify macroprudential policies based on the distinction that the need for macroprudential policies arises from two dimensions predicated upon the concept of systemic risk: the *cross-sectional* and *time-series* dimensions of systemic risk. First, the *cross-sectional* or *structural* perspective of macroprudential regulation contemplates the distribution of risks across the financial sector and the interrelationships between different markets and financial institutions.¹¹⁸ It examines the common exposures, negative externalities, and risks that can arise from the interconnections between banks and other non-bank financial institutions.¹¹⁹ The interconnectedness of the financial system might mitigate small shocks by spreading them, but amplifies large shocks as they reach more parties.¹²⁰ Thus, macroprudential regulation aims to reduce the contagion or effects of a shock.¹²¹ The approach also aims to correct misaligned incentives and related market failures, such as moral hazard, especially with the systemically important financial institutions.¹²² Cross-sectional risks are typically

¹¹³ Lastra (n 70) 316.

¹¹⁴ Armour and others (n 22) 409-416

¹¹⁵ Some discussions on macroprudential policies had taken place prior to the Financial Crisis. See, e.g., Claudio Borio, 'Towards a Macroprudential Framework for Financial Supervision and Regulation?' (2003) No 128 Bank for International Settlements Working Papers.

¹¹⁶ Lastra (n 70) 316.

¹¹⁷ See Chapter 2.2.

¹¹⁸ Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7; Armour and others (n 22) 412; Lastra (n 70) 313.

¹¹⁹ Armour and others (n 22) 412.

¹²⁰ de Nicolò, Favara and Ratnovski (n 23) 10.

¹²¹ Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7.

¹²² Grünewald (n 6) 9.

addressed by, *e.g.*, increasing capital and liquidity buffers, which will be discussed in more detail in Chapter 3.¹²³

Second, the *time-series* or *cyclical* perspective of macroprudential regulation is concerned with the accumulation of systemic risk over time, *i.e.*, risks that arise from the *procyclicality* of the financial system.¹²⁴ According to the ESRB, such cyclicity originates from the “tendency of financial institutions to assume excessive risks in the upswing and become excessively risk-averse in the downswing”.¹²⁵ Financial crises, therefore, tend to occur in waves, and such waves also include individual regional crises with contagion effects.¹²⁶ One of the main post-crisis criticisms of the Basel Accords was that they had provided for ‘procyclical’ measures. A macroprudential approach to regulation, thus, aims for financial institutions to make countercyclical efforts (“lean against the wind”), meaning efforts directed in the opposite direction of lending and investment trends to proactively address the emergence of systemic risk.¹²⁷ Another key objective of macroprudential regulation is to enable central banks and supervisory authorities to prevent the emergence of systemic risks to financial stability *ex-ante*, meaning before financial market participants recognize the risk and adjust their behaviors, which can exacerbate the systemic risks.¹²⁸ Attention has been turned to models that emphasize the risks of increasing levels of debt and leverage in households and financial institutions and their possibility to create financial instability. The new wisdom is that financial cycles of credit and leverage are fundamentally vital to economic stability.¹²⁹

In sum, macroprudential regulation has climbed to the top of the regulatory agenda after the Financial Crisis because of the urgent need to ensure the safety of the financial and economic system as a whole. In its application, it has consisted of the introduction of new institutional arrangements and supervisory authorities as well as various regulatory tools. The next chapter will examine these in further detail, with a focus on the developments in the EU.

¹²³ Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7.

¹²⁴ Borio, ‘Implementing a Macroprudential Framework: Blending Boldness and Realism’ (n 83) 3.

¹²⁵ Recommendation of the ESRB (n 78). See also Armour and others (n 22) 413.

¹²⁶ Alexander, *Principles of Banking Regulation* (n 6) 44.

¹²⁷ Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7.

¹²⁸ *Ibid.*

¹²⁹ Armour and others (n 22) 412.

3. EU Macroprudential Framework

The framework for financial regulation in the EU has changed rapidly and profoundly in the recent years since the Financial Crisis. This chapter first presents the foundations of financial supervision in the EU, focusing on the framework for macroprudential supervision. It then presents a non-exhaustive overview of macroprudential instruments in the EU, following the structure developed by the European Systemic Risk Board (“ESRB”), and provides deeper insight into the market failures targeted by macroprudential regulation.

3.1 EU Macroprudential Supervision

To be effective, macroprudential measures require strong institutional frameworks with international, regional, and national dimensions.¹³⁰ A central feature of the introduction of macroprudential regulatory reforms in particular in the EU has been institutional restructuring, including the creation of new institutions, so-called ‘macroprudential authorities’.¹³¹

The Financial Crisis highlighted the absence of a European financial stability framework in the single financial market.¹³² Following the post-crisis reforms, the EU financial regulation system now operates essentially on two levels: (i) an EU-wide set of rules and rule-making agencies—the European System of Financial Supervision (ESFS) (see figure 1), and (ii) a Banking Union for the euro area Member States (“Eurozone”).¹³³ The first pillar of the ESFS constitutes the three European Supervisory Authorities (ESAs) conducting microprudential supervision – the European Banking Authority (EBA), the European Securities and Markets Authority (ESMA), and the European Insurance and Occupational Pensions Authority (EIOPA), acting together through a Joint Committee.¹³⁴ In

¹³⁰ Armour and others (n 22) Chapter 19.

¹³¹ Ibid 425; Alexander, *Principles of Banking Regulation* (n 6) 53. Similar developments have taken place in the US and the UK. In the US, the Dodd-Frank Act established the Financial Stability Oversight Council. In the UK, the Bank of England created the Financial Policy Committee.

¹³² Pedro Gustavo Teixeira, *The Legal History of the European Banking Union* (Oxford Hart Publishing 2020) 169. The new European supervisory architecture is based on the recommendations from the de Larosière Report (n 103).

¹³³ Teixeira (n 132) 160.

¹³⁴ Ibid. The ESAs were established already in January 2011. On the basis of the recommendations of the de Larosière Report issued in 2009 (n 103), the Commission put forward legislative proposals adopted later in 2010: Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending decision No 716/2009/EC and repealing Commission decision 2009/78/EC [2010] OJ L331/12 (“EBA Regulation”); Regulation (EU) No 1094/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Insurance and Occupational Pensions Authority)

broad terms, each authority pursues a different objective: the EBA primarily focuses on prudential regulation, ESMA on market efficiency and conduct of business, and EIOPA on consumer protection.¹³⁵ Responsibility for supervising regulated firms however largely remains with the relevant national competent authorities (“NCAs”).¹³⁶

The European System of Financial Supervision (ESFS)	
Microprudential Supervision	Macroprudential Supervision
European Banking Authority	European Systemic Risk Board <i>Voting authorities:</i> ECB, EU national central banks, Commission, ESAs <i>Non-voting authorities:</i> EU national financial supervisors, President of the Economic and Financial Committee
European Securities and Markets Authority	
European Insurance and Occupational Pensions Authority	
Joint Committee of European Supervisory Authorities	
National financial supervisors (NCAs)	

Figure 1 The European System of Financial Supervision in 2011 (Source: Teixeira (n 132) 161).

The second pillar, macroprudential supervision, is delegated to the ESRB. Macroprudential oversight at the EU level is accomplished by two operative levels: the ESRB, and the NCAs. According to the regulation governing the ESRB (the “ESRB Regulation”)¹³⁷, the ESRB shall be responsible for:

“macro-prudential oversight of the financial system within the Union in order to contribute to the prevention or mitigation of systemic risks to financial stability in the Union that arise from developments within the financial system and taking into

amending decision No 716/2009/EC and repealing Commission decision 2009/79/EC [2010] OJ L331/48 (“EIOPA Regulation”); Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority) amending decision No 716/2009/EC and repealing Commission decision 2009/77/EC [2010] OJ L331/84 (ESMA Regulation)

¹³⁵ Armour and others (n 22) 543; articles 8-10 of the EBA Regulation, EIOPA Regulation and ESMA Regulation. These authorities have the power to issue non-binding guidelines and recommendations, promote coordination and convergence among the national regulatory authorities, conduct peer reviews, collect information, and monitor market developments. In certain areas, they also have the power to write legally binding technical standards and make legally binding decisions, if endorsed by the Commission.

¹³⁶ See, e.g., Teixeira (n 132) 160ff.

¹³⁷ Regulation (EU) No 1092/2010 of the European Parliament and of the Council of 24 November 2010 on European Union Macro-Prudential Oversight of the Financial System and establishing a European Systemic Risk Board [2010] OJ L 311/1 (the “ESRB Regulation”).

account macroeconomic developments, so as to avoid periods of widespread financial distress”.¹³⁸

The ESRB’s tasks, therefore, include identifying, preventing, and mitigating systemic risk and issuing warnings where such systemic risks are deemed significant. One of its key tasks is also to research and collect information from Member State banks, and provide the ESAs with such information.¹³⁹ The ESRB produces annual reports and guidelines to highlight emerging risks to financial stability, analyze the measures taken by Member States, and offer advice on the application of macroprudential regulation in the banking sector.¹⁴⁰ Perhaps more importantly, the ESRB can issue (non-legally binding) recommendations and warnings for the prevention of systemic risks to the EU, the ECB, Member States and the ESAs or national supervisory authorities, which function based on an ‘act or explain’ mechanism.¹⁴¹ Thus, the ESRB has no power to use macroprudential instruments directly since the responsibility for the actual introduction of macroprudential instruments rests with the NCAs.

The decision-making body of the ESRB is its general board, which consists of over 60 voting and non-voting members, including governors of the national central banks, representatives of the ECB, the Commission, and the chairpersons of the ESAs.¹⁴² In light of the potential need to make quick and effective decisions, the high number of voting members has been criticized. There has also been skepticism as to its independence because of the broad membership consisting of representatives of other EU authorities and the Member States. Some commentators argue that it resembles more of a coordination mechanism among central bankers, rather than its own organization, in particular as it does not have legal personality or autonomous intervention power.¹⁴³

¹³⁸ ESRB Regulation, Art 3(1).

¹³⁹ Ibid, Arts 3(2) and 15(5).

¹⁴⁰ Ibid, Art 3. See also ESRB, ‘Reports of the ESRB’ <<https://www.esrb.europa.eu/pub/reports/html/index.en.html>> accessed 17 May 2022.

¹⁴¹ ESRB Regulation, Arts. 16 and 17. The addressee of any such the recommendation or warning must provide adequate justification for any subsequent inaction. See also ESRB Regulation, recital (20) and Art 17(2). If the ESRB considers that its recommendation “has not been followed or that the addressees have failed to provide adequate justification, for their inaction, it shall, subject to strict rules of confidentiality, inform the addressees, the Council and, where relevant, the European Supervisory Authority concerned”

¹⁴² Ibid, Arts. 4 and 11. The number of voting members is 37, and consists of the general board, the president and vice-president of the ECB, governors of the member state central banks, a member of the Commission, the chairpersons of each ESA, and representatives from the ESRB’s two Advisory Committees (Advisory Scientific Committee and Advisory Technical Committee).

¹⁴³ Brigitte Haar, ‘Organizing Regional Systems: The EU Example’, in Niamh Moloney, Eilís Ferran and Jennifer Payne (eds), *The Oxford Handbook of Financial Regulation* (Oxford University Press 2015) 179-181.

The EBA remains the regulatory agency responsible for managing the Single Rulebook for the banking sector in the EU (see Chapter 3.2) and for ensuring its consistent application. It does so by providing guidelines and in particular by adopting binding technical standards and guidelines.¹⁴⁴ Therefore, the tasks of the ESRB and the rest of the ESFS are to define the surrounding frameworks and coordinate monitoring and decision-making around macroprudential policies.¹⁴⁵

The ESFS structure is, however, complicated by the Banking Union, which was established for the Eurozone in 2012. The euro area sovereign debt crisis in 2010 revealed some of the flaws of the European monetary union. A common currency leads to an even greater interdependence between the euro area countries, and a higher risk of contagion in times of crisis.¹⁴⁶ As a first aid to the sovereign debt crisis, the Eurozone Member States created a funding facility, the European stability mechanism (ESM), to be able to directly recapitalize the failing Eurozone banks. This however did not solve any long-term issues, but merely highlighted the moral hazard problem inherent in bank rescues – namely, the incentive to take greater risks than if government support was unavailable.¹⁴⁷ The European Council, therefore, opted to create a separate Banking Union for the Eurozone and offer the rest of the Member States the option to participate, if they wished.¹⁴⁸

The first and most central part of the process of creating the Banking Union was the centralization of bank supervision to the European level through the single supervisory mechanism (“SSM”).¹⁴⁹ This is considered the first pillar of the banking union and consists of the conferral of certain responsibilities for micro- and macro-prudential supervision of Eurozone credit institutions to the ECB.¹⁵⁰ The ECB has exclusive responsibility for, *i.e.*, the authorization and licensing of credit institutions, monitoring compliance with capital,

¹⁴⁴ n 135. See also EBA, ‘Missions and Tasks’ < <https://www.eba.europa.eu/about-us/missions-and-tasks> > accessed 17 May 2022. The binding technical standards are legal acts which specify rules in a directive or a regulation, to ensure consistent harmonization. The EBA drafts the binding technical standards and if endorsed and adopted by the Commission, they are legally binding and directly applicable in all member states.

¹⁴⁵ Alexander, *Principles of Banking Regulation* (n 6) 53.

¹⁴⁶ Haar (143) 179; Teixeira (n 132) 137. The Financial Crisis was followed by a sovereign debt crisis in Europe, when Greece disclosed a public deficit much larger than what it had previously reported. The debt crisis was exacerbated by the lack of confidence in the capacity of the EU institutions and the euro area to manage the crisis. The monetary union had been established without jurisdiction for banking supervision and crisis management competencies.

¹⁴⁷ See Chapter 2.1. See also Armour and others (n 22) 543.

¹⁴⁸ Armour and others (n 22) 545. Non-euro countries wanted to keep their domestic banking supervisors, particularly the UK.

¹⁴⁹ Council Regulation (EU) No 1024/2013 of 15 October 2013 conferring specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions [2013] OJ L 287/63 (the “SSM Regulation”).

¹⁵⁰ Commission, ‘A Roadmap Towards a Banking Union’ (Communication) COM (2012) 0510 final 4.

liquidity, leverage, and governance requirements, and carrying out stress tests and supervisory reviews for all Eurozone credit institutions.¹⁵¹ The ECB is also directly responsible for the supervision of several Eurozone banks considered to be systemically important.¹⁵² The ECB currently directly supervises 115 banks, which collectively hold 82 percent of banking assets in the Eurozone.¹⁵³ For banks that are not directly supervised by the ECB, NCAs maintain day-to-day supervisory responsibility while the ECB is responsible for setting the supervisory rules articulating a common approach.¹⁵⁴ The ECB does not, however, have any disciplinary power, except for the power to impose administrative penalties.¹⁵⁵ National authorities, therefore, remain important even within the Banking Union.

The second pillar of the Banking Union is the single resolution mechanism (“SRM”), which establishes a common framework for the resolution of euro area banks consistent with the bank recovery and resolution directive. The two first pillars of the Banking Union, the SSM and the SRM, are in place and fully operational. The Commission has put forward a proposal for the third pillar, the European deposit insurance scheme (EDIS) in 2015, but this proposal has not yet progressed.¹⁵⁶

Even though the EU created the ESRB, the ECB is arguably the central actor in macroprudential oversight, specifically because of its role in macroprudential supervision within the Eurozone.¹⁵⁷ Giving responsibility for macroprudential oversight to central banks is on the other hand often considered warranted, especially considering the vast amounts of information that is needed for effective macroprudential supervision and the need to have effectively senior oversight.¹⁵⁸ The ECB’s president is also the chair of the ESRB, and votes on the ESRB General Board together with the ECB’s vice-president, which means that the

¹⁵¹ SSM Regulation, Art 4.1.

¹⁵² Ibid, Art 6(4); Euro area banks are deemed to fall in this category if their assets exceed EUR 30 billion, or 20 per cent of the GDP of the participating state of establishment, or if they are identified by the relevant NCA as being of significant relevance to the domestic economy. In addition, at least the three most significant credit institutions of each participating country will be subject to direct supervision.

¹⁵³ ECB, ‘Single Supervisory Mechanism’ <<https://www.bankingsupervision.europa.eu/about/thessm/html/index.en.html>> accessed 17 May 2022.

¹⁵⁴ SSM Regulation, Art 1(6) and 5(2). In addition, tools that have no EU origin are out of the ECB’s reach.

¹⁵⁵ Ibid, Art 18.

¹⁵⁶ Commission, ‘A Roadmap Towards a Banking Union’ (n 150) 4; Commission, ‘What is the Banking Union’ <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/banking-union/what-banking-union_en> accessed 17 May 2022.

¹⁵⁷ Armour and others (n 22) Chapter 27. Similar patterns exist notably in the US but also in the UK, where macroprudential authorities have been created but the central banks still remain very important.

¹⁵⁸ Ibid 609.

ECB is closely involved in the decision-making and the agenda-setting for the ESRB.¹⁵⁹ The ECB also provides the ESRB with relevant data and analysis.¹⁶⁰ In addition to directly supervising the largest Eurozone banks, the ECB also has the power to take responsibility for additional banks that it deems to pose a threat to systemic stability.¹⁶¹ Another key competence for the ECB is the power to apply the Basel III macroprudential tools, such as the countercyclical buffer, with direct application to all Eurozone banks. Further, it is empowered to apply more stringent macroprudential measures than those applied by the NCAs, if such measure is enabled under EU law (see Chapter 3.2).¹⁶² In addition, the SSM Regulation establishes multiple coordination mechanisms and obligations regarding the calibration of macroprudential instruments for the ECB to the NCAs and vice versa.¹⁶³

In sum, at the EU level, macroprudential supervision continues to be the responsibility of the Member States, while the EU actors (in particular the ESRB) can use soft law powers to ensure a coherent implementation of EU financial law, coordinate the supervisory practices of the Member States, and monitor broader systemic risk in the European financial market.¹⁶⁴ Within the Banking Union, the ECB has significant powers to directly apply macroprudential regulation to the Eurozone banks. Commentators have criticized the assignment of partial macroprudential powers to the ECB of essentially rendering the ESRB “irrelevant”.¹⁶⁵ As becomes apparent, there is currently an overlap in, and unclear organization of, responsibility for macroprudential supervision in the EU, caused primarily by the existence of the Banking Union.¹⁶⁶ Macroprudential supervisory powers are ambiguously divided between the EBA, the ESRB, NCAs, and the ECB. The architecture is further complicated by the fact that, in some Member States, the central bank conducts macroprudential policy, and in others, there is a separate authority tasked with this purview.¹⁶⁷ It is also important to note that the powers of NCAs differ between Member

¹⁵⁹ ESRB Regulation, Art 5(1).

¹⁶⁰ Commission, Report from the Commission to the European Parliament and the Council on the mission and organization of the European Systemic Risk Board (ESRB) COM (2014) 508 final.

¹⁶¹ SSM Regulation, Art 6(5)(b).

¹⁶² Ibid, Art 5(2).

¹⁶³ Ibid, Arts 5, 9(1)(3) and 6(2).

¹⁶⁴ Alexander, *Principles of Banking Regulation* (n 6) 53.

¹⁶⁵ Lastra (n 70) 329; André Sapir, 'Europe's Macroprudential Policy Framework in Light of the Banking Union' in Dirk Schoenmaker (ed), *Macroprudentialism* (CEPR Press, VoxEU eBook 2014) 167.

¹⁶⁶ Alexander, *Principles of Banking Regulation* (n 6) 54.

¹⁶⁷ European Systemic Risk Board, 'List of National Macroprudential Authorities and National Designated Authorities in EU Member States' (August 2017) <https://www.esrb.europa.eu/national_policy/shared/pdf/esrb.170825_list_national_macroprudential_authorities_national_designated_authorities_in_EUMemberStates.en.pdf> accessed 17 May 2022. The CRR and CRD IV allow in certain areas, such as article 136 CRD IV, that member states establish a “designated authority” to

States.¹⁶⁸ The above aspects, therefore, provide for a complex and cumbersome macroprudential supervisory arrangement in the EU.

3.2 Macroprudential Instruments

In addition to the reorganization of the European financial supervisory regime, several substantive legislative reforms were also introduced after the Financial Crisis to, *i.e.*, implement the Basel Accords. These reforms include stronger prudential requirements for banks, improved protection for depositors, and rules for managing failing banks. The prudential regulatory framework for banks in the EU consists of three main pillars. The first pillar consists of minimum capital requirements. The second pillar consists of the supervision of banks' activities and risks, including the supervisory review enhancement process (the "SREP"). The SREP enables supervisors to, *e.g.*, require banks to hold additional capital, if they consider that the minimum requirements under Pillar 1 are insufficient for a particular risk. The third pillar consists of market scrutiny, focusing on disclosure enhancement. These rules, together with related regulatory technical and implementing standards by the Commission and the EBA, are called the Single Rulebook.¹⁶⁹

The primary legislation which form the Single Rulebook are the Capital Requirements Regulation¹⁷⁰ and the Capital Requirements Directive IV.¹⁷¹ Although having a primarily microprudential focus, they also include macroprudential supervisory powers

be responsible for the use of a certain macroprudential instrument, as opposed to the NCA. The designated authority will typically be the central bank, but in some cases a separate, national, macroprudential authority is chosen.

¹⁶⁸ See, *e.g.*, Commission, 'Impact Assessment Report accompanying the documents Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) No 575/2013 on prudential requirements for credit institutions as regards requirements for credit risk, credit valuation adjustment risk, operational risk, market risk and the output floor and Proposal for a Directive of the European Parliament and of the Council amending Directive 2013/36/EU as regards supervisory powers, sanctions, third-country branches, and environmental, social and governance risks, and amending Directive 2014/59/EU' (Staff Working Document) SWD (2021) 320 final 20. The CRD requires member states to provide competent authorities with a minimum set of powers to exercise supervision. Several member states have considered it necessary to introduce additional supervisory powers and have used the discretion allowed under the CRD.

¹⁶⁹ Valia Babis, 'Single Rulebook for Prudential Regulation of Banks: Mission Accomplished?'(2015) 26 European Business Law Review 779, 787ff.

¹⁷⁰ The CRR has been amended in 2019, with the Regulation (EU) 2019/876 of the European Parliament and of the Council of 20 May 2019 amending Regulation (EU) No 575/2013 as regards the leverage ratio, the net stable funding ratio, requirements for own funds and eligible liabilities, counterparty credit risk, market risk, exposures to central counterparties, exposures to collective investment undertakings, large exposures, reporting and disclosure requirements, and Regulation (EU) No 648/2012 [2019] OJ L 150/1 (the "Capital Requirements Regulation II" or "CRR II").

¹⁷¹ The CRD IV has been amended in 2019, with the Directive (EU) 2019/878 of the European Parliament and of the Council of 20 May 2019 amending Directive 2013/36/EU as regards exempted entities, financial holding companies, mixed financial holding companies, remuneration, supervisory measures and powers and capital conservation measures [2019] OJ L 150/253 (the "Capital Requirements Directive V" or "CRD V").

and macroprudential tools to be applied under certain conditions by the corresponding national macroprudential authority.¹⁷² The CRR sets out the rules for the calculation of certain capital and liquidity requirements, which are directly applicable for EU credit institutions and certain investment firms. The CRD includes rules on bank governance and risk management as well as rules establishing the supervisory powers and responsibilities of NCAs. A majority of these rules originate from the standards provided by the Basel Committee, through the Accord of 1988 (“Basel I”) and the successors Basel II (2004) and Basel III (2010).¹⁷³ The post-crisis EU prudential reforms, based on Basel III, focused on increasing the quality and quantity of regulatory capital, introducing new rules aimed at reducing banks’ excessive leverage, increasing resilience to liquidity shocks, and addressing too-big-to-fail problems.¹⁷⁴

The ESRB has set out five intermediate objectives to make macroprudential policy more “operational, transparent and accountable” and to provide “an economic basis for the election of instruments”, four of which are relevant to the banking sector.¹⁷⁵ For each intermediate objective, the ESRB has identified the underlying market failure and selected indicative instruments to serve as a framework for Member State macroprudential policy.¹⁷⁶ This Chapter will present a non-exhaustive overview of EU macroprudential tools based on the ESRB’s framework. This framework is summarized below in Figure 2, with some modifications, and includes, but is not limited to, the instruments provided by the CRR and CRD IV.¹⁷⁷

¹⁷² The Single Rulebook also encompasses various other directives, such as the Bank Recovery and Resolution Directive (BRRD) and the Deposit Guarantee Schemes Directive (DGSD). <<https://www.eba.europa.eu/regulation-and-policy/single-rulebook/interactive-single-rulebook>>.

¹⁷³ Bank for International Settlements, ‘History of the Basel Committee’ <<https://www.bis.org/bcbs/history.htm>> accessed 17 May 2022.

¹⁷⁴ See, e.g., Commission, Impact Assessment Report (n 168) 6.

¹⁷⁵ Recommendation of the ESRB (n 78). The recommendation also includes a fifth objective on strengthening the resilience of financial infrastructures. This objective has been omitted from this analysis because it does not directly fall within the narrower scope of macroprudential banking regulation considered here. See also ESRB, ‘Flagship Report on Macro-prudential Policy in the Banking Sector’ (n 42) 7.

¹⁷⁶ Recommendation of the ESRB (n 78).

¹⁷⁷ Ibid; ESRB, ‘The ESRB Handbook on Operationalising Macro-prudential Policy in the Banking Sector (2019) 164. The list of indicative instruments has been updated in 2019. This figure includes and summarizes information from both the original ESRB recommendation and the updated changes. See also Lastra (n 70) 320-322 for a partly similar interpretation.

Macprudential Policy	Underlying Market	Suggested Instrument
Intermediate objective	Failure	
(i) Mitigate and prevent excessive credit growth and leverage	<ul style="list-style-type: none"> • Credit crunch externalities • Endogenous risk-taking • Risk illusion • Bank runs • Interconnectedness externalities 	<ul style="list-style-type: none"> • Countercyclical capital buffers and the systemic risk buffer • Increased capital conservation buffer • Increased own funds requirements • Sectoral capital requirements • Macroprudential leverage ratios
(ii) Mitigate and prevent excessive maturity mismatch and market illiquidity	<ul style="list-style-type: none"> • Fire sales externalities • Bank runs • Market illiquidity 	<ul style="list-style-type: none"> • Adjustment to liquidity ratios or liquidity buffers • Restrictions on funding sources
(iii) Limit direct and indirect exposure concentrations	<ul style="list-style-type: none"> • Interconnectedness externalities • Fire sales externalities 	<ul style="list-style-type: none"> • Systemic risk buffer • Large exposure restrictions or measures for intra-financial sector exposures • Increased own funds requirements
(iv) Limit the systemic impact of misaligned incentives to reduce moral hazard	<ul style="list-style-type: none"> • Moral hazard and ‘too big to fail’- issues 	<ul style="list-style-type: none"> • Capital buffers for G-SIIs and O-SIIs • Systemic risk buffer • Increased capital conservation buffer • Increased own funds requirements

Figure 2 EU Macroprudential policy intermediate objectives, underlying market failures, and selected instruments.

The first intermediate objective, mitigating excessive credit growth and leverage, is one of the central goals of macroprudential policy. It targets some of the primary externalities of the banking sector, and causes of systemic risk discussed in Chapter 2, such as bank runs and credit crunches caused by, *e.g.*, fire sales, and other behavior which causes excessive

risk-taking.¹⁷⁸ A distressed financial institution is likely to react by shrinking its balance sheet assets and operating with lower capital ratios, rather than raising new capital, thereby raising the risks of a crisis occurring and spreading to other institutions. Consequently, regulation aims to prevent financial institutions from such shrinking of balance sheet assets and excessive deleveraging.¹⁷⁹ The principal recommended macroprudential tool for addressing such externalities is capital buffers, *i.e.*, additional capital requirements, aimed to reduce the risk that unexpected losses would result in banks breaching their minimum capital requirements. The formal difference between capital buffers and minimum capital requirements is the consequences of a breach. A breach of minimum capital requirements prevents banks from operating, while a breach of capital buffer requirements leads to an obligation to restrict distributions to shareholders and managers (*i.e.*, in the form of dividends or bonus payments) until compliance with the capital ratio is restored.¹⁸⁰

The CRD IV sets out five different types of capital buffers, four of which are based on the Basel Accords, and one of which is EU-specific. The Basel-based buffers include the increased capital conservation buffer¹⁸¹, the countercyclical capital buffer¹⁸², buffers for global systemically important institutions, and other systemically important institutions¹⁸³, and the EU-specific buffer is the systemic risk buffer¹⁸⁴. Among these, only the countercyclical capital buffer and the global systemically important institution buffer have mandatory rates with which institutions must comply in certain scenarios, while the rest are

¹⁷⁸ Recommendation of the ESRB (n 78). Endogenous risk-taking refers to incentives that generate excessive risk-taking (for instance, the weakening of lending standards) during an economic boom. The ESRB explains ‘risk illusion’ as “the collective underestimation of risk related to short-term memory and the infrequency of financial crises”.

¹⁷⁹ Armour and others (n 22) 417; Hanson, Kashyap and Stein (n 80) 6-8. For these reasons, Hanson, Kashyap and Stein define macroprudential regulation as “an effort to control the social costs associated with excessive balance-sheet shrinkage on the part of multiple financial institutions hit with a common shock”.

¹⁸⁰ Armour and others (n 22) 306-307. Capital buffers, are, thus effectively capital requirements in addition to the minimum capital requirements.

¹⁸¹ The capital conservation buffer is set out in article 129 CRD, which is calibrated at 2.5% of the total amount of assets adjusted by the riskiness of these assets (Risk Weighted Assets, RWA), to ensure that banks have an additional layer of usable capital that can be drawn down when losses are incurred. Article 458 CRR allows member states to increase the capital conservation buffer above the 2.5% rate requirement, if the existing rate is not considered adequate to address excessive credit growth by the NCA. See also ESRB, The ESRB Handbook on Operationalising Macro-prudential Policy (n 177) 9.

¹⁸² CRD IV, Arts 130 and 135-140; ESRB, The ESRB Handbook on Operationalising Macro-prudential Policy (n 177) 8ff.

¹⁸³ CRD IV, Art 131.

¹⁸⁴ *Ibid*, Arts 133-134. The article holds that member states should be able to require certain institutions to hold a systemic risk buffer in order to prevent and mitigate macroprudential or systemic risks, in addition to a capital conservation buffer and a countercyclical capital buffer. The buffer may also be applied to risks which stem from exposures to specific sectors, so long as they are not already addressed by the other buffers.

under the discretion of the NCAs.¹⁸⁵ Of specific importance is the countercyclical capital buffer. In simple terms, countercyclical capital regulation requires banks to hold more regulatory capital during good times and permits them to hold less than what would be usually required during bad times. As a result, the capital buffers are aimed at mitigating the potential procyclicality of capital requirements, as evidenced in the Financial Crisis.¹⁸⁶

Other tools which can mitigate excessive credit growth and leverage include the so-called ‘macroprudential use of Pillar 2 tools’, meaning that supervisors can tighten existing prudential requirements, such as own funds requirements and sectoral requirements, when the SREP indicates that a specific bank is contributing to systemic risk.¹⁸⁷ Many macroprudential tools can also be implemented based on Article 458 CRR, which allows Member States to use ‘national flexibility measures’ following certain specific notification and authorization procedures if NCAs consider that other measures are insufficient to address systemic risk.

Because of the link between real estate and the Financial Crisis, national regulators have, in particular, opted to introduce macroprudential tools that aim to restrict the build-up of credit in the real estate and housing industry.¹⁸⁸ Examples of such macroprudential tools are tighter loan-to-value (LTV) and loan-to-income (LTI) – ratios, essentially requiring banks to hold more capital against certain types of risky real estate lending or restricting the proportion of bank assets that can consist of such loans. Where implemented, these are currently based on national law.¹⁸⁹ Evidently, macroprudential regulation is intentionally not

¹⁸⁵ ESRB, *The ESRB Handbook on Operationalising Macro-prudential Policy* (n 177) 29. For the countercyclical capital buffer, a mandatory reciprocity up to a buffer rate of 2.5% applies from 2019, which means that the buffer applies to all exposures in a specific jurisdiction irrespective of the country of origin of the creditor. This means that an institution established in a Member State different from the one setting the countercyclical capital buffer rate has to apply the same rate on exposures towards clients located in the Member States setting the rate. For the global systemically important institution buffer, a surcharge between 1% and 3.5% RWA is applicable from 2016.

¹⁸⁶ Alexander, *Principles of Banking Regulation* (n 6) 75; Armour and others (n 22) 417. See also Katarzyna Barbara Budnik and Johannes Kleibl, ‘Macroprudential Regulation in the European Union in 1995-2014: Introducing a New Data Set on Policy Actions of a Macroprudential Nature’ (2018) No 2123 ECB Working Paper No.

¹⁸⁷ ESRB, *The ESRB Handbook on Operationalising Macro-prudential Policy* (n 177) 9. Increased own-funds requirements are based on Article 458 CRR and provides a specific type of additional capital requirement. Sectoral requirements can be used if credit growth and leverage is attributable to a particular sector. Examples are sectoral loan-to-value (LTV) requirements based on national law (the proportion between the value of a secured loan in comparison to the value of an asset used as security for said loan (*i.e.*, the value of a mortgage in comparison to the value of the mortgaged asset) or sectoral loan-to-income or debt(service-)-to-income requirements (LTI or DSTI requirements).

¹⁸⁸ Armour and others (n 22) 415-418. The link between real estate and financial crises is not a new phenomenon. Real estate crashes have been a “near-universal trigger for banking crises”, since real estate generally attracts large volumes of credit financing.

¹⁸⁹ Armour and others (n 22) 419-422; Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7.

sector-neutral, but rather recognizes that certain sectors are more inclined to contribute to systemic risks than others.¹⁹⁰ Lastly, leverage ratios (if provided for in national law) can also hinder excessive leverage by limiting a bank's total assets in relation to its equity.¹⁹¹

The focus of the second intermediate objective is market liquidity. The Financial Crisis demonstrated that excessive credit growth typically coincides with increased maturity mismatch, *i.e.*, increased reliance on short-term funding for long-term assets, and solely strengthening capital buffers does not sufficiently address liquidity risk.¹⁹² Liquidity risks to financial stability can materialize in the form of market liquidity risk (*i.e.*, the inability to sell assets with little or no impact on prices because of market illiquidity or related pressure from fire sales) or funding liquidity risk (*i.e.*, the inability to issue new debt, for instance, because of bank runs).¹⁹³ To reduce such risks, instruments such as liquidity ratios¹⁹⁴, liquidity buffers¹⁹⁵, the Net Stable Funding Ratio ("NSFR")¹⁹⁶, and other restrictions on funding sources can be used to require banks to finance non-liquid assets with stable funding, and increase high-quality liquid assets.¹⁹⁷

The third objective aims to limit shocks arising from large exposures to specific sectors (*e.g.*, real estate) or assets (*e.g.*, asset-backed securities). Large, common exposures can exacerbate the externalities from, *e.g.*, fire sales, and increase contagion in other shocks to the financial system.¹⁹⁸ Apart from capital-based instruments (such as the systemic risk buffer or increased own funds requirements), large exposure restrictions can be used to limit the exposure to a certain client or groups of clients or certain sectors relative to the bank's capital.¹⁹⁹

Lastly, the fourth macroprudential objective intends to reduce the moral hazard caused by government bailouts, as identified in Chapter 2.1, which is particularly relevant for SIFIs. Shocks to such SIFIs can lead to serious adverse impacts on the economy and liquidity shortages for the rest of the financial system. Because of their high contribution to

¹⁹⁰ Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 7.

¹⁹¹ ESRB, The ESRB Handbook on Operationalising Macro-prudential Policy (n 177) 9.

¹⁹² Ibid 7ff.

¹⁹³ Ibid 104ff; Recommendation of the ESRB (n 78) Annex.

¹⁹⁴ Ibid. Examples of liquidity ratios are liquidity charges or loan-to-debt (LTD) limits.

¹⁹⁵ Ibid. NCAs can introduce liquidity buffers based on CRR, Art 458.

¹⁹⁶ Recommendation of the ESRB (n 78) Annex. The net stable funding ratios (NSFR) (based on Article 458 CRR), decrease the weight of limits to less stable funding. The NSFR aims to constrain banks to fund long-term assets with stable funding of at least one-year maturity.

¹⁹⁷ Recommendation of the ESRB (n 78) Annex.

¹⁹⁸ ESRB, The ESRB Handbook on Operationalising Macro-prudential Policy (n 177) 7ff.

¹⁹⁹ Recommendation of the ESRB (n 78) Annex. Large exposure limits can be introduced based on CRR, Art 458.

systemic risk, governments are more likely to bailout such institutions, amplifying moral hazard. Consequently, an even further increase in capital requirements could curb the moral hazard by forcing shareholders to internalize some of the costs of risky lending, *i.e.*, costs that would arise if bank loans were not repaid.²⁰⁰ Thus, special capital buffers have been introduced for such institutions, typically leading to an additional capital surcharge of between 1 and 2.5 percent of risk-weighted assets.²⁰¹ If deemed insufficient, other flexible capital-based instruments, such as the systemic risk buffer or capital conservation buffer, can also be used to target risks stemming from systemically important institutions.²⁰²

Thus, the EU has a rather broad and complex range of macroprudential tools. Moreover, as the power to use macroprudential tools still rests with the NCAs, surveys confirm that there is significant variation in the use of macroprudential instruments available within the EU.²⁰³ According to the ECB, the most frequently reported macroprudential tools among the Member States are limits on large exposures, capital buffers, liquidity requirements, and regulatory lending standards.²⁰⁴ In general, the range of macroprudential tools is far broader than the range of traditional microprudential regulation. Certain instruments that are microprudential in style and aim to ensure the soundness of a specific institution, such as capital requirements, can also lead to macroprudential benefits by reducing risks of contagion in the financial sector.²⁰⁵ Macroprudential policy can also include an abundance of other tools, some of which are not ‘prudential’ in nature, and some of which have previously been used for other policy objectives. The list of macroprudential tools can be complemented with instruments borrowed from other areas of economic policy that can also serve macroprudential aims, such as monetary policy tools, fiscal policy tools and central counterparty clearing.²⁰⁶ The broad scope of macroprudential policy and the significant discretion for NCAs in choosing which tools to implement increase the possibility for a high divergence in the use of macroprudential regulation between the Member States.

In addition to the above instruments, data-gathering and analysis is a central part of macroprudential regulation.²⁰⁷ A key objective of macroprudential regulation is, after all, to

²⁰⁰ Masur and Posner (n 60) 878.

²⁰¹ See (n 178) and (n 179).

²⁰² ESRB, *The ESRB Handbook on Operationalising Macro-prudential Policy* (n 177) 13; Bart Stellinga, ‘The Rise and Stall of EU Macro-Prudential Policy. An Empirical Analysis of Policy Conflicts over Financial Stability, Market Integration, and National Discretion’ (2021) 59 *Journal of Common Market Studies* 1438, 1439.

²⁰³ Budnik and Kleibl (n 186) 28ff.

²⁰⁴ *Ibid* 13ff.

²⁰⁵ Armour and others (n 22) 416.

²⁰⁶ Lastra (n 70) 317; Budnik and Kleibl (n 186).

²⁰⁷ *Ibid*.

identify the build-up of systemic risk as early as possible. This requires an overview of not only all financial institutions, but also larger developments in the economy. The ESRB, the ECB and Member State banks have developed various tools to analyze macroeconomic data, and to identify systemic risk.²⁰⁸ Some central techniques in measuring and monitoring systemic risk are, *e.g.*, the concept of conditional value at risk (“CoVar”), which measures the contribution of an individual institution’s risk to systemic risk, and centrality analysis, which examines patterns of linkages between financial institutions to understand which of them are important to a particular financial system.²⁰⁹

Of specific importance in macroprudential data-gathering and analysis is so-called ‘stress-testing’. It is one of the main post-crisis innovations and has become an established element of macroprudential regulation. Stress tests are analytical ‘what if’ exercises that measure how financial institutions would be affected by a change in variables, or ‘stress’.²¹⁰ Stress tests serve to allow authorities to identify whether banks are sufficiently capitalized to resist shocks to the financial system and require institutions to build up strength and provide information on existing vulnerabilities.²¹¹ Stress tests can also be used to assess broader capital adequacy by assessing financial institutions not only based on whether they are sufficiently capitalized in isolation but whether they are strong enough to withstand extended periods of losses and system-wide financial instability.²¹² In particular, economy-wide stress tests can help identify shocks that may arise from endogenous risks caused by the interconnectedness of the financial system.²¹³ In the EU, the CRD IV requires supervisors to perform annual stress tests on the banks under their supervision, and the EBA defines common stress test methodologies by issuing guidelines.²¹⁴ By providing valuable information to banks and regulators, stress-testing thus act as an *ex-ante* tool to prevent the build-up of systemic risks within the financial system. Based on the information gathered from the stress tests, both the financial institutions and regulators can make strategic decisions to mitigate the risks.²¹⁵ In particular, they can help with the calibration of macroprudential instruments, such as when to activate the countercyclical capital buffer.²¹⁶

²⁰⁸ Armour and others (n 22) 428.

²⁰⁹ Lastra (n 70) 323. Among different techniques to measure systemic risk, a distinction can be made between network analyses (such as the centrality analyses) and price-based measures (such as CoVAR).

²¹⁰ Choudhury (n 18) 85.

²¹¹ Cullen and Mähönen (n 10) 13.

²¹² Greenlaw and others (n 77) 35.

²¹³ Ron Anderson and others, ‘Macroprudential Stress Tests and Policies: Searching for Robust and Implementable Frameworks’ (2018) 18/197 IMF Working Paper 7.

²¹⁴ CRD IV, Art 100; Babis (n 169) 786.

²¹⁵ Cullen and Mähönen (n 10) 13.

²¹⁶ ESRB, ‘Flagship Report on Macro-prudential Policy in the Banking Sector’ (n 42) 12.

Because of its multiple benefits, if performed properly, stress-testing has been called the “most powerful prudential tool [authorities] have at [their] disposal for safeguarding the resilience of the financial system”.²¹⁷

In sum, several steps have been taken in the EU to address the shortcomings revealed in the Financial Crisis. According to the de Larosière Report, a central issue in the EU was the lack of coordination between Member States, insufficient supervisory powers and resources, inadequate macroprudential oversight and the lack of a centralized decision-making mechanism.²¹⁸ The restructuring of EU framework for financial supervision, including the creation of the ESRB and the Banking Union, entailing the additional mandates for the ECB in macroprudential policy, addresses many of these concerns. Although the creation of EU macroprudential oversight, especially through the SSM for the Eurozone, reduces the number of actors whose actions must be coordinated in preventing and mitigating systemic risk, the overall structure remains complex and includes overlaps in mandates. In addition to the restructuring of financial supervision, the EU has also introduced several analytical tools and macroprudential instruments to enable the ECB and the NCAs to address systemic risk. The EU toolkit implements and expands on the international standards developed by the Basel Committee. While a broad range of tools is important to address a broad range of systemic risks, an unclear and complex conceptual framework can also hamper implementation and lead to divergence between macroprudential regulation among the Member States.²¹⁹ After having established the EU macroprudential framework, the following chapter will examine the major challenge of this century to the EU and the global community: climate change.

²¹⁷ S.G. Cecchetti, ‘On the Separation of Monetary and Prudential Policy: How Much of the Pre-crisis Consensus Remains?’ (2015) CEPR Discussion Paper 10949.

²¹⁸ de Larosière and others (n 103) 38-43

²¹⁹ See for example Mario Draghi, Welcome remarks by Mr Mario Draghi, President of the European Central Bank and Chair of the European Systemic Risk Board, at the fourth annual conference of the ESRB, Frankfurt am Main, 26 September 2019.

4. Climate Change as a Cause of Systemic Risk

The above chapters have outlined the macroprudential approach to financial regulation, which focuses on the prevention and mitigation of systemic risk. This chapter will examine the financial risks arising from climate change, the market failures that such risks can create, especially, why these market failures create systemic risk, and hence, threaten financial stability.

4.1 Climate Change and Financial Risk

Climate change refers to a change of the earth's climate as a direct or indirect result of human activity that alters the composition of the global atmosphere, which is in addition to what may be considered natural climate variability.²²⁰ Climate change is caused by human activities that increase the atmospheric concentrations of greenhouse gases, which are predominantly caused by the burning of fossil fuels, but also by intensive agriculture and land-use change.²²¹ This prevents the earth's natural cooling cycle from functioning properly and causes rising global temperatures, which adversely affect natural ecosystems and humankind.²²²

The earth's temperature has increased by approximately 1.2°C since the industrial revolution.²²³ The Intergovernmental Panel Committee on Climate Change (the "IPCC") has warned that exceeding an increase of 1.5°C poses multiple risks to ecosystems and humans, which may be irreversible.²²⁴ Increased awareness surrounding the severity of climate change risks and their direct correlation with greenhouse gas emissions has led the international community to commit to reducing emissions in 2015 by signing the so-called 'Paris Agreement'.²²⁵ The Paris Agreement established the well-known goal: to limit the rise in global average temperatures to well below 2.0 °C compared to preindustrial levels, striving to limit the increase to 1.5°C. The IPCC holds that limiting global warming to 1.5°C

²²⁰ United Nations, Resolution of the General Assembly, 'Framework Convention on Climate Change' (20 January 1994) A/RES/48/189 (the UNFCCC) Art 1.

²²¹ IPCC, 'Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change' (Cambridge University Press 2007) 2.

²²² IPCC, 'Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change, Sustainable Development, and Efforts to Eradicate Poverty' (2018) 4ff.

²²³ Copernicus Climate Change Service (n 3). Global warming is currently at around 1.21°C above pre-industrial levels (value refers to 2022).

²²⁴ IPCC, Summary for Policymakers, Climate Change 2022 (n 1) 11ff.

²²⁵ n 2.

would reduce or slow down the impact of climate change.²²⁶ Experts suggest that reaching 1.5°C of global warming is likely to happen between 2030 and the early 2050s. If the current warming trend continues, the 1.5°C mark would be reached by 2033.²²⁷

The financial sector has during the past decade recognized the risks arising from climate change on the financial system.²²⁸ Such risks are commonly placed in two categories: *physical risks* and *transition risks*.²²⁹ Physical risks are defined as the economic costs and financial losses that result from increasingly frequent and severe extreme weather events, as well as other long-term changes to the environment that impact the economy.²³⁰ Physical risks are further described as either acute – arising from climate and weather events – or chronic – if they arise from progressive shifts in climate and weather patterns or gradual loss in the ecosystem.²³¹

The physical risks of climate change are already in evidence. The number of extreme weather events has more than tripled since the 1980s, and resulted in around \$5.2 trillion of global losses.²³² 2021 was one of the costliest years for weather disasters, with four individual weather events each individually leading to over \$20 billion of economic damage: Hurricane Ida in the US, February winter weather disasters in the US and Mexico, July flooding in Europe and seasonal summer flooding in China.²³³ The direct impacts of physical risks for the banking sector include damage to properties and assets financed by financial institutions.²³⁴ From a wider perspective, physical risks can also have a radical impact on the economy in the long term. When extreme weather events become more frequent and severe

²²⁶ IPCC, Summary for Policymakers, Climate Change 2022 (n 1) 15.

²²⁷ Copernicus Climate Change Service (n 3).

²²⁸ Carney (20); Bolton and others (n 19) 17.

²²⁹ Ibid. Sometimes, a third type of risk is also discussed, namely liability risk. This refers to increased legal action concerning parties seeking compensation for losses and damages arising from the effects of climate change from companies and financial institutions that they hold responsible. However, liability costs are commonly considered to arise from especially physical risks and are, therefore, often included within its assessment.

²³⁰ Bolton and others (n 19) 17. Long-term implications of climate change include, *e.g.*, changes in precipitation, ocean acidification and rising sea levels. Indirect effects of climate change are, *e.g.*, soil degradation and drought.

²³¹ NFGS, 'Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' (May 2020) 4. Examples of acute physical risks are heatwaves and wildfires, droughts, landslides, floods, and storms, while examples of chronic physical risks are rising sea levels, rising temperatures, and ocean acidification.

²³² Munich Reinsurance Company, 'A Stormy Year: Natural Catastrophes 2017'(2018) Topics Geo <<https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/topics-geo-2017.html>> accessed 17 May 2022; Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 6.

²³³ Jeff Masters, 'Third-costliest Year on Record for Weather Disasters in 2021: \$343 Billion in Damages' (2022) *Yale Climate Connections* <<https://yaleclimateconnections.org/2022/01/third-costliest-year-on-record-for-weather-disasters-in-2021-343-billion-in-damages/>>.

²³⁴ Steele (n 12) 115.

over time, they can disrupt economic trade by disrupting supply chains and infrastructure, increasing operating and capital costs, and creating resource shortages.²³⁵ Long-term shifts in the climate can have further adverse effects on the economy by impacting labor supply and productivity, thereby lowering overall output and employment rates.²³⁶ Fewer jobs and costs arising from extreme weather events to households can further impact demand for consumer goods and services, leading to even less revenues for businesses and repeating the cycle.²³⁷ The frequency and severity of physical risks will significantly increase with every 1°C of additional warming and certain risks, such as extreme weather events, will increase progressively with the temperature rise.²³⁸

Transition risks, on the other hand, are risks that arise from the process of adjustment to a low-carbon economy, by changes in political, regulatory, technological, market, or consumer sentiment and behavior.²³⁹ Climate change-related risks and consequences are becoming increasingly acute, complex, and difficult to manage.²⁴⁰ Restraining global warming below the 1.5°C benchmark would require net global human-caused emissions of carbon dioxide, one of the largest greenhouse gases, to decrease by almost half by 2030, and reach net zero around 2050.²⁴¹ Such drastic emissions reductions would require rapid and far-reaching transitions in all sectors of the global economy and substantial upfront public and private investments.²⁴² As the global community seeks to reach these goals, their actions may generate further risks, especially if they take place abruptly and have not been adequately planned.²⁴³ Government policies and new regulations lead to increased operational and compliance costs for businesses.²⁴⁴ New policies and technological

²³⁵ NFGS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 13.

²³⁶ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 20. The Basel Committee holds that “reductions in labor productivity from climate change could result in a global economic cost of more than \$2 trillion by 2030 and a decrease in output of over 30% in the second half of the 21st century”.

²³⁷ Christina Parajon Skinner, ‘Central Banks and Climate Change’ (2020) 75 *Vanderbilt Law Review* 1301, 1323.

²³⁸ IPCC, *Summary for Policymakers, Climate Change 2022* (n 1).

²³⁹ NFGS, ‘Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision’ (n 231) 10.

²⁴⁰ IPCC, *Summary for Policymakers, Climate Change 2022* (n 1) 20ff.

²⁴¹ *Ibid* 33.

²⁴² *Ibid* 23ff; Signe Krogstrup and William Oman, ‘Macroeconomic and Financial Policies for Climate Change Mitigation: A Review of the Literature’ (2019) 19/185 *IMF Working Paper* 14; Agnieszka Smoleńska and Jens van’t Klooster, ‘A Risky Bet: Climate Change and the EU’s Microprudential Framework for Banks’ (2022) 8 *Journal of Financial Regulation* 51, 52.

²⁴³ IPCC, *Summary for Policymakers, Climate Change 2022* (n 1) 20ff; Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 5.

²⁴⁴ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 8.

advancement concerning energy transition can affect the pricing of products in traditional sectors, such as in the automotive industry, and reduce certain companies' market shares, resulting in lower profitability and losses for financial institutions.²⁴⁵ Likewise, consumers and investors are likewise starting to become increasingly aware of climate change, and are shifting their behavior towards climate-friendly consumption and investment opportunities. This can have an impact on the strategies of companies and banks but also the value of assets.²⁴⁶

Financial supervisors and international organizations have identified multiple causal chains (so-called *transmission channels*) linking physical and transition risks to traditional financial risk categories.²⁴⁷ Long-term scenario analyses for financial institutions suggests that physical and transition risks can materialize as increased credit, market, liquidity, operational, and insurance risks.²⁴⁸ The main impacts from a macroeconomic perspective are considered to be credit, market and liquidity risk.²⁴⁹

The banking sector plays an important role as a credit intermediary, and is therefore exposed to firms' physical and transition risks. How such risks create solvency or liquidity risks for banks depends on the concentration of exposures as well as the extent to which such risks lead to defaults or affect asset valuations.²⁵⁰ Damage to property and assets from climate change may, for example, result in the write-off of assets and compromise physical collateral. According to a recent analysis, physical risks could affect up to 30% of the Eurozone banking system's exposures to corporates. A major concern is also the concentration of such exposures: recent analysis indicates that exposures to physical risks are higher for weakly capitalized and/or less profitable banks.²⁵¹

Moreover, frequent weather events affect insurance firms due to such events causing an increased number of claims and, in turn, higher premiums.²⁵² Consequently, this could

²⁴⁵ NFGS, 'Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' (n 231) 13.

²⁴⁶ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 8.

²⁴⁷ See, e.g., NFGS, 'First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk' (n 7); Basel Committee, *Climate-related risk drivers and their transmission channels* (n 256) 16.

²⁴⁸ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 24.

²⁴⁹ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 20.

²⁵⁰ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 24.

²⁵¹ Ibid 6. The ESRB has concluded that 70% of the banking system credit exposures to firms subject to high or increasing physical risks are concentrated in the holdings of only 25 banks.

²⁵² NFGS, 'First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk' (n 7) 13; NFGS, 'Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' (n 231) 12. "For example, the Dutch Central Bank (DNB) estimated that the climate-related claims burden may rise between 25% and 131% by 2085 compared to 2016 due to more frequent and severe hail and thunder, an increase in the intensity of rainfall, and sea level rise."

lead to underinsurance. When losses are uninsured the burden instead falls on households and companies.²⁵³ In the long-term, such weather events can give rise to a deterioration in borrowers' ability to repay debts and potential depreciation of assets used for collateral, increasing banks' credit risk.²⁵⁴ Similarly, companies with business models that are not aligned with the transition to a low-carbon economy face risks related to reduced revenue and business disruption, increasing the credit exposure banks have to such sectors.²⁵⁵ Recent estimates hold that G20 financial institutions have nearly \$22 trillion of exposures to carbon-intensive sectors, of which on-balance sheet bank loans constitute up to 60% of such exposures.²⁵⁶

Changes in banks and companies' projected earnings could also be reflected in financial markets, creating market risks.²⁵⁷ Especially the impact of transition policies on carbon-intensive sectors could affect energy and commodity prices, as well as corporate bonds and equities if the markets are not prepared.²⁵⁸ A specific market risk arises from asset losses. Bans and limitations on the use of fossil fuels may make extracting certain proportions of fossil fuel reserves uneconomical, and create significant risks and costs for oil, energy, and utility industries.²⁵⁹ This may lead to early retirement or total write-offs of such assets, a concept termed *stranded assets*.²⁶⁰ This can impact banks' balance sheets by an increase in companies' propensity to default or devaluations of collateral.²⁶¹ As an illustrative example, British Petroleum, a major oil producer, announced in 2020 that it will write off up to \$17.5 billion from the value of its oil and gas assets in anticipation of lower

²⁵³ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 7. According to the ESRB, only 35% of economically relevant climate losses on average are insured in the EU.

²⁵⁴ NFGS, 'Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' (n 231) 12.

²⁵⁵ Sandra Batten, Rhiannon Sowerbutts and Misa Tanaka, *Let's Talk About the Weather: the Impact of Climate Change on Central Banks* (May 2016) 603 Bank of England Staff Working Paper 8.

²⁵⁶ Fintech & Finance News, 'Moody's: G20 Financial Institutions Face \$22 Trillion of Exposure to Carbon-intensive Sectors' (29 September 2021) <<https://ffnews.com/newsarticle/moodys-g20-financial-institutions-face-22-trillion-of-exposure-to-carbon-intensive-sectors/>> accessed 17 May 2022.

²⁵⁷ NGFS, 'First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk' (n 7) 13.

²⁵⁸ Batten, Sowerbutts and Tanaka (n 255) 8; Skinner (n 237) 1324.

²⁵⁹ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 14.

²⁶⁰ NFGS, 'Technical Document. Guide for Supervisors: Integrating Climate-related and Environmental Risks into Prudential Supervision' (n 231) 12; International Energy Agency and Organisation for Economic Co-operation and Development, 'Redrawing the Energy Climate Map: World Energy Outlook Special Report' (10 June 2013) 98. The International Energy Agency defines stranded assets as "those investments which have already been made but which, at some time prior to the end of their economic life (as assumed at the investment decision point), are no longer able to earn an economic return as a result of changes in the market and regulatory environment brought about by climate policy".

²⁶¹ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 14.

demand and increased pressure to shift toward a low-carbon economy.²⁶² Some studies estimate that fossil fuel and carbon-intensive companies account for one-third of the global leveraged loan market, emphasizing the large impact a “stranding” of such assets could have.²⁶³

The financial risks arising from climate change will vary significantly across EU regions but also across sectors and financial institutions.²⁶⁴ The variation derives from large differences in exposure to physical risks, but also in the level of adaptation and mitigation action taken, as well as the economic diversification, capital market flexibility, and public infrastructure.²⁶⁵ Certain sectors are also likely to be particularly exposed to physical risks, such as real estate and agriculture, and to transition risks, such as the energy sector, and financial institutions and insurers exposed to any of these sectors could be particularly affected.²⁶⁶ The impact of physical risks also depends on institutions and firms’ exposures to physical risks and the risk mitigation measures in place. Physical and transition risks are also closely interrelated. If a transition to a low-carbon economy is slow, more physical risks will materialize. In turn, a sudden increase in extreme weather events and related damages and losses may trigger fast government responses and increase transition risks.²⁶⁷

The above examples are only a few of the many ways in which climate change risks can lead to financial risks. A central aspect of climate change is the uncertainty around which risks may materialize, when, and in what manner. This gives rise to concerns of climate change having wider risks on financial stability. The following section will therefore consider these risks within the framework of market failures, and more specifically, as creating a systemic risk.

4.2 Climate Change and Systemic Risk

Until recently, climate change was considered an ancillary risk to financial markets, essentially as an issue of corporate social responsibility, rather than financial risk, let alone

²⁶² Stanley Reed, ‘BP Prepares for a Future That Needs Less Oil (June 15, 2020. Updated September 16, 2021) The New York Times <<https://www.nytimes.com/2020/06/15/business/energy-environment/bp-oil-gas-write-down.html>> accessed 17 May 2022.

²⁶³ ESRB Advisory Scientific Committee, ‘Too Late, Too Sudden: Transition to a Low-carbon Economy and Systemic Risk’ (No 6, February 2016) 12.

²⁶⁴ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 6.

²⁶⁵ NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 14.

²⁶⁶ NGFS, ‘Technical Document. The Macroeconomic and Financial Stability Impacts of Climate Change: Research Priorities’ (June 2020) 4.

²⁶⁷ Batten, Sowerbutts and Tanaka (n 255) 7ff.

a risk that is of a systemic nature.²⁶⁸ The physical and transition risks of climate change are however not only at the level of individual businesses and financial institutions. As discussed above in Chapter 4.1, climate change causes broader credit and market risks. Because the financial risks from physical and transition risk factors affect so many businesses, sectors, and geographies, their full impact has the potential to create systemic risk.

The potential of climate change to create systemic risk and the specific pathway through which it should occur largely depends on the level and timing of mitigation measures taken. Different hypothetical climate scenarios by NFGS, introduced in 2020, provide a structured basis for financial supervisors to consider such questions. The different scenarios are organized into four frameworks, which are illustrated below in Figure 3: an orderly scenario, a disorderly scenario, a ‘hot house world’ scenario, and a ‘too little, too late’ scenario.²⁶⁹

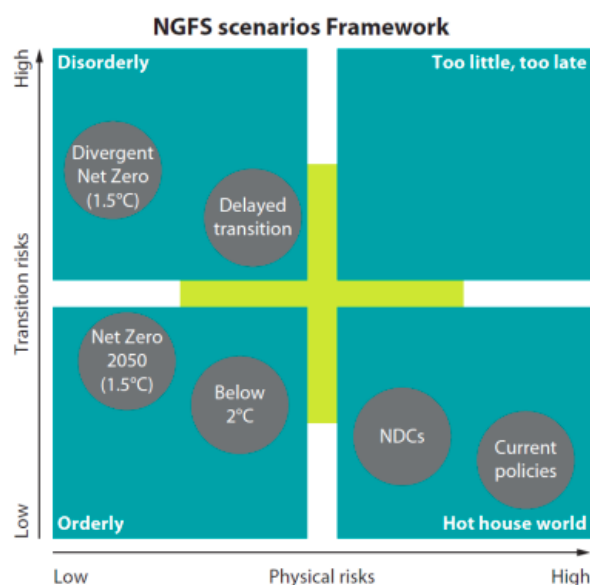


Figure 3 NGFS Climate Scenarios Framework (Source: NGFS, First Comprehensive Report. A Call for Action – Climate Change as a Source of Financial Risk (n 7))

In an orderly scenario, cuts to greenhouse gas emissions are carried out according to the targets established in the Paris Agreement (*i.e.*, reaching net-zero emissions around 2050). This scenario assumes that governments implement immediate policy measures for a transition to a low-carbon economy in an ‘orderly’ manner. This allows firms and financial

²⁶⁸ Steele (n 12) 113.

²⁶⁹ NGFS, ‘Climate Scenarios for Central Banks and Supervisors’ (June 2021) <<https://www.ngfs.net/en/ngfs-climate-scenarios-central-banks-and-supervisors-june-2021>> accessed 17 May 2022. The climate scenarios have been updated in 2021. The NGFS scenarios build on the IPCC representative concentration pathways and shared socioeconomic pathways to provide information on climate outcomes and socio-economic background.

institutions to adapt business models and behavior, thus reducing transition risks.²⁷⁰ This scenario would entail some physical risks as well as climate change-related GDP losses, mostly attributable to transition policies, but events such as fire sales from the repricing of carbon assets would probably not create systemic risk.²⁷¹ Considering the difficulties so far experienced so far in global climate change mitigation and the challenges in reaching current emissions reduction targets, even within the EU, the likelihood of an orderly scenario currently appears rather low.

Under a disorderly scenario, emission targets would be met, but policy measures would be implemented late, abruptly, and through more stringent measures. This scenario would likely entail higher physical risks compared to the orderly scenario, and significantly higher transition risks. An abrupt increase in emissions prices and energy costs combined with uncoordinated policy action could lead to disruptions in energy supply and revaluations of carbon-intensive firms. These could potentially cause shock events, since infrastructure, technology and markets would not have adequate time to adapt.²⁷² A disorderly scenario would therefore entail that climate change mitigation targets are met, but in a way that potentially causes financial instability over the short term.²⁷³

In a hot house world (or ‘business as usual’) scenario, the global community continues with the current policies and emission cuts, leading to some climate mitigation measures. These would however be insufficient to meet the Paris Agreement targets, leading to a temperature rise of around 3.5°C by 2100. This would entail a deterioration of living conditions and irreversible impacts, as discussed in Chapter 4.1. Physical risks would arise from the disruptions to ecosystems, infrastructure, economic trade, and health, while transition risks would likely be limited. The final scenario, policy action consisting of ‘too little, too late’, is essentially a variation of the hot house world scenario and constitutes the least explored scenario. To briefly summarize, it entails considerations of a situation where sudden, high physical risks exacerbate the adverse impacts of a hot house world.²⁷⁴

²⁷⁰ Dirk Schoenmaker and Rens van Tilburg, ‘What Role for Financial Supervisors in Addressing Environmental Risks’ (2016) 58 *Comparative Economic Studies* 317, 321.

²⁷¹ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 41-46. The ECB and ESRB have analyzed macroeconomic outcomes of the different NFGS climate scenarios.

²⁷² NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 16.

²⁷³ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 41-46. See also Bolton and others (n 19) 53.

²⁷⁴ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 41-46.

Systemic risks are most likely to arise within the disorderly or the hot house world scenarios, through two main channels: from shock events arising from the revaluation of carbon-intensive assets, and from severe and frequent physical risks.²⁷⁵

First, because of high transition risks caused by abrupt transition policies and reactions, shock events could arise from changes in investors' perception of profitability or assessment of risk. It is currently unclear if and how markets price climate risks, and how this affects banks' market risks.²⁷⁶ A sudden re-evaluation of climate-related risks and stranded assets (*e.g.*, as a result of an external shock, such as a natural disaster), could lead to large-scale asset revaluation and motivate panicked behavior. This could in turn trigger sudden collapses in asset prices, bank runs or fire sales and widespread instability, or, as Carney refers to, a "climate Minsky moment", thus constituting some of the very factors creating systemic risk, as outlined in Chapter 2.2.²⁷⁷

As discussed in Chapter 2, a major cause of systemic risk is the high interconnectedness of the financial system.²⁷⁸ This risk is exacerbated for climate change financial risks, as they are not specific for a sector or market. Initial shocks such as re-evaluations of carbon-intensive assets could trigger second-round effects across various markets, regions, and asset classes, simultaneously.²⁷⁹ Consequently, market risks are compounded by the global nature of transition risks and could have systemic consequences for the financial system if financial markets and institutions do not have sufficient time to adjust.

Second, it is easy to imagine how a large number and varied combination of physical risks could amount to systemic risk. In 2019, the world experienced the first "climate-change bankruptcy", as PG&E, a Californian power utility, went insolvent following a series of massive wildfires and property damage, linked to a prolonged period of drought and poorly maintained equipment.²⁸⁰ The fall of either a systemically important financial institution, or

²⁷⁵ ESRB Advisory Scientific Committee (n 263) 1.

²⁷⁶ See Chapter 5.1. See also Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 17; ECB/ESRB Project Team on Climate Risk Monitoring (n 263) 6. Numerous studies have been conducted on the existence of a 'carbon premium' in financial markets, but the evidence is mixed.

²⁷⁷ Carney (n 20) 2; Bolton and others (n 19) 18ff; Hyman Minsky is a financial economist whose model was widely used to understand the 2008-09 financial crisis. Minsky describes the way that unsustainable financial bubbles tend to expand on waves of confidence and then burst, threatening not just a recession but a "financial heart attack", a blow to bank balance sheets that radiates to the entire economy.

²⁷⁸ See Chapter 2.3.

²⁷⁹ Steele (n 12) 129.

²⁸⁰ Chunka Mui, 'PG&E Is Just the First Of Many Climate Change Bankruptcies' (2019) *Forbes* <<https://www.forbes.com/sites/chunkamui/2019/01/24/pge-is-just-the-first-of-many-climate-change-bankruptcies/>> accessed 17 May 2022.

the correlated stress from several smaller firms failing, could cause events amounting to a systemic crisis.²⁸¹

Systemic risk could also arise from the macroeconomic impacts of the transition to a low-carbon economy, such as sudden changes in energy usage.²⁸² Even in an orderly scenario, the transition to a low-carbon economy may result in energy price increases and increased production costs, depending on, *e.g.*, the availability and efficiency of renewable energy. Such developments, in combination with other shock events or financial frictions, could lead to higher contagion of stress and systemic risk.²⁸³ For instance, a sudden change in climate conditions and extreme weather events could lead to large and correlated losses.²⁸⁴ Especially extreme weather events are prone to cause volatility in the pricing of commodities, which can potentially lead to supply shocks. The oil supply shocks in the 1970s and 1980s serve as an example of how the price instability of central goods, such as oil or agricultural products, can give rise to higher inflation. If combined with other macroeconomic impacts of climate change discussed in Chapter 4.1, such as higher unemployment or slower economic growth, the price instability could cause stagnation.²⁸⁵ So-called ‘feedback loops’ between the financial system and the economy could also amplify the macroeconomic risks arising from climate change, and create another source of instability for the financial system. For example, damage to property and assets serving as collateral could increase losses, prompting banks to restrict lending in certain regions, further weakening the wealth of the households and companies in the region.²⁸⁶ Further, recent reports from the ECB and the ESRB have further pointed out the high degree of concentration in climate risk exposures among banks, often along with existing vulnerabilities. This adds to the likelihood of climate change financial risks becoming systemic.²⁸⁷

²⁸¹ Choudhury (n 291) 62.

²⁸² ESRB Advisory Scientific Committee (n 263) 1.

²⁸³ *Ibid* 7ff; Schoenmaker and Tilburg (n 270) 324-326.

²⁸⁴ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 7ff.

²⁸⁵ Skinner (n 237) 1324.

²⁸⁶ NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 13.

²⁸⁷ Ivana Baranović and others, ‘The Challenge of Capturing Climate Risks in the Banking Regulatory Framework: Is There a Need for a Macroprudential Response?’ (2021) 15 *Macroprudential Bulletin*, European Central Bank < https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/html/ecb.mpbu202110_1~5323a5baa8.en.html > accessed 17 May 2022. The findings are based on the ECB economy-wide climate stress test in 2021 which tested the impact of climate change on more than four million firms worldwide and 1,600 Eurozone banks under three different climate policy scenarios.

The above discussion demonstrates that systemic risk is likely to arise particularly in a disorderly transition scenario to a low-carbon economy, or in a scenario where climate change is not mitigated.²⁸⁸ Although the transition to a low-carbon economy and the significant structural changes needed for it could give rise to transition risks, the overall costs would very likely be lower than those arising from no action at all (a ‘hot house world’).²⁸⁹ Experts estimate that an increase of 1.5°C in temperature already would reduce global GDP by 8 percent by 2100, with falls of up to 20% in global GDP if mitigation proves insufficient or ineffective.²⁹⁰ The World Bank has estimated that the annual economic cost of human-induced environmental depletion was around \$6.6 trillion already in 2008, equivalent to 11 percent of global GDP.²⁹¹ If the average global temperature rises by 4°C above pre-industrial levels over the next 80 years (*i.e.*, if environmentally unsustainable activity continues at the same pace as currently), the global GDP loss could go up to more than \$23 trillion per year.²⁹²

Climate change risks are therefore widely considered to fulfill the notion of systemic risk.²⁹³ Shocks to the financial system could arise from either physical or transition risks, and, most likely, through a combination of both. The timing and severity of the economic impacts will depend on the frequency and severity of extreme weather events and on the nature and the speed at which the world will transition to a low-carbon economy (*i.e.*, which of the NFGS climate scenarios takes place).²⁹⁴ Unless the systemic risk is adequately reflected in management or shareholders’ decision-making, or addressed through regulation, banks will underestimate the risks they face.²⁹⁵ The materialization of the negative externalities from climate change would create significant public costs. Such costs could

²⁸⁸ ESRB Advisory Scientific Committee (n 263) 6.

²⁸⁹ NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 16.

²⁹⁰ Carbon Brief, ‘The Impacts of Climate Change at 1.5C, 2C and beyond’ (4 October 2018) <https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees/?utm_source=web&utm_campaign=Redirect> accessed 17 May 2022; ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 4.

²⁹¹ United Nations Environment Programme Finance Initiative and Principles for Responsible Investment, ‘Universal Ownership: Why Environmental Externalities Matter to Institutional Investors’ (2011) 4 <https://www.unepfi.org/fileadmin/documents/universal_ownership_full.pdf> accessed 17 May 2022.

²⁹² Gregg Gelzinis and Graham Steele, ‘Climate Change Threatens the Stability of the Financial System’ (2019) American Progress 1 <<https://www.americanprogress.org/article/climate-change-threatens-stability-financial-system/>> accessed 17 May 2022.

²⁹³ See, *e.g.*, Choudhury (n 291) 52; Bolton and others (n 19) 1; Steele (n 12) 122ff.

²⁹⁴ See also IPCC, ‘Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the Impacts of Global Warming of 1.5°C’ (n 222).

²⁹⁵ Commission, Impact Assessment Report (n 168) 18.

include, *e.g.*, the costs of public rescues of financial institutions,²⁹⁶ but also the broader economic harm generally caused by financial crises, combined with the massive estimated costs related to physical risks including the costs of mitigating physical destruction from natural disasters and relocating large populations.²⁹⁷

Although the systemic risk aspect of climate change financial risks may have similarities to the risks that led to the Financial Crisis, it poses many new, unprecedented challenges because of its special features. First, climate change is global in both its causes and consequences. Even if the impacts of climate change are local, the emissions are produced and accumulate on a global level. The impacts are thus not dependent on the local contribution to global pollution.²⁹⁸ Second, the impacts of climate change span across unusually long-time horizons, typically several decades, exceeding the horizons of traditional business planning and risk management. Third, climate-related risks have in common that they are highly complex in regard to their frequencies, speeds, and intensities.²⁹⁹ There is significant uncertainty around the magnitude, timing, and type of impact of climate change, as well as around the costs and measures that will be necessary to mitigate climate change. In particular extreme weather events can appear with varying frequencies and severities, making them extremely difficult to predict.³⁰⁰ Many climate change developments, such as the relationship between temperature rises and extreme events, are, furthermore, highly non-linear, meaning in this context that the risks and impacts exhibit tipping points.³⁰¹ As an illustration, this increases the likelihood of asset mispricing and the occurrence of price shocks.³⁰² Moreover, because of the lack of climate-related changes of this extent in the past, and because of the uncertainty around their occurrence, very little use can be made of historical experience to assess the exposure to climate systemic risk, the typical method used by financial institutions to manage such risks.³⁰³ Collectively,

²⁹⁶ Ibid 5. For example, the amount of state aid used by EU member states to support the banking sector alone as a result of the financial crisis over the 2008-2017 period is estimated to have been EUR 2 trillion.

²⁹⁷ Steele (n 12) 139; Bolton and others (n 19) 5.

²⁹⁸ Stern (n 60) 27-29. In addition, climate change involves significant inequalities. The volume of global greenhouse gas emissions is not uniform; developed countries have historically caused the majority of emissions, while developing countries are particularly exposed to climate change risks, because of their geography, dependence on agriculture and relatively weaker economies.

²⁹⁹ John Armour, Luca Enriques and Thom Wetzer, 'Mandatory Corporate Climate Disclosures: Now, but How?' (2021) No 614 European Corporate Governance Institute Working Paper Series in Law 9-11; Bolton and others (n 19) 4-8.

³⁰⁰ Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 6.

³⁰¹ Ibid 5; Grünewald (n 6) 4; Nicholas Stern, 'Towards a Carbon Neutral Economy: How Government Should Respond to Market Failures and Market Absence' (2022) 6 Journal of Government and Economics, 2.

³⁰² Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 17-18.

³⁰³ Ibid 9; Armour, Enriques and Wetzer (n 314) 9-10.

these factors altogether give rise to a “deep or radical” level of uncertainty on how climate change financial risks and their impacts will develop, which poses challenges for standard economic theories of externalities.³⁰⁴ Lastly, despite the uncertainties, scientists agree that there is, nevertheless, a high certainty that some combination of climate change risks will materialize, and that the impacts are likely to have a significant effect on the global economy.³⁰⁵ As discussed in Chapter 4.1, some of the risks have already started to occur. Because of these features, a recent study from BIS and the Banque de France refers to climate change as a “*green swan event*”: a new type of complex systemic risk with fundamentally unpredictable and irreversible consequences, making it a greater risk than most other financial crises and potentially posing an existential threat to humanity.³⁰⁶

³⁰⁴ Ibid 5ff; Bolton and others (n 19) 23-46; Stern (n 60) 25.

³⁰⁵ Stern (n 60) 25; IPCC, Summary for Policymakers, Climate Change 2022 (n 1) 10ff.

³⁰⁶ Bolton and others (n 19) 3. The concept of a “Green swan” derives from the “black swan”, referring to events that are unexpected and rare, have wide-ranging or extreme impacts and can only be explained after the fact. Examples of black swan events can be terrorist attacks or natural catastrophes. Green swans, or “climate black swans”, differ from black swans because of (i) the high certainty that some combination of climate change risks currently discussed will materialize, (ii) the magnitude of climate change risks make it even more serious than most financial crises and can pose an existential threat to humanity, and (iii) climate change is more complex than black swans, because of the various possible chain reactions and second-round effects.

5. Regulating Climate Change as a Cause of Systemic Risk

Chapter 4 concluded that the financial risks posed by climate change have the potential to be so far-reaching that they are widely considered to collectively constitute a systemic risk to financial stability. Following the public interest theories of regulation, however, regulatory intervention requires not only that there is a market failure, but also that private law mechanisms are insufficient to correct it, and that regulatory intervention can appropriately correct the market failure, or at least improve the status quo.³⁰⁷

This chapter first examines what are the market failures underlying climate change and why the market is incapable of addressing such market failures and the risks arising from climate change. It then assesses the suitability of EU macroprudential regulation to address the said market failure, by both applying macroprudential regulation to the problem at hand as well as considering the costs and benefits of such regulatory intervention. Finally, the chapter will conclude with considerations of private interest theories, looking at what challenges might exist when a macroprudential regulatory approach to mitigate climate change risks is translated into action.

5.1 Why is the Market not Adequately Addressing Climate-Related Risks?

Pollution is a classic example of a negative externality.³⁰⁸ As discussed in Chapter 2.1, the reason for regulating negative externalities is that the cost of producing a product generally does not reflect the total cost to society of the production or consumption of that good. Those who produce greenhouse gas emissions by producing or consuming carbon-intensive goods are causing climate change, the social costs of which have been described in Chapter 4 herein. If market prices do not reflect the social cost of such greenhouse gas emissions and the resultant climate change, *i.e.*, significant costs to society and future generations and the creation of systemic risk as concluded in Chapter 4, it would constitute a negative externality, and hence lead to excessive production and consumption.³⁰⁹ The first important question in the determining the existence of a market failure is thus to clarify whether the market is adequately internalizing the risks related to climate change.

There is evidence that some financial institutions have already started divesting from high-carbon assets; green finance and ESG-investing have emerged as the financial

³⁰⁷ See Chapter 1.3.

³⁰⁸ Ogus (n 27) 35; Baldwin, Cave and Lodge (n 27) 18.

³⁰⁹ Baldwin, Cave and Lodge (n 27) 18.

innovations of the century.³¹⁰ Although these developments are important in increasing funding for sustainable projects, there is mixed evidence of their actual impact, with particularly serious concerns around ‘greenwashing’, *i.e.*, the use of marketing to portray a company’s products or activities as environmentally friendly when they are, in fact, not.³¹¹ Although a majority of financial institutions now acknowledge that climate change poses financial risks, the incorporation of such risks into their business models is limited, and it seems that only the most immediate physical and transition risks are considered, with less emphasis on the long-term credit and market risks discussed in Chapter 4.2³¹² As a result, both the NFGS and the ECB have therefore concluded that there is a serious risk that the social cost of carbon emissions, and, ultimately, climate change financial risks, are mispriced in financial markets.³¹³ The ESRB considers that market pricing of climate risks appears “heterogeneous at best, and absent at worst”.³¹⁴ Although the evidence is mixed, multiple studies based on empirical analysis confirm that while some financial markets have started to reflect carbon emission risk to some extent, the conclusion is nevertheless that markets are not adequately pricing climate change risks, particularly not transition risks.³¹⁵

The mispricing stems from several issues. First, there is still a lack of clear, sufficient, and consistent data on climate change-related financial risks, leading to an informational market failure.³¹⁶ The levels of uncertainty surrounding climate change, as discussed in

³¹⁰ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 39; Dimitri G Demekas and Pierpaolo Grippa, ‘Financial Regulation, Climate Change, and the Transition to a Low-Carbon Economy: A Survey of the Issues’ (2021) 296 IMF Working Papers 7. Green finance is commonly defined as the financing of investments that provide environmental benefits. As an example, the amount of green labelled bonds outstanding in Europe already exceeds EUR 500 billion, with a 20-30% growth in the past years, while assets in ESG-labelled funds have increased by 170% since 2015.

³¹¹ Commission, Strategy for Financing the Transition to a Sustainable Economy (n 3). See also Torsten Ehlers, Benoît Mojon and Frank Packer, ‘Green Bonds and Carbon Emissions: Exploring the Case for a Rating System at the Firm Level’ (2020) Bank for International Settlements Quarterly Review 31, where a central finding was that there is no clear evidence so far that green bond issuances are associated with reductions in carbon intensity over time.

³¹² ESRB, Positively Green: Measuring Climate Change Risks to Financial Stability (n 7) 14.

³¹³ NGFS, ‘First Comprehensive Report. A Call for Action - Climate Change as a Source of Financial Risk’ (n 7) 4. The NFGS holds that “there is a strong risk that climate-related financial risks are not fully reflected in asset valuations”; Isabel Schnabel, ‘When Markets Fail – The Need for Collective Action in Tackling Climate Change’ (Speech at the European Sustainable Finance Summit September 28, 2020) <https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200928_1~268b0b672f.en.html> accessed 17 May 2022. Isabel Schnabel, Member of Executive Board, ECB, states that “there is a broad agreement that climate risks continue to be mispriced in financial markets”. ESRB, ‘Review of the EU Macroprudential Framework for the Banking Sector – March 2022’ (n 12)

³¹⁴ ESRB, Positively Green: Measuring Climate Change Risks to Financial Stability (n 7) 14.

³¹⁵ For analyses on why the market is mispricing climate change risks, as well as examples of instances where markets are pricing such risks to a certain extent, see *Ibid* 16ff; Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 17. See also Armour, Enriques and Wetzler (n 314). It is worth noting that there are also studies showing markets that overestimate climate change risks, such as in major disaster regions.

³¹⁶ ESRB, Positively Green: Measuring Climate Change Risks to Financial Stability (n 7) 14.

Chapter 4.2, further exacerbate the issue. Thus, the market is arguably currently unable to fully price climate change risks, as data is largely unavailable and subject to extreme levels of uncertainty.³¹⁷

The newly adopted Taxonomy Regulation and proposed reforms to disclosure and benchmarks frameworks entail considerable progress to mitigate greenwashing and enhance transparency and availability of sufficient data in the EU.³¹⁸ An increasing number of commentators, however, argue that rectifying issues through disclosure requirements and transparency will not be sufficient to reduce the allocative inefficiencies in market pricing, and that the measures fail to reflect the severity and urgency of the financial risks posed by climate change.³¹⁹ In the end, financial markets have been designed to facilitate investment in the most efficient manner possible, leading to serious concerns of markets' abilities to create incentives for sufficiently pricing and thus managing climate-related risks.³²⁰ This is reflected in how most sustainable investment strategies are currently generally structured: either the sustainable businesses generate superior or comparable returns to less sustainable investments, or the sustainable investment generates profits by way of reputational benefits.³²¹ Moreover, investments and risk assessments are typically short-sighted, while the losses resulting from climate change will be felt over a longer time period. As noted in the introduction, the long-term horizons of climate change risks lead to a time inconsistency in investment decisions, referred to as the 'tragedy of the horizon'.³²²

Economists and policy-makers have traditionally considered carbon pricing, such as Pigovian carbon taxes, *i.e.*, a direct tax on the carbon content of goods and services, or emissions trading schemes, as the best option to internalize climate externalities from a financial perspective. Due to the similar reasons as listed above for mispricing as well as strong political resistance, carbon taxing has however been insufficient to reallocate capital

³¹⁷ Cullen and Mähönen (n 10) 10.

³¹⁸ See for example, Commission, 'Action Plan: Financing Sustainable Growth' (Communication) COM (2018) 97 final. Following the action plan, the Commission introduced three legislative proposals: a proposal for regulation on the establishment of an EU classification system (the taxonomy regulation) to facilitate sustainable investment; a proposal for regulation on improving disclosure requirements on how institutional investors integrate ESG factors in their risk processes; a proposal to amend the benchmark regulation, creating new categories of low-carbon and positive carbon impact benchmarks. See, among others, the European Green Deal from December 2019, the Sustainable Europe Investment Plan, and the European Green Deal Investment Plan from January 2020. The latest is the Sustainable Finance Strategy 2021. See also Cullen (n 6) 62.

³¹⁹ See, *e.g.*, Cullen and Mähönen (n 10) 3; Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 1; Steele (n 12); Choudhury (n 18) 59; Ahlström and Monciardini (n 18) 195; Cullen, Mähönen and Rapp Nilsen (n 18) 15ff.

³²⁰ Cullen and Mähönen (n 10) 7; ESRB, Positively Green: Measuring Climate Change Risks to Financial Stability (n 7) 14.

³²¹ Cullen and Mähönen (n 10) 3.

³²² See Chapter 1.1.

towards low-carbon activities and has not led to the inclusion of the social cost of emissions into market prices.³²³

In sum, because of (i) the complexity of climate change risks, (ii) the lack of complete data, and (iii) because climate change financial risks are likely to materialize over a long time period and impose distributed costs to society and future generations, the prices of goods and services that generate emissions do not currently account for climate change costs. Concurrently, the private returns of investments in climate mitigation and emissions reductions are lower than their total social return. Hence, there are no direct cost incentives to reduce emissions and mitigate climate change. This leads to an overproduction of greenhouse gas emissions and the underestimation of climate change systemic risk, and therefore, suboptimal capital allocation, *i.e.*, a negative externality.³²⁴ Consequently, climate change is the result of a market failure; according to the prominent Stern Review, climate change is “the greatest example of a market failure we have ever seen”.³²⁵

In addition to the presence of negative externalities, climate change mitigation can be seen as including aspects of a global public good: those who pay for it (*e.g.*, by reducing emissions) cannot exclude others from enjoying the benefits, and the enjoyment of the climate and its benefits does not reduce the amount available to others, leading to an ‘underproduction’ of climate change mitigation.³²⁶ As discussed in Chapter 2.2, financial stability also constitutes a public good. Consequently, as both financial stability and climate mitigation are global public goods, market participants do not have sufficient incentives to invest the necessary capital to ensure their ‘production’, as the benefits of a stable, sustainable economy will spill over to free-riders, who do not pay for (a ‘tragedy of the commons’), leading to serious collective action problems.³²⁷

Although the negative externality of greenhouse gas emissions and the public good-aspect of emissions reductions are the most commonly recognized market failures contributing to climate change, scholars have also identified other additional market failures. These are based on factors which have largely been discussed in this thesis, *e.g.*, market

³²³ Bolton and others (n 19) 6-8; Campiglio (n 12) 222-223.

³²⁴ Stern (n 60) 24; Krogstrup and Oman (n 242) 14; Cullen (n 6) 65; Demekas and Grippa (n 310) 6; Alexander, *Principles of Banking Regulation* (n 6) 354; Bolton and others (n 19) 6.

³²⁵ Stern (n 60) viii.

³²⁶ See Chapter 2.1. See also Stern (n 60) 37; Demekas and Grippa (n 310) 6; Ogus (n 27) 34–36. Certain commodities contain some aspects of public goods and are referred to as ‘impure public goods’. Such impure public goods can be produced in the market to a certain extent, but are nevertheless subject to a degree of market failure. Climate change mitigation measures can provide local benefits, and hence some private benefits, but efforts to reduce global greenhouse gas emissions constitute a ‘pure’ public good.

³²⁷ Alexander, *Principles of Banking Regulation* (n 6) 350.

failures relating to innovation and development, incomplete and imperfect capital markets regarding information and creditworthiness, and ‘short-termism’, referring to the ‘tragedy of the horizon’, *i.e.*, the tendency of capital markets and firms to act in accordance with a short-term perspective.³²⁸

In sum, the presence of both a negative externality in greenhouse gas emissions and the public good features of climate change mitigation give rise to climate change and systemic risk. According to public interest theories of regulation, however, the existence of a market failure only gives a *prima facie* justification for regulatory intervention.³²⁹ Nevertheless, if market mechanisms would be capable of nevertheless achieving allocative efficiency, *e.g.*, through mechanisms such as environmental laws, private contracts, and court judgments, there would be no justification for regulation solely based on the existence of a market failure.³³⁰

Concerning negative externalities that affect a large number of private parties, but only impose a small loss on each individual party, such externalities should, theoretically, remain uncorrected. This theory is based on transaction and information costs. Rationally, private parties will only seek to correct a failure or enforce their rights where the expected benefits exceed the expected costs. Furthermore, the lack of information necessary to correct a failure will generally exacerbate this issue of enforcement. Concerning climate change as well as systemic risk, private bargaining is not only expensive but infeasible, as the externalities affect not only society at large but also future generations.³³¹ Therefore, an increasing number of scholars agree that market mechanisms, on their own, are inadequate to correct the negative externalities in financial markets which are contributing to climate change.³³² In regards to climate change mitigation, the precise existence of features of a public good, and the ensuing free-riding, demonstrates that market mechanisms are insufficient to determine the correct quantity and quality of such a good.³³³ Climate change and the ensuing systemic risk is thus not corrected by the market unless policy intervenes, creating a *prima facie* public interest in regulation.

³²⁸ Krogstrup and Oman (n 242) 15; Stern, 2022 (n 301) 3. See also Cullen (n 6) 69.

³²⁹ See Chapter 5.3 and Ogus (n 27) 27-28. There is a sufficient public interest for the regulator to act only if the market is incapable of correcting the failure itself. Further, this only applies in such a case that the applicable regulatory intervention would then also cause more benefits than the social costs of the intervention.

³³⁰ Hertog (n 28) 6ff; Ogus (n 27) 27-28. See also, *e.g.*, Cullen and Mähönen (n 10) 4.

³³¹ *Ibid*; Coase (n 64) 1.

³³² Alexander, *Principles of Banking Regulation* (n 6) 357.

³³³ Ogus (n 27) 33.

5.2 Analysis of the Potential Application of Macroprudential Tools to Climate Change Risks

The previous chapter concluded that the presence of negative externalities and the public good-character of climate change mitigation and financial stability contribute to climate change. Chapter 4 furthermore concluded that the climate change financial risks are capable of collectively affecting the financial system as a whole and causing serious, adverse impacts on the real economy. Thus, climate change systemic risk falls within the scope of the objectives of macroprudential regulation. As a result, this chapter proceeds by examining whether the current macroprudential toolkit could be capable of addressing the market failures underlying climate change systemic risk, *i.e.*, incentivize financial institutions to address climate change systemic risk by internalizing the costs of their contribution to such risk.

As discussed previously in Chapter 2.4 herein, macroprudential tools targeted at the cross-sectional dimension of systemic risk aim to mitigate and prevent externalities and the risks that can arise from the interconnectedness of financial institutions. Preliminary findings of the ESRB conclude that, in particular, large exposure limits could be relevant for addressing cross-sectional dimensions of climate-related risks. Scholars have likewise held that large exposure limits could be used to restrict banks' exposure to carbon-related sectors of the economy or other assets with high exposure to climate change risks, thereby both limiting bank funding to such industries and increasing resilience to future shocks.³³⁴ Large exposure limits have, however, been designed to prevent financial institutions from incurring large losses owing to the failure of a particular client or group of connected clients.³³⁵ Climate change financial risks, however, include concentrations across regional, sectoral, and firm levels.³³⁶ The ESRB, therefore, notes that using the current framework would require clarification on how to group clients based on climate change financial risks.³³⁷

Another possible option would be to include exposure to high-carbon industries in the scope of criterion in identifying SIFIs. Chapter 4 discussed that certain banks and sectors are more exposed to physical risks than others, suggesting that climate-related risks can be

³³⁴ ESRB (2016), 17; Grünewald (n 6) 6; Cullen and Mähönen (n 10) 16; Schoenmaker and Tilburg (n 270) 326.

³³⁵ See Chapter 3.2.

³³⁶ See Chapter 4, See also Ivana Baranović and others, 'The Challenge of Capturing Climate Risks in the Banking Regulatory Framework: Is There a Need for a Macroprudential Response?' (2021) 15 ECB Macroprudential Bulletin <https://www.ecb.europa.eu/pub/financial-stability/macroprudential-bulletin/html/ecb.mpbu202110_1~5323a5baa8.en.html> accessed 17 May 2022.

³³⁷ ESRB, 'Review of the EU Macroprudential Framework for the Banking Sector – March 2022' (n 12) 52.

more concentrated than overall exposures. According to the ECB, more than 70% of the banking system credit exposures to firms that are located in areas highly or increasingly exposed to physical risks are held by only 25 banks.³³⁸ Thus, market risks can be exacerbated with concentrated exposures to carbon assets by increasing the risks of contagion and second-round effects. Identifying and managing such high-risk institutions could mitigate systemic risk.

The discussion in this paper so far has largely focused on how the interconnectedness of the financial system can cause systemic risk when climate change risks materialize. As climate change risks do not have a similar patterns as regular financial cycles, mitigating the temporal dimensions of climate change systemic risk is less straightforward. Some scholars however identify a ‘carbon cycle’, referring to “an excessive credit growth in high-carbon industries that feeds into excessive levels of carbon emissions, followed by a sudden correction or downswing”.³³⁹ The hypothesis is that the financial system is in the middle of a very long, upward cycle of credit growth in carbon industries, and steep reductions in carbon emissions would eventually lead to a correction of such excessive credit growth and end the cycle.³⁴⁰ Macroprudential tools such as capital and liquidity requirements could help build up capital buffers, and ease the transition to a low-carbon economy, and thereby reduce transition risks and ultimately the credit risks involved. The most discussed instrument is climate-risk adjusted capital requirements, in the form of applying either a green supporting factor (“GSF”) or a brown penalizing factor (“BPF”) to minimum capital requirements. Such adjustments would be considered macroprudential if designed and applied to address the risks to the financial system as a whole, rather than individual banks’ balance sheets.³⁴¹ Commentators and regulators have however so far been especially cautious of the implementation of a GSF, because of possible negative impacts on financial stability and doubts on the actual impact of a GSF, caused, *e.g.*, by the limited success of the use of a similar supporting factor with small- and medium-enterprises in the EU.³⁴²

³³⁸ ECB, ‘Financial Stability Review’ (May 2021) 105 < <https://www.ecb.europa.eu/pub/financial-stability/fsr/html/ecb.fsr202105~757f727fe4.en.html> > accessed 17 May 2022.

³³⁹ Grünewald (n 6) 7; Schoenmaker and van Tilburg (n 270) 322.

³⁴⁰ Grünewald (n 6) 7.

³⁴¹ D’Orazio and Popoyan, (n 16) 28. A BPF would likely be more effective from a macroprudential standpoint, among other reasons. It would raise risk weights on carbon-intensive investments and thus discourage further investment in high-carbon activities and help build banks’ capital reserves to withstand losses climate change financial risks.

³⁴² See, *e.g.*, D’Orazio and Popoyan, (n 16) 28; Schoenmaker and van Tilburg (n 270) 323; Smoleńska and van’t Klooster (n 260) 57-59; Cullen (n 11) 84; Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 17; Prudential Regulation Authority, ‘Climate-related Financial Risk Management and the Role of Capital Requirements: Climate Change Adaptation Report 2021’ (2021) Bank of England 28.

Other suggestions include the use of the countercyclical capital buffer and the sectoral leverage ratio. D’Orazio and Popoyan suggest that an increased capital buffer before the build-up of carbon-intensive credit growth and leverage related to carbon-intensive assets could help both prevent such growth as well as absorb shocks to carbon-intensive loans, and consequently mitigate the effects of such shocks and contribute to the transition to a low-carbon economy.³⁴³ A sectoral leverage ratio would limit banks’ exposure to targeted groups, such as carbon-intensive assets, by restricting the level of debt financing to such investments (essentially the same impact as a credit ceiling).³⁴⁴ A concern with liquidity requirements, such as liquidity coverage ratios, is the potential to unintentionally constrain banks’ willingness to lend to green economic activities.³⁴⁵ Moreover, liquidity requirements have been considered to encourage investments towards liquid shorter-term assets, while green economic activities typically require long-term financing.³⁴⁶

Similarly to the countercyclical buffer, the systemic risk buffer framework under the CRD IV could be used to address climate change financial risks. To the extent that an NCA considers that risks related to climate change have the potential to result in serious negative consequences for the financial system and the real economy in the Member State, they could introduce a systemic risk buffer rate for those risks where they consider the introduction of such rate ”effective and proportionate to mitigate those risks”.³⁴⁷ The systemic risk buffer framework allows supervisory authorities to target specific economic activity or geographical areas.³⁴⁸ This could be useful for targeting specific sectors or areas that are most exposed to climate change financial risks and, thus, address local specificities. An example of a capital buffer application in this direction can be drawn from Norway. Norway introduced a systemic risk buffer in 2020 for the whole banking sector. One of the reasons cited was that the Norwegian economy is characterized by a unilateral corporate sector, with a high dependence on the petroleum sector. The NCA considered that lower petroleum prices

³⁴³ D’Orazio and Popoyan, (n 16) 30.

³⁴⁴ See, e.g., Grünewald (n 6) 9.

³⁴⁵ Ibid; Le Quang and Scialom (n 175) 7.

³⁴⁶ Campiglio (n 12) 226. However, Campiglio notes that it is unclear whether the trend towards liquid, shorter-term assets is occurring as a reaction to regulation, or rather as a reaction to the current economic situation. For an opposing view, see Esko Kivisaari, ‘Sustainable Finance and Prudential Regulation of Financial Institutions’ in Paul G Fisher (ed), *Making the Financial System Sustainable* (Cambridge University Press 2020) 95-97.

³⁴⁷ CRR, Art 133. See also Commission, Impact Assessment Report (n 168).

³⁴⁸ EBA, Final guidelines on the appropriate subsets of sectoral exposures to which competent or designated authorities may apply a systemic risk buffer in accordance with Article 133(5)(f) of the Directive 2013/36/EU (September 30, 2020, Guideline) EBA/GL/2020/13. The EBA has specified the article and confirmed this.

or reduced demand could have a significant negative effect on the economy as a whole.³⁴⁹ This example illustrates how the systemic risk buffer appears to be flexible in both its scope and application, thus constituting an option for macroprudential authorities to address climate change systemic risk.

Capital buffers have, however, been largely established as a direct reaction to the procyclical rules before the crisis. There are serious doubts whether they will be sufficient alone to prevent the growth of future credit-fueled asset shocks.³⁵⁰ A specific challenge is identifying the correct timing and calibration of *e.g.*, the countercyclical capital buffer.³⁵¹ Most of the capital buffers also only target bank activity as a whole (the systemic risk buffer being an exception), rather than specific asset classes, which would be more suitable for climate change financial risks. In general, despite the broad range of possible tools policy identified in Chapter 3.2, macroprudential policy has so far primarily consisted of adapting and enhancing traditional microprudential tools (such as capital requirements) by redirecting them to limit systemic risk and safeguard financial stability.³⁵² Commentators however frequently criticize the over-reliance on capital tools in mitigating systemic risk. Critics of the post-crisis reforms argue that the use of capital regulation is at its core still based on the same conservative approach as before the most recent crisis and applying such tools to climate change financial risks would not be sufficient.³⁵³ The ECB further considers that large parts of capital requirements rules are backward-looking, meaning they rely on historical data to measure the relationships between risk factors and exposures, and, are therefore, insufficient to capture climate change risks. A preliminary observation by the ECB explains that the measures are only capable of indirectly capturing climate risks.³⁵⁴

An important part of macroprudential policy is also the identification and assessment of systemic risk. This is especially important with climate change risks, because of the inherent complexity of the risks at hand, as noted in Chapter 4. Specifically, the incorporation of climate change risks into stress testing has become a focus for supervisors in recent years. Regulators and commentators alike have emphasized that developing

³⁴⁹ ESRB, Notification by the Norwegian Ministry of Finance on the systemic risk buffer (SyRB), <https://www.esrb.europa.eu/pub/pdf/other/esrb.notification20201105_SyRB_NO~6fe1a30e2b.EN.pdf> accessed 17 May 2022.

³⁵⁰ Armour and others (n 23) 419.

³⁵¹ Grünewald (n 6) 9.

³⁵² Armour and others (n 23); Gaëtan Le Quang and Laurence Scialom, 'Better Safe than Sorry: Macroprudential policy, Covid 19 and Climate Change' (2021) *International Economics* <<https://doi.org/10.1016/j.inteco.2021.07.002>> accessed 17 May 2022.

³⁵³ *Ibid.*

³⁵⁴ ECB/ESRB Project Team on Climate Risk Monitoring (n 11).

comprehensive climate risks stress tests is, in addition to raising awareness, an important first step for calibrating and eventually evaluating macroprudential tools for such ends.³⁵⁵ Explorative climate stress tests have been conducted in the EU within the past few years.³⁵⁶ Past stress tests on carbon exposure have, for instance, emphasized the vulnerability to stranded assets.³⁵⁷ The ECB recently launched an EU-wide supervisory climate risk stress test that it will perform during the first half of 2022 to assess banks' preparation for handling financial and economic shocks stemming from climate risk. The ECB stress test relies on the climate change scenarios developed by the NGFS.³⁵⁸ The stress test does not yet, however, have direct implications for banks.³⁵⁹

It seems, therefore, that there are, in theory, potential ways in which climate change financial risks could be addressed by the current EU macroprudential tools available to Member States, such as capital buffers, despite the lack of an explicit mention of such risks in the relevant legal instruments.³⁶⁰ Stress-testing has become an especially important part of identifying climate change systemic risk. The current EU legal framework does not prevent banks from considering ESG risks in their decision-making, risk assessment, or use of macroprudential tools.³⁶¹ Some commentators have even claimed that there is no need to modify the current prudential framework, and that EU supervisors are well-equipped to

³⁵⁵ D'Orazio and Popoyan, (n 16) 27.

³⁵⁶ Smoleńska and van't Klooster (n 260) 63. For example, the Dutch Central Bank and the French supervisory authority have conducted climate-related stress tests. The ECB conducted a climate stress test in 2020-2021, with the intent to improve its understanding of climate-related systemic risks.

³⁵⁷ Carbon Tracker Initiative and Grantham Research Institute, 'Wasted Capital and Stranded Assets' (19 April 2013) < <https://carbontracker.org/reports/unburnable-carbon-wasted-capital-and-stranded-assets/>> accessed 17 May 2022. A stress-test by the Carbon Tracker Initiative and Grantham Research Institute in 2014 revealed that at least \$6.74 trillion would be wasted in developing reserves at the prevailing capital expenditure of fossil fuel site and field development.

³⁵⁸ ECB, 'ECB Banking Supervision Launches 2022 Climate Risk Stress Test' (Press Release, 27 January 2022)

<<https://www.bankingsupervision.europa.eu/press/pr/date/2022/html/ssm.pr220127~bd20df4d3a.en.html>> accessed 17 May 2022.

³⁵⁹ Ibid. The 2022 ECB EU-wide climate stress test will be included in the SREP and could potentially impact individual banks' capital requirements indirectly in the future.

³⁶⁰ Commission, Impact Assessment Report (n 168) 18; Smoleńska and van't Klooster (n 260) 55. There is no specific capital requirement, such as a risk-weighting for assets exposed to climate change risks. The only (narrow) exception is Article 501a CRR2, which applies a GSF (of 0.75) to lending to infrastructure project entities contributing to environmental objectives. The Commission is mandated to report on the impact of this GSF (with the support of EBA) by 28 June 2022. Relatedly, paragraph 510 (Pillar 1) of Basel III includes specific requirements for banks to assess the impact of specific environmental risks on credit and operational risk exposures, but these refer mainly to transaction-specific risks to be considered over the course of due diligence exercises and transaction screening. These are narrowly defined and do not constitute macroprudential tools. See Basel Committee, 'Guidance on the Application of the Core Principles for Effective Banking Supervision to the Regulation and Supervision of Institutions Relevant to Financial Inclusion' (2016) Bank of International Settlements.

³⁶¹ Commission, Impact Assessment Report (n 168) 18.

address climate change financial risks.³⁶² Despite the increased attention to climate-related risks, very few financial institutions have implemented macroprudential tools yet to address such risks, and exposures to climate risk have largely remained the same.³⁶³ The ECB recently concluded similarly that “[w]hile steps are being taken to adapt policies and procedures, few institutions have put in place C&E [climate-related and environment] risk practices with a discernible impact on their strategy and risk profile“.³⁶⁴ The Basel Committee also confirmed in 2020 that only a few countries globally have incorporated the assessment of climate change financial risks into their supervisory frameworks.³⁶⁵ A partial exception is the UK, where the Prudential Regulation Authority (“PRA”) explicitly expects banks to assess their exposure to climate-related risks and take into account such exposures using current capital frameworks.³⁶⁶ This mismatch in theory and policy raises questions with respect to whether regulators and financial institutions are simply insufficiently considering such risks, or whether the regulatory framework is itself insufficient.

The Commission acknowledged in October 2021 that there is no dedicated capture of sustainability risks in the EU prudential framework.³⁶⁷ The Commission argues that because of the lack of an explicit reference to ESG risks, supervisory powers are not applied systematically and consistently.³⁶⁸ Similarly, the EBA has repeatedly acknowledged that the current legal requirements are “insufficient to provide incentives for a systematic and consistent management of ESG risks by banks”.³⁶⁹ In line with the conclusions found in Chapter 5.1 concluded, the Commission explains that the consequences of the lack of a prudential regulation of climate risks includes a continued mispricing of risks and inadequate capitalization of banks’ exposures, leading to a higher probability of a future financial crisis.³⁷⁰

³⁶² Chaves and other (n 10); Pierre Monnin, ‘Systemic Risk Buffers – the Missing Piece in the Prudential Response to Climate Risks’ (2021) Council on Economic Policies Policy Brief 1; Grünewald (n 6) 6.

³⁶³ D’Orazio and Popoyan, (n 16) 34; Chaves and others (n 10).

³⁶⁴ ECB, ‘The State of Climate and Environmental Risk Management in the Banking sector - Report on the Supervisory Review of Banks’ Approaches to Manage Climate and Environmental Risks’ (2021) 2.

³⁶⁵ Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 5. The Basel Committee has recently concluded that a majority of jurisdictions did not have an explicit mandate to assess climate-related financial risks, and that only some jurisdictions have considered how such risks could impact financial stability, while even fewer have incorporated their assessment into supervisory frameworks, such as China, Brazil, and Peru.

³⁶⁶ Prudential Regulation Authority (n 342) 32ff. However, the considerations mostly relate to the microprudential use of capital requirements. In its 2021 report, the PRA held that there is no current explicit consideration of climate-related risks in the macroprudential regime. The PRA is currently in the process of addressing these gaps within the macroprudential regime.

³⁶⁷ Commission, Impact Assessment Report (n 168) 18.

³⁶⁸ Ibid 29.

³⁶⁹ Ibid 18.

³⁷⁰ Ibid 25.

The Commission consequently presented amendments to the CRR and CRD IV as part of the Banking Package 2021.³⁷¹ In the relevant impact assessment report, the Commission explored two options for including ESG risks in the prudential framework: the inclusion of “measures for a better management of ESG risks by banks” (option 1) and the adaptation of minimum capital requirements to reflect ESG risks (option 2).³⁷² In its proposal, the Commission decided to proceed only with the first option, which consists of a set of supervisory and risk management measures that do not directly target banks’ minimum capital requirements, but relate to the SREP and Pillar 2 rules.³⁷³ The proposals are largely based on recommendations by the EBA regarding how to incorporate ESG risk mitigation into the supervisory process.³⁷⁴

The proposed amendments to the CRR consist mainly of harmonized definitions of the different types of ESG risks,³⁷⁵ and new and extended requirements for credit institutions to report and disclose exposure to ESG risks.³⁷⁶ The proposed amendments to the CRD, on the other hand, introduce new powers for NCAs to monitor that credit institutions have risk management strategies and processes in place for identifying and managing ESG risks.³⁷⁷ An example of an amendment directed to credit institutions directly is the proposals for revised articles 73 and 74, which hold that credit institutions shall consider the short, medium, and long-term horizons of ESG risks in their strategies and processes for evaluating internal capital needs as well as adequate internal governance.³⁷⁸ The proposal also includes encouragement to consider climate-related risks when applying macroprudential tools, although it does not directly incorporate an obligation to do so. For example, recital 36 of

³⁷¹ See Commission, Proposals (n 17). The Commission is using the need to amend the CRR and the CRD IV to implement the final Basel III standards also as an opportunity to also reinforce the need for ESG risks to be included consistently in credit institutions’ risk management systems and supervision.

³⁷² This was envisaged as adapting the so-called Pillar 1 capital requirements, by lowering capital requirements for sustainable exposures, and increasing capital requirements for unsustainable activities.

³⁷³ Commission, Proposals (n 17).

³⁷⁴ Ibid; EBA, ‘Report on Management and Supervision of ESG Risks for Credit Institutions and Investment Firms’ (2021). See also Smoleńska and van’t Klooster (n 260) 59.

³⁷⁵ Proposal for new Article 4(1) (52d to 52i) CRR.

³⁷⁶ Proposal for a new paragraph (h) to Article 430(1) CRR and a revised Article 449a CRR. As noted above, Article 501c CRR is also amended to advance the date for the EBA to deliver its report on the prudential treatment of exposures to environmental and social factors from 28 June 2025 to 2023.

³⁷⁷ Examples are: Proposal for new Article 87a CRD IV, under which competent authorities shall require credit institutions to have “robust strategies, policies, processes and systems for the identification, measurement, management and monitoring of ESG risks over an appropriate set of time horizons”; the proposal for revised article 98 introduces an explicit mentioning of ESG risks into the SREP; and the proposal for a revised article 104 CRD IV holds that competent authorities may require credit institutions to reduce risks arising from the misalignment with relevant EU policy objectives relating to ESG factors, for example by adjustments to business models, governance strategies and risk management.

³⁷⁸ Proposal for revised articles 73 and 74 CRD IV. See also proposal for an amendment to article 76 CRD IV, which requires management bodies to develop plans for the current and forward-looking impacts of ESG risks.

the proposal to amend the CRD IV states that: ” [t]o the extent that the relevant competent or designated authorities, as applicable, consider that risks related to climate change have the potential to have serious negative consequences for the financial system and the real economy in Member States, they should introduce a systemic risk buffer rate for those risks where they consider the introduction of such rate effective and proportionate to mitigate those risks.” The proposal also includes new mandates for the EBA to produce guidelines for the uniform assessment and management of ESG risks, as well as a new mandate for the ESAs to develop new guidelines for stress testing of ESG risks.³⁷⁹

The proposed amendments, therefore, mostly relate to enhancing bank governance, strategy, and individual institutions’ risk assessment processes. Although the explicit inclusion of ESG risks into such frameworks would be a step towards a ‘dedicated capture’ of climate change risks, and target some of the underlying issues, they do not in their current form constitute a prudential treatment of climate change systemic risk. Thus, it remains to be seen whether further proposals by the Commission, or the current proposal under the Banking Package 2021, will evolve to include explicit references to a macroprudential regulation of climate-related systemic risk.

In sum, the above overview demonstrates that there are many potential suggestions and pathways for addressing climate change risks through macroprudential regulation. Among these, capital buffers, large exposure limits, information gathering and risk assessment, including climate stress tests, are the most advocated ones.

5.3 Is Macroprudential Regulatory Intervention Justified?

Under economic theories of regulation, the existence of a market failure only gives rise to a *prima facie* public interest justification for regulatory intervention. Government intervention still needs to be more successful in correcting the market failure than the market or private law (as noted in Chapter 5.1) and the benefits of regulation need to outweigh the costs of regulation.³⁸⁰ The purpose is to assess whether the proposed regulation would improve the current situation without imposing unreasonable costs on society, and to ensure that proposed interventions are proportionate to the harm that the intervention is intended to

³⁷⁹ Proposal for a new Article 87a and revised Article 100 CRD IV, respectively.

³⁸⁰ Ogus (n 27) 30. Examples of costs of regulation are increased transaction costs and misallocations created in other parts of the economy.

address. This is commonly done through a cost-benefit analysis.³⁸¹ The feasibility of this final assessment is difficult and depends on the quantitative evidence available. Nevertheless, a cost-benefit analysis without definitive answers can still provide a useful ‘rationality-check’ for policymaking.³⁸²

To understand the magnitude of the potential costs of climate change, it is useful to compare it to the last systemic crisis: the Financial Crisis. The crisis and the following decline in economic activity across the world are estimated to have caused estimated losses of more than \$15 trillion, which was approximately 20% of the value of total world annual production, with an increase in public debt of 21% of GDP.³⁸³ In comparison to climate change-related economic costs, the World Bank has estimated that the annual economic cost of human-induced environmental depletion was around \$6.6 trillion already in 2008, equivalent to 11 percent of global GDP. Natural disasters alone have already resulted in losses of more than \$5 trillion globally between 1980 and 2018.³⁸⁴ Furthermore, experts estimate that already limiting the increase to 1.5°C in temperature would reduce global GDP by 8 percent by 2100, with losses of up to 20% in global GDP if mitigation proves insufficient or ineffective.³⁸⁵ Consequently, if the average global temperature rises by 4°C above pre-industrial levels over the next 80 years (*i.e.*, if environmentally unsustainable activity continues at the current pace), the global GDP loss is estimated to be more than \$23 trillion per year.³⁸⁶ Thus, the estimated long-term losses of a climate change are of a significantly larger scale than those of the Financial Crisis, and will affect the entire world, thus constituting a truly global threat. Moreover, scientists have concluded that several climate change impacts are irreversible. Consequently, regulators and scholars alike have stressed not only the benefits, but also the urgency in taking climate mitigation measures and reducing emissions to meet the target to limit global warming to under 2°C or below to prevent the high damages arising from a ‘hot-house world’-scenario.³⁸⁷ Moreover, the role of the EU banking sector in contributing to climate change and the related systemic risk is clear. The global banking sector remains the largest financier of carbon-intensive

³⁸¹ Baldwin, Cave and Lodge (n 27) 315; Hertog (n 28) 6ff; Ogus (n 27) 30. Especially more complex public interest theories of regulation emphasize on the need to explain how and why regulation is comparatively more successful in correcting the failure and achieving allocative efficiency than the market or private law, and why the efficiency gains outweigh the costs of regulation.

³⁸² Armour and others (n 22) 71.

³⁸³ ESRB, ‘Flagship Report on Macro-prudential Policy in the Banking Sector’ (n 42) 6.

³⁸⁴ Basel Committee, Climate-related Risk Drivers and their Transmission Channels (n 11) 6.

³⁸⁵ ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 4.

³⁸⁶ Gelzinis and Steele (n 292) 1.

³⁸⁷ Stern (n 60) 572; Bolton and others (n 19); ECB/ESRB Project Team on Climate Risk Monitoring (n 11) 4.

companies.³⁸⁸ Four of the top global 15 funders of fossil-fuel activities are headquartered in the EU, having contributed more than \$45 billion to such companies.³⁸⁹ EU regulators' have also acknowledged the high exposure of EU banks to climate change financial risks.³⁹⁰

Assessing the specific costs and benefits of using macroprudential regulation to mitigate climate change and the entailing systemic risk, however, further complicates this task for a multitude of reasons. First, the effectiveness of macroprudential policies in the face of a systemic crisis have not yet been properly tested.³⁹¹ The Covid-19 pandemic was the first global crisis with a systematic macroprudential framework in place. During the peak of the pandemic as of the date of this paper, the banking sector, however, benefited from sizable public support measures to households and corporate clients, and their balance sheets were, therefore, not significantly affected. Governments and central banks also responded with swift and rigid fiscal and monetary policy measures. For example, the functioning of capital buffers to absorb shocks was therefore not fully tested.³⁹²

Second, the concrete benefits of successful macroprudential regulatory interventions are difficult to measure. As discussed in Chapter 2.3, the ultimate objective of macroprudential regulation is to ensure financial stability as well as to anticipate and mitigate systemic risks. As opposed to, *i.e.*, monetary policy and the objective of price stability, macroprudential objectives are more difficult to define by a single numerical measurement. Essentially, if a macroprudential approach to regulation is successfully implemented, the result is that a financial crisis is avoided.³⁹³ This lack of a metric by which to measure benefits, especially in the short term, poses difficulties for effective regulation.³⁹⁴

Because of the difficulties of achieving a precise cost-benefit analysis for climate change mitigation through macroprudential regulation, regulators may need to rely on other means of justification. A reason for some of the doubts around the real costs of climate

³⁸⁸ Cullen (n 6) 77.

³⁸⁹ BankTrack and others, 'Banking on Climate Change: Fossil Fuel Finance Report Card' (June 2017) <https://www.banktrack.org/download/banking_on_climate_change_1/ran_banking_on_climate_change_2017.pdf> accessed 17 May 2022.

³⁹⁰ See Chapter 4.2.

³⁹¹ Budnik and Kleibl (n 186) 4.

³⁹² European Commission, 'Targeted Consultation on Improving the EU's Macroprudential Framework for the Banking Sector' (2021), <https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/2021-banking-macroprudential-framework-consultation-document_en.pdf> accessed 17 May 2022, 5.

³⁹³ See, *e.g.*, Borio, 'Implementing a Macroprudential Framework: Blending Boldness and Realism' (n 83) 5. Other, arguably more concrete, criteria of success may be identified and analyzed, such as the strengthening the resilience of the financial system or mitigating the upswing of the financial cycle.

³⁹⁴ See, *e.g.*, Pierre Schammo, 'Inaction in Macro-prudential Supervision: Assessing the EU's Response' (2019) 5(1) *Journal of Financial Regulation* 1, 11.

change and the capacity of macroprudential regulation to address climate change risks stems from the high levels of uncertainty regarding the manner in which climate change financial risks and their impacts will develop, as noted in Chapter 4.2.³⁹⁵ Because of this radical uncertainty, a traditional cost-benefit analysis based on quantitatively weighing outcomes of regulation for climate change is of limited use, or at least challenging.³⁹⁶ The magnitude of the risks at hand requires an exercise of balancing risk and uncertainty, which dates back to the 1920s and the theories developed by Knight and Keynes.³⁹⁷ Theoretically, the concept of risk refers to a scenario of different possible outcomes with calculable probabilities, whereas the concept of uncertainty refers to the lack of sufficient evidence to calculate probabilities for each possible outcome or even properly discern all possible outcomes.³⁹⁸ Many climate change consequences are fundamentally uncertain as described by Knight; there is not only a lack of data to calculate climate change risk, but also a lack of understanding in the exact consequences that climate change will have and the measures that will be sufficient to mitigate it. This causes severe limitations to existing risk-modelling techniques.³⁹⁹

In the face of such uncertainty, several scholars, therefore, advocate for adopting a *precautionary approach* to financial regulation, a common justification for regulations in the environmental context.⁴⁰⁰ The concept draws on the precautionary principle, which is a well-established principle in environmental protection and encourages the adoption of preventative policies to avert serious and irreversible damage in the face of uncertainty.⁴⁰¹ According to a precautionary approach, governments should act even when the probability of the risks materializing is uncertain if the concern is scientifically sound and the possible harm from such risks is serious and irreversible. Nevertheless, a precautionary approach nevertheless requires the mitigation measures to be proportional to the magnitude of possible harm and consider the impacts of both action and inaction.⁴⁰² One of the earliest references

³⁹⁵ Basel Committee, *Climate-related Risk Drivers and their Transmission Channels* (n 11) 5; Bolton and others (n 19) 23-46.

³⁹⁶ Choudhury (n 18) 73. See also Cullen and Mähönen (n 10) 10; Stern (n 61) 25- 34; Cullen (n 6) 74; Armour, Enriques and Wetzler (n 314) 25.

³⁹⁷ Frank H Knight, *Risk, Uncertainty and Profit* (Houghton Mifflin Company 1921); John Maynard Keynes, 'The General Theory of Employment' (1937) 51 *The Quarterly Journal of Economics* 209. See also Stern (n 61) 25- 34; Smoleńska and van't Klooster (n 260) 65-66.

³⁹⁸ Knight (397) 235; Keynes (n 397) 214.

³⁹⁹ Smoleńska and van't Klooster (n 260) 67; Bolton and others (n 19) 43.

⁴⁰⁰ Le Quang and Scialom (n 352) 6; Cullen (n 6) 63; Chenet and others, 'Climate-related Financial Policy in a World of Radical Uncertainty: Towards a Precautionary Approach' (2019) UCL Institute for Innovation and Public Purpose, Working Paper Series IIPP WP 13, 12; Cullen, Mähönen and Rapp Nilsen (n 18) 7-11.

⁴⁰¹ *Ibid.*

⁴⁰² Choudhury (n 18) 73; Cullen, Mähönen and Rapp Nilsen (n 18) 7-11.

to the principle in legal instruments is Principle 15 of the 1992 Rio Declaration.⁴⁰³ Other international agreements, such as the United Nations Framework Convention on Climate Change and the Paris Agreement, also reflect the will to apply a precautionary approach, despite the lack of full scientific certainty around climate change.⁴⁰⁴ The precautionary principle has been formally adopted in the EU in Article 191(2) of the Treaty on the Functioning of the European Union (TFEU). The Commission has also endorsed its use as a tool in legal analysis, particularly in the fields of environmental and international law.⁴⁰⁵ Macroprudential regulation in itself is considered a form of precautionary financial policy.⁴⁰⁶ As discussed in Chapter 2.3, the foundation of macroprudential policy is that while the future is highly uncertain, the concerns over the aggregation of systemic risk that could lead to financial crises necessitate *ex-ante* regulatory intervention.

Thus, the previous sections thus conclude the first assessment of this thesis, namely whether the use of macroprudential regulatory tools to address climate change risks can be justified following public interest theories. Climate change constitutes a systemic risk, caused by market failures. Macroprudential regulation, aimed to regulate such systemic risk, likely provides suitable regulatory tools to address the market failures underlying climate change, although further analysis and experience is likely required to assess whether the existing tools can successfully target climate change systemic risk, or whether a macroprudential regulation of climate change systemic risk will necessitate amendments to the current regulatory framework. Adopting macroprudential regulatory tools to address climate change risks can be justified due to the magnitude and high likelihood of the potential costs of climate change systemic risk, and, in particular, if a precautionary approach to financial regulation and the objectives of macroprudential regulation are considered.⁴⁰⁷

⁴⁰³ UN Rio Declaration on Environment and Development, Vol I, A/CONF.151/26.

⁴⁰⁴ Article 3(3) of the United Nations, Resolution of the General Assembly, ‘Framework Convention on Climate Change’ (20 January 1994) A/RES/48/189 (the UNFCCC) (“United Nations Framework Convention on Climate Change”) states that “The Parties should take precautionary measures to anticipate, prevent or minimize the causes of climate change and mitigate its adverse effects. Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing such measures...”. The will to agree on a specific threshold in the Paris Agreement, *i.e.*, keeping global warming under 2°C as compared to pre-industrial levels, despite the uncertainties surrounding the costs of mitigation and the impacts of global warming, also illustrates a precautionary approach.

⁴⁰⁵ Commission, ‘Communication from the Commission on the Precautionary Principle’ COM (2000) 0001 final. See also Cullen (n 6) 79.

⁴⁰⁶ Grünewald (n 6) 11; Chenet and others (n 400) 12.

⁴⁰⁷ Chenet and others (n 400) 12; Choudhury (n 18) 70ff.

5.4 Challenges in Implementing Macroprudential Regulation

The previous chapters have thus concluded that there is a public interest to regulate climate change systemic risk, and several macroprudential instruments could be suitable for addressing climate change systemic risk. Supervisory reviews, however, reveal that national regulators seem to have been reluctant to implement such policy measures so far.⁴⁰⁸ A report led by Alexander Kern similarly concludes that the banking regulatory framework is not being used to its full capacity; “with some notable exceptions, systemic environmental risks appear to be in the collective blind spot of bank supervisors.”⁴⁰⁹

Possible explanations for the lack of implementation can be constructed based on private interest theories of regulation. As introduced in Chapter 1.3, private interest theories highlight the extent to which self-interested behavior of the different actors involved in the regulatory process, as well as pressure from interest groups, can hamper the processes of identifying a market failure as well as determining and applying the appropriate regulatory instrument.⁴¹⁰ Particularly, literature has analyzed how particularly the use of macroprudential policy is largely a question of politics, not just a process of competent authorities conducting information-gathering, analysis, and taking regulatory action.⁴¹¹

A specific notion that has gained a lot of traction in macroprudential literature is *inaction bias*, which refers to the tendency of regulators and supervisors to favor inaction over action when considering the deployment of macroprudential tools.⁴¹² Despite an increased awareness of climate change financial risks and their consequences, supervisors and market participants repeatedly refer to the need for better analytical understanding and data as a reason to postpone real action (*i.e.*, a ‘wait and see’ approach).⁴¹³ Regulators and supervisors may decide not to act for many reasons. Such a decision might be based on legitimate assessments that a particular risk will solve itself without regulatory intervention,

⁴⁰⁸ See Chapter 5.2.

⁴⁰⁹ Alexander, ‘Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?’ (n 12) 7.

⁴¹⁰ Baldwin, Cave and Lodge (n 27) 75.

⁴¹¹ Armour and others (n 22) 424ff and 80ff. Relatedly, Armour and others highlight the issues that arise with the ‘dynamics’ of regulation, meaning the process in which the content of regulation changes over time (‘rule-making’) and is converted from rules to action through supervision and enforcement.

⁴¹² Schammo (n 394). See also Claudio Borio, ‘Macroprudential Frameworks: (Too) Great Expectations?’ in Dirk Schoenmaker (ed), *Macroprudentialism* (CEPR Press, VoxEU eBook 2014) 38; Armour and others (n 22) 564ff. Inaction bias is sometimes also referred to as supervisory forbearance.

⁴¹³ Le Quang and Scialom (n 352) 5-6; Grünewald (n 6) 10; EU High-Level Expert Group on Sustainable Finance, ‘Financing a Sustainable European Economy’ (2018) Final Report 67.” The HLEG has not sought to conduct a complete review of the bank regulatory framework and its impact on sustainability lending. It is the view of the HLEG that further development of best practices on ESG and longer-term sustainability risk assessments is still needed to ensure that sustainability is better integrated into the banking sector, while at the same time ensuring financial stability.”

or that the social costs of intervention in such particular scenario would exceed the benefits.⁴¹⁴ The calibration of macroprudential tools entails a difficult assessment of, firstly, identifying the aggregation of systemic risk, and secondly, choosing the right instruments to prevent such aggregation, without excessively constraining ongoing economic growth.⁴¹⁵ The misapplication of macroprudential tools, especially those restricting leverage or credit growth, may cause problems within the financial system, such as increased financial risk-taking, and therefore does warrant a careful assessment.⁴¹⁶ Consequently, uncertainty around the exact impacts of macroprudential instruments can constitute a cause of inaction.

A problem, however, arises when decisions not to act are made based on political pressure or the pursuit of private interests. Private interests are likely to have a considerable influence on the macroprudential regulatory process for many reasons. First, macroprudential regulation is likely to foster resentment among industry participants and politicians.⁴¹⁷ As Claudio Borio, head of the Monetary and Economic Department (MED), Bank for International Settlements, expressed it, “the essence of good macroprudential policy is to take the punchbowl away just as the party gets going.”⁴¹⁸ Macroprudential tools impose costs on banks and other financial institutions, and reduce profits by forcing them to increase capital retention or restrict certain lending. Thus, macroprudential instruments measures also, indirectly or directly, restrict borrowers’ access to credit, and tends to suppress (near-term) economic growth. Such restrictive measures in a time of economic growth for a greater cause, *i.e.*, financial stability, will naturally be politically controversial and highly unpopular.⁴¹⁹ The Chicago theory of government highlights the ability of economically powerful and concentrated interest groups to use political power to pressure legislators and regulatory authorities to obtain advantages from the regulatory tools and their implementation.⁴²⁰ Because of the costs of macroprudential policy, the banking industry is likely to aim to influence regulation and macroprudential policymaking. Further, because of

⁴¹⁴ Armour and others (n 22) 564.

⁴¹⁵ *ibid* 423.

⁴¹⁶ Steven L. Schwarz, ‘Banking and Financial Regulation’ (2017) in Francesco Parisi (ed), *The Oxford Handbook of Law and Economics: Volume 2: Private and Commercial Law* (Oxford University Press 2017) 438; Alexander, *Principles of Banking Regulation* (n 6) 3.

⁴¹⁷ Armour and others (n 22) 411.

⁴¹⁸ Borio, ‘Macroprudential Frameworks: (Too) Great Expectations?’ (n 412) 37, paraphrasing William Martin, former US Federal Reserve Chair.

⁴¹⁹ Schammo (n 394) 11; Armour and others (n 22) 422. See also Borio, ‘Implementing a Macroprudential Framework: Blending Boldness and Realism’ (n 83) 11.

⁴²⁰ Stigler (n 35) 11-13. See also Ogus (n 27) 46; Baldwin, Cave and Lodge (n 27) 75.

the important role banks play in society, the banking industry often has strong political voice and an ability to influence policy.⁴²¹

Second, while the costs of macroprudential regulation are visible and realized in the short term, previous chapters have concluded that the benefits accrue over the long term, are difficult to quantify, and are dispersed across and for all stakeholders. The issue with both macroprudential policy and climate change financial risks is that both, thus, require action that spans out over the long term, typically a decade or more. The electoral cycles for politicians or supervisory assessments cycles typically run according to much shorter time horizons, such as between 3 and 5 years.⁴²² Agents in charge of legislating or regulating may, therefore, have incentives not to intervene and, *e.g.*, let distressed financial institutions continue to operate or continue neglecting climate change systemic risk, hoping that no risks materialize until the agent in question has moved on to a different task or job, or until macroeconomic conditions organically resolve the risk.⁴²³ Personal incentives can be the avoidance of confrontation with management and shareholders, political interests of legislators who might want to gain the support of industry participants or voters, as well as personal career objectives of agency staff members, within the agency or in the private sector.⁴²⁴

Some scholars also focus on the impacts of principal-agent relations, arising from the information asymmetries discussed in Chapter 2.1.⁴²⁵ Financial regulation, and in particular macroprudential regulation, is complex, technical, and generally has low salience with the public. Therefore, financial regulatory tasks are largely delegated to regulatory agencies staffed with experts.⁴²⁶ The existence of varying interests and information asymmetries is further compounded in EU macroprudential decision-making, as such decision-making involves such a broad range of actors, presented in Chapter 4.1: the ECB, national central banks, European and national supervisory authorities as well as EU agencies and the Commission. The EBA has a significant role in the creation of the Single Rulebook given its role in formulating specific rules and advice on proposals.⁴²⁷ The CRR/CRD IV includes a set of macroprudential tools which then the ECB and NCAs have the power to implement,

⁴²¹ Elias Bengtsson, 'Macroprudential Policy in the EU: A Political Economy Perspective' (2020) 46 *Global Finance Journal* 100490 3-4.

⁴²² *Ibid* 3; Schammo (n 394) 12.

⁴²³ Armour and others (n 22) 564-565.

⁴²⁴ *Ibid*; Baldwin, Cave and Lodge (n 27) 46; Paul Tucker, 'The Political Economy of Macroprudential Regimes' in Dirk Schoenmaker (ed), *Macroprudentialism* (CEPR Press, VoxEU eBook 2014) 64ff.

⁴²⁵ Bengtsson (n 421) 2.

⁴²⁶ Baldwin, Cave and Lodge (n 27) 45-48; Armour and others (n 22) 81.

⁴²⁷ See Chapter 3.1. See also Smoleńska and van't Klooster (n 260) 55.

largely following their discretion. Following private interest theories, these ‘agents’ in charge of implementation may end up pursuing their own goals rather than the tasked objectives, because of misaligned incentives, explaining the diversion from the public interest objective pursued by macroprudential regulation.⁴²⁸

The ESRB has repeatedly recognized the prevalence of inaction bias in EU macroprudential policy, and called for adjusting the design of tools and introducing common standards to macroprudential tools to reduce such risk.⁴²⁹ In general, uncertainty is inherent in the employment of macroprudential concerning the right way to assess risks, which instruments to use, and how to calibrate the interventions. This uncertainty is exacerbated with respect to climate change systemic risk, because of the high degree of uncertainty surrounding the nature and extent of risks to financial stability.⁴³⁰ Thus, the exercise of discretion is an important aspect of macroprudential decision-making, not only because the approach to regulation is still in such an early stage, but also because of the variety of complex risks that the approach is intended to catch.⁴³¹ Discretionary measures allow regulators to tailor measures to fit the specific features of a particular systemic risk, and the risks that lead to it, while also mitigating concerns of regulatory arbitrage.⁴³² On the contrary, a more prescriptive rules-based approach could mitigate inaction bias and the impact of private interests and political economy pressures.⁴³³

The international context brings yet another potential source of mismatch between public interest and the interests of legislators and regulators. As financial institutions are increasingly mobile, governments may want to attract financial institutions to their jurisdictions. One way to do so is by providing an attractive regulatory environment.⁴³⁴ When it comes to controlling systemic risk, the most appealing regulatory approach is unlikely to be in the public interest.⁴³⁵ The interference of self-interests can be exacerbated at the EU level. In addition to regulatory competition, Member States may have other national concerns and local specificities they wish to prioritize.⁴³⁶ Stellinga builds on the

⁴²⁸ Baldwin, Cave and Lodge (n 27) 45-48; Armour and others (n 22) 81.

⁴²⁹ ESRB, ‘Review of the EU Macroprudential Framework for the Banking Sector – March 2022’ (n 12)

⁴³⁰ See Chapter 2.3.

⁴³¹ ESRB, *The ESRB Handbook on Operationalising Macro-prudential Policy* (n 171) 174.

⁴³² Tucker (n 424) 65.

⁴³³ Borio, ‘Implementing a Macroprudential Framework: Blending Boldness and Realism’ (n 83) 11. Roughly, in the case of precise rules, the circumvention of a rule becomes easier over time.

⁴³⁴ See, e.g., Armour and others (n 22) 82ff.

⁴³⁵ Schwarcz (n 416) 438; Alexander, *Principles of Banking Regulation* (n 6) 3.

⁴³⁶ Bart Stellinga, ‘The Rise and Stall of EU Macro-Prudential Policy. An Empirical Analysis of Policy Conflicts over Financial Stability, Market Integration, and National Discretion’ (2021) 59 *Journal of Common Market Studies* 1438, 1439.

‘financial trilemma’ framework to explain the conflicts in designing EU macroprudential policy.⁴³⁷ The financial trilemma framework claims that there are inherent tensions between the pursuit of (1) financial stability, (2) market integration, and (3) national regulatory discretion (see Figure 4).⁴³⁸ EU actors, such as the Commission, the ECB and the ESRB, are likely to aim for financial stability and integration.⁴³⁹ Currently, NCAs are, however, the main actors in charge of calibrating macroprudential regulatory tools within the EU. A strong implementation of such tools by NCAs could thus contribute to financial stability. If such implementation is not cohesive among the Member States, the calibration of such tools could however harm the single market as well as invite regulatory arbitrage. Although centralizing more macroprudential powers to the EU could solve such concerns, national regulatory discretion would be frustrated.⁴⁴⁰ To a certain extent, this has already taken place within the Eurozone through the SSM, because of the supervisory powers of the ECB concerning the largest banks.

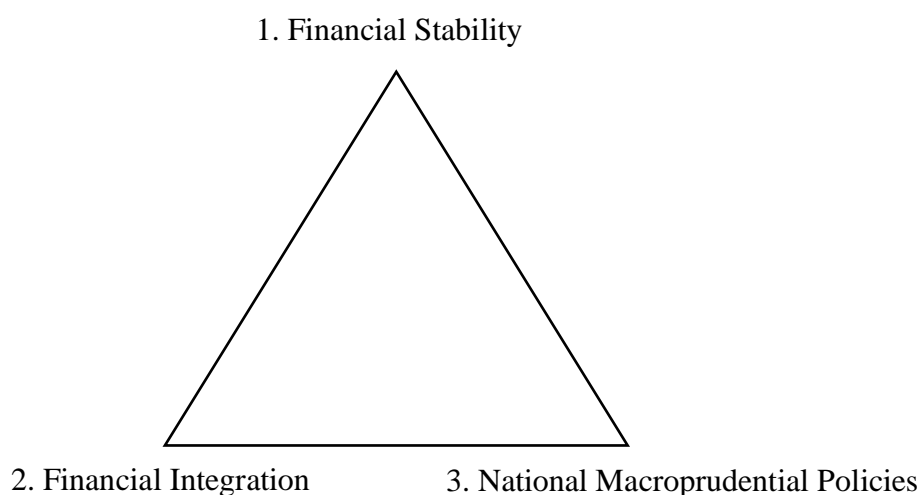


Figure 4 The Financial Trilemma (Source: Schoenmaker, 'The Financial Trilemma' (n 70) 57)

Retaining at least a certain degree of national discretion in macroprudential policy is, however, generally considered desirable. Because of differences in macroeconomic cycles

⁴³⁷ Ibid, 1439ff; ESRB, *The ESRB Handbook on Operationalising Macro-prudential Policy* (n 171) 212. Similarly, also the ESRB has considered incompatibilities of national macroprudential policy and challenges in implementing macroprudential regulation using the framework of the financial trilemma.

⁴³⁸ Schoenmaker, 'The Financial Trilemma' (n 70) 57. Schoenmaker argues that regarding the three policy goals, "[a]ny two of the three objectives can be combined but not all three; one has to give".

⁴³⁹ Stellinga (n 436) 1442-1443.

⁴⁴⁰ Ibid 1439.

and in the structure of financial sectors, systemic risks are likely to be country-specific to a certain extent. This applies for climate change risks, where in particular physical risk exposures are region- and geography-specific. It is therefore important that NCAs remain able to control, *e.g.*, the timing of deploying macroprudential tools.⁴⁴¹ Member States' macroprudential policy aims may further vary depending on, *e.g.*, the structure of such individual Member State's national financial system and international exposure. Member States with domestically based banks that have a high economic exposure in other Member States would likely aim for financial integration, while Member States with less internationally-focused domestic banks would likely aim for financial stability.⁴⁴² In contrast, the market shares of domestic financial institutions may also potentially have an impact on macroprudential policy stances. For example, Bengtsson concludes on the basis of empirical analysis that in the EU, a large share of foreign banks within a domestic economy increases the likelihood of active macroprudential stances.⁴⁴³

These circumstances give reasons to believe that, especially following private interest theories, macroprudential regulators and supervisors are vulnerable to the interference of self-interest, both internally and externally. These aforementioned instances of self-interest can help offer explanations regarding the rationale as to why the regulatory reality deviates from what the optimal regulation would otherwise be from a public interest perspective. The existence of varying self-interests is further compounded in EU macroprudential decision-making, both because it involves such a diverse range of actors in the regulatory process, and because of potential divergence in the priorities of the individual Member States.

⁴⁴¹ Sapir (n 165) 162.

⁴⁴² Stellinga (n 436) 1442-1443. See also Bengtsson (n 421) 4. In more detail, the theory explains that Member States whose banks conduct less cross-border economic activity will not be as affected if financial integration is impeded, and foreign banks are subject to greater scrutiny in other Member States. Such Member States would, therefore, aim for financial stability, and the gains that arise from promoting it. On the contrary, Member States with domestic banks that conduct extensive cross-border activity would likely support financial integration, either at the cost of a weaker macroprudential policy, or alternatively, by supporting its centralization to the EU.

⁴⁴³ Bengtsson (n 421) 10-12. According to Bengtsson, this could imply, *e.g.*, the persuasive structural power of the domestic banking sector.

6. Conclusion

Climate change risks are becoming systemic and pose a threat to financial stability. Regulatory authorities have progressively started recognizing such risk and exploring the incorporation of such risks into the supervision of banks. This thesis has provided an overview of the discussion on what role macroprudential regulation of the banking sector should play in addressing climate change risk, by examining the issue from the perspective of economic theories of regulation.

A key takeaway from the Financial Crisis was that although microprudential regulation is important, it is not sufficient to ensure financial stability by itself. This realization resulted in an increased focus on a macroprudential approach to regulation, based on a macroeconomic perspective to bank supervision. The central objective of macroprudential regulation is to identify and mitigate systemic risks to financial stability, arising from both the high interconnectedness of the financial system as well as through the accumulation of systemic risk over time. Ultimately, the aim is to reduce the social costs of widespread financial distress.

This thesis also provided an overview of the current macroprudential framework in the EU. The creation of the ESFS, especially the ESRB, constituted a major aspect in the ensuing post-crisis macroprudential regulatory reform. Through the creation of the Banking Union, the ECB has a critical role in macroprudential supervision in the Eurozone. Despite the extensive reforms, the Member States largely remain in control of the implementation of macroprudential regulation. The EU macroprudential toolkit constitutes a part of the Single Rulebook, and requires Member States to designate macroprudential authorities and equip them with various macroprudential tools, such as capital buffers and liquidity requirements. A majority of the tools are, however, provided for in the Capital Requirements Directive IV, and their implementation is largely at the discretion of the NCA. Because of the wide national discretion and implementation power of Member States, the macroprudential policies in the EU still largely diverge between the Member States.

After having established the principles of macroprudential regulation and the toolkit available in the EU, this thesis continued to examine the ostensibly most pressing systemic risk that, not only the European, but the global community currently faces - climate change. Climate change causes unprecedented risks not only to humanity and the world at large, but also to the financial system. To incorporate climate change into financial supervision, regulators classify climate change risks as either physical or transition risks. In the event that

the global community fails to mitigate such risks, the physical and transition risks are collectively capable of creating some of the shock events that macroprudential regulation aims precisely to address: (i) widespread market risk from the re-evaluation of carbon-intensive assets, (ii) a systemic crisis caused by severe and frequent physical risks, and (iii) shocks to the financial system arising from the accumulation of risk due to the macroeconomic impacts of physical consequences of climate change and of the transition to a low-carbon economy. Currently, the risks associated with climate change are not reflected in market prices, nor are they adequately taken into consideration through banks' risk assessments. As the different scenarios developed by the NGFS illustrate, further regulatory delay will only increase the likelihood and aggregation of climate change systemic risk.

Climate change is the consequence of a negative externality of the production and consumption of carbon-intensive goods and services. Simultaneously, climate mitigation also has characters of a public good. The nature of these market failures and the current incapacity of market-based mechanisms to correct the suboptimal capital allocation provide an analytical foundation for appropriate regulation and for explaining why macroprudential regulation is necessary to combat climate change systemic risk. Recent studies by scholars and EU authorities, such as the ESRB and the ECB, have explored potential ways in which the current EU macroprudential tools could mitigate climate change systemic risk. These academic works illustrate how many macroprudential tools appear to be promising options to help mitigate climate change systemic risk, especially the use of large exposure limits, capital buffers, sectoral leverage ratios and the inclusion of climate change exposures in the determination of SIFIs. Ensuring that climate change risks are adequately reflected in banks' balance sheets helps to both increase incentives to divert from carbon-intensive assets, and increase resilience against potential systemic risk. Considering the high costs of climate change on society at large as well as future generations, including the costs if the systemic risk posed to the financial system would materialize, the implementation of such tools can be justified, supported by public interest theories of regulation.

Significant uncertainties around the effects of calibrating macroprudential tools still remain, and an effective implementation might require changes to the structure of the instruments. The Commission, the EBA and the ESRB have recognized that the current regulatory framework is insufficient to provide incentives for the management of climate change risks by banks. In its proposals under the Banking Package 2021 the Commission has suggested possible ways to include explicit obligations to monitor and manage climate change financial risks. The Commission, however, decided to postpone any comprehensive

adjustments to capital regulation, awaiting further assessment by the EBA.⁴⁴⁴ Despite the potential need to amend the macroprudential regulatory framework to better suit climate-related risks, some of the current rules, such as the systemic risk buffer, are flexible and could be implemented to mitigate climate change risks. While regulators and financial institutions have analyzed the risks arising from climate change, only a few countries have acted upon these risks. Alexander aptly summarized the state of play, noting that “systemic environmental risks appear to be in the collective blind spot of bank supervisors”.⁴⁴⁵

Shifting from public interest in theory to in practice, Chapter 5.4 highlights that macroprudential policy faces several challenges relating to its political sensitivity and interest group resistance. Because the costs of macroprudential interventions are felt immediately, while the benefits appear after a significant delay, the supervisory discretion in implementing macroprudential regulation may currently lead to inaction bias, favoring inaction over action. The complexity of the current European macroprudential supervisory framework compounds the issue of private interests, in particular national interests, interfering with the implementation of regulation towards climate change systemic risk mitigation.

While a range of initiatives to increase banks’ climate change risk management are already underway, the urgency of climate change can be considered to require immediate action. Because of the fundamental uncertainty around climate change systemic risks, as to both how and when they will materialize, regulators are postponing action, awaiting further information. Advocates of a precautionary approach to financial regulation support regulatory intervention, despite this uncertainty and the political sensitivity of macroprudential policy. The potential magnitude and irreversibility of climate change risks arguably necessitates bold and urgent regulatory intervention. Mervyn King, the former head of the Bank of England, argues for a more holistic approach to capital regulation thusly: “[i]f the nature of the certainty is unknown... It is better to be roughly right than precisely wrong, and to use a simple but more robust measure of required capital”.⁴⁴⁶ Fortunately, macroprudential regulation was designed to deal with such uncertainty in the face of systemic risk. While the costs of deploying macroprudential regulation to climate change risks are uncertain, regulators and financial institutions are already able to conceive what the

⁴⁴⁴ Commission, Impact Assessment Report (n 168) 54.

⁴⁴⁵ Alexander, ‘Stability and Sustainability in Banking Reform: Are Environmental Risks Missing in Basel III?’ (n 12) 7.

⁴⁴⁶ Mervyn King, *The End of Alchemy: Money, Banking, and the Future of the Global Economy* (WW Norton & Company 2016) Chapter 4, as cited in Chenet, Ryan-Collins and van Lerven, 2021 (n 18) 10.

price of inaction might be. In sum, there is a strong case for deploying macroprudential regulation to mitigate climate change systemic risk.

The interference of private interests and political conflicts is not the only relevant factor to consider when analyzing the difficulties of implementing macroprudential tools and inaction bias. Several other factors might be equally important to consider, either independently or in combination with the factors discussed above, such as regulatory arbitrage.⁴⁴⁷ Further research should also aim to investigate the feasibility and impact of calibrating macroprudential tools for climate change risks in greater detail, and thus, the potential need to update the design of such tools to better suit climate-related risks.⁴⁴⁸ Concerning the EU, the desirability and legitimacy of the current institutional framework and the division of responsibility between the ECB, and the ESRB, and the relevant national authorities present pressing topics of discussion.⁴⁴⁹ It should be emphasized that while important, prudential regulation of banks is not the only instrument to mitigate climate change risk in the banking sector. Other policies, most notably monetary and fiscal policy, to name a few, should also play a role.

⁴⁴⁷ Armour and others (n 22) 84-85.

⁴⁴⁸ The ECB and the ESRB have pointed out that the structure and operation of macroprudential tools themselves might be contributing to inaction bias. ESRB, 'Review of the EU Macroprudential Framework for the Banking Sector – March 2022' (n 12)

⁴⁴⁹ For discussions on this, see, *e.g.*, Stellinga (n 436) and Schammo (n 394).

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