EUROPEAN CENTRAL BANK

EUROSYSTEM

Climate-related risks and a macroprudential framework

MPPG workshop, Vilnius

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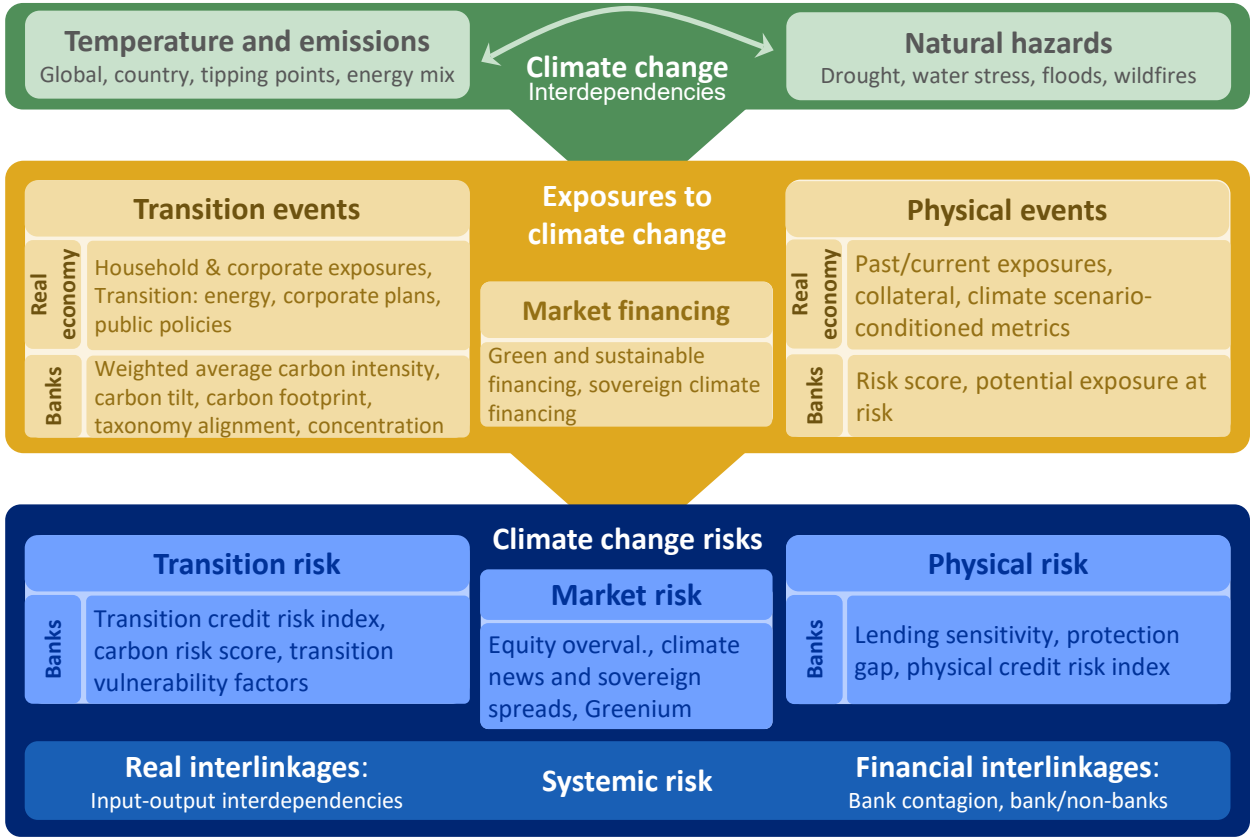
Overview

1. Climate-related factors
2. Transition risk
3. Physical risk
4. Concluding remarks towards policy

Surveillance framework for climate-related financial stability risks

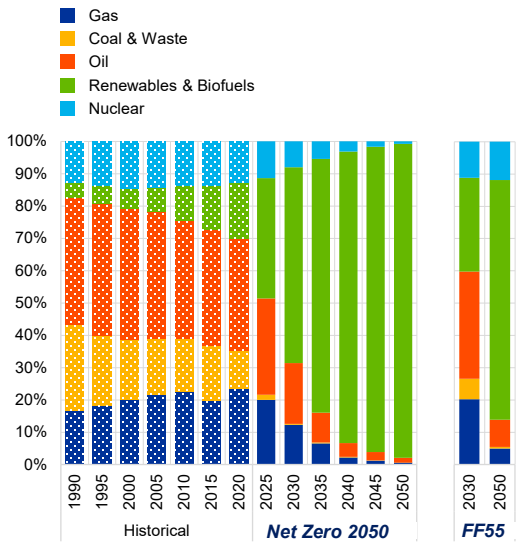


Source: ECB/ESRB Project Team on climate risk, 2023.

Climate-related factors

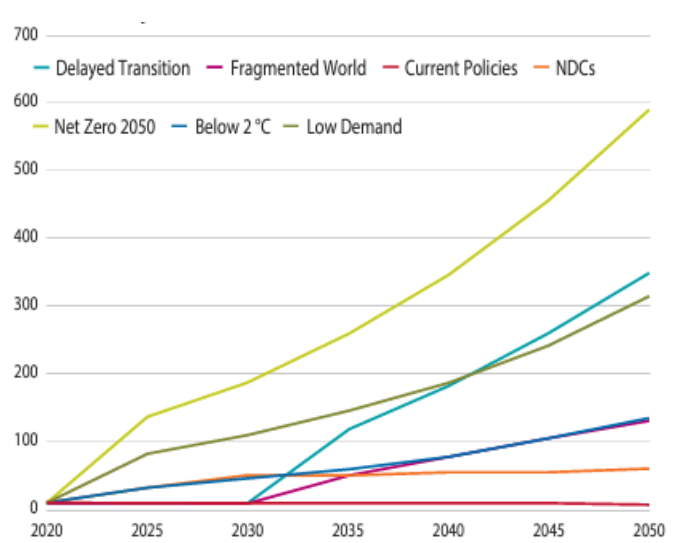
Climate transition implies large and uneven energy adjustment with uncertain carbon price pathways and non-pricing policies

Historical and projected EU energy mix, and energy mix compatible with current renewable energy targets



Sources: Eurostat Energy Balances, NGFS Climate Scenarios and JRC Energy Scenarios Interactive Tool. Notes: Projections based on "Net Zero 2050" MGFS scenario and the "fit for 55" package (FF 55) is based on the EU Reference Scenario by the European Commission.

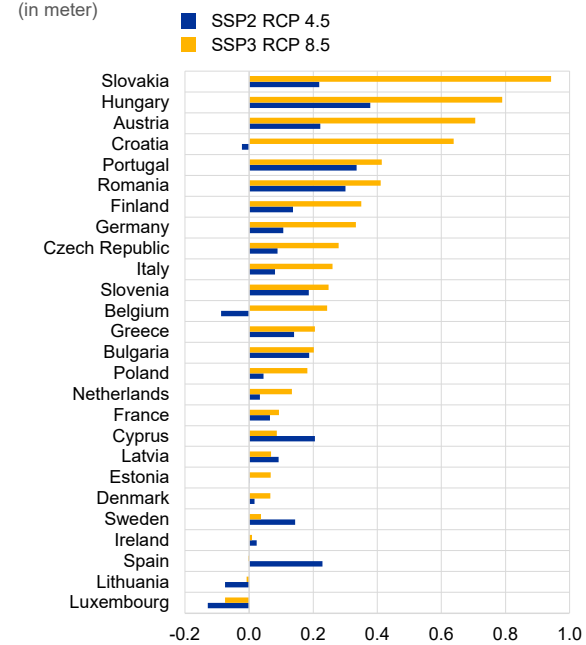
Shadow Carbon Price



Source: IIASA NGFS Climate Scenarios Database, REMIND model. Published in "NGFS Scenarios for central banks and supervisors" (NGFS, 2023). Shadow carbon prices are a weighted average of regional carbon prices at global level, see IIASA Portal. End of century warming outcomes shown.

Magnitude of physical risk heterogeneous across countries, hazards and transition scenarios

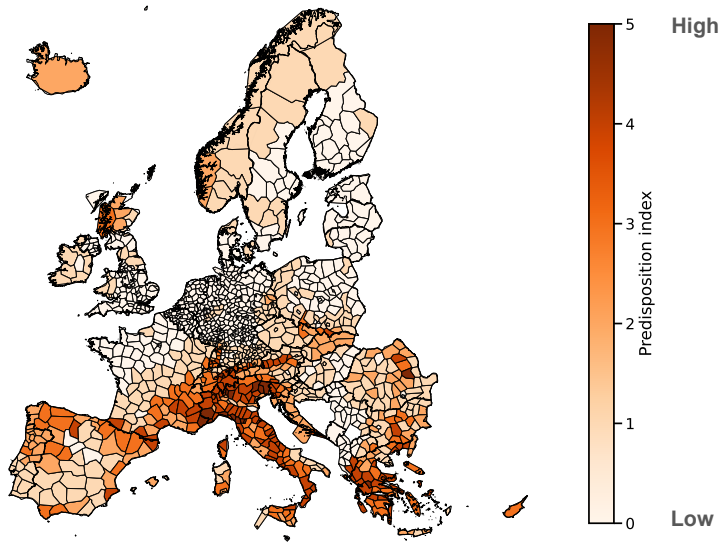
Projected change in flood intensity by 2050 of 100-year return period



Source: TU Delft. Published in "Chartbook for monitoring financial stability impacts of climate" (ECB/ESRB Project Team report, 2023). Notes: Flood intensity measures the projected increase in water depth during historical flood events. Data aggregated at country level taking weighted averages across affected areas.

Landslide predisposition in Europe

(Predisposition index (1-5), median, 100-year return period)



Source: DRMKC RDH (JRC). Published in "Climate change-related statistical indicators" (ECB SSC, 2024). Notes: Data aggregated at NUTS3 level taking medians across affected areas. Scores for landslides 100-year return period from 1 (low) to 5 (extremely high).

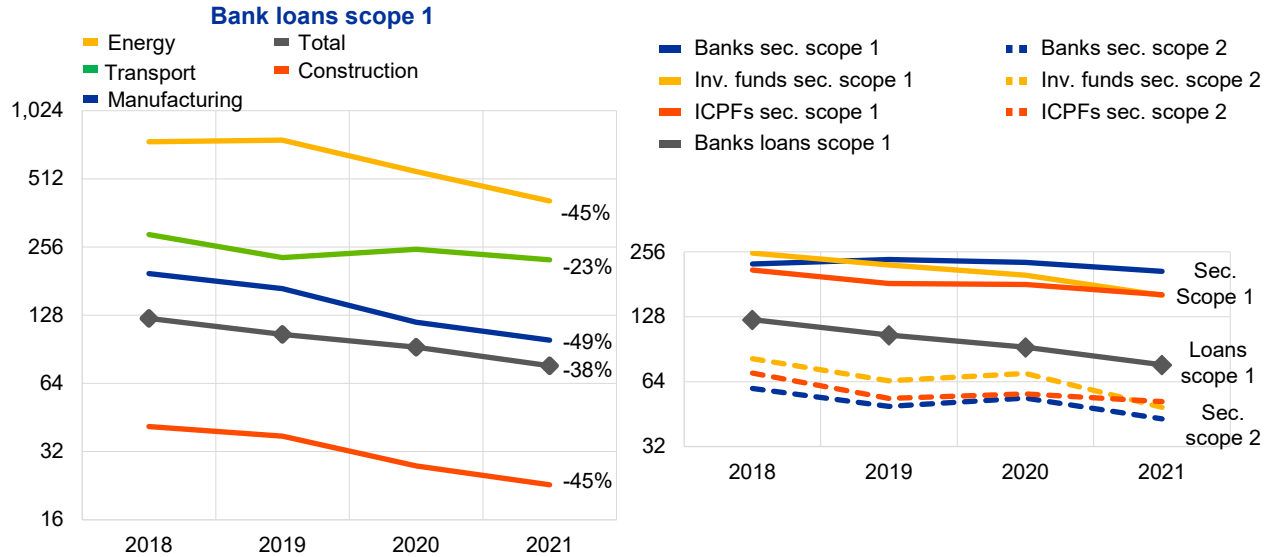
Transition risk

Risk concentration: instruments, sectors, financial institutions

Weighted Average Carbon Intensity (WACI) in the euro area

WACI of bank loans by sector & of financial institutions by instruments

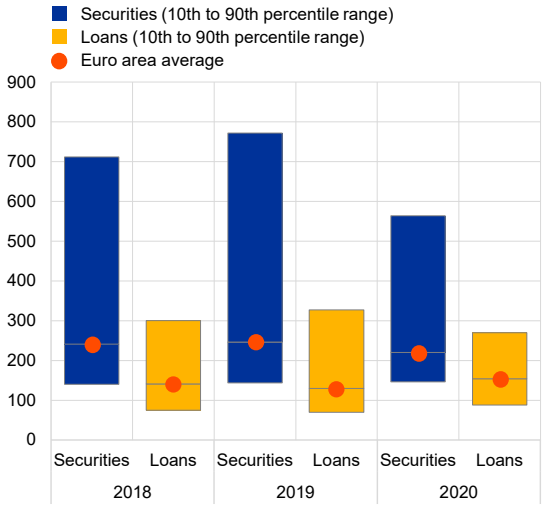
(tonnes of CO2 emissions per million EUR of revenue, log2 scale)



Sources: ESCB calculations based on data from AnaCredit, RIAD and Institutional Shareholder Services (ISS).and ECB calculations
Notes: WACI is adjusted for inflation and exchange rate effects. Loans at corporate group level. Methodological notes: Climate change-related statistical indicators" (ECB SSC, 2024). Notes: Securities include listed shares and debt securities of deposit-taking corporations (S122) and are computed at group level. The charts comprise Scope 1 and Scope 2 emissions. WACI is adjusted for inflation and exchange rate effects.

WACI of loans & securities across banks

(Scope 1 emissions in tonnes CO2e per million euro)

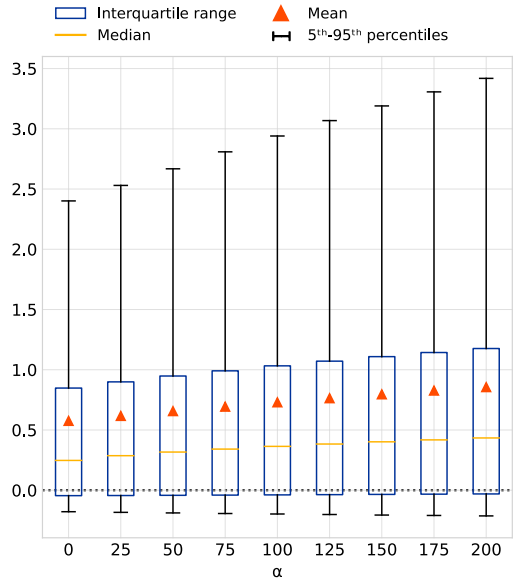


Sources: ESCB calculations based on AnaCredit, Securities Holding Statistics (SHSS), Institutional Shareholder Services (ISS), Refinitiv, EU Emissions Trading System (EU ETS), Eurostat Air Emissions Accounts (AEA) and Orbis by Bureau van Dijk. Published in "Climate change-related statistical indicators"

Transition risk scenarios and forward-looking information are vital for assessing amplifications and

Rising carbon costs increase default correlation

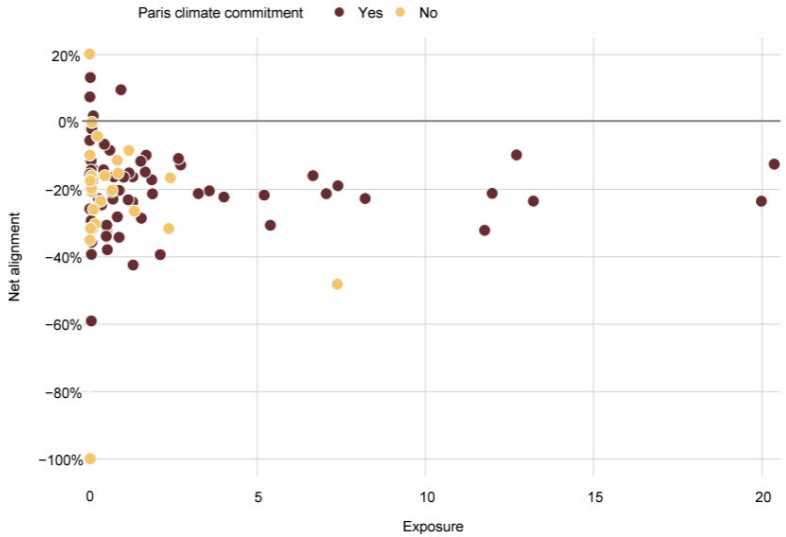
(Pearson Correlation Coefficient, in percentages)



Sources: AnaCredit, Urgentem, NGFS, Moody's Credit Edge and ECB calculations. Published in "Climate-related risks to financial stability" (ECB, FSR May 2022). Notes: Euro area sample of firms, default simulations based on 500,000 Monte Carlo iterations. Cost parameter α incorporates carbon price shock (€/tCO$_2$) and cost pass-through factor onto consumers (Belloni et al., 2022, fn 19).

Limited alignment is transition & litigation risk, if left unaddressed

(net alignment in percentages, exposure in EUR billions)



Sources: IEA, AI, RMI and ECB calculations. Published in "Risks from misalignment of banks' financing with the EU climate objectives" (ECB SSM, 2024). Notes: Every dot represents one significant institution. The net alignment is computed using the IEA NZE 2050 decarbonisation pathway. Net alignment of higher than 20% is reduced to 20%, and net alignment of lower than -100% is raised to -100% for visualisation purposes.

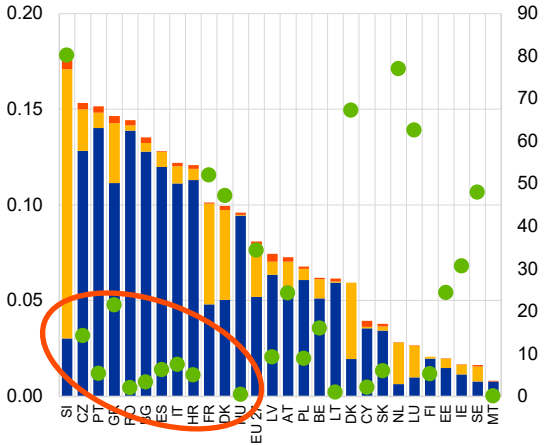
Physical risk

Losses from physical risks may raise protection gap and create fiscal challenges

Losses of extreme climate-related events

LHS: percent of GDP; RHS: share in percent of total losses

- Average uninsured yearly losses
- Average insured yearly losses
- Average yearly EUSF support paid for climate-related disasters
- Share of insured losses (right-hand scale)

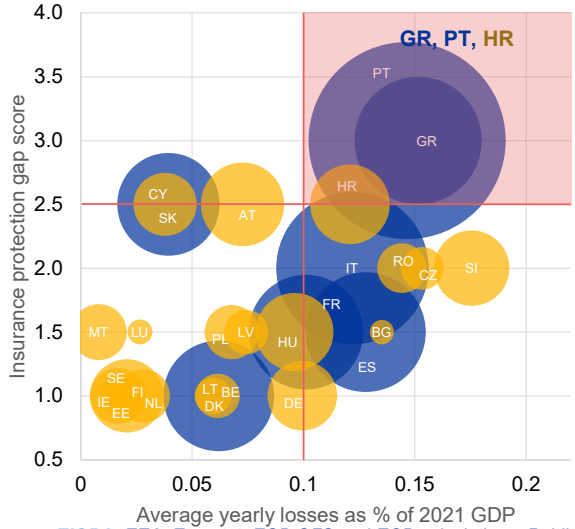


Sources: CATDAT, Eurostat, EUSF data and ECB calculations. Cumulated losses from 1980-2021. Published in "Climate change and sovereign risk" as part of the Financial Stability Review (ECB, May 2023).

Losses and protection gap for wildfires

(average yearly losses (1980-2021), bubble size: government debt

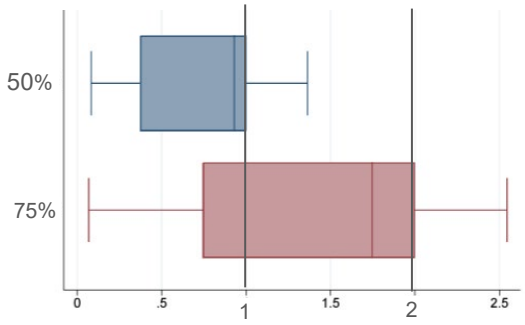
- Debt-to-GDP ratio > 100%
- Debt-to-GDP ratio < 100%



Sources: EIOPA, EEA, Eurostat, ECB GFS and ECB calculations. Published in "Chartbook for monitoring financial stability impacts of climate" (ECB/ ESRB, 2023). Bubble size proportional to debt-to-GDP ratio. y-axes: EIOPA's estimated protection gap peril-specscore, 0 no gap,... , 4 very high).

Increase in gross insurance premia for river and coastal floods

Necessarity increase in premium for coverage to 50% or 75% respectively

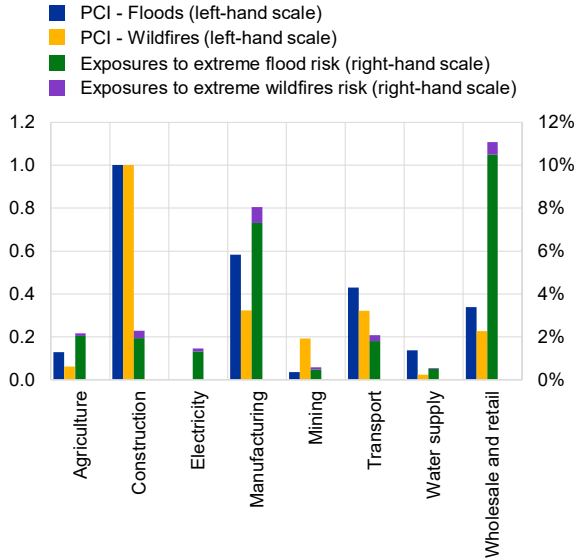


Source: JRC. Published in "Flood protection gap: evidence for public finances & insurance premiums" (JRC, 2023). Notes: Percentage increase of gross underwritten premium across EU Member States to raise insurance penetration for river & coastal floods to 50% (blue) or 75% (red). NL and GR (outliers) excluded.

Concentrated physical risk may be amplified through global supply chain disruptions

Physical-to-credit risk-intensity is concentrated among sectors

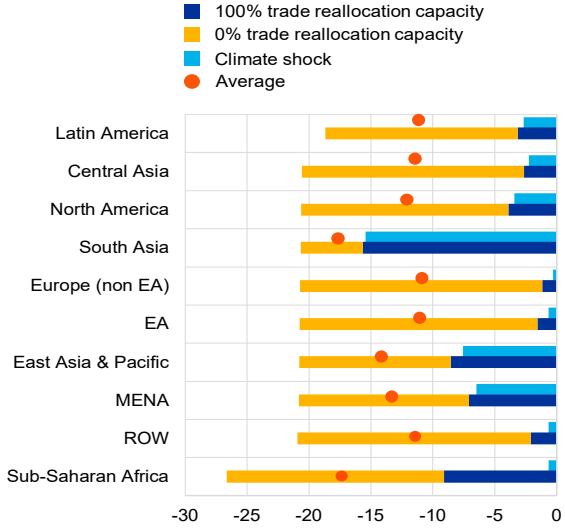
(LHS: min-max normalised PCI; RHS: share of vulnerable to total corporate loan exposures in percentages)



Sources: ECB calculations based on Moody's 427, Register of Institutions and Affiliates Database and AnaCredit. Published in "Towards macroprudential frameworks for managing climate risk" (ECB/ESRB, 2023). Notes: Exposure to flood and wildfire risk is measured via forward-looking risk scores from Moody's 427. These normalised scores range from 0 to 100 and measure the frequency and intensity of the respective hazard based on a firm's geographical location at address level. Firms are categorised as tail risk firms for floods (wildfires) if their flood (wildfire) score is above 75 (50).

Initial output losses can be amplified through supply chains, but trade reallocation would mitigate risks.

(x axis: GDP decline in percentage points)



Sources: OECD, S&P Global Ratings, AnaCredit, SHSG, FINREP and ECB calculations. Published in "Towards macroprudential frameworks for managing climate risk" (ECB/ESRB, 2023). Amplified GDP losses are simulated through input-output models. A 100% Trade Reallocation Capacity (in dark blue) implies no cost for reorganising supply chains across trading partners and 0% precludes trade reorganisation. An adverse climate scenario is considered, i.e. RCP 8.5 scenario by 2050 with no adaptation measures and where all country-specific hazards materialise simultaneously across the world.

Concluding remarks towards a macroprudential framework for climate-related risks

Climate-related risks for financial stability

Transition risks

- **Carbon price increase & volatility** may pose risks for debt servicing
- **Regulatory requirements, technological and sentiment change** may suddenly create stranded assets

- **Bank exposures to HHs & NFCs** are concentrated among sectors and high-emitters; Bank interest income predominantly from exposures to high-emitting firms
- **Declining carbon intensity by FIs** could result in stranded assets & asset price volatility
- **Forward-looking financial markets price shocks on impact,** in contrast to more gradual evolution of credit risk

Identified climate-related risks for financial stability

Physical risk:

More frequent & intensive hazards may damage physical assets and can disrupt supply chains

- **Solvency risk for (re-)insurers** with rising premia, insurance gap, uninsurable hazards, risk transfer
- **Sovereign debt sustainability concerns** may spill over to financial stability
- **Amplification** via compounding risks, tipping points, real and financial interlinkages

Data-induced risk:

- **Mispricing of risk and asset prices** may create abrupt asset flows (revisions of expectations)
- **Low frequency events are challenging** for updating risk frameworks
- **Exacerbated policy inaction bias:** Uncertainty in risk assessment is challenge for policy calibration

Why a macroprudential approach to address climate risks?

Classic systemic risk channels

- Spillovers
- Non-linearities
- Interconnections

Climate risks' unique features

- Concentration + correlation of risks
- Irreversibility of climate-related losses
- Unpriced externalities from lending to carbon-intensive firms, leading to risk build up
- Interaction btw. physical & transition risk

Risk of underestimation / late response

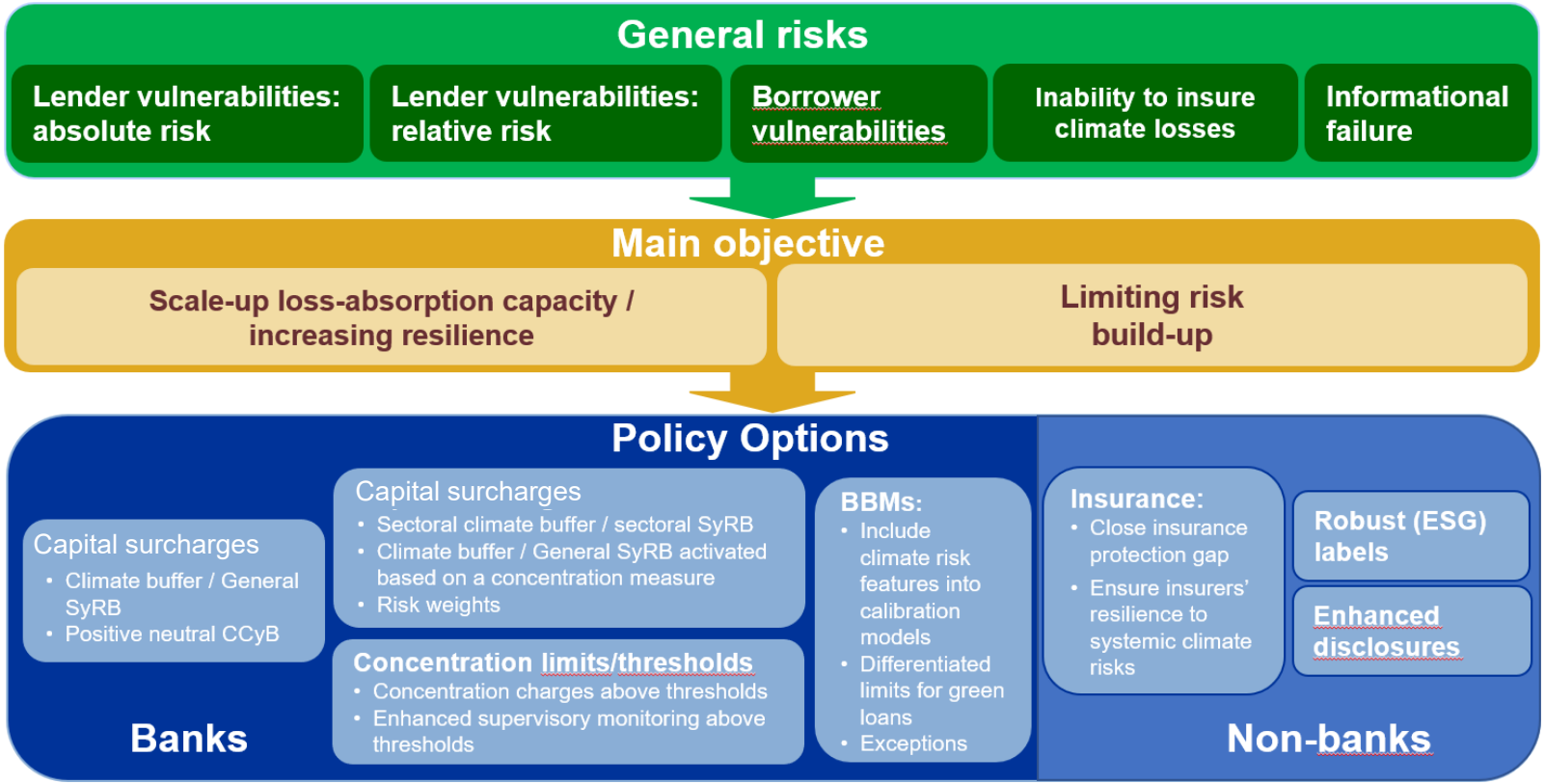
- Uncertainty over scale and timing
- Lack of data and unsuitability of backward-looking historical data
- Endogeneity of climate risk

Macroprudential policy can address **systemic aspects of climate risk** by:

1. making the system **less prone to climate risks** by preventing the build-up of risks
2. building systemic **resilience to climate risks** by increasing loss-absorbing capacity
3. having a **system-wide perspective**, preventing the migration of risks across financial system
4. usefully **complementing supervisory efforts and microprudential measures**

See also ECB blog: Climate risk, the macroprudential view (December 2023)

A macroprudential framework for climate-related financial risk



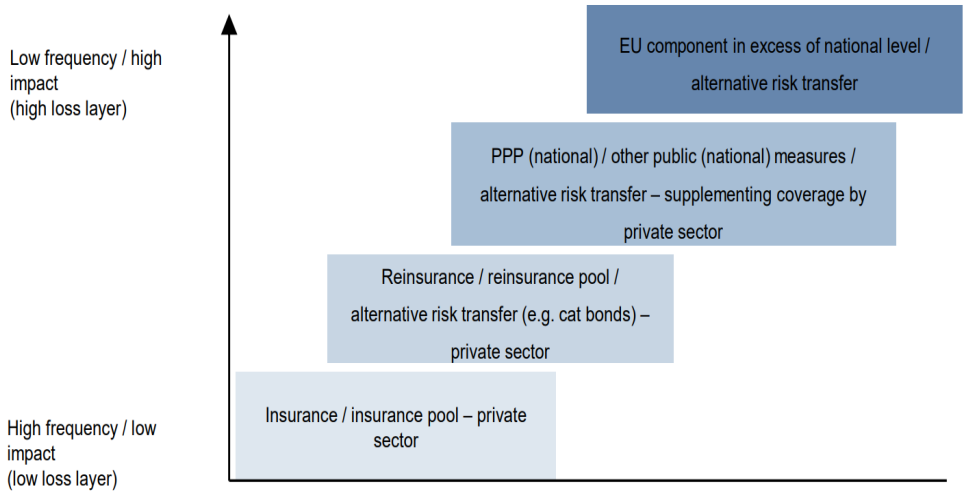
Source: ECB/ESRB Project Team.


Towards macroprudential frameworks for managing climate risk
December 2023
by
ECB/ESRB Project Team
on climate risk
EUROPEAN CENTRAL BANK
EUROSYSTEM
ESRB
European Systemic Risk Board
European System of Financial Supervision

Background

Addressing risks in the non-banking sector

A ladder approach to catastrophe insurance



Source: ECB/ESRB Project Team.

Addressing greenwashing risks

- Greenwashing can be a driver for the materialisation of several standard financial risks (ESA reports)
- Further analysis needed to estimate the impact of greenwashing risks on financial stability
- Short-term need to: (i) converge towards robust standards, definitions and labels in the sustainable finance sphere; (ii) close climate data gaps; and (iii) enhance disclosure quality
- Ongoing initiatives: EU supervisory work on greenwashing, recent public consultation launched by the European Commission to explore potential changes to SFDR disclosures, recent proposal of the European Commission for a regulation on ESG rating activities, externally-verified European green bond standard.