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Report on the monitoring of climate-related risk to financial stability



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REPORT FROM THE COMMISSION

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EXECUTIVE SUMMARY

Multiple efforts are under way at national, European, and global level to measure, monitor and counter the adverse effects of climate change on financial stability. The European Commission has been stepping up efforts to monitor and address potential systemic risks to the European Union's financial system stemming from climate change. This report is based on a mandate given by the Commission's 2021 Strategy for Financing the Transition to a Sustainable Economy. It takes stock of the analytical work being carried out in the European Union (EU) and identifies key challenges related to measuring the impact of climate-related risks on financial stability ⁽¹⁾ and outlines the policy responses taken so far at EU level.

Despite limited available analyses, this report covers both the transition and physical risks of climate change. It finds that the impact on financial stability varies substantially between countries and economic sectors and points to potential systemic risks.

Recent vulnerability analyses have found that loan and investment exposures to mining, manufacturing and electricity are particularly prone to transition risks. On physical risks, loan exposures that subject borrowers to high physical and financial vulnerability in terms of their credit risk are concentrated in certain countries. Sector-specific and economy-wide stress tests have shown that all financial market participants are impacted to varying degrees.

For **banks**, the 2023 stress test led by the European Central Bank (ECB) determines aggregate losses for the median bank between 0.6-1% relative to portfolio size, while the 10% most vulnerable banks lose twice that amount. However, a vulnerability analysis in the 2023 report of the ECB and the European Systemic Risk Board (ESRB) based on new short-term scenarios design combining sudden transition with adverse macroeconomic conditions points to an overall firm-level increase in the Probability of Default (PD) of 2.3 percentage points (pps) on average, with significant variation between industries. For electricity and gas firms, the analysis finds an increase of 7 pps by 2027, of which 5 pps are due to transition risks alone. The higher PDs also translate into a higher credit risk for the corporate loan portfolios in the banking sector. The portfolio PDs for banks are projected to rise by 1.7 pps between 2022 and 2027 and by an additional 0.1 to 0.2 pps due to other modelled shocks. Between 1/2 and 2/3 of the rise in credit risk is due to transition risks alone.

For **insurers** in the European Economic Area (EEA), the 2020 sensitivity analysis shows that losses in equity investments in carbon-intensive sectors can be substantial. They can reach more than 25% loss of value in the adverse scenario modelling high transition risks before accounting for any counterbalancing investments. These losses are driven by investments in fossil fuel extraction, especially oil and gas. For the occupational pension fund sector, analysis reveals that a disorderly transition scenario induces a sizeable 12.9% drop in value, corresponding to asset valuation losses of around EUR 255 billion.

For **investment funds** an adverse scenario would involve an aggregate write-down of 1.2% over the next 15 years, but higher greenhouse gas emitting investment portfolios could face losses of up to 14%. However, using the most recent short-term scenarios combining both a sudden transition and adverse macroeconomic conditions, the European Securities and Market Authority (ESMA) estimates that European investment funds may face reductions of up to 70% of the total value of equity holdings from the shock applied in 2023, with

⁽¹⁾ See action point 3(e) of the ANNEX to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 'Strategy for Financing the Transition to a Sustainable Economy' {SWD(2021) 180 final}.

losses attenuating in later years following dynamic adjustments. However, the overall loss is mainly (i.e., 4/5 of the impact) driven by macroeconomic assumptions rather than the sudden climate transition scenario. The biggest sectoral losses would stem from mining and quarrying, water and waste management and agriculture, forestry, and fishing.

As these stress tests contribute to an ongoing learning process by the industry, supervisors and regulators, the analyses will need to be refined and complemented, to capture (i) all relevant exposures; (ii) interactions between the financial and the real economy; (iii) compounding effects; (iv) interactions within the financial system and (v) environmental risks (biodiversity and nature loss). Current estimates on the impact of climate-related risks should thus be considered as a lower bound or floor estimate for the real impact of climate-related risks, as the current projections are likely to underestimate the overall impact of climate change.

New initiatives such as the Fit for 55 cross-sectoral exercise and other analytical work will improve our understanding of these risks. While the results will only be available in 2025, ongoing discussions on possible micro and macroprudential policy responses allow to establish some key principles: measures should be risk-based, take a holistic approach, capture different sectors, and be coordinated between the authorities responsible for microprudential and macroprudential measures. Building on the ongoing analytical work and the findings of the Fit for 55 exercise, and as part of its overall strategy, the Commission will assess further improvements to the micro- and macroprudential frameworks for banks and non-banks.

INTRODUCTION

This report is structured as follows: Chapter 1 describes the current state-of-play of climate-related financial risk analysis in the EU; Chapter 2 presents the key results of this analysis (i.e., key financial stability risks identified so far) as well as limitations to interpreting these results; Chapter 3 summarises the possible policy responses; and Chapter 4 sets out the policy outlook. The Annex provides more detail on European policy initiatives that tackle climate-related risks.

1 STATE-OF-PLAY OF RISK ANALYSIS

When assessing financial stability, two types of climate-related risks should be considered: physical risks and transition risks. Physical risks are mostly linked to extreme weather events or natural catastrophes caused by climate change. Transition risks drivers refer to policy changes and changes in technology and consumer preferences. Physical and transition risks have balance-sheet effects for non-financial and financial institutions alike. In particular, physical risks may take the form of a natural hazard which could destroy inventory, damage real estate, cause business interruptions, reduce revenues and increase costs. However, transition risks can also have a material impact. Shifts in the regulatory environment (new environmental and climate legislation) or in consumer preferences (change in modes of transportation) may alter the strategy of a company or leave stranded assets behind. Thus, both risks may create institution-specific and systemic financial stability risks through traditional channels, such as credit and market risk, and various transmission and amplification mechanisms.

Related to this, risks stemming from litigation are often also considered as a subset of physical or transition risks (see Network for the Greening of the Financial System

(NGFS⁽²⁾). For example, litigation related to physical risks could arise where a company is found liable for causing a climate hazard, for example a wildfire. As regards transition risks, a company may face legal disputes for investing in polluting activities for instance.

1.1 Progress in data availability and vulnerability analysis

Physical and transition risks can affect all economic actors, including banks, insurance companies, non-financial companies, households, and states.

Measuring these climate-related risks requires two types of data – exposure and risk data⁽³⁾.

- The **exposure dimension** refers to how much entities are exposed to physical and transition risks. For example, for transition risks, it measures how much the operations depend on emissions - which will be targeted by climate policies.
- The **risk dimension** refers to how exposures translate into economic losses. For example, how future profits depend on business activities causing emissions. In addition to the direct impact on economic actors, system-wide effects may depend on interdependencies between hazards or overlapping exposures for entities due to common supplies.

There has been some progress in the measurement of climate-related risks. New datasets were collected or gathered based on newly disclosed information. However, the 2023 ECB/ESRB report⁽⁴⁾ still warns about data gaps and data quality. In particular, direct emissions by firms are 7% higher when externally validated. For households, granular datasets are often missing. For states, the impact from climate risks on expenditures and revenues, other than disaster financing, are very difficult to estimate.

Another difficulty for measuring climate-related risks is the limited data availability and data comparability across jurisdictions. Since capital markets are internationally connected, climate-related risks may spill over not only because natural hazards are contagious but also because of financial or trade flows. While considerable progress has been made thanks to international initiatives⁽⁵⁾, more work is needed to put in place a fully-fledged monitoring framework of climate-related risks that also takes cross-border factors into account.

With respect to physical risk, the Joint Research Centre (JRC) of the European Commission has developed a web-platform for European-wide risk data and methodologies for Disaster Risk Assessment. This platform aims to fill data gaps.⁽⁶⁾

⁽²⁾ NGFS (2021): Climate-related litigation: Raising awareness about a growing source of risk ([link](#)).

⁽³⁾ See ECB/ESRB (2022) The macroprudential challenge of climate change. Figure 2 and Table 1.

⁽⁴⁾ See ECB/ESRB (2023) Towards macroprudential frameworks for managing climate risks.

⁽⁵⁾ See, for example, the FSB progress report on climate-related disclosures, October 2022, <https://www.fsb.org/wp-content/uploads/P131022-2.pdf> and the FSB roadmap for addressing financial risks from climate change, July 2022. <https://www.fsb.org/wp-content/uploads/P140722.pdf>

⁽⁶⁾ <https://drmkc.jrc.ec.europa.eu/risk-data-hub>)

1.2 Progress in scenario analysis and stress testing

The preferred instruments for gauging the impact of climate shocks on the financial sector are stress tests. The key milestones in conducting stress tests are: (1) **designing the scenarios** that underpin baseline and shock developments for macro-financial variables used in the stress tests; and (2) **stress test models** that translate these variables into profit and losses and balance sheet positions of non-financial sectors (companies, households, potentially states) and financial institutions.

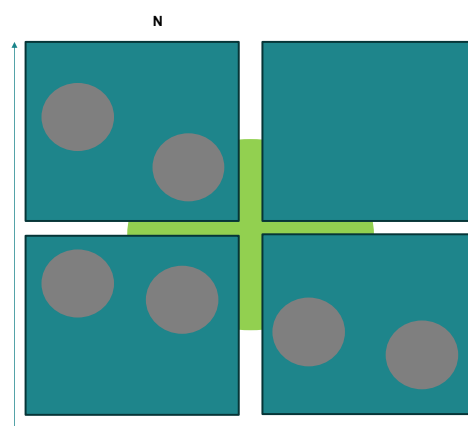
1.2.1 Scenarios

To help with designing scenarios, the NGFS has developed scenarios that are now widely used in public institutions and beyond ⁽⁷⁾. Based on the scenarios and findings of the International Panel on Climate Change (IPCC), these scenarios not only enable regulators and supervisors to better understand the risks they want to explore, but they also help policymakers identifying where we currently are with regards to our climate trajectory and which hypothetical future we are directing ourselves towards.

The first set of scenarios released in 2020 consists of three model scenarios ⁽⁸⁾:

- An *orderly scenario* with early and gradually more stringent policy changes, reaching net zero CO₂ emissions before 2070 with a 67% chance to limit global warming to below 2 degrees Celsius.
- A *disorderly scenario* with delayed and more abrupt policy changes (only after 2030), entailing higher transition risks but still reaching the ‘below 2°C’ target.
- A *hot house scenario* with essentially no policy changes or transition risks, but very high physical risks as emissions rise until 2080, leading to global warming of more than 3 degrees Celsius.

Figure 1: NGFS scenarios



The **second vintage** of 2021 refines and splits each representative scenario into two sub-variants ⁽⁹⁾:

- A variant of the orderly scenario features policies that are now strong enough to limit global warming to 1.5 degrees Celsius (‘Net Zero 2050’).
- The disorderly scenario now also incorporates a variant with divergent cross-sectoral policies. This also implies higher transition costs.

⁽⁷⁾ See, for instance, NGFS Technical Document (October 2021): Scenarios in Action – A progress report on global supervisory and central bank climate scenario exercises. [scenarios-in-action-a-progress-report-on-global-supervisory-and-central-bank-climate-scenario-exercises.pdf](#)

⁽⁸⁾ In addition, five alternative scenarios have been published under the first vintage ‘to help users explore how specifying different key assumptions would change the results.’ For details see [*820184_ngfs_scenarios_final_version_v6.pdf](#).

⁽⁹⁾ NGFS (June 2021): NGFS Climate Scenarios for central banks and supervisors.

- The hot house scenario now includes a variant in which at least already pledged policies are implemented (nationally-determined contributions (NDCs)).

On **transition risks**, three models are used to gauge policies (proxied by the carbon emission price) associated with the global warming outcomes and other key assumptions in the above scenarios, such as assumptions on technological progress and changing consumer preferences. Subsequently, a macro-econometric model⁽¹⁰⁾ maps these scenarios into macro-financial variables as an input for stress tests, such as gross domestic product (GDP), inflation, interest rates, etc.

Similarly, a damage function and the econometric model **map physical climate risks** into macro-financial variables. The latest NGFS scenarios (Phase IV) were released in November 2023. Technical improvements include: (i) enriching the acute physical risk modelling by including two more hazards - droughts and heatwaves, in addition to river floods and cyclones; and (ii) increasing geographical granularity. The updated scenarios also better reflect the latest GDP pathways and country-level commitments, as well as a more disorderly future considering recent developments. Two new scenarios have also been introduced: one exploring the consequences of delayed, divergent, and thus overall ineffective climate action, and another Paris-aligned scenario reflecting the need for substantial behavioural changes to avoid the worst impacts of physical risk. Additionally, the “Divergent Net Zero” scenario was phased out as it was deemed unrealistic that a 1.5 degrees Celsius could be reached without multilateral coordination.

While the latest NGFS scenarios demonstrate rapid and significant progress, **challenges** remain. In particular, refinements are needed to: (i) provide more granular sectoral macro-financial variables; (ii) include additional macroeconomic transmission channels (like the impact of drought on food prices), with an explicit role for the financial sector in transition pathways and (iii) nature loss risks exacerbating climate risks.

While it is too early to say with certainty which scenario our global economy seems to be heading towards, the NGFS scenarios indicate that without some significant policy changes, there would be a risk of alignment with the scenarios under the “Hot House World” category.

1.2.2 Stress test exercises

Stress test models translate macro-financial developments under both the baseline and adverse scenarios into key financial stability indicators for individual financial institutions and for the financial system as a whole. So far, many stress tests of climate-related risks have either focused on certain sectors within the financial system or have provided an economic-wide picture. Many national authorities, as well as EU bodies, including the European Commission⁽¹¹⁾, have made efforts to understand the implications of transition and physical risks for the economy and the financial sector. A selection of exercises carried out by EU bodies is presented below.

⁽¹⁰⁾ NiGEM-model by the National Institute of Economic and Social Research.

⁽¹¹⁾ Alessi et al., (2022), Accounting for climate transition risk in banks' capital requirements JRC Working papers in economics and finance, No. 8, Bellia et al., (2023), Local Banks and flood risk: the case of Germany, JRC Working Papers in Economics and Finance, No 13, and Bellia, et al., (2023), Flood protection gap: evidence for public finances and insurance premiums, JRC Working Papers in Economics and Finance, No 10

Sectoral stress tests for the banking sector

In May 2021, the European Banking Authority (EBA) presented the results of its first EU-wide pilot exercise on climate risk for banks. A total of 29 volunteer banks from 10 countries, representing 50% of the EU banking sector's total assets, participated. The focus of the exercise was on transition risks and on EU non-small to medium enterprises (SME) corporate exposures. The banks' exposure data was evaluated using different classification approaches. Moreover, on physical risk, a joint EBA/ECB tool was used for a scenario analysis and relied on climate risk scenarios developed by the NGFS.

This pilot was designed as a learning exercise for the climate risk assessment and classification approaches to assess the 'greenness' of exposures. Moreover, it was used to investigate how well banks deal with data and methodological challenges⁽¹²⁾.

The ECB 2022 Banking Supervision bottom-up stress test provides further insights on how well banks are prepared to deal with climate risk. The stress test examined 104 significant banking institutions to assess how well they had developed climate risk stress-testing frameworks, climate risk factors and climate risk projections. It also assessed transition risks and physical risks for 41 significant institutions with a constrained bottom-up test. Unlike other stress tests, this exercise focused on building capacities, and the ECB analysed a range of qualitative and quantitative information on the resilience of non-financial corporates and euro area banks to transition and physical risk under the various climate policy scenarios.

Sectoral stress tests for the insurance and IORP (institutions for occupational retirement provision) sectors

In 2018, the European Insurance and Occupational Pensions Authority (EIOPA) conducted a bottom-up stress test for the insurance and reinsurance sector that included a natural catastrophe (NatCat) scenario⁽¹³⁾. EIOPA subsequently developed a set of methodological principles to be considered in future climate change stress tests of the (re)insurance sector⁽¹⁴⁾.

In 2020, EIOPA carried out a top-down sensitivity analysis on the impact of a transition risks scenario on (a subset of) the investment portfolio of insurers in the EEA⁽¹⁵⁾. Using data reported under Solvency II, combined with external data sources, EIOPA mapped insurers' holdings of equity and corporate bonds (including those in collective investment undertakings/CIUs) against climate-policy relevant sectors and technologies (e.g., electric cars in the automotive sector). EIOPA then measured any changes in value of those asset holdings, including government bonds, under a late and sudden transition scenario, and assessed its impacts on the investment portfolio of insurers. The main assumptions used concern data availability issues and extrapolation and model choices. In 2021, they started assessing the insurance sector's exposure to physical risks, with a particular focus on property insurance⁽¹⁶⁾. The latter assessment involved collecting a large amount of data

⁽¹²⁾ EBA (2021): Mapping Climate Risks: Main Findings from the EU-wide Pilot Exercise; link: Mapping climate risk: Main findings from the EU-wide pilot exercise (europa.eu).

⁽¹³⁾ EIOPA (2018): Insurance Stress Test 2018 [Insurance stress test 2018 (europa.eu)].

⁽¹⁴⁾ EIOPA (2022): Methodological principles of insurance stress testing – climate change component [Methodological principles of insurance stress testing - climate change component (europa.eu)].

⁽¹⁵⁾ EIOPA (2020): Sensitivity analysis of climate-change related transition risks [Sensitivity analysis of climate-change related transition risks (europa.eu)].

⁽¹⁶⁾ EIOPA (2022): Discussion Paper on physical climate change risks [Discussion paper on physical climate change risks (europa.eu)].

from a sample of insurers covering 59% of the EEA’s market-wide gross written premium (GWP) of fire and other damages to property (a line of business that accounts for approximately 26% of the total non-life GWP of the sample). While this bottom-up exercise was exploratory in nature, it provided a first assessment of the exposure of the non-life insurance industry in the EEA to key weather-related perils (windstorm, wildfire, river flood and coastal flood risks). The main takeaways are detailed in Section 2.2.2.

In 2022, EIOPA carried out a **bottom-up climate stress test of institutions for occupational retirement provisions** (IORPs) for the first time. It covered more than 65% of the EU IORP market measured by assets ⁽¹⁷⁾. The objective was to test the resilience of European IORPs in a transition risks scenario. This scenario, developed by EIOPA together with the ESRB and the ECB, is based on the ‘disorderly, delayed transition scenario’ of the NGFS ⁽¹⁸⁾ and simulates a sudden, disorderly transition due to delayed policy action, resulting in an abrupt carbon price increase. The scenario does not consider physical risks, litigation risks or second-round effects stemming from climate change, but the carbon price shock is assumed to be frontloaded and, for all the variables, the shocks occur instantaneously on 31 December 2021. Moreover, the scenario does not include the subsequent economic recovery and the benefits stemming from the green transition, and assumes ‘no policy change’, which means neither monetary policy nor fiscal policy actions are considered to offset the impacts of the scenario. While this first climate stress test is considered a learning exercise in an emerging field, it already provides insights into potential drivers and pockets of risk in the EU IORP sector (as described in Section 2.2.2.).

Asset management sector

In 2021, ESMA conducted a first **climate-related financial risk assessment for investment funds** ⁽¹⁹⁾. Using a dataset of EUR 8 trillion of European investment fund portfolio holdings for 23 352 funds, ESMA found that investment funds whose portfolios are tilted towards more polluting assets (in terms of carbon emissions) tend to have more similar portfolios compared to funds with less polluting underlying assets. This is because they tend to directly invest in the same firms affected by climate-related risks. As regards the impact of climate change, the assessment relies on the modelling of two shocks, one from an abrupt change in policy leading to a carbon price of USD 100 per tonne and one stemming from technological change leading to lower CO₂ emissions.

Economy-wide stress tests

At EU level, the ECB/ESRB project team focused on a coordinated banking, insurance, and investment fund scenario analysis in its **2021 report**. The analysis built on and was conducted in the same manner as the **2021 ECB top-down economy-wide climate stress test for non-financial corporates and banks**. It looked at around 1 600 banks, covering up to 80% of the bank loans in the euro area. Both exercises look at non-financial firms and financial institutions/banks in great detail, cover a 30-year time frame, are based on outputs from the first vintage of the NGFS scenarios, and apply a novel set of climate-

⁽¹⁷⁾ EIOPA (2022): 2022 IORP Climate Stress Test Report [2022 IORP Climate Stress Test Report (europa.eu)].

⁽¹⁸⁾ NGFS (2021): NGFS Climate Scenarios for central banks and supervisors (Phase II) [NGFS Climate Scenarios for central banks and supervisors].

⁽¹⁹⁾ ESMA (2021): Report on Trends, Risks and Vulnerabilities, [esma50-165-1524_trv_1_2021 \(4\).pdf \(europa.eu\)](#).

specific models to capture the direct and indirect transmission channels of climate risk drivers via corporates to banks through credit and market risks. The stress test also includes a feedback loop with the real economy ⁽²⁰⁾.

In its **2022 report**, the **ECB/ESRB project team** extended its analysis to multiple areas. The report complements the NGFS scenarios, adding short-term scenarios that incorporate acute physical climate shocks (heatwave, floods) and covering the five most adverse years in the NGFS disorderly transition scenario. Moreover, it uses these scenarios to compare different credit and market risk models by their output results for corporate default probabilities, losses given default, equity prices, and bond spreads. It also assesses the vulnerabilities to transition and physical risks of households and states under these scenarios. Furthermore, it investigates interactions between different sectors within the financial system. It looks at these scenarios using ECB, EIOPA, and ESMA stress test models to gauge their impact on the banking, insurance, and investment fund sectors. Finally, the report discusses dynamic balance sheets as well as amplification mechanisms, and interconnectedness in and across real and financial sectors.

In addition, building on its first top-down climate stress test of 2021, in 2023 the ECB published the results of its **second top-down economy-wide climate stress test** ⁽²¹⁾. This edition introduces new eight-year short-term scenarios that combine NGFS scenarios with adverse macroeconomic projections and provides more detail per sector and per country. Moreover, the modelling allows for potential amplification of transition risks through the supply chain.

In the 2023 report, the **ECB/ESRB project team** improved upon the scenario-based vulnerability assessment. For **transition risks**, it introduced two short-term scenarios: (i) a benchmark scenario; and (ii) a variant with uncertainty associated with the transition. Both share many similarities with two of the three NGFS short-term scenarios.

The benchmark scenario assumes that a sudden transition occurs when there are unfavourable macroeconomic conditions. This causes a 20x price increase for carbon over the 5 years following the transition. The adverse macroeconomic environment is due to geopolitical tensions following Russia's invasion of Ukraine, with gas prices up by 170% from EUR 65 to EUR 180 and oil prices up by 55% from EUR 55 to EUR 85. The transition and the turmoil in energy markets, together with unfavourable macroeconomic conditions, lead to a 10% contraction of GDP (in the first 2 years).

The second scenario assumes, in addition to a sudden transition, an uncertainty shock which is modelled via an increase in the corporate risk premiums of 100 basis points for 4 years, leading to a 15% drop in EU equity prices. For households, a confidence shock is calibrated. The uncertainty shock adds an additional GDP contraction of 1.1% after five quarters.

For **physical risk**, the ECB/ESRB report outlines only a flooding scenario with detailed hazard data, location of firms, assumptions about the share of damaged physical assets and an economic impact.

⁽²⁰⁾ Alogoskoufis et al. (2021): ECB Economy-wide Climate Stress Test; ECB Occasional Paper Series No. 281; Links: [ECB's Economy-Wide Climate Stress Test by Nepomuk Dunz, Tina Emambakhsh, Tristan Hennig, Michiel Kaijser, Charalampos Kouratzoglou, Carmelo Salleo](#) SSRN and [Shining a light on climate risks: the ECB's economy-wide climate stress test \(europa.eu\)](#).

⁽²¹⁾ See Emambakhsh et al. (2023): [The Road to Paris: stress testing the transition towards a net-zero economy](#).

Despite the considerable progress of stress test exercises outlined above, challenges remain. The key challenges will be discussed in Section 2.2.4 below.

2 KEY CLIMATE-RELATED FINANCIAL STABILITY RISKS IN THE EU

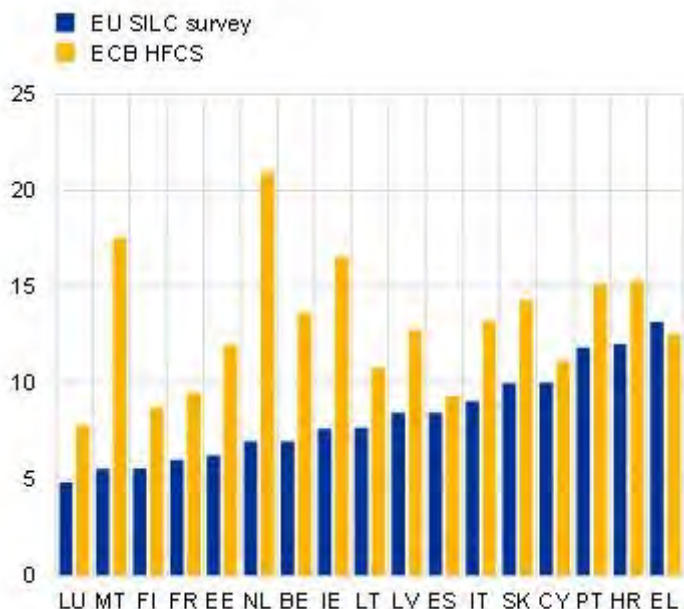
This chapter presents the **key findings of recent exposure and vulnerability analyses and stress test exercises carried out by the ECB/ESRB project team**. The 2023 report involved a rich monitoring framework covering climate change, exposures to climate change and vulnerabilities. It also included indicators for monitoring markets and systemic risk assessment.

2.1 Exposures, risks, and vulnerabilities

Every vulnerability analysis starts with a definition of **exposure metrics**. While the Commission has developed a method to estimate the greenness of financial portfolio ⁽²²⁾, the ECB/ESRB project team ⁽²³⁾ identifies exposure metrics separately for households and financial institutions.

Household exposure to transition risks can be captured via spending on energy and household emissions. But not all households can cope equally well with higher energy spending or more expensive emissions. In turn, the report suggests energy-to-income and energy-to-expenditure ratios which vary considerably between countries, ranging from 5% for energy-to-income in Luxembourg to roughly 12% in Greece (Figure 2).

Figure 2: Average energy-to-income (EU-SILC) and average energy-to-expenditure (HFCS) by country ⁽²⁴⁾



⁽²²⁾ Alessi, et al., (2023), Taxonomy alignment and transition risk: a country-level approach, JRC Working Papers in Economics and Finance No 12, and Alessi et al., (2022), Two sides of the same coin: Green Taxonomy alignment versus transition risk in financial portfolios. International Review of Financial Analysis, 102319.

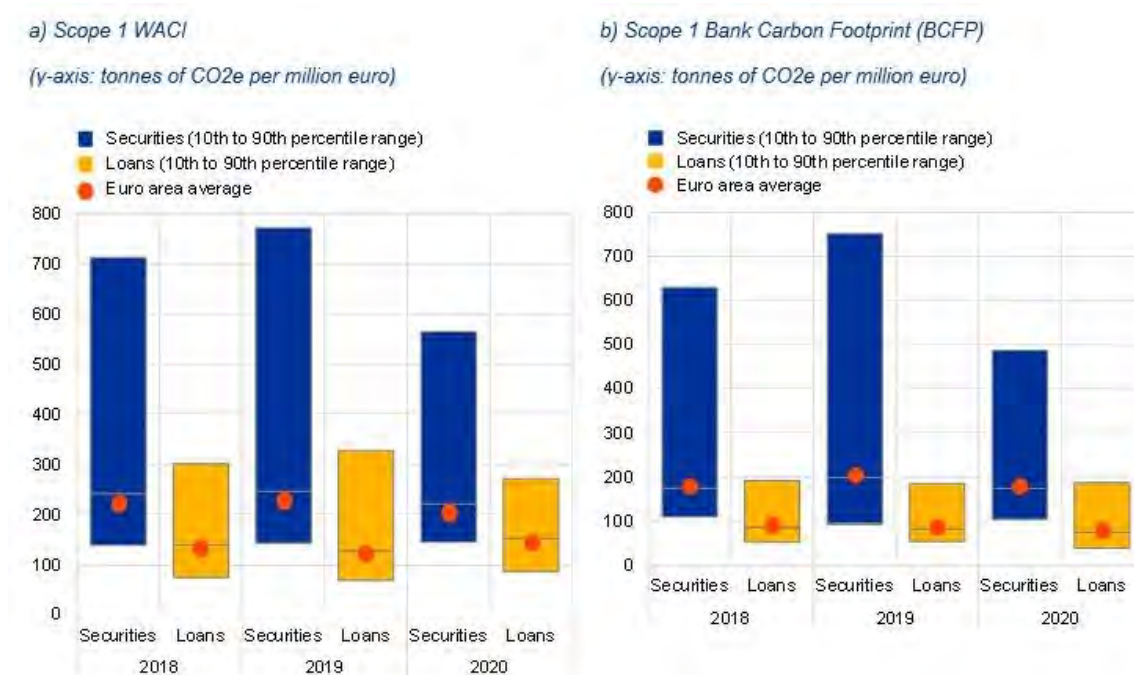
⁽²³⁾ ECB/ESRB (2023) Towards macroprudential frameworks for managing climate risk.

⁽²⁴⁾ ECB/ESRB (2023) Towards macroprudential frameworks for managing climate risk, Chart 1b.

To capture banks' exposure to transition risks stemming from non-financial corporations, the ECB/ESRB proposes several metrics. These include the weighted average carbon intensity (WACI) and the bank carbon footprint (BCFP). The WACI corresponds to the loan-weighted exposure of the euro banking system to carbon-emitting activities of non-financial corporations. In particular, at the bank's loan portfolio level, it is measured as the weighted sum of emissions over revenues of each borrower. The weights correspond to the ratio of the loan for that borrower relative to the total amount of loans in the bank's portfolio.

The BCFP, on the other hand, measures the firms' financed greenhouse gas emissions divided by the outstanding loans or securities.

Figure 3: Exposures of the financial sector to high-emitting firms via loans and debt securities ⁽²⁵⁾



Taken together, both metrics suggest that the **average exposure to transition risks has been stable over past 3 years** no matter the measurement approach used, although there is significant variation between countries.

To transform these exposure metrics into **vulnerability metrics**, exposures must be linked with financial parameters, such as probability of default and loss given default. These measures are designed to detect when high climate-related risks meet financially weak entities. The proposed metrics are therefore differentiated by type of economic activity:

For financial institutions, the ECB/ESRB team proposes several metrics: The **transition-to-credit risk intensity (TCI)** corresponds to the product of a firm's PD and its emission intensity which is then aggregated over the total loan portfolio. A higher emission intensity increases that measure more if the emitting firm has a higher PD. Moreover, the ECB/ESRB report emphasises the need to incorporate forward-looking information since

⁽²⁵⁾ ECB/ESRB (2023) Towards macroprudential frameworks for managing climate risk, Chart 4.

the past may be a poor proxy for the future given the projected evolution of climate change. The ECB/ESRB report therefore estimates the TCI under a ‘sudden transition scenario’.

Figure 4 shows that in 2014-2022 the overall TCI was stable, but of course the pandemic in 2020 with increasing PDs drove the overall TCI upwards just as any other macroeconomic downturn would. Nevertheless, even though the pandemic was a short-term event, it significantly reduced the financial ability - absent of fiscal support - to cushion risks, including climate risks. Based on the projected transition scenario, TCI is expected to triple in the first year of the projection (2023) and remain elevated until 2024. Then, as of 2025, TCI is expected to fall mainly due to the fast reduction in emission intensities, while PDs are expected to remain elevated. ⁽²⁶⁾

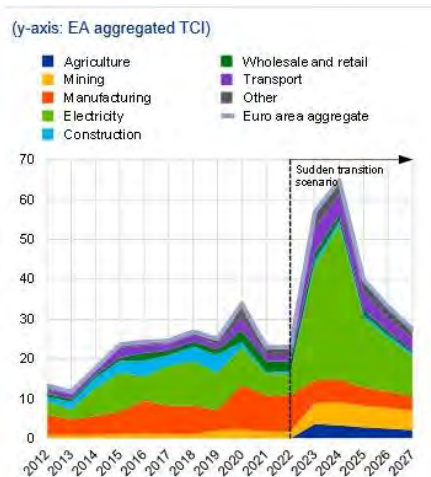


Figure 4: The Transition-to-credit-risk intensity (TCI)

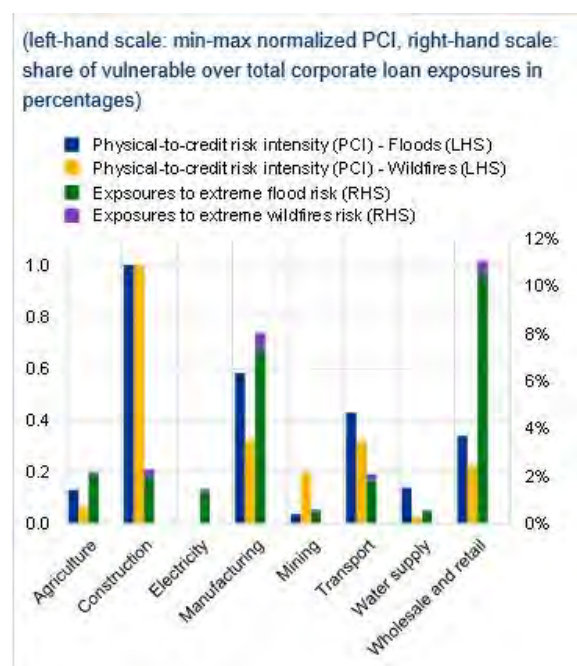
Another proposed metric is climate risk sensitivity (CRS), which relates the expected losses triggered by an increase in carbon prices to the loan exposures.

Although physical exposure metrics are difficult to determine, the ECB/ESRB provides an estimate for physical-to-credit risk intensity (PCI). This is calculated in the same manner as the TCI, but also captures physical risk. Figure 5 ⁽²⁷⁾ shows that the construction and manufacturing industries have the highest PCI scores for floods and wildfires, while simple exposures to flood and wildfire risks are highest for wholesale and manufacturing companies.

⁽²⁶⁾ ECB/ESRB (2023) Chartbook - Towards macroprudential frameworks for managing climate risk, Chart 18a

⁽²⁷⁾ ECB/ESRB (2023) Chartbook - Towards macroprudential frameworks for managing climate risk, Chart 20b

Figure 5: The physical-to-credit risk intensity (PCI)



In addition to these metrics for exposures and vulnerabilities, there are also more system-wide proxies available whose purpose is to capture channels of risk spillovers and risk amplifiers. In particular, measures to assess interdependencies between physical and transition risks have been developed, and amplifiers along the cross-border supply chain as well as measures for overlapping portfolios of financial institutions have been analysed. Section 2.2.4 sets out the results and outlines common challenges.

2.2 Stress test results

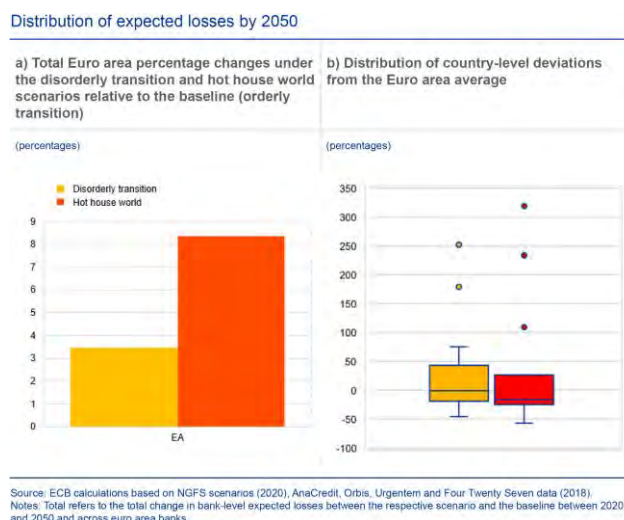
Based on stress test methodologies set out in Section 1.2.2, EU-level stress tests have already identified key risks but have not yet developed into fully-fledged capital adequacy exercises. They clearly demonstrate the benefits of early action and an orderly transition. The following sections summarise key takeaways from the major EU-level stress tests conducted so far.

2.2.1 Banks

For the banking sector and euro area banks (and their corporate clients), the most recent stress test is the **ECB 2021 top-down climate stress test**. This examines stress for non-financial firms and banks under three different scenarios, with the stress captured by different levels of probabilities of defaults (PDs) for firms. Regarding banks, as for the *credit risk channel*, these corporate PDs are then translated into bank loan portfolio's PDs, losses given default (LGDs) and ultimately overall expected losses. Figure 6⁽²⁸⁾ shows the increase in these losses in the two adverse scenarios compared to the baseline scenario of an orderly transition.

⁽²⁸⁾ Alogoskoufis et al. (2021): ECB Economy-wide Climate Stress Test; ECB Occasional Paper Series No. 281, Chart 43

Figure 6: Distribution of expected losses by 2050



For the impact of climate risks on banks' corporate bond portfolios (*market risk channel*), the increase in market losses compared to an orderly transition are shown in Figure 7.⁽²⁹⁾

⁽²⁹⁾ Alogoskoufis et al. (2021): ECB Economy-wide Climate Stress Test; ECB Occasional Paper Series No. 281, Chart 45

Figure 7: Distribution of expected market losses between 2020 and 2050: percentage changes relative to the baseline scenario

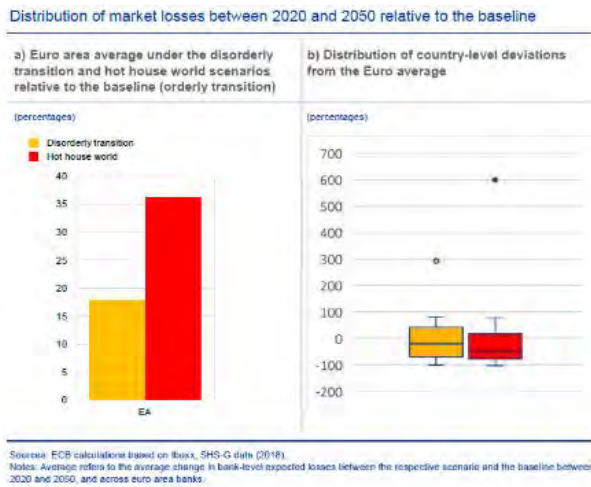
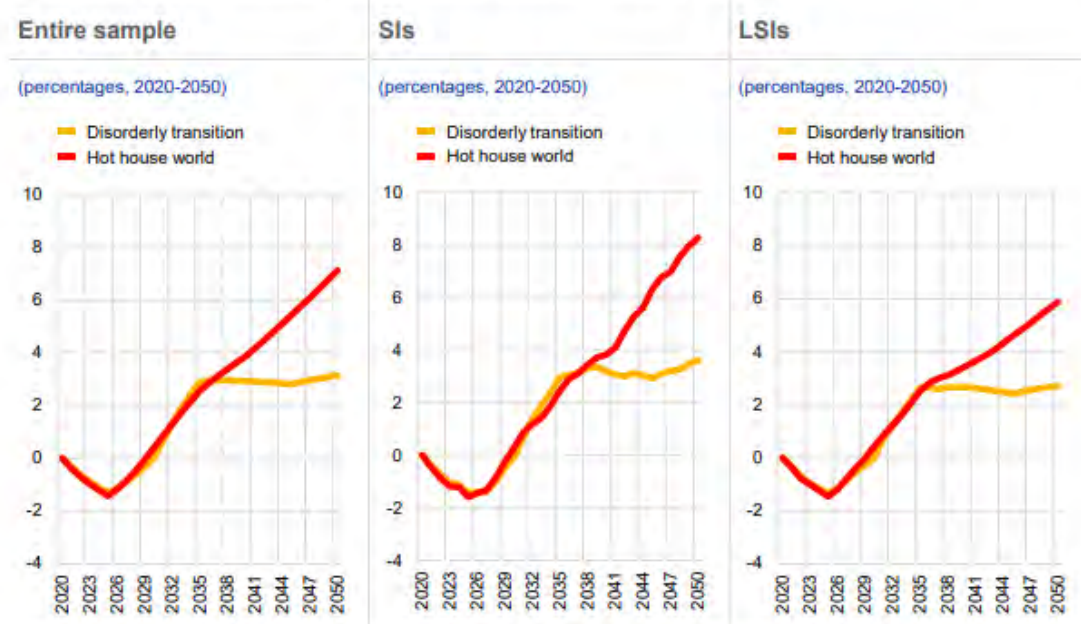


Figure 8: Probabilities of default: percentage changes relative to the baseline scenario

Probabilities of default: percentage changes relative to the baseline scenario

All the charts display the median percentage changes under the disorderly transition and hot house world scenarios relative to the baseline (orderly transition)



Source: ECB calculations based on NGFS scenarios (2020), AnaCredit, Orbis, IBACH, Urgentem and Four Twenty Seven data (2018).
 Notes: Banks are classified as significant institutions (SI) based on the definition set out in the SSM Regulation and SSM Framework Regulation. Median bank refers to the median probability of default per year and scenario of the respective sample.

The exercise therefore demonstrates the overall benefits in terms of fewer market losses of early policy action under the orderly (baseline) transition scenario compared to a disorderly transition.

This is underscored in Figure 8 ⁽³⁰⁾, which makes the same point by comparing default probabilities, which underpin expected losses, over time. Thanks to its level of detail, the exercise also shows that risks of unmitigated climate change are **concentrated geographically as well as in specific sectors**, and physical risks increase non-linearly over time without policy changes. For the corporations and banks most exposed to climate change, its impact could be very significant and could entail systemic risks, particularly for banks with concentrated exposure and mostly driven by physical risk.

The results of the **ECB 2021 top-down climate stress test** are broadly in line with earlier findings from the **EBA EU-wide pilot climate exercise of May 2021** which analysed the same scenarios but was limited to a subset of the corporate exposure of 29 volunteer banks from 10 countries, exhibiting higher levels of expected loss under the NGFS hot house world scenario than would be the case with a disorderly or orderly transition ⁽³¹⁾.

The **2021 ECB/ESRB report** uses the same methodology and has the same level of detail as the ECB 2021 top-down climate stress test. It extends the top-down analysis beyond banks to the insurance and asset management sectors, with the aim of measuring climate risks for the whole EU financial system.

The report confirms the key result of the ECB 2021 stress test, namely **higher credit or market risk losses** in the event of a late or ineffective climate transition, not only for banks but also for insurers and investment funds.

For the **EU banking sector, credit risk losses under the adverse climate scenarios are estimated at 1.60-1.75% of corporate risk-weighted assets over 30 years**. The losses are higher in the hot house world scenario (1.75%) than in the disorderly transition scenario (1.6%). This observation applies both to sectoral concentration of bank losses (with electricity and real estate together accounting for over half of the total impact) and the broader distribution of bank level losses. These losses are around half of those under the adverse scenario used in conventional macroeconomic stress tests, although conventional stress tests have a far shorter time horizon.

The stress test was complemented by the outcomes of the **ECB 2022 Banking Supervision bottom-up stress test**, which was not a typical capital adequacy exercise but rather a learning exercise for banks and supervisors alike. The ECB concluded that, overall, banks have **not yet sufficiently included climate risk in their stress testing and internal models**, although almost 2/3 of banks' income from non-financial corporate customers stem from greenhouse gas-intensive industries ⁽³²⁾. The bottom-up stress test has limited coverage in terms of both the number of banks and their exposure. Nevertheless, it confirms the heterogeneity and concentration of risks across banks and the loss-minimising nature of an orderly transition.

According to the **second ECB climate stress test** carried out in 2023, aggregate losses for a newly designed transition horizon of 8 years vary depending on the scenario but for the median bank they stand at 0.6-1% relative to portfolio size. However, for the 10% most vulnerable banks the impact is expected to double. While the impact remains limited

⁽³⁰⁾ Alogoskoufis et al. (2021): ECB Economy-wide Climate Stress Test; ECB Occasional Paper Series No. 281, Chart 37

⁽³¹⁾ EBA (2021): Mapping Climate Risks: Main Findings from the EU-wide Pilot Exercise; link: Mapping climate risk: Main findings from the EU-wide pilot exercise (europa.eu).

⁽³²⁾ Further information and banks' climate change-related risk management practices and capacity are included in the 2022 ECB Thematic Review on Climate and Environmental Risks (Final results), assessing the banking sector's alignment with supervisory expectations. Link: Presentation: Results of the 2022 thematic review on climate-related and environmental risks (europa.eu).

compared to portfolio size, exposures to transition-vulnerable sectors tend to be concentrated to a subset of carbon-intensive sectors to which systemically important institutions are particularly exposed.

Climate change can also carry a risk when compounded with other factors. The ECB/ESRB project team ⁽³³⁾ therefore looked at relevant short-term scenarios to explore possible compounding effects. It found that compared to a baseline scenario, the **weighted average probability of default would increase by 0.7 pps between 2022 and 2027 due to adverse macroeconomic conditions**. Transition risks adds 1.4 pps, but the combination adds another 0.2 pps. Overall, the increase in the PD stands at 2.3 pps, but there is significant variation between sectors. Electricity and gas firms see an increase in PD of more than 7 pps until 2027, with 5 pps coming from transition risks. The higher PDs translate also into a higher credit risk for the corporate loan portfolios in the banking sector. The portfolio PD for banks rise by 1.7 pps between 2022 and 2027, and by an additional 0.1-0.2 pps due to other modelled shocks. Between 1/2 and 2/3 of the rise in credit risk is due to transition risks alone.

2.2.2 Insurers and occupational pension funds

Regarding the insurance and reinsurance sector, **EIOPA's 2020 sensitivity analysis** shows that losses in equity investments of EEA insurers in carbon-intensive sectors can be high (**reaching more than 25% loss of value in the adverse scenario modelling high transition risks** before accounting for any counterbalancing investments). Losses are driven, in particular, by investments in fossil fuel extraction, especially oil and gas.

While the overall impact on the balance sheets of the insurance sector is counterbalanced by investments in renewable energy and insurers' well diversified portfolios, it is still clear that these investments may expose the insurance sector to transition risks in the event of a late and sudden transition scenario.

For the EU insurance sector, the **2021 ECB/ESRB report** predicts market risk revaluation losses in key climate-sensitive sectors for equity and, to a lesser extent, corporate bond investments over the next 15 years under a disorderly transition scenario. **While average impacts are quite modest**, amounting to about 5.1 pps, revaluation losses under a disorderly transition scenario could be very significant in climate relevant sectors for equity and corporate bond investments. Modelling thus suggests particularly **large losses of 15% for equity holdings in oil, gas and cars/trucks**.

For the occupational pension fund sector, the disorderly transition scenario in **EIOPA's 2022 climate stress test** shows that IORPs are materially exposed to transition risks. **On the asset side, the stress scenario would lead to a sizeable 12.9% drop in value**, corresponding to asset valuation losses of around EUR 255 billion. The bulk of the drop in value would be in equity and bond investments, demonstrating the sector's vulnerability to climate risks, especially regarding investments in carbon-intensive industries. A drop in liabilities due to simultaneously rising interest rates would help offset a large part of the asset-side losses on the funding ratio, although not all. Financial positions of IORPs would therefore still worsen slightly (-2.9 pps). The results of the qualitative questionnaire revealed that 86% of IORPs do not use environmental stress testing as part of their risk management.

⁽³³⁾ ECB/ESRB, 2023, Towards macroprudential frameworks for managing climate risks.

For physical climate change risks, **EIOPA's 2022 discussion paper** looks at the consequences of three major European natural catastrophes and finds that, historically, insurance companies included in the sample have been well placed to handle the resulting claims. It confirmed the conclusion of the **2018 EIOPA insurance stress test** that the groups exposed to the events included in the NatCat scenario were generally resilient to the shocks, but that the events led to a minor decrease in aggregate excess assets over liabilities -2.7% and in the aggregate solvency capital ratio (-3%) post-stress. The limited impact of the NatCat scenario is mainly due to the reinsurance treaties in place, with 55% of losses transferred to reinsurers. The most affected participants are therefore reinsurers and insurers directly involved in reinsurance activities. The results also showed that the NatCat losses affected a limited number of counterparties (the top 5 reinsurers accumulated 53% of the top 10 reinsurance recoveries), highlighting a potential concentration of risk. However, EIOPA's 2022 discussion paper insists that windstorm is the most insured peril (accounting for EUR 42.6 trillion), followed by river flood (EUR 28.9 trillion), wildfire (EUR 22.8 trillion) and coastal flood (EUR 9.1 trillion), and that the future evolution of these hazards may have large negative impacts on the (re)insurance sector.

Moreover, EIOPA stresses that overall coverage is often relatively limited, with only about a quarter of the total losses caused by extreme weather and climate-related events across Europe insured in the past. Insurance protection gaps vary significantly among Member States and among different perils due to differences in exposures and national protection schemes in place, among other factors. EIOPA highlights that raising premiums and amending insurance conditions (e.g., exclusions in risky areas) are likely to lead to higher premiums and less available or affordable coverage for policyholders.

The **second ECB climate stress test** carried out in 2023 estimates how much transition risks translates into losses for insurance companies and pension funds by assessing the losses for the securities portfolios. Insurance companies and pension funds may suffer relative losses of up to 15%, depending on the scenario.

2.2.3 *Asset management companies*

ESMA's assessment of climate-related financial risk assessments for investment funds shows that within the European financial sector, investment funds are more **exposed to climate-sensitive economic sectors than banks, insurers and pension funds** ⁽³⁴⁾. Using a data set of European investment fund portfolio holdings for 23 352 funds worth EUR 8 trillion, ESMA found that total system-wide losses ranged between EUR 152 billion and EUR 443 billion. Solely relying on firm emissions, ESMA finds that most 'brown' **fund losses range from around 9-18% of affected assets. In contrast, funds investing in less polluting firms exhibit losses of 3-8% over 5 years.**

On the EU asset management sector, the **2021 ECB/ESRB report** finds that market risk losses could also affect EU investment funds. Adverse scenarios suggest a direct aggregate **asset write-down of 1.2% in holdings of equity and corporate bonds** (equivalent to EUR 62 billion) in total in the next 15 years. Since most losses in the fund universe are driven by investments in energy producers, they could be amplified in case of fire sales. At fund level, **investment portfolios composed of high-emitting companies could see losses of up to 14%** in total in the next 15 years.

Furthermore, for the **2022 ECB/ESRB report**, the project team developed a framework for the climate risk stress testing of investment funds with two layers of contagion. A stress

⁽³⁴⁾ ESMA (2021) Report on Trends, Risks and Vulnerabilities, [esma50-165-1524_trv_1_2021 \(4\).pdf](https://www.esma.europa.eu/press-material/press-conferences-and-news/esma-report-on-trends-risks-and-vulnerabilities) (europa.eu).

test based on short-term transition shocks suggests that the integration of sustainability information by funds has made network amplification less likely. Overall, ‘greener’ funds display better results, while non-green funds may suffer consequent stress.

The analysis also highlighted that climate risks may amplify the systemic vulnerabilities of investment funds as the transition to a greener economy advances and certain assets become stranded. Investment funds might be hit by a decline in the value of assets under management if they own a significant share of stranded assets, coinciding with financial losses in other parts of the financial system due to common exposures, which could in turn trigger significant outflows and further price dislocation in stranded assets and, potentially, in non-stranded assets as well.

The **second ECB climate stress test** conducted in 2023 found that for investment funds, short-term transition scenarios translate into portfolio losses of up to 12%. According to the 2023 ECB/ESRB report, ESMA estimates a sudden transition scenario combining transition risks with adverse macroeconomic conditions to result in losses of up to 70% of total assets under management immediately after the transition shock hits, followed by a slight recovery in the following years. Around 4/5 of these losses are attributable to the macro-financial component of the scenario modelled leaving a smaller impact for the transition shock, the dynamic fund adjustment, and the uncertainty shock. The biggest sectorial losses stem from mining and quarrying, water and waste management and agriculture, forestry, and fishing. This estimation is based on portfolios of 19 000 European investment funds with EUR 10 trillion in assets under management.

2.2.4 Interpretation of results and common challenges

The various sectoral and economy-wide stress tests demonstrate that, while there are clear benefits to adapting policies early, the overall risks seem to be concentrated on certain sectors, regions, and financial market participants. Similarly, the vulnerability analysis points to certain sectors and regions having significant exposures. It is important to note that these exercises are part of a learning process about climate-related risks. A more refined analysis is needed as current exercises are undermined by data limitations and modelling difficulties. Analysing the exercises leads us to identify eight main shortcomings:

Firstly, while the climate exposure, risk and vulnerability indicators described in Section 2.1 help calibrate important parameters of climate stress test models, **historical relationships** that underpin conventional stress tests are largely missing or misleading when it comes to climate change. In particular, robust links between key economic and financial indicators and climate are missing, while misleading links persist because past climate change data is a poor proxy for the future.

For example, physical risks will increase in frequency and intensity in the future. Replacing past data with forward-looking assumptions is not straightforward since data is scarce, and any forward-looking data is very heterogenous, in terms of information provided, the methodologies and assumptions used, and the reliability of disclosures. This is particularly the case for CO₂ emissions data. Due to the lack of uniform and binding disclosure standards, forward-looking information disclosed by companies is very difficult to compare and aggregate. For instance, firms disclosing forward-looking metrics may rely on different climate-related scenarios (e.g., those developed by the NGFS or the Intergovernmental Panel on Climate Change/IPCC) and emissions pathways (national vs global). Furthermore, the metrics may refer to different time horizons, base or target years, and scope of data (e.g., scope 1/2/3 emissions, absolute emissions vs emission intensity).

Additionally, the Commission has recently shown that despite an increase in data on GHG (greenhouse gases) emissions, overall coverage remains low, and discrepancies could have an impact on firm performance assessment. ⁽³⁵⁾

Box 1: How disclosures of non-financial corporations will improve the measurement of climate-related risks

Several recent EU policies directed at companies in all economic sectors will help improve stress test exercises by making useful data available at company-level.

Large corporations (>250 employees) as well as listed companies (including listed SMEs) are required by the **Corporate Sustainability Reporting Directive (CSRD)** to provide corporate sustainability disclosures covering environmental, social and governance (ESG) information as from the 2025/2026 financial year (depending on their size). The CSRD covers over four times more companies than the previous Non-Financial Reporting Directive/NFRD. It explicitly states that the sustainability report must include forward-looking, retrospective, qualitative and quantitative information covering the short, medium and long term.

The content of CSRD disclosures is further specified in the **European Sustainability Reporting Standards (ESRS)** adopted on 31 July 2023, which provide details on what to disclose according to ESG standards (which include climate topics). As a result, one can obtain a very broad overview on the company itself, on suppliers and customers along the whole value chain, and on the company's history, current situation and forward-looking transition plans.

The ESRS/CSRD reporting also requires the relevant non-financial and financial enterprises to assess and disclose their taxonomy alignment. Focusing on "green"-related aspects, the **Taxonomy Regulation (EU 2020/852)** provides a definition for 'environmentally sustainable activities'. If it is not aimed at assessing risks related to environmentally harmful activities, the Taxonomy yet provides useful information on the "green" part of companies' activity. For non-financial enterprises, the key taxonomy indicators are: (i) the proportion of turnover; (ii) capital expenditures; and (iii) operating expenditures relating to their taxonomy-aligned activities. Financial companies such as banks and insurance companies, on the other hand, are required to aggregate data of their investees to disclose financial indicators, such as the green asset ratio (GAR). The **Taxonomy Delegated Act on Disclosures** provides additional guidance on the content and presentation of such disclosures ⁽³⁶⁾.

In addition to these disclosure requirements, further targeted disclosure requirements affect the following entities:

- It is proposed that issuers that plan to issue non-equity securities that make sustainability-related claims need to provide certain sustainability

⁽³⁵⁾ See Papadopoulos (2023), External assurance of carbon disclosures indicates possible underestimates in reported European corporate emissions data. JRC Working Papers in Economics and Finance, No 9 and Papadopoulos, G. (2022) Discrepancies in corporate GHG emissions data and their impact on firm performance assessment, JRC Working papers in economics and finance, No. 12

⁽³⁶⁾ The obligation results from the CSRD in combination with ESRS that requires to disclose taxonomy-alignment indicators and that this information is audited at a reasonable level of assurance.

disclosures in the attached prospectuses in line with the **Listing Act proposal**.

- Companies choosing to issue bonds using the **European Green Bond Standard** need to publish disclosures for their green bonds that comply with the requirements laid down in the Regulation establishing the standard. This means disclosing the intended allocation of proceeds (before issuance) and progress made in this allocation (yearly).

Companies seeking bank financing (if not covered by the CSRD or the other disclosure requirements listed above) might face **indirect reporting requirements laid down in financial sector disclosure regulations** (e.g. if banks request companies and value chain partners to disclose certain sustainability-related data to meet their own sustainability-linked obligations).

Secondly, it is important to capture **all relevant asset exposures, and for the insurance sector, also liability exposures** in stress test exercises. Due to data limitations, current exercises focus only on certain exposures. For example, for banks, assessed exposures do not include exposures to the trading book, and non-bank financial institutions are sometimes solely assessed in terms of the impact on their equity and bond portfolio holdings (and not technical provisions in the case of insurance companies).

Thirdly, the optimal time horizon needs to be carefully calibrated. The **time horizon** of 1-5 years for conventional stress tests is much too short to examine the full extent of transition risks from climate change. On the other hand, a longer time horizon, such as the 30 years in the NGFS scenarios, can increase uncertainty about the stress test results. In addition, longer time horizons should not distract attention from potential abrupt policy changes, which could lead to rapid transitions. In the most recent 2023 stress test, the ECB developed new short-term transition scenarios with an eight-year horizon.

Fourthly, the short time horizon of conventional stress tests somewhat justifies the simplifying assumption that financial institutions do not adjust their balance sheet and/or change their business model during the examination period (*static balance sheet* assumption). This assumption is put in much more doubt with a longer time horizon, as not allowing for **dynamic balance sheets** and changes in business models would be highly unrealistic. However, the impact of incorporating dynamic balance sheet may be ambiguous. With longer horizons, transition risks may decline if financial institutions react to climate-related risks by reducing their exposures. However, for abrupt changes, dynamic balance sheets may induce fire sales and, in turn, valuation discounts.

Fifthly, especially over a longer horizon, **interactions between the financial and the real economy** need to be sufficiently captured. Financial institutions are likely to implement transition plans and reduce their exposures to transition risks over time. This will likely increase the financing cost for polluting companies and assets, reducing the attractiveness of climate-negative activities and, therefore, possibly mitigating climate change itself. Ultimately, multiple feedback loops from particular sectors between real economic activities and the financial sector come into play, aggravating or mitigating financial risks (evolution of the composition of the investment portfolio towards a higher or lower share of polluting activities).

Sixthly, **interactions between the different sectors of the financial system** are important for evaluating the system-wide exposure to climate risks. For example, over the medium and long-term horizon, the interdependencies of banks and insurance companies may

become increasingly important. Similarly, divestments by investment funds may trigger the re-evaluation of certain assets given their size, which will destabilise investors with similar portfolios.

Seventhly, losses on biodiversity and nature degradation may exacerbate climate-risks in various dimensions.

And finally, climate change could have a **wider and compounding impact on the economy** than currently modelled. In particular, indirect impacts of climate change would need to be considered, including increase in food prices, migration, repricing of assets and rising social inequalities. All these indirect drivers will, in turn, impact the real economy as well as the financial sector, even more so as they could also trigger political instability.

This list of shortcomings may not be exhaustive. The current results of stress tests should therefore be interpreted with caution and are expected to be a floor estimate of the impact of climate-related risks. **Adding and combining the factors described above could significantly increase the measured climate-related risks to financial stability.**

3 OVERVIEW OF POLICY RESPONSES

3.1 Disclosure

Enhanced disclosures allow financial institutions and investors to better assess climate risks. The EU has made advances in this area by adopting three major pieces of legislation:

1. the Sustainable Finance Disclosure Regulation (SFDR), which requires asset managers, insurers and pension providers, banks for their asset management activities, and financial advisers to disclose how their investment decisions affect people and the environment, and how sustainability risks are integrated, both at entity and product level;
2. the Taxonomy Disclosures Delegated Act, which requires the financial sector to provide specific key performance indicators such as the green asset ratio for banks/credit institutions or the green investment ratio for asset managers; and
3. regulatory technical standards for the banking and insurance sectors, setting out disclosure obligations on the exposure to and the management of climate risks.

New disclosure regimes, such as the mandatory requirements set out in the CSRD and the ESRS for corporations adopted in July 2023 (see Box 1 in Section 2.2.4 above), will ensure that financial market participants disclose the data points needed to meet their SFDR requirements.

3.2 Microprudential measures

Banking and insurance rules, namely the review of the Capital Requirements Regulation (CRR3) and Directive (Capital Requirements Directive or CRD6) and of Solvency II, require banks and insurers to integrate ESG risks into their risk management systems.

While quantitative requirements are not yet concerned, EU rules are being stepped up to fully integrate ESG risks (environmental, social and governance) risks into governance, risk management and disclosure requirements. As agreed in the Banking Package, banks will be required to internally perform stress tests on their resilience to climate-related risks.

Regarding insurers, the Commission proposed in the Solvency II review that, if materially exposed to climate-related risks, they should analyse two temperature scenarios (one below and one above 2 degrees). Bank supervisors are tasked with reviewing banks' exposures to and management of ESG risks, including how banks will perform during the transition to the relevant EU and international sustainability objectives.

The adequacy of the management and risk profile of banks and insurers in terms of ESG exposures and sustainability risks should also be reflected in their respective regular supervisory reviews and their own risk and solvency assessments, which may impact their individual capital add-on requirements.

3.3 Macprudential measures

Climate-related risks can be systemic when they trigger spill-over and second-round effects across the financial system. This is because of the interconnectedness across multiple sectors, tipping points and other systemic amplifiers. Thus, while many estimates of losses resulting from first order impacts of climate change appear manageable at face value, particularly over a long horizon, systemic risk channels could amplify their systemic impact.

Four systemic amplifiers were identified by the ECB/ESRB 2023 report:

- (1) **Climate shocks are mutually reinforcing.** Even seemingly localised hazards related to heat and water stress could lead to abrupt financial market repricing.
- (2) **Global supply chains could propagate shocks across borders,** especially in the euro area that is a very open economy. International exposures could magnify domestic losses due to floods especially if there is little possibility for trade relocation.
- (3) **Counterparty risk reinforces risk propagation** through the financial system, through credit, market and liquidity linkages across financial firms.
- (4) **Sovereigns to cover underinsured climate losses:** the insurance protection gap across euro area countries is significant, with only 25% of climate losses currently insured and up to 95% of climate losses uninsured in some countries. It is likely to worsen with the aggravation of climate shocks, leaving both financial institutions and governments heavily exposed to climate risks.

As regards the non-bank financial intermediation, systemic risks arise, for example, for investment funds and insurers as they are more exposed to market risk when they hold larger corporate securities holdings. These asset owners are also interconnected with the banking sector through cross-equity holdings, loans, common exposures, and direct cash deposits.

For investment funds, a political agreement was reached in July 2023 to review the Directive on undertakings for collective investment in transferable securities (UCITS Directive) and the Directive on alternative investment fund managers (AIFM Directive), introducing harmonised rules on the selection and use of liquidity management tools for UCITS and open-ended alternative investment funds. This should allow fund managers and national competent authorities to better cope with redemption pressure under stressed market conditions, including when triggered by climate-related market corrections.

For the insurance sector, new supervisory powers should allow national competent authorities to remedy liquidity vulnerabilities in exceptional circumstances, for example through requiring the reinforcement of liquidity positions or the temporary suspension of redemption rights.

For the banking sector, candidate measures have been identified (see Section 4 or Annex).

3.4 National measures

Since the nature and magnitude of climate-related risks varies across EU Member States, the Commission also endorses country-level policy initiatives to address specific vulnerabilities.

These initiatives are typically part of the European Semester, the Recovery and Resilience Facility, the Technical Support Instrument or the Vienna initiative ⁽³⁷⁾.

Under the European Semester, the Commission publishes country-specific recommendations for each Member State on an annual basis. The Commission has repeatedly drawn the attention to climate-related vulnerabilities that need to be addressed, e.g., in the country reports for Portugal (2023), Bulgaria (2022), the Netherlands (2020) and Greece (2023).

Starting in 2021, the Recovery and Resilience Facility finances reforms and investments in Member States, which should in turn advance the green and digital transitions. The reforms and investments should also make Member States' economies and societies more resilient, thereby indirectly helping to mitigate climate-related financial stability risks. Investments relate, for example, to sustainable mobility, improving the energy efficiency of residential buildings, renewable energy sources and the circular economy.

The Commission's Technical Support Instrument provides tailor-made technical expertise to Member States to design and implement reforms. It includes the flagship project 'ESG risk management framework for the financial sector', launched in 2023 which has been joined by Bulgaria, Cyprus, Greece, Finland, France, Croatia, Ireland, Italy, Latvia, Romania, and Slovenia.

Lastly, under the Vienna initiative, a working group on climate change-related oversight and risk assessment, was set up in October 2021. It focuses on three strands of activity: (i) improving data quality used in the quantification of climate risks facing borrowers; (ii) reviewing recent regulatory developments at EU and international level linked to climate change; and (iii) knowledge sharing and developing a common understanding on the transition paths for different economic sectors. Further details on national measures are set out in the Annex.

4 POLICY OUTLOOK

The Commission is monitoring climate-related risks to financial stability in order to further develop its policy responses. Its key objectives are to improve the measurement of climate-related risks and broader environmental risks to financial stability and to investigate which

⁽³⁷⁾ The European Bank Coordination "Vienna" Initiative is a framework for safeguarding the financial stability of emerging Europe. Since January 2009, the Vienna Initiative has brought together public and private sector stakeholders of EU-based cross-border banks active in emerging Europe, which own much of the banking sectors in that region and also hold a significant part of government securities.

measures are necessary to cushion these risks. Given the urgency of climate change, both objectives must be addressed in an iterative manner. In other words, shortcomings in data availability and quality must not be a reason for postponing investigations into how to cushion these risks.

Progress on **measuring risks** will be made, for example, thanks to the *one-off stress testing exercise* planned for in the Commission's 2021 Communication on a 'Strategy for Financing the Transition to a Sustainable Economy' and which was formally mandated in March 2023 ⁽³⁸⁾. The exercise is conducted jointly by the European Supervisory Authorities, the ECB, and the ESRB.

This will be a cross-sectoral and top-down exercise aimed at testing the resilience of the system during the transition towards the Commission's 2030 climate targets. The exercise will focus on possible near-term shocks that may occur during the implementation of the Commission's Fit for 55 package ⁽³⁹⁾, which is assumed to progress as planned.

The ESRB General Board has finalised the adverse scenarios, which have a short time horizon and a special focus on transition risks in the financial sector until 2030. The impact that the anticipation of increasing physical risks may have on asset valuations will also be considered. The added value of this exercise is its cross-sectoral and system-wide approach.

The exercise will also examine contagion, i.e., how stress propagates through the financial system and produces second-round effects. In other words, how the financial institutions' reactions could amplify stress. It will therefore provide a better understanding of the possible vulnerabilities in the financial system as a whole. The various supervisors will be using their own stress test frameworks, including data and models, and the exercise will be based on end-2022 balance sheet data. This work should produce insights into the financial system's vulnerability to climate risks and into its capacity to support green investments under stress. More generally, policy conclusions are expected by Q1-2025, in time to inform the next mandate of the Commission.

On **cushioning risks**, the Fit for 55 exercise will provide insights into the financial system's vulnerability to climate risks and its capacity to support green investments under stress. These results, in combination with other results from EU stress tests and scenario analysis, will feed into wider policy discussions as already announced ⁽⁴⁰⁾. In particular, the Commission will present its assessment, in a report to be published in 2025, of how risks identified by stress tests or scenario analysis can be integrated into micro- and macroprudential regulation and supervision for banks and non-banks.

Specific measures could come from studies analysing the banking and insurance sectors:

- The EBA and the EIOPA have a mandate to evaluate the risk differential between assets, based on their sustainability drivers ('green', 'non-green' and 'brown' assets). EIOPA is to deliver a report in 2024 and EBA a series of reports. These will provide a better basis for discussing prudential risk-based measures in Pillar 1, based on sustainability profiles, targeting 'green' or 'brown' assets, for example. In October 2023, the EBA published a first report on the role environmental and

⁽³⁸⁾ See [Mandate for the FF55 one-off exercise.pdf \(europa.eu\)](#)

⁽³⁹⁾ See <https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/>.

⁽⁴⁰⁾ See action point 3(e) of the ANNEX to the Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 'Strategy for Financing the Transition to a Sustainable Economy' {SWD(2021) 180 final}.

social risks play in the prudential framework, assessing how the current framework captures these risks. It recommends targeted improvements to accelerate the integration of environmental and social risks across Pillar 1 and sets out areas for further assessment. In December 2023, EIOPA published a consultation paper ⁽⁴¹⁾ on the potential for a specific prudential treatment of sustainability risks, following on from the 2022 discussion paper on methodology and data sources ⁽⁴²⁾.

- Building on the major progress made under the European taxonomy on the definition of ‘green’ activities and building on the final ESA reports on greenwashing in the financial sectors (expected in May 2024), further initiatives could be developed to help curb greenwashing in the EU.
- In addition, the Banking Package review agreed by the co-legislators requires that banks adopt concrete plans to identify and manage ESG risks arising from their business strategies in the medium to long term. The plans must incorporate at least the banks’ sustainability-related commitments and public disclosures (both mandatory and voluntary). Similarly, as part of the Solvency II review, co-legislators have provisionally agreed to require insurers to develop specific plans to monitor and address financial risks arising from sustainability factors, including those arising from the transition to net zero. The proposed corporate sustainability due diligence directive (CSDDD), requires financial service providers above a certain size threshold, including insurers and banks, to draw up transition plans. The Accounting Directive, as amended by the CSRD, will require large companies, including insurers and banks, to disclose their transition plans alongside other non-financial information in their annual management reports.

More broadly, several important aspects need to be considered when calibrating policy responses. Firstly, different time horizons and expected developments in transition and physical risks make it necessary to carefully determine the appropriate time horizon for prudential regulation and supervision. Furthermore, risk transfers between different sectors need to be considered for the financial system as a whole. For example, the insurance protection gap for natural catastrophes and climate-related events, due to a lack of coverage against these risks in some sectors or geographical areas, may have immediate implications for risk exposure in the banking sector and the real economy. Coordination is therefore needed between the authorities responsible for microprudential and macroprudential measures. In addition, although the disclosure framework has developed rapidly in the past few years, it mainly concerns the asset side of the balance sheet, whereas extending disclosure obligations to the liability side could improve transparency.

The Commission will also assess how climate-related policy considerations should be taken into account in the review of the EU macroprudential toolkit for banks and non-banks. For the banking sector, some existing macroprudential instruments ⁽⁴³⁾ could be used to address systemic risks. Possible measures include: (i) a systemic risk buffer (SyRB) (general or sectoral); (ii) concentration limits; or (iii) borrower-based measures (BBMs). While other tools (e.g. counter-cyclical buffer or systemically-important institutions

⁽⁴¹⁾ https://www.eiopa.europa.eu/consultations/consultation-prudential-treatment-sustainability-risks_en

⁽⁴²⁾ https://www.eiopa.europa.eu/consultations/discussion-paper-prudential-treatment-sustainability-risks_en

⁽⁴³⁾ Figure 11 of the ECB/ESRB Project Team report ‘Towards macroprudential frameworks for managing climate risk’.

buffers) could be interpreted, redesigned, or enhanced to address these risks, there are still obstacles to overcome to calibrate them and to avoid unintended outcomes. Policy discussions on important aspects for implementing a macroprudential approach are ongoing in international fora. Further details are set out in the Annex.

The above considerations will help determine the appropriate response to climate-related risks to financial stability. Aside from climate change, the Commission is investigating other environmental risks, such as risks stemming from the loss of biodiversity and the degradation of ecosystems. Work on climate-related risks may help address these separate but related fields. As announced in its strategy for financing the transition to a sustainable economy, the Commission intends in the medium term to extend systemic risk considerations to environment-related financial risks, cover non-bank financial intermediaries and assess the treatment of assets where environmental exposures are unknown.

5 CONCLUSION

Climate-related risks to financial stability are very diverse and their magnitude is not yet fully understood. There are multiple ways through which climate change could impact financial stability. How these risks to financial stability will evolve will depend on the world's mitigation and adaptation efforts and can be minimized with further climate action, done in a coordinated and timely manner. Quantifying the impact of these climate risks on financial stability today is difficult for many reasons, including: (i) uncertainties about links between economic/financial indicators and climate, as they are mainly based on past data; (ii) the vast and variable time horizons involved; (iii) the unprecedented nature of the risks; (iv) the interconnections between financial sectors and the real economy; and (v) how risks could propagate throughout the system.

Over the past years, supervisors, central banks, and researchers have advanced the understanding of some of these risks through stress testing and vulnerability analyses, but significant work remains to be done. Some of the results of these exercises show that the impact of climate risks is concentrated in certain sectors, regions, and financial market participants. The limitations of such exercises, should be noted, however, as it is likely that they underestimate the impact and risks associated with climate change.

Future actions that could significantly improve the precision and magnitude of such exercises include: (i) seizing all relevant exposures; (ii) modelling interactions between the financial sector and the real economy; (iii) factoring in compounding effects; (iv) capturing the interactions between different segments of the financial sector and (v) interactions with the loss of biodiversity and nature degradation. Once all significant shortcomings are addressed, a further assessment of climate-related risks might call for a targeted policy response. In that respect, the Commission's Fit for 55 exercise is an opportunity to learn more about the resilience of the European financial sector, and its results are expected to feed into future policy actions. Calibrating these policy responses will ensure that no blind spots remain in terms of pockets of risk, while at the same time avoiding the double counting of risks.

The prudential framework is developing to properly integrate requirements to address climate-related risks. So far it has focused mainly on risk management and transparency requirements. Building on the ongoing analytical work and the findings of the Fit for 55

exercise, and as part of its overall strategy, the Commission will assess further improvements to the micro- and macroprudential frameworks for banks and non-banks.

6 APPENDIX: POLICY INITIATIVES ADDRESSING POCKETS OF RISK

This Annex details how existing **policy initiatives address today’s key challenges** to measuring climate-related risks, as well as how they address **pockets of risk**. It examines disclosure specific to the financial sector, microprudential policies and macroprudential policies.

6.1 Disclosure

Collecting and disclosing information on climate risks and impacts forms the basis for assessing and managing these risks. Moreover, disclosures can support the drafting of regulatory policies to address climate-related financial stability risks. The EU has released a range of sustainability-related disclosure obligations in the recent years. This Annex provides an overview of requirements for the financial sector specifically, beyond the disclosure obligations described above (see Box 1 above) for non-financial firms.

6.1.1 Cross-sectoral disclosures in the financial sector

The **SFDR** is a transparency framework that requires financial market participants (e.g. asset managers, insurers and pension providers, and banks for their asset management activities) and financial advisers to disclose sustainability information to investors. They must disclose how their investment decisions affect people and the environment, and how sustainability risks are integrated, both at entity and product level (including on their exposure to companies active in the fossil fuel sector, the carbon footprint of their portfolio, and the share of investments impacting biodiversity-sensitive areas).

Financial market participants and financial advisers must also disclose information on how they consider sustainability risks, i.e., publish on their websites information about how they integrate sustainability risks into their investment decision-making process and into their remuneration policies. To meet these disclosure obligations, market participants will rely partly on the sustainability information reported by investee companies in line with the **CSRD** which amends the Accounting Directive (2013/34/EU), with detailed rules set out in the **ESRS** delegated act⁽⁴⁴⁾.

Certain financial companies are themselves subject to the **CSRD/ESRS** and will report on their own environmental, social and governance (ESG) performance, including their climate risk performance and taxonomy indicators. The definition of ‘sustainable activities’ is set out in the **Taxonomy Regulation (EU 2020/852)**.

The **Taxonomy delegated act on disclosures** further specifies the content and presentation of the information to be disclosed under the Taxonomy Regulation and sets out specific key performance indicators for the financial sector. These include the **green asset ratio** for banks/credit institutions and the **green investment ratio** for asset managers.

To provide them with appropriate products, the financial sector is obliged to collect information on the **ESG preferences of their investees (MIFID II)** and insurance policy holders (**Insurance Distribution Directive**). ESG rating agencies will be required by the **ESG Rating Regulation** to provide transparency on their methodologies, operations, and governance.

⁽⁴⁴⁾ Commission Delegated Regulation of 31.07.2023 supplementing Directive 2013/34/EU of the European Parliament and the Council as regards sustainability reporting standards.

Lastly, the **Benchmark Regulation** was updated in 2019 to add a sustainability-related disclosure obligation for benchmark administrators (i.e., entities that provide indices such as DAX and CAC 40), to be used in financial instruments or financial contracts. Benchmark administrators must disclose whether and how a given benchmark or family of benchmarks takes ESG into consideration when designed. They must also publish, in benchmark statements, how well ESG aspects are reflected. The benchmark statement includes some mandatory sustainability indicators. Such disclosures allow users to identify benchmarks that better fit their needs, including from a sustainability risk management point of view, and to benefit from information that eases their own disclosure requirements.

6.1.2 Disclosures in the banking sector

Banks must disclose how they manage ESG risks and take them into account in their governance, as well as how they address climate change transition risks. To that end, the European Commission has adopted technical standards to update the disclosure templates that are to be used by large, listed banks when disclosing ESG risks, in line with the Capital Requirements Regulation. Furthermore, the implementing act adopted in December 2022⁽⁴⁵⁾, will ensure that market participants are well-informed about large, listed institutions' ESG exposures, risks and strategies.

These disclosure measures promote market discipline on the pricing of climate-related risks into banks' funding instruments. The Banking Package agreed by co-legislators (CRR3 review) will extend the requirements to all banks, rather than large, listed banks only, as is currently the case. In addition, to ensure wider transparency on sustainability, the co-legislators introduced new amendments to the Banking Package that require banks to explicitly disclose and report exposures to high-risk and harmful sectors (e.g., fossil fuel-producing sectors).

6.1.3 Disclosures in the insurance sector

As part of the revised implementing technical standards on reporting and disclosure for the insurance sector, insurers will have to report to supervisors the following sustainability-related information: (i) information on the share of investments exposed to climate change-related transition and physical risk; and (ii) information about exposure to climate risks via non-life insurance contracts and whether the design of the relevant product makes allowance for risk-prevention measures (financial incentives for the policyholder to mitigate the underlying insured risk, e.g. through rebates on premiums or lower deductibles, or tailored risk expertise provided by the insurer to advise the policyholder on the available risk mitigation measures). These changes will apply as of end-2023, i.e., as from the 2023 reporting due at the beginning of 2024.

In addition, as part of the provisionally-agreed amendments to the Solvency II Directive, insurers will have to disclose information on their sustainability risks in their **solvency financial and condition report**, to be developed by level 2 and level 3 measures.

(45) Commission Implementing Regulation (EU) 2022/2453 of 30 November 2022 amending the implementing technical standards laid down in Implementing Regulation (EU) 2021/637 as regards the disclosure of environmental, social and governance risks, OJ L 324, 19.12.2022, p. 1–54.

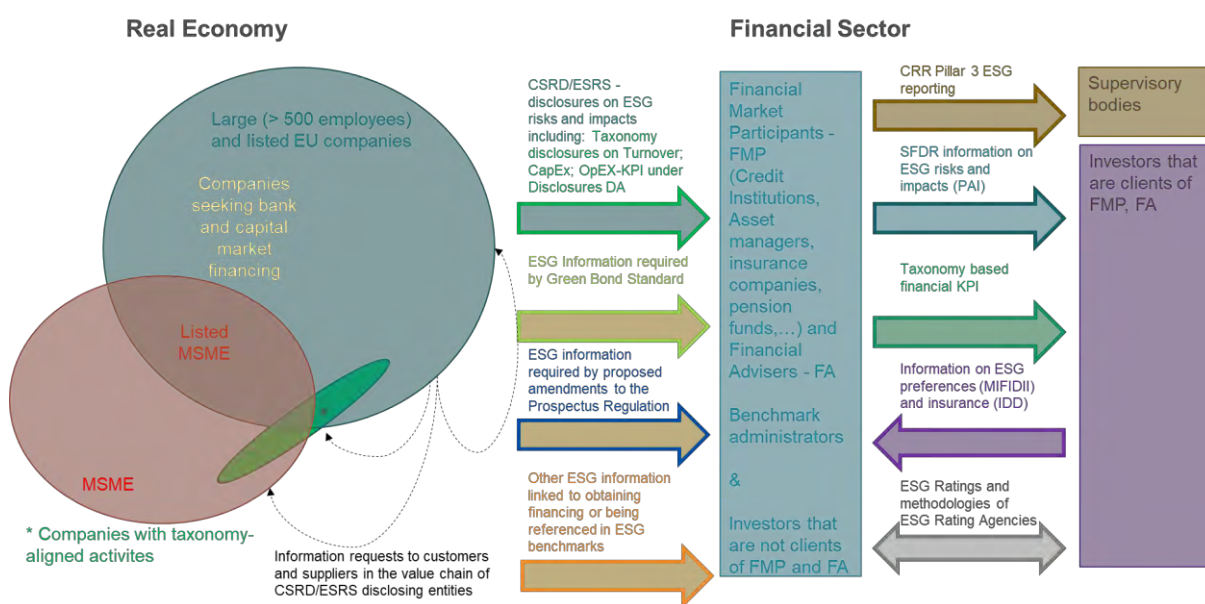
6.1.4 Easier access to publicly-disclosed information: the European Single Access Point (ESAP)

The revised disclosure regime will improve the scope and quality of the disclosed information on climate-related risks. Relatedly, setting up the ESAP will facilitate access to this information by providing one single access point for public financial and sustainability-related information about companies operating in the EU and their investment products. Since the ESAP data will be provided in a digital format and in all EU languages, this platform will also facilitate the analysis, monitoring and supervision of climate-related risks.

6.1.5 Summary and role of disclosures

Figure 9 summarises the sustainability-related disclosures applicable to the financial and non-financial sector, which serve as a basis for regulatory action. The following sections provide more detail on micro- and macroprudential policies addressing climate change risks.

Figure 9: Overview of sustainability-related disclosures



6.2 Microprudential policies

Beyond the measures already in place, the **Banking Package** includes **proposals** for new **Pillar 2 and Pillar 3** measures that would require all banks to systematically identify, disclose and integrate ESG risks into their risk management. Banks would be required to internally stress test their resilience to the long-term negative impacts of climate-related, and more broadly of ESG, financial risks. They would also have to develop concrete medium- to long-term plans to identify, monitor and manage the ESG-related financial risks they are exposed to, and their supervisors would need to assess those plans and the ESG-related risks as part of the regular supervisory reviews. Such plans would need to

consider and be consistent with the bank's voluntary or regulatory sustainability commitments.

Under the proposal, bank supervisors would therefore have to review banks' exposures to and their management of ESG risks and assess banks' capital robustness to meet both the relevant EU sustainability objectives and the broader transition pathways over the short, medium and long term. The adequacy of banks' management and risks profile in terms of ESG exposures is to be reflected in their regular supervisory reviews [SREP], which may impact their individual Pillar 2 capital add-on requirements. In addition, as part of a need to ensure proper supervisory empowerment on sustainability matters, the co-legislators included amendments to the Banking Package that explicitly allow supervisors to require adjustments to the medium- to long-term plans of banks or take other measures as part of their supervisory review process of ESG risks.

The Commission's proposal for the Solvency II review includes a requirement for a long-term climate change scenario analysis. For the insurance or reinsurance undertakings' own risk and solvency assessment (ORSA), this means that a materiality assessment of exposure to climate change risk will need to be performed. If the risk is material, this will need to be complemented by an analysis of the impact of at least two long-term climate change scenarios on the company's business.

EIOPA's Opinion on the supervision of the use of climate change risk scenarios in ORSA⁽⁴⁶⁾ sets out supervisory expectations on: (i) identifying climate change risk exposures; and (ii) the integration, by insurers, of climate change risk scenarios in their ORSA (Pillar 2). As a follow-up to EIOPA's 2021 Opinion, EIOPA published an application guide in August 2022⁽⁴⁷⁾ detailing how to perform a climate change materiality assessment and use climate change scenarios in the ORSA. The guidance aims to help insurers (especially SMEs) to meet their supervisory obligations. EIOPA will monitor the application of their 2021 Opinion by the national competent authorities, as part of their oversight supervisory activities. In addition to the requirements put forward in the Commission's proposal, as part of the provisionally agreed amendments to the Solvency II Directive, insurers will be required to explicitly take into account the short-, medium- and long-term horizon when assessing sustainability risks. Moreover, they will need to develop specific plans, targets and processes to address the financial risks stemming from sustainability factors. Supervisors will in turn need to assess those plans and the sustainability risks as part of their supervisory review process. Insurers will also be required to disclose information on sustainability risks as part of the Solvency Financial Condition Report.

In August 2022, a package of amendments to sectoral delegated acts targeted at the insurance sector entered into force, requiring insurers to integrate sustainability risks and factors into their risk management system (including their ORSA and their remuneration policy) and their investment strategy. It also requires insurers to integrate sustainability factors, risks and preferences into: (i) the product oversight and governance requirements

⁽⁴⁶⁾ EIOPA (2021): Opinion on the supervision of the use of climate change risk scenarios in ORSA (Opinion on the supervision of the use of climate change risk scenarios in ORSA | Eiopa (europa.eu).

⁽⁴⁷⁾ EIOPA (2022): Application guidance on climate change materiality assessments and climate change scenarios in ORSA (Application guidance on climate change materiality assessments and climate change scenarios in ORSA (europa.eu).

for insurers and insurance distributors; and (ii) the rules on conduct of business and investment advice (suitability assessments) for insurance-based investment products.

In addition to the review of the Solvency II Directive, the Commission launched a **Call for Advice to EIOPA to review the rules for occupational pension funds**. EIOPA published its technical advice in September 2023 ⁽⁴⁸⁾, suggesting changes to the IORP II Directive to: (i) further strengthen the inclusion of sustainability-related risks in the investment decisions of IORPs; (ii) consider the long-term impact of investment decisions on sustainability factors; and (iii) better reflect the sustainability preferences of members and beneficiaries.

Further measures are still **under discussion** for Pillars 1-3.

For **Pillar 1**, EBA and EIOPA are working on the prudential treatment of exposures to environmental and social factors. The Basel Committee on Banking Supervision (BCBS) Taskforce on Climate-related Financial Risks (TCFR) will be advancing the debate.

For **Pillar 2**, the BCBS published in June 2022 a set of ‘Principles for the effective management and supervision of climate-related financial risks’ aimed at improving related practices ⁽⁴⁹⁾.

For **Pillar 3**, the TFCR suggests following a sequential approach and building on the disclosure-related work of other international organisations, such as the International Sustainability Standards Board (ISSB). The Basel Committee supported in November 2022 the development of a BCBS Pillar 3 disclosure framework on climate-related financial risks, built on, and complemented by parallel disclosure initiatives being carried out by the ISSB and other authorities. The ISSB in June 2023 issued its inaugural Standards (IFRS S1 and S2), which could be effective for annual reporting periods beginning after 1 January 2024, subject to potential jurisdictions’ timelines.

The remaining subsection will **analyse how both current and upcoming microprudential measures cater for climate-related financial risks to financial stability**. One key consideration is the policy **interplay between macroprudential and microprudential measures**. The macroprudential response to financial stability risks should collaborate with its microprudential counterpart to ensure a continuum, while being mindful of potential trade-offs. In certain cases, regulatory tools may well be justified from both a microprudential and a macroprudential perspective. In the overall context of climate-related financial risks to financial stability, both will also depend on, and interact with, a broader set of public policies aimed at limiting and adapting to climate change.

To complement the policy initiatives already implemented or envisaged under the 2021 Banking Package (i.e., new Pillar 2 and extension of Pillar 3), Pillar 1 measures will also be implemented. The Capital Requirements Directive sets out five capital buffer requirements that form a combined buffer requirement. These requirements are set at bank entity or group level to address system-wide risks. These buffers must be met with CET1, on a cumulative basis, except for the global systemic institution buffer (G-SII) and the other systemically-important institutions buffer (O-SII), in which case the higher buffer will apply.

⁽⁴⁸⁾ https://www.eiopa.europa.eu/publications/technical-advice-review-iorp-ii-directive_en

⁽⁴⁹⁾ BCBS (2022): Principles for the effective management and supervision of climate-related financial risks. <https://www.bis.org/bcbs/publ/d532.htm>

The denominators of these buffer requirements are the level of risk-weighted assets (RWAs) of the banks. As RWAs would be impacted by the common Pillar 1 and individual Pillar 2 requirements for each of the risk standards used to compute the bank's total RWAs (i.e. under the credit risk, market risk, and operational risk approaches used by the bank), macroprudential measures would need to reflect all climate-related financial risks not embedded in the idiosyncratic bank's RWAs to essentially capture all remaining systemic aspects of climate risks for each risk category that are compounded at a system-wide level.

The authorities responsible for macroprudential policies should consider microprudential requirements and coordinate with microprudential authorities before taking steps to ensure the most effective and coherent policy mix to mitigate climate-related risks at the macro level. Macroprudential measures are outlined in the next section of this report.

G-SII and O-SII buffers may already partly address second-round effects, as the most systemically relevant banks hold additional capital to address the potential negative effects that these institutions would have on the international or domestic financial system if they were to fail. However, while these buffers take direct interconnections into account through the underlying indicators, this may not be the case for indirect interconnections such as common exposures and portfolio overlap and correlations. Banks may be exposed to similar climate risk concentrations across jurisdictions or geographic areas or sectors vulnerable to climate-related risks, which may raise systemic concerns beyond each individual bank's risk.

Furthermore, most exposures to large non-financial corporations (NFCs) across systemically important banks may be linked to companies with similar climate risk profiles via capital markets. Through exposures of those NFCs to common climate risk factors and similar capital markets funding channels, systemically important banks may become exposed to correlated losses. In this regard, the key consideration is to what extent there would be a need to adjust the levels (or indicators) of the systemically- or domestically-important bank buffers.

The materialisation of physical and transitional climate risks has a time-dimension, but it is not clear whether this affects financial cycles/cyclical systemic risks. Additionally, time-variant systemic financial risks related to climate change, e.g. the possibility of 'green financial (boom/bust) cycles' could deviate from 'standard' financial cycles, and may merit further exploration, depending on their significance.

Two legal frameworks relevant to **asset management** have been amended, mainly to ensure that fiduciary duty embeds sustainability-related risks. These are: (i) the Commission Delegated Regulation on the Alternative Investment Fund Manager Directive⁽⁵⁰⁾; and (ii) the Commission Directive implementing the UCITS Directive⁽⁵¹⁾.

6.3 Macroprudential policies

Climate change has the potential to affect the entire economy and be a significant threat to financial stability, as it could contribute to the build-up of systemic risks. This is due to the relative unpredictability, potential magnitude and far-reaching impact of climate change. While certain aspects of climate risks can be tackled with microprudential tools in Pillar 1, Pillar 2 or Pillar 3 frameworks, as indicated in Section 6.2 above, its systemic dimension

⁽⁵⁰⁾ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021R1255>.

⁽⁵¹⁾ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32021L1270>.

(spill-over and second-round effects across the financial system, interconnectedness and tipping points) might warrant a macroprudential response. Policy interplay needs to be carefully calibrated, as climate change is addressed by a broader set of public policies, which depend and build upon one another. The unprecedented nature of climate change requires coordinated action (NGFS, 2019) and a wider policy response, as well as a consistent approach across sectors.

As research progresses, the system-wide relevance of both physical and transition risks, and consequently the need for a macroprudential policy response to address financial externalities (that microprudential regulation does not address, as it focuses on the idiosyncratic risks of individual institutions) becomes more obvious. The ECB/ESRB project team's work on climate change-related financial risks, alongside other ongoing initiatives, e.g. by the Financial Stability Board (FSB)⁵², BCBS and EBA, seeks to identify and develop evidence-based policies to address such systemic aspects of climate-related financial risks (⁵³).

Some existing macroprudential instruments (⁵⁴), such as the SyRB, could address climate-related systemic risks in the banking sector (⁵⁵). Concentration limits or BBMs could also be explored, while other tools (e.g. counter-cyclical buffers or systemically-important institution buffers) could be interpreted, redesigned, or enhanced for these purposes, but obstacles to their calibration and potential unintended outcomes (⁵⁶) may need to be overcome.

The SyRB, designed to cater for systemic risks that are not covered by other available macroprudential instruments, seems the most suitable tool to also address climate-related risks. Given this flexibility of the SyRB framework, various design options could be envisaged for this tool, according to the latest ECB/ESRB report. A broad application of the SyRB could cover all banks (one single rate) or, for a more targeted calibration, a general SyRB with multiple rates applying to different risk buckets could be designed. The SyRB could also be calibrated in order to specifically target the concentration of exposures that are more sensitive to climate-related financial risks.

(⁵²) Taskforce on Climate-related Financial Disclosures.

(⁵³) In the fourth and final year of its mandate, the ECB/ESRB project team proposes three frameworks for relating climate risks to financial stability: (i) addressing risk surveillance; (ii) macroprudential policy; and (iii) broader risks to nature.

(⁵⁴) Figure 11 of the ECB/ESRB report 'Towards macroprudential frameworks for managing climate risk'.

(⁵⁵) 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 (CRDVI) explicitly acknowledges that the provisions in Article 133 on the systemic risk buffer framework may already be used to address various kinds of systemic risks, including risks related to climate change.

(⁵⁶) Table 13 of the ESRB/ECB report '[The macroprudential challenge of climate change](https://www.europa.eu)' ([europa.eu](https://www.europa.eu)).

To apply the SyRB to different sectors, the EBA Guidelines ⁽⁵⁷⁾ could benefit from some adaptation, such as adding new definitions or sub-dimensions (including more granular sector classification levels or even firm-level data) ⁽⁵⁸⁾.

Concentration thresholds could also be applied to limit banks' exposures to the geographical areas or sectors most exposed to climate risks. Such measures could discourage or even prevent further increases in systemic risk. If accurately calibrated, they might also incentivise banks to reduce their exposure concentrations. Climate-related concentration risks do not currently appear to be fully captured by the large exposure Pillar 1 framework. Therefore, at EU level, the EBA could propose amendments to the supervisory reporting and disclosures framework, as well as the development of environment-related concentration risk metrics.

BBMs have been identified as another useful instrument for taking climate-related financial risks into account. BBMs are targeted, flexible tools, that could be applied (e.g., for mortgages) depending on whether properties are more (or less) exposed to physical and transition risks. They are, however, designed/implemented at national level (i.e., they are not integrated into the EU legal framework) and because they are considered before a loan is actually granted, they can only apply to new loans. Exploratory work on BBMs (on current and potential future regulatory practices) is under way to examine whether they could be used across the EU as a tool to protect banks against climate risk.

The non-bank financial intermediation (NBFIs) sector plays a critical role in the structural build-up and potential materialisation of climate-related financial stability risks. Climate shocks, especially in a delayed transition scenario (see Section 1.2.1), are likely to first result in revised market expectations (in equity and corporate bond markets), before hitting the balance sheet of banks. Investment funds and insurers are inherently more exposed to market risk due to larger corporate securities holdings but remain nonetheless interconnected with the banking sector through cross-equity holdings, common exposures and direct cash deposits. Climate-induced market corrections may initiate fund redemptions and possibly trigger fire sales across fund and insurance holdings. Leverage may further amplify such market pressures.

On investment funds in particular, in July 2023 a political agreement was reached on the review of the UCITS Directive and the AIFM Directive, which will introduce harmonised rules on the selection and use of liquidity management tools for UCITS and open-ended alternative investment funds. This should allow fund managers and national competent authorities to better cope with redemption pressure under stressed market conditions, including when triggered by climate-related market corrections. New supervisory powers for the insurance sector should allow national competent authorities to remedy liquidity vulnerabilities in exceptional circumstances, for example through requiring the reinforcement of liquidity positions or the temporary suspension of redemption rights. Further policy exploration can be carried out to develop concentration risk instruments.

⁽⁵⁷⁾ EBA 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 Directive 2013/36/EU.

⁽⁵⁸⁾ In this sense, the EBA (2023b) has expressed its readiness to assist in the review of these guidelines, notably on the appropriate subsets of exposures to which the competent authority or the designated authority may apply a systemic risk buffer.

The **potential for the NBFIs sector to further improve the management of climate-related financial stability risks and system-wide risk-sharing** also needs to be considered. For example, capital markets may price climate-related risks more efficiently than less liquid loan markets. Moreover, reducing the insurance protection gap may limit the potential impact of climate-related risks on the real economy⁽⁵⁹⁾. The insurance-climate protection gap is being discussed as part of the Commission’s climate resilience dialogue, in order to reach a common understanding among stakeholders on the climate-protection gap in insurance, and to explore solutions to address this gap at EU level.

Various key aspects (e.g., legal basis, nature of mandates, precise policy calibration) need to be considered when putting in place a macroprudential approach to addressing systemic risks related to climate change. The debate on its application and effectiveness will therefore continue until further progress is made in the relevant fora, and until a stronger body of evidence is gathered. In the near future, climate-related policy considerations could be taken into account as part of the review of the EU macroprudential toolkit for banks and non-banks.

6.4 Country-specific initiatives

Since the nature and magnitude of climate-related risks varies between Member States, the Commission also encourages each EU country to introduce their own policy initiatives to address specific vulnerabilities.

6.4.1 *European Semester*

Every year the Commission proposes country-specific recommendations accompanied by country reports in which it identifies and analyses the main challenges faced by each Member State. The Commission has repeatedly drawn countries’ attention to climate-related vulnerabilities that need to be addressed. For example, the Portuguese country report (2023) highlights that the financial sector ‘remains exposed to natural catastrophes, including low-frequency catastrophes such as wildfires, earthquakes and – increasingly – floods, particularly in the southern part of the country’. The Bulgarian country report (2022) underlines that ‘there are significant public budget climate risks for Bulgaria, with insurance coverage for floods and wildfires rather low’. The Dutch country report (2020) notes that: ‘Due to the risks that the energy transition might have on financial institutions, the central bank is also including the data on sustainable assets owned by financial institutions in its stress test scenarios. Furthermore, Dutch banks have pledged to measure, monitor, manage and reduce the environmental footprint of their balance sheets’. As a final example, the Greek country report (2023) points out that ‘Greece has one of the highest insurance protection gaps in Europe for natural disasters, particularly earthquakes and wildfires.

6.4.2 *Recovery and Resilience Facility*

The Recovery and Resilience Facility (RRF), which entered into force on 19 February 2021, finances reforms and investments in Member States from February 2020 (start of the COVID-19 pandemic) until 31 December 2026. To that end, it makes available EUR 723.8 billion in loans (EUR 385.8 billion) and grants (EUR 338 billion).

⁽⁵⁹⁾ ECB-EIOPA Discussion Paper [Policy options to reduce the climate insurance protection gap \(europa.eu\)](https://www.ecb.europa.eu/press/pr/discussion_papers/2022/20220901/discussion_paper_20220901_en.pdf).

To benefit from RRF support, Member States submit recovery and resilience plans to the European Commission, setting out the reforms and investments to be implemented by end-2026. Member States can then receive financing for these actions, up to a previously agreed amount. Each plan should effectively address the challenges identified under the European Semester, particularly the country-specific recommendations adopted by the Council. It should also advance the green and digital transitions and make Member States' economies and societies more resilient. The resources allocated to the green transition pillar of the RRF are substantial and directly or indirectly help mitigate climate-related financial stability risks.

For example:

- In Italy, 37% of resources from the RRF are allocated to the green transition pillar. They are directed towards sustainable mobility (EUR 32.1 billion), energy efficiency related to residential buildings (EUR 12.1 billion) and renewable energy and circular economy (EUR 11.2 billion).
- In Spain, 40% of resources from the RRF are allocated to the green transition pillar. They are directed towards innovative renewable energy sources (EUR 3.9 billion) and energy efficiency in residential renovations (EUR 3.4 billion). The Spanish recovery and resilience plan also includes a law on climate change and energy transition, which is currently in force.
- In Austria, 59% of resources from the RRF are allocated to the green transition pillar. They are directed towards emission-free transport (EUR 0.3 billion), the circular economy (EUR 0.2 billion), energy efficiency for residential buildings (EUR 0.2 billion) and environmental mobility (EUR 0.5 billion). The Austrian recovery and resilience plan also includes changes to the tax system to benefit the climate.

6.4.3 Technical Support Instrument

The Commission's Technical Support Instrument (TSI) provides tailor-made technical expertise to EU Member States to help them design and implement reforms. Several TSI projects are directly or indirectly related to climate-related financial stability risks. One key project is the 'ESG risk management framework for the financial sector', a flagship project launched in 2023 which has been joined by Bulgaria, Cyprus, Greece, Finland, France, Croatia, Ireland, Italy, Latvia, Romania, and Slovenia.

Earlier, in 2022, the project titled 'Sustainable finance – supervisory capacity enhancement' benefited Croatia, Malta, Poland, and Romania.

Many other similar projects have benefited specific countries, such as: (i) a Greek project (2021) enhancing 'processes, methodologies of the Bank of Greece on conduct and product oversight supervision in the area of insurance as well as a research into protection gaps in insurance'; (ii) a Hungarian project (2022) 'developing a supervisory framework for financial risks stemming from biodiversity-related losses'; and (iii) a Romanian project (2021) supporting an 'environmental scenario analysis and climate risk assessments for Austria and Romania'.

6.4.4 Vienna initiative

As part of the Vienna initiative, a working group on climate change-related oversight and risk assessment was set up in October 2021. This working group has three workstreams focusing on:

- i. The availability of relevant data and improving data quality, with the aim of making a review of current practices in the compilation of information/data used in the quantification of climate risks facing borrowers. The workstream will help with drafting a common questionnaire on indicators of SMEs' exposure to transition and physical risks.
- ii. Regulatory developments and supervisory practices: This workstream has been focusing on reviewing recent relevant regulatory developments at EU and international level linked to climate change (for example, regarding the treatment of infrastructure financing). It also focuses on current practices in the central, eastern and southeastern country region (which are quite diverse in terms of complexity and focus).
- iii. Transition scenarios and strategies, aimed at knowledge sharing and common understanding of the transition paths for different economic sectors, in the context of macroeconomic scenarios and country strategies.

The findings of the work streams have been discussed in several workshops of the working group, and a dedicated report will be endorsed by the Full Forum of the Vienna initiative.

