



EUROPEAN CENTRAL BANK

EUROSYSTEM

The role for macroprudential policy in an evolving technological and climate finance landscape

EBA Policy Research Workshop -
"Technological Innovation, Climate
Finance and Banking Regulation"

26 October 2022

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Overview

- 1 Key financial stability vulnerabilities at present and the role for macroprudential policy
- 2 Climate change: risks and policy response
- 3 Technological innovation: risks, opportunities and policy response

1.

Key financial stability
vulnerabilities at present and the
role for macroprudential policy

Key financial stability themes at present

1 Low growth, high inflation, tighter financial conditions are exposing non-financial sector vulnerabilities

2 Financial markets and non-banks increasingly vulnerable to negative surprises

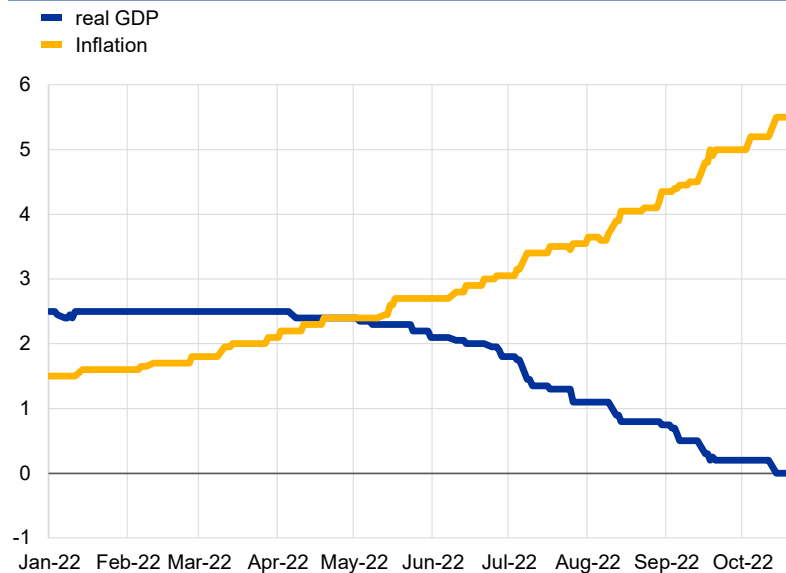
3 Banks benefitting from higher interest rates but asset quality outlook deteriorates

Low growth, high inflation and unemployment key triggers for unravelling vulnerabilities

- Growth expectations have continued to be revised down, and inflation expectations up
- Looking ahead, a key issue for financial stability will be to what extent unemployment will increase

Evolution of euro area real GDP and inflation forecasts for 2023

Percentages

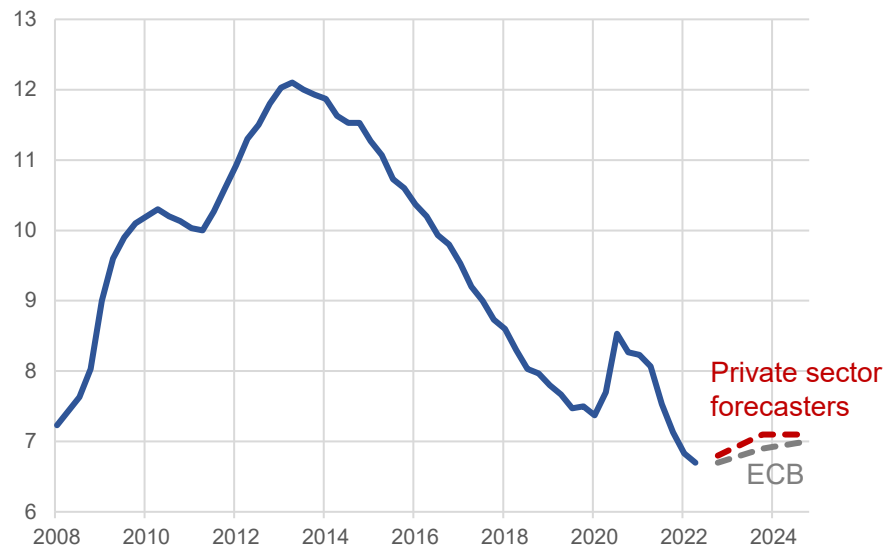


Source: Bloomberg.

Notes: Average of forecasts by 56 private sector forecasters.

Euro area unemployment and forecasts by the ECB and market participants

Percentages



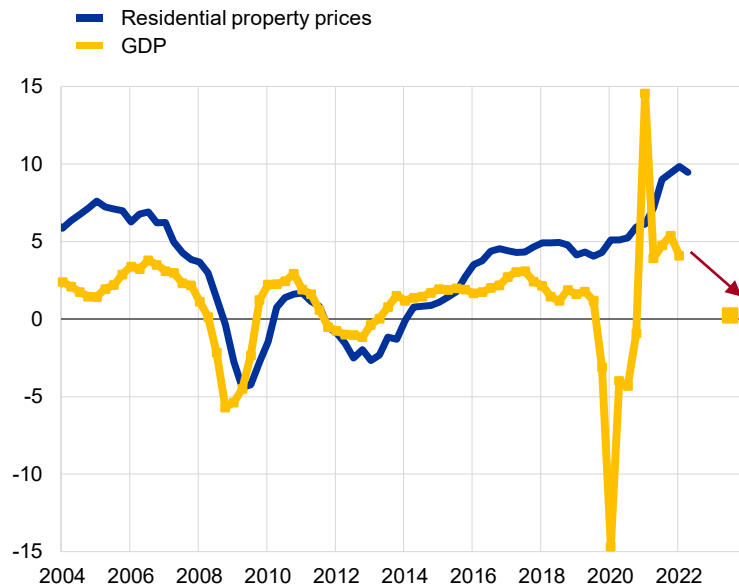
Sources: Bloomberg and ECB.

Low growth, high inflation tighter financial conditions exposing non-financial sector vulnerabilities

- Signs of a turn in the real estate cycle may compound vulnerabilities of euro area households
- Corporate earnings growth expectations have continued to decline

Euro area residential property prices and real GDP growth

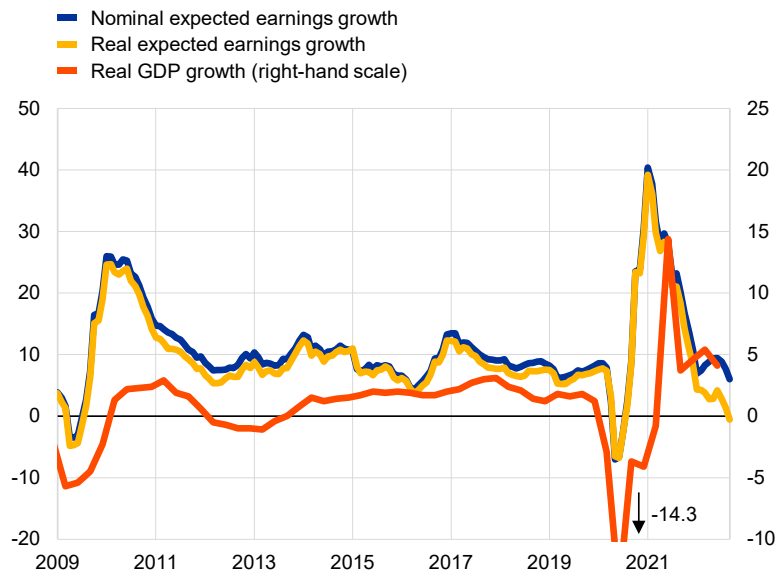
Percentage change per annum



Source: ECB

Real and nominal expected earnings growth for the EURO STOXX and real GDP growth

Percentage change per annum



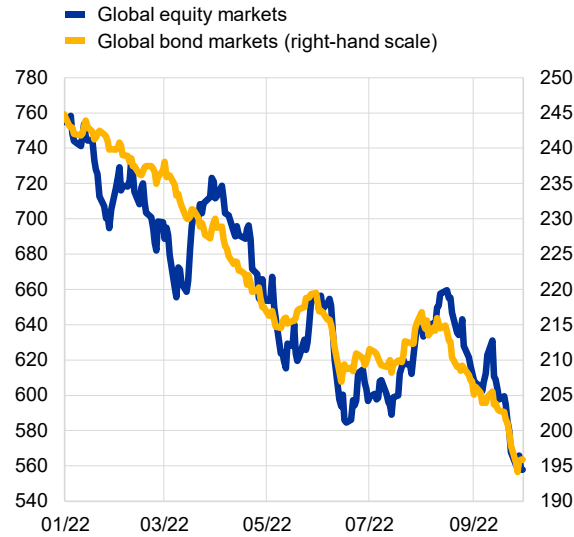
Sources: Refinitiv and Haver Analytics.

Financial markets and non-banks increasingly vulnerable to negative surprises

- High volatility and lower market liquidity in some segments increase the risk of a disorderly correction
- Low non-bank liquid asset holdings could amplify any adverse market dynamics

Developments in global equity and bond markets

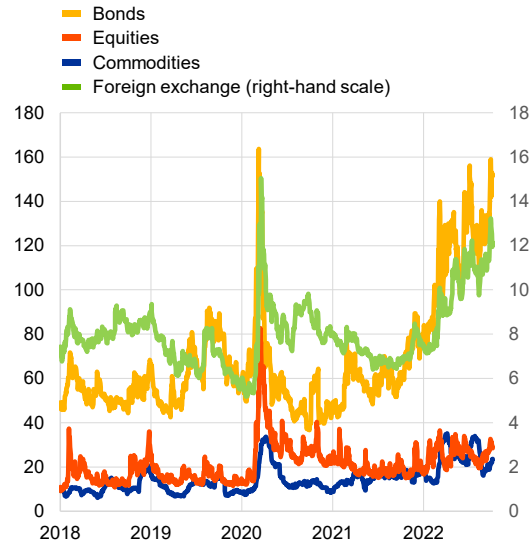
Indices



Source: Bloomberg Finance L.P.

Market volatility in equity, bond, foreign exchange and commodity markets

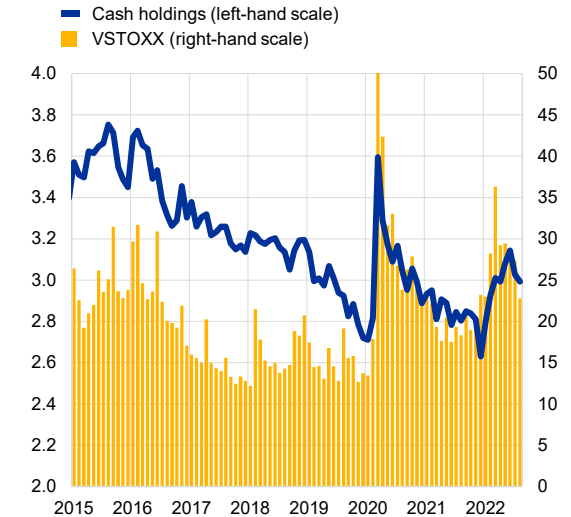
Indices



Source: Bloomberg Finance L.P.

VIX and cash holdings of investment funds

Percentages of total assets, index



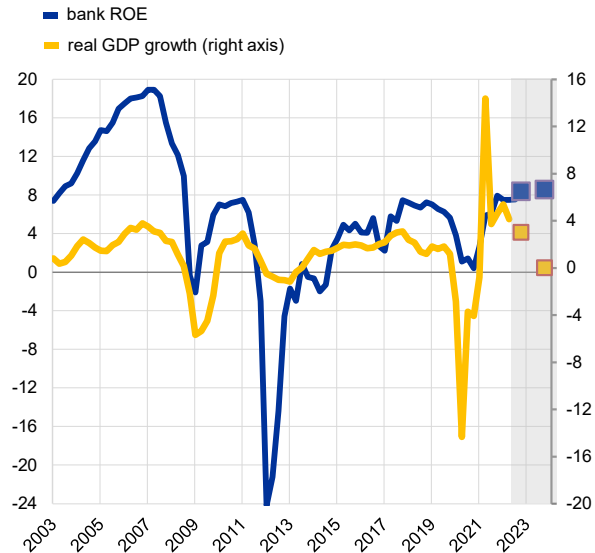
Sources: Bloomberg and ECB.

Banks benefitting from higher interest rates but asset quality outlook deteriorates

- Analysts' bank ROE expectations seem rather optimistic given the weaker growth outlook
- Worsening asset quality prospects and higher funding costs may pose headwinds

Historical and expected euro area real GDP growth and banks' return on equity

Percentages

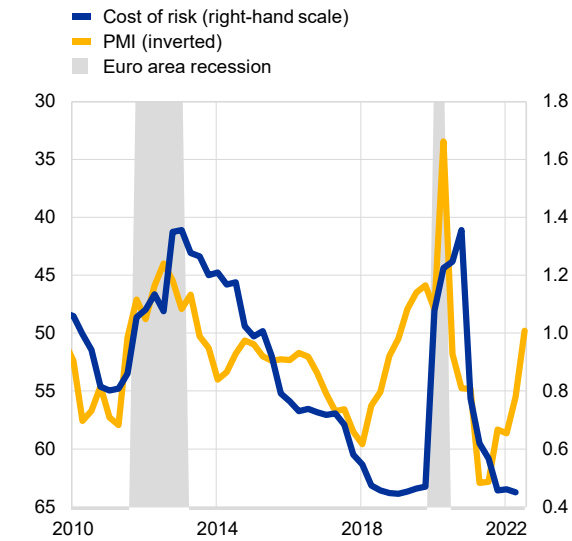


Source: Bloomberg.

Note: Private sector expectations for GDP growth and bank ROE for 2022 and 2023.

Euro area banks' cost of risk and PMI

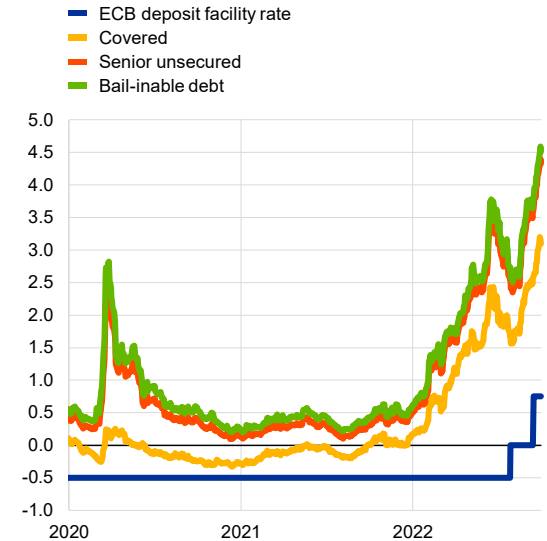
Index; diffusion index



Sources: Bloomberg Finance L.P. and Refinitiv.

Market funding costs and the ECB deposit facility rate

Percentages



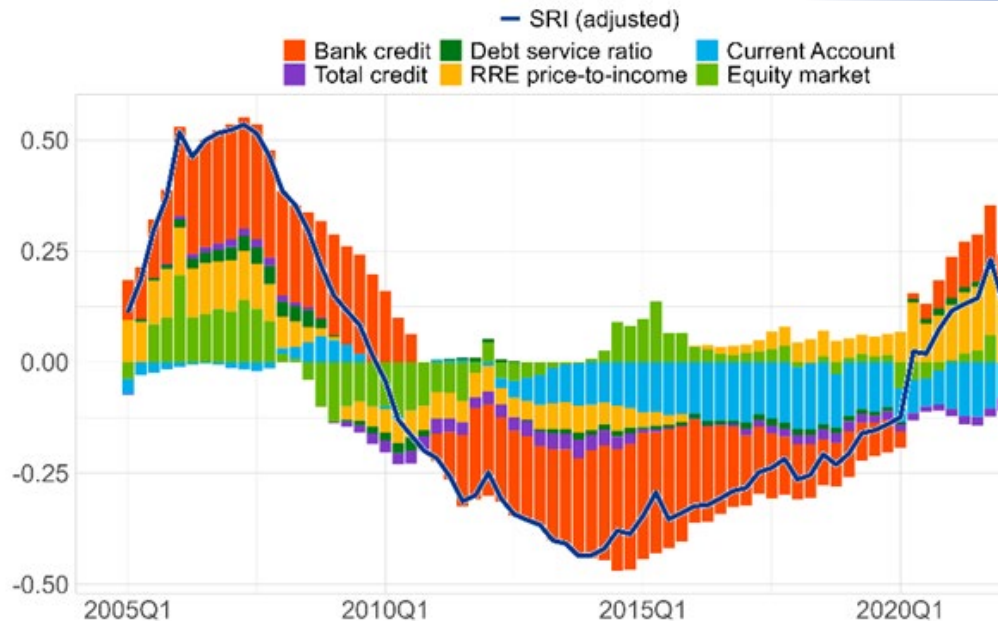
Source: IHS Markit..

Macroprudential policy decision making has become more challenging

- War in Ukraine compounds existing vulnerabilities and increases the likelihood of risk materialisation
- From a risk perspective higher capital buffers to address vulnerabilities still warranted in several countries

Euro area Systemic Risk Indicator (SRI) decomposition

Deviation from median in terms of SD



Sources: ECB and ECB calculations.

Left: See Lang et al. (2019), ECB Occasional Paper No. 2019, for technical details.

Conceptually there are reasons to still increase macroprudential buffers in some cases

Rationale for building additional (releasable) capital buffers still applies...

- Capital buffers preserve / enhance resilience in challenging environment and ensure that banks are able to withstand systemic risks, should they materialise at a later point in time
- Existing capital headroom and capital generation mitigate the risk of acting pro-cyclically
- Possibility for authorities to release buffers if and when adverse developments materialise

...but developments pose challenges for macroprudential authorities

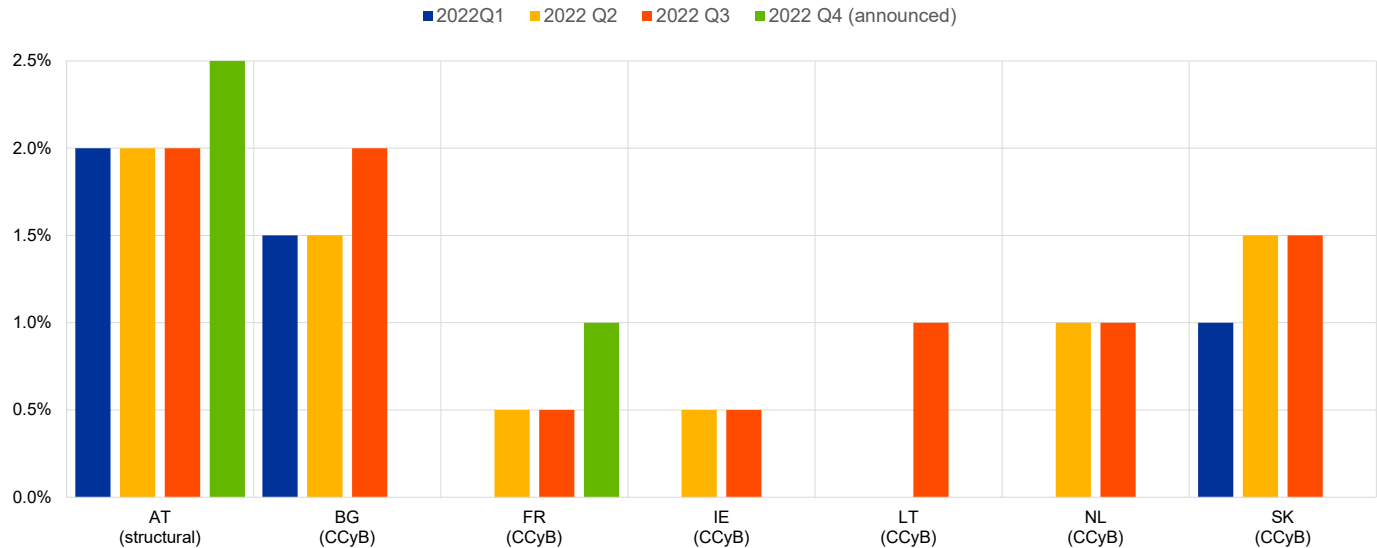
- Need to consider near-term headwinds to avoid unintended tightening of credit conditions
- Communication challenges, particularly for a tool labelled as 'countercyclical capital buffer'

Targeted buffer increases may still be considered in selected countries

- Some countries implemented or announced increases in capital buffers recently
- Further increases may be considered in some countries with still robust macroeconomic conditions and macro-financial imbalances

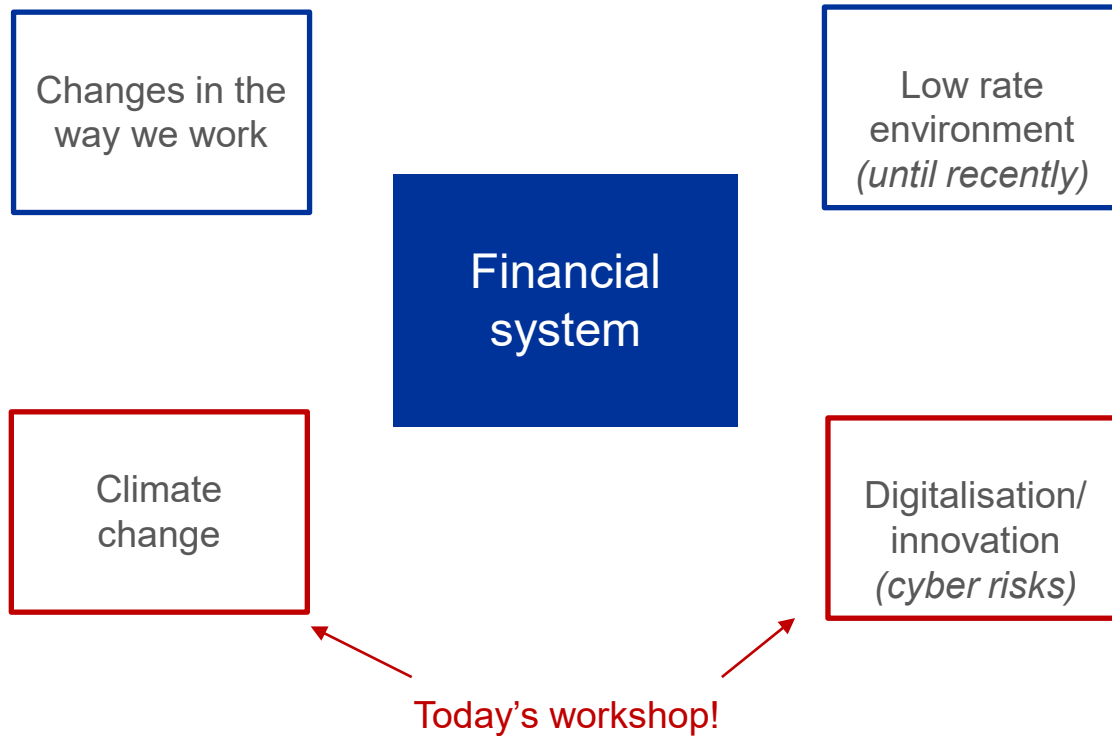
Changes in announced rates for broad-based capital buffers in recent months

Applicable rate in the respective country



Sources: ECB and ECB calculations.

Various internal and external factors have led to a need for the financial system to adjust the way it operates



2.

Climate change: risks and policy response

A monitoring framework for climate risks for the financial system

Exposure dimension

Risk dimension

Institution-specific

Non-financial

Transition: Emissions (actual & forward-looking)

Physical: Climate-related hazards
(floods, wildfires, heatwaves,...)

Transition: Impact on profits & costs,
technological obsolescence, risk perceptions

Physical: Asset damages, insurance costs, production
disruption

Financial

To non-financial sectors

- credit instruments (loans, debt sec., equity,...)
- contingent liabilities (insurance, derivatives)

Vulnerability of counterparts: indebtedness,
leverage, provisions
*climate-related impact on credit risk (PD, LGD), market
risk (asset valuation)*

System-wide

Climate: interdependent hazards

NFCs: In-/output interdependencies

Financial Institutions: overlapping exposures

Clustered risks, interconnectedness

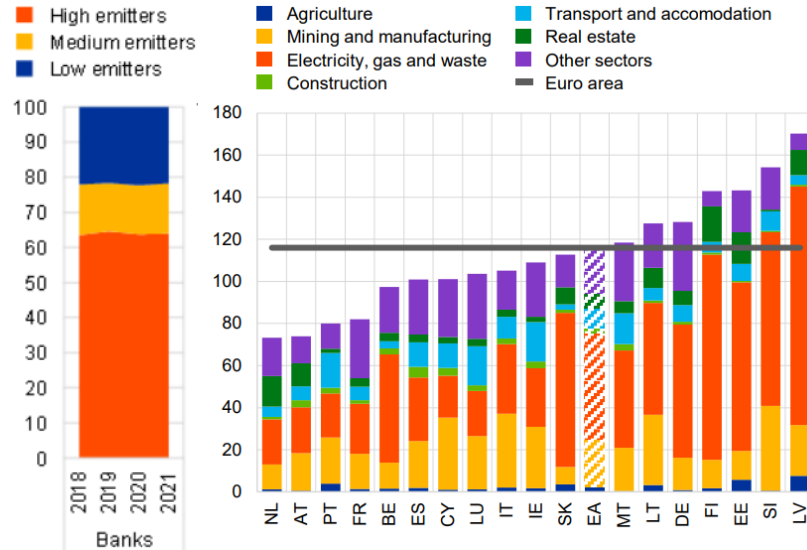
*Dynamic risk amplification & propagation
(joint defaults, contagion, fire sales)*

Increased exposures of banks to transition risk

- Around two-thirds of EA banks' corporate credit exposures are directed towards high-emitting firms
- Estimated transition risk increased since 2012, with significant differences across sectors

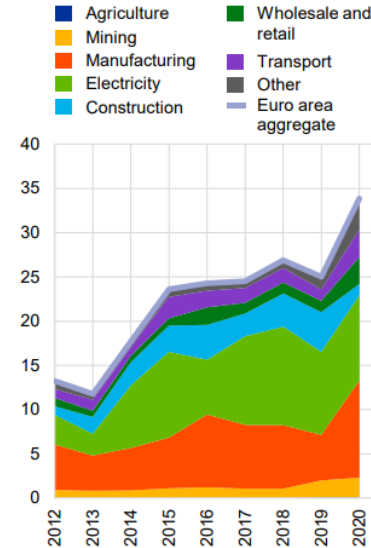
Banks' credit exposures to high vs low emitting firms and loan-weighted emission intensity by country

(left: share of total EA banks' credit exposures; right: kg of CO₂e per € 1,000 revenues in 2020)



PD-weighted emissions-to-loans ratio over time and by economic sector

(left: aggregate EA PD-weighted emissions-to-loans ratios and sectoral shares)



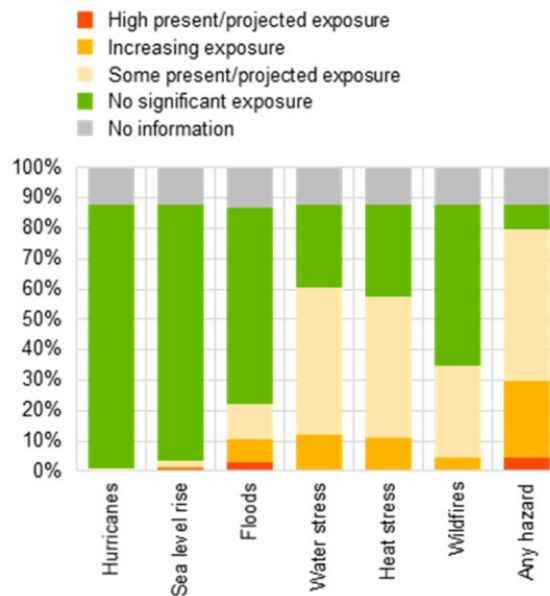
Source: AnaCredit, Urgentem and ECB calculation. Notes: high/low emitters are defined here as firms with reported emission intensity in the top/bottom 33% of the distribution across euro area bank borrowers as of end-2020.

Source: AnaCredit, Urgentem and ECB calculation. Notes: the time series covers both inferred and reported emissions for 1,250 firms, which comprise 10% of AnaCredit exposures.

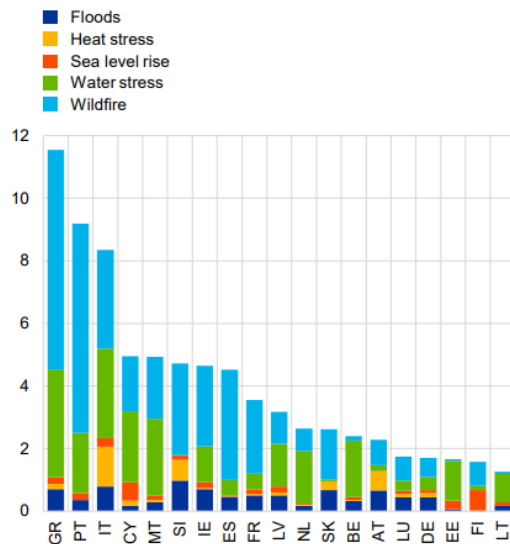
The long-term benefits of the transition more than compensate its short-term costs

- ~ 30% of EA banks' corporate credit exposures subject to high/increasing physical risk
- Climate scenario analysis shows that the impact of physical risk on most vulnerable banks could be very severe

Share of EA banks' credit exposures to corporates by physical risk level (percentages)

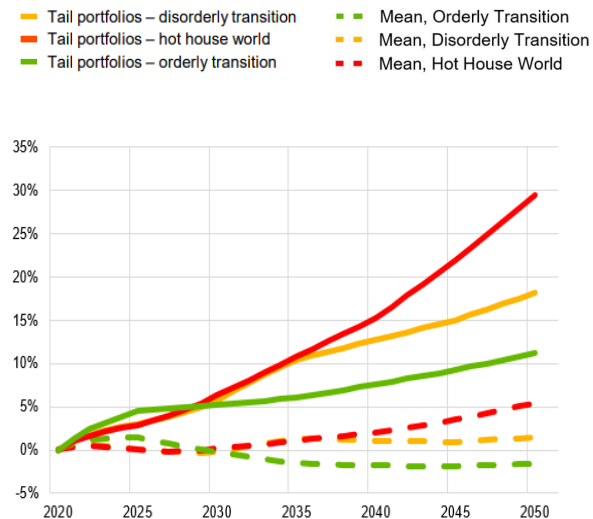


Share of loan exposures to firms with high PD-weighted physical risk score over loans ratio (percentages)



Source: Four Twenty Seven, AnaCredit and ECB calculations.

Evolution of EA banks' credit portfolio PDs over 30 years under 3 scenarios (% differences from 2020)



Source: ECB economy-wide climate stress test, September 2021.

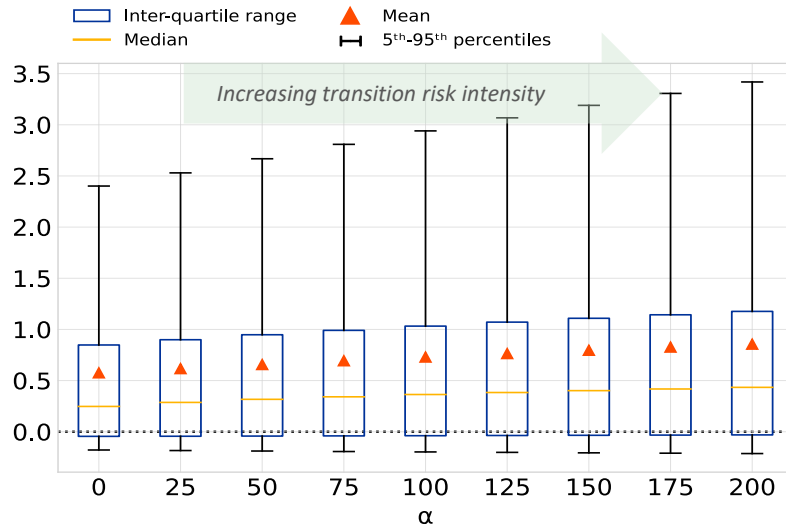
Source: Four Twenty Seven, AnaCredit and ECB calculations. Notes: The indicators and risk levels are based on data integrating information on the current and projected (until 2040) extent of the different physical hazards.

Common climate change shocks imply increased default correlations for corporates

- Transition risk constitutes a common shock to high emitting firms
- Transition risk intensity of 200 €/tonCO₂ can increase average default correlations in the system by ~90%
- Correlations increase more for firms with low-pre-existing correlations (50th vs. 90th percentile)

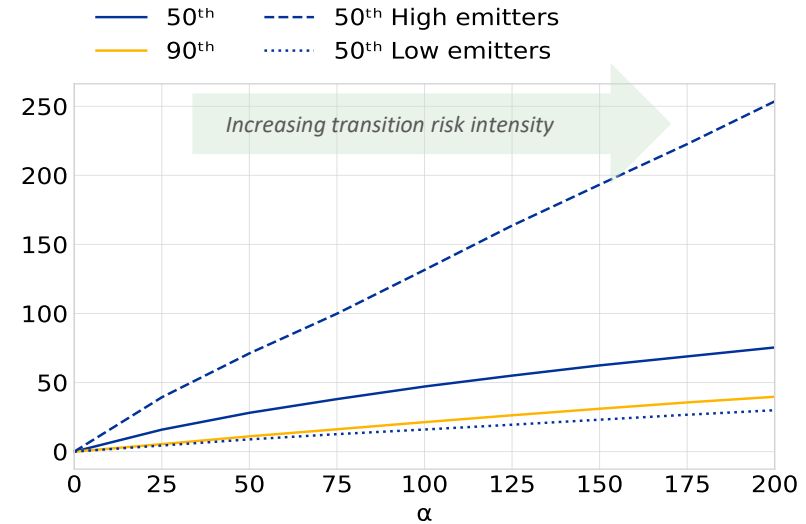
Firm-to-firm correlations

increasing with transition risk intensity α ; €/tonCO₂, %



Impact on the distribution of default correlations

€/tonCO₂, %



Notes: Increasing percentiles of the distribution of pairwise correlations as a function of transition risk intensity. The distribution is that of firm-to-firm correlations for all possible pairs of firms in the sample.

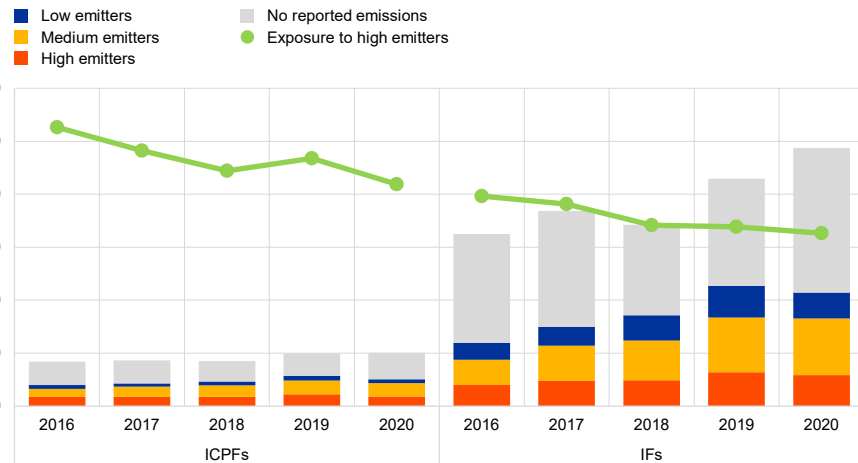
Source: Based on a multi-firm Merton model and 500k bootstrapped Monte Carlo simulations on the full EA Moody's Credit Edge sample. The transition risk intensity parameter $\alpha = (1 - \beta)T$ incorporates both the transition risk shock T as well as a pass-through factor β capturing the degree to which firms can pass the cost of a transition risk shock to consumers. In this sense α represents the marginal cost of transition risk borne by firms in €/tonCO₂.

Non-banks' exposures to transition and physical risk have also increased

- Non-banks' exposures to high-emitting firms have slightly decreased but remains high
- Physical risk exposures to “worst in class” industry groups increasing

Non-banks' asset holdings of high and low emitting firms

Market value of asset holdings in euro trillions, exposure in %



Source: SHSS, Urgentem and ECB calculations

Note: High/low emitters are defined here as firms with reported emission intensity in the top/bottom 33% of the distribution across euro area bank borrowers as of end-2020. Exposure to high emitting firms (in %) does not take into account firms with no reported emissions.

Non-banks' asset holdings of firms with high (worst in class) and low (best in class) physical risk

Market value of asset holdings in euro trillions, exposure in %



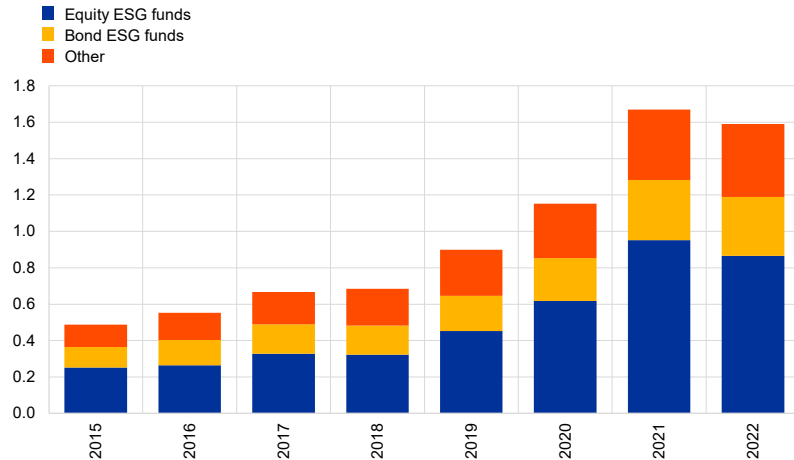
Source: SHSS, Four Twenty Seven and ECB calculations

Note: “Best in class”, “Average”, “Worst in class” are industry group ratings defined by Four Twenty Seven, as of 2021. Exposure to worst in class firms (in %) does not take into account firms with no ratings.

Green finance in increasingly important for supporting the low-carbon transition

- Green financial markets continue to grow, but maintaining such momentum requires decisive regulatory actions to strengthen capital markets.
- Firms can use leverage to reduce their emissions by channelling debt towards green investments, but high indebtedness constrains their transition performance.

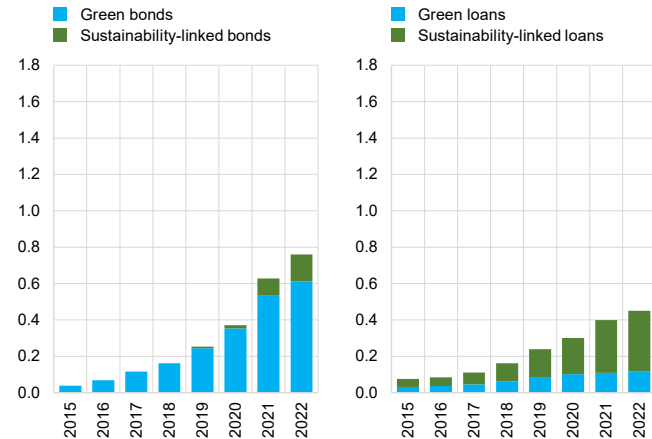
Asset under management of euro area ESG funds Euro trillions



Source: Bloomberg Finance L.P.

Note: ESG funds correspond to all sustainable funds identified using Morningstar intentions attributes based on information provided in funds' prospectuses. 2022 data as of 12th October.

Outstanding amount of green and sustainability-linked bonds and loans Euro trillions



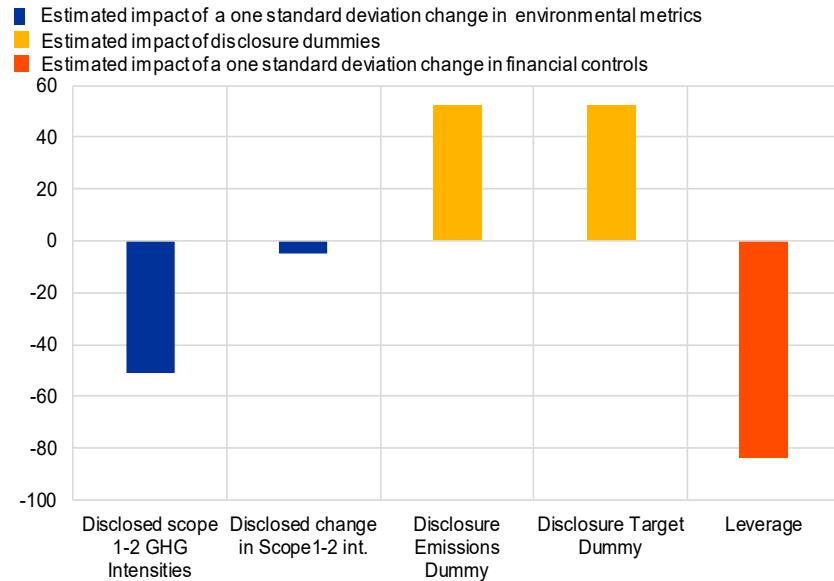
Source: Bloomberg Finance L.P.

Financial markets are pricing transition risk to some extent

- High emissions of firms are associated with higher credit risk, but disclosure moderates this relationship.
- ESG and Green funds' flows tend to be more resilient to past negative performance.

Magnitude of transition risk metrics on credit ratings vis-a-vis leverage

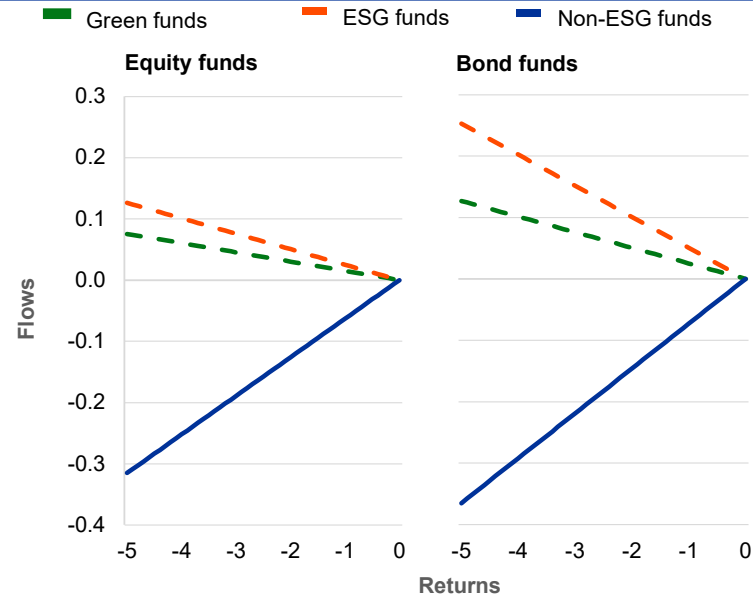
Percentage of a credit notch



Source: Bloomberg and authors' calculations; from [Carbone, Giuzio, Kapadia, Krämer, Nyholm and Vozian \(2021\)](#).

Flow sensitivities to past negative returns of green, ESG and non-ESG corporate bond and equity funds

Coefficient estimates; dashed line: statistically not significant

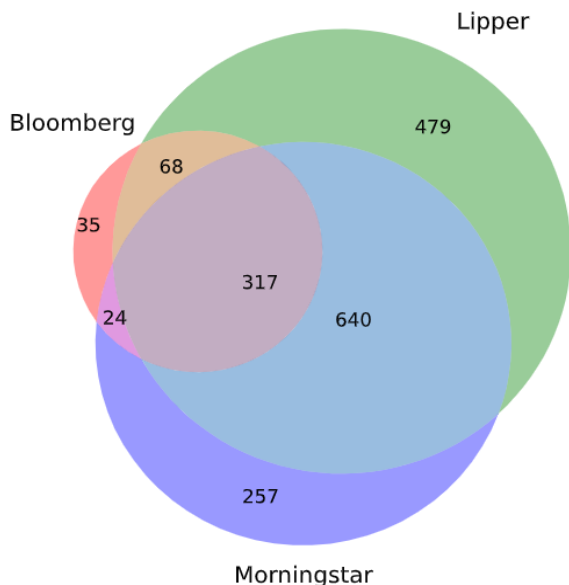


Source: EPFR Global, Bloomberg and authors' calculations. From [Capota, Giuzio Kapadia and Salakhova \(2022\)](#).

The risk of greenwashing is high in the fund sector, in the absence of an ESG fund label

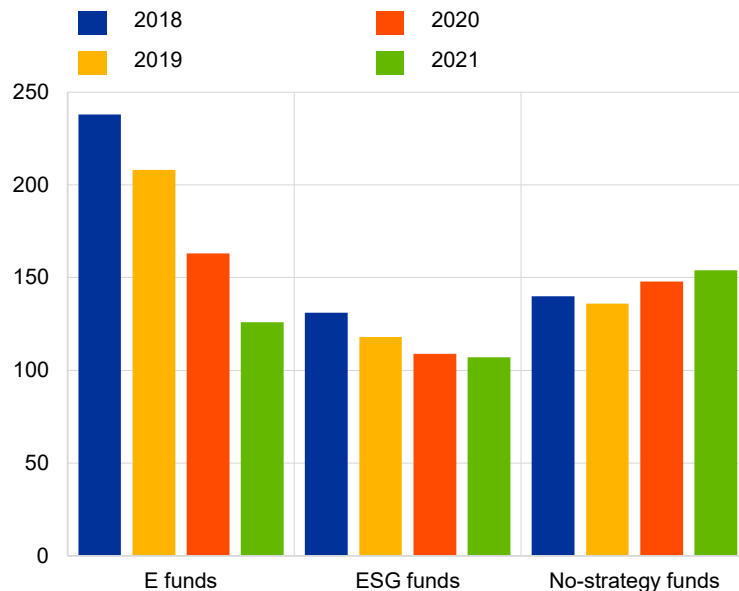
- Three main data providers agree in less than 20% of cases that a fund is ESG
- At the same time, ESG funds seem to reduce the emission intensities of their portfolios more than non-ESG funds

Funds classified as ESG by three providers number of funds per category



Source: Morningstar, Bloomberg Finance L.P., Refinitiv Lipper and ECB calculations.

Change of emissions intensity by fund strategy tCO2e per USD million revenues, scope 1, 2 and 3 emissions



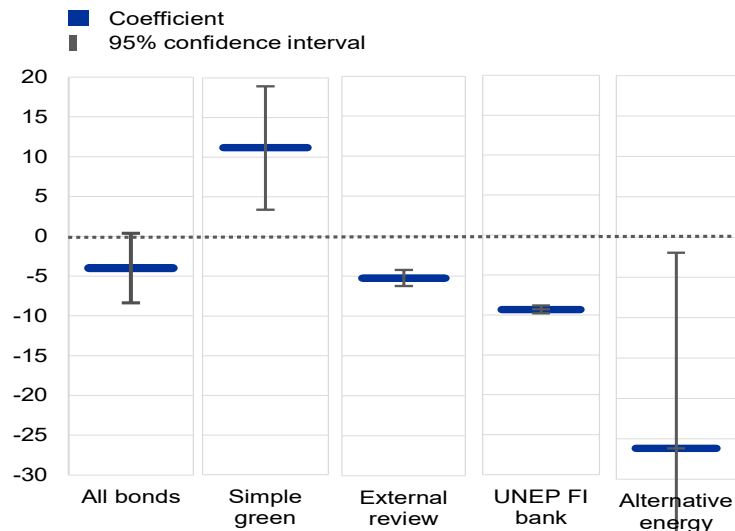
Source: Morningstar, Bloomberg Finance L.P., Refinitiv Lipper and ECB calculations.

Green bonds with higher credibility benefit from cheaper funding in the bond market

- Green bonds with an external review and issued by greener firms trade at a greenium. The EU Green Bond Standard would enhance investors' confidence in this asset class
- The demand for green bonds and the greenium has increased over time

Greenium in euro area secondary bond markets

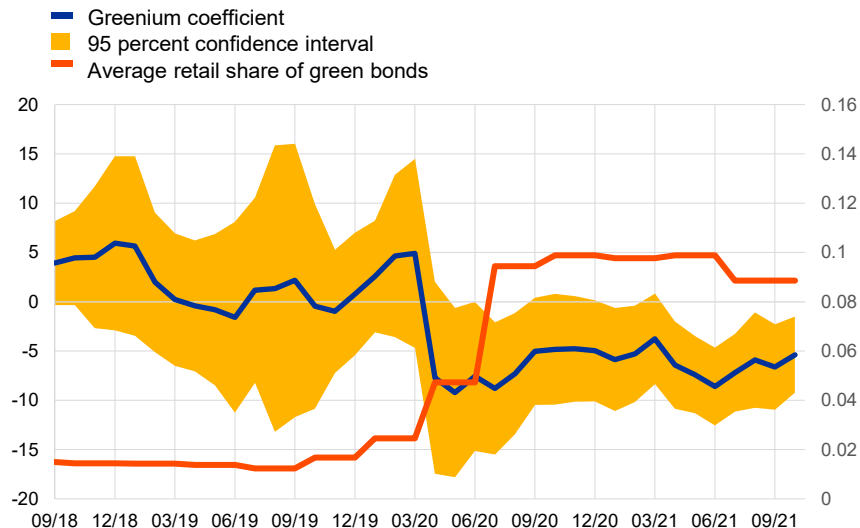
Basis points, difference between green and conventional bonds



Source: Bloomberg, ECB Centralised Securities Database and authors' calculations. From [Pietsch and Salakhova \(2022\)](#).

Monthly greenium and retail share of green bonds

Basis points, difference between green and conventional bonds



Source: Bloomberg, ECB Centralised Securities Database and authors' calculations. From [Pietsch and Salakhova \(2022\)](#).

Policies can improve the effectiveness of green financial markets

NEEDS

Data gaps

1. Enhanced climate disclosure
2. Forward-looking emissions targets
3. Credible transition plans with milestones

Financial markets, instruments and standards

1. Development of green capital markets
2. Green and sustainable bonds and ESG funds
3. Specific focus on the environmental dimension of ESG

INITIATIVES

TCFD

IFRS

EFRAG/CSRD

Green CMU

EU Green Bond Standard

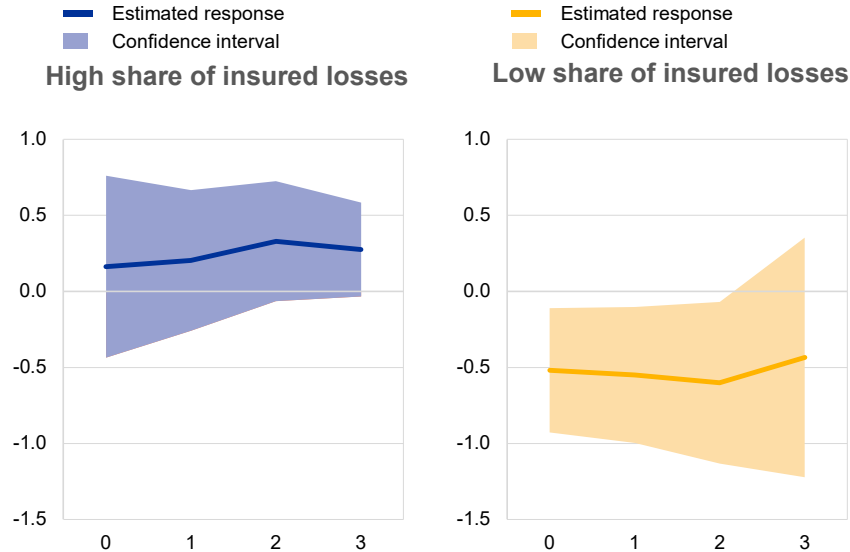
Labels for ESG and environmental funds

Insurance mitigates macroeconomic and financial costs of catastrophes

- Only 22% of losses from extreme weather events are insured in Europe. When this share is low, GDP growth rates decrease significantly following large-scale disasters.
- A widening insurance protection gap may pose financial stability risks and reduce credit provision in countries with large banking sector exposures to physical risk events.

Impact of insured vs uninsured losses from a large-scale disaster on annual GDP growth rate

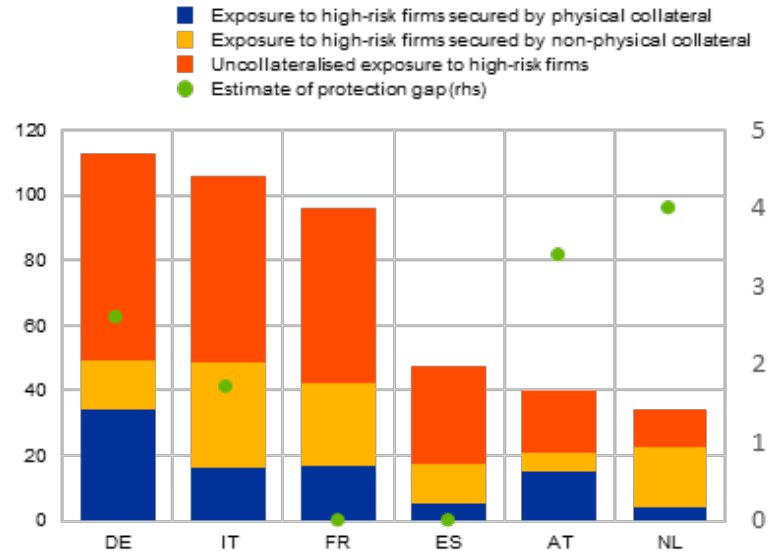
y-axis: percentage; x-axis: quarters after a disaster



Source: CATDAT, Eurostat and ECB calculations.

Exposure of euro area banks to high-risk firms for floods in different countries

lhs: euro billions; rhs: protection gap score



Source: EIOPA Dashboard, Anacredit, 427 and ECB calculations. From [“The macroprudential challenge of climate change”](#), ECB/ESRB Project Team on climate risk monitoring, July 2022. www.ecb.europa.eu ©

Policy should aim to reduce the climate insurance protection gap

- ECB and EIOPA are working together to assess the role of insurance in mitigating the macroeconomic costs of catastrophes.
- Closing the protection gap would reduce the macroeconomic losses, and incentivise adaptation and risk reduction from policyholders.

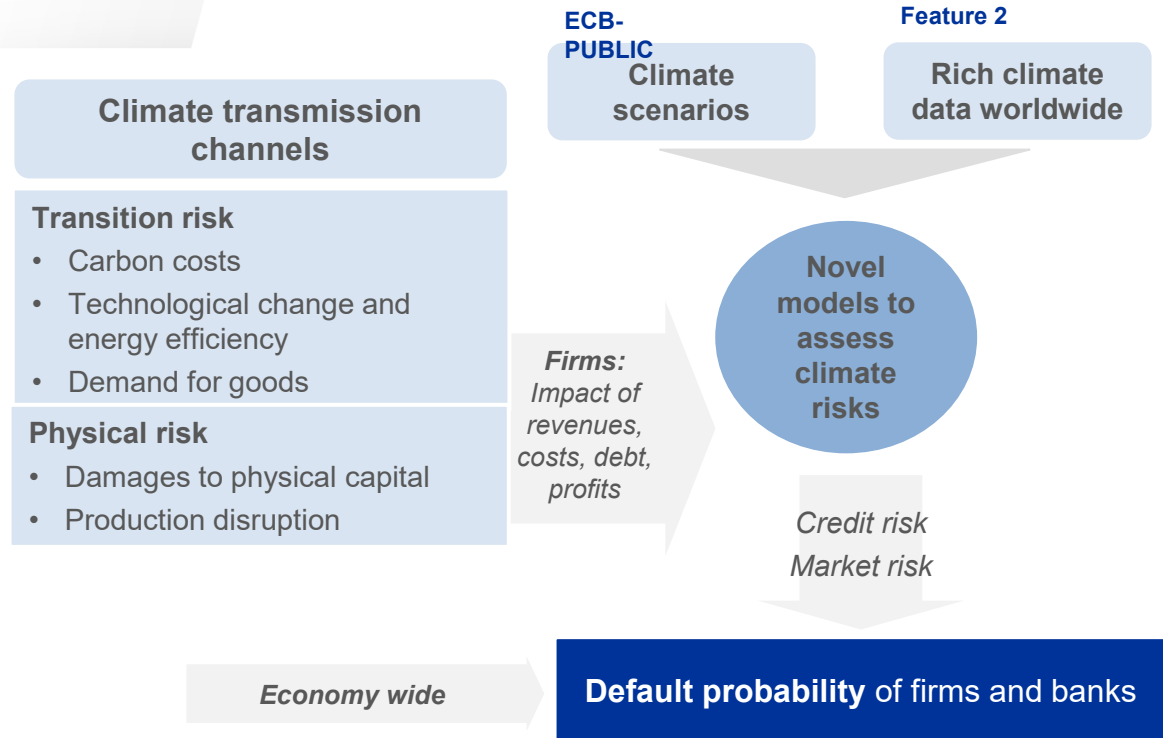


Climate stress tests help identify climate risks and support policy

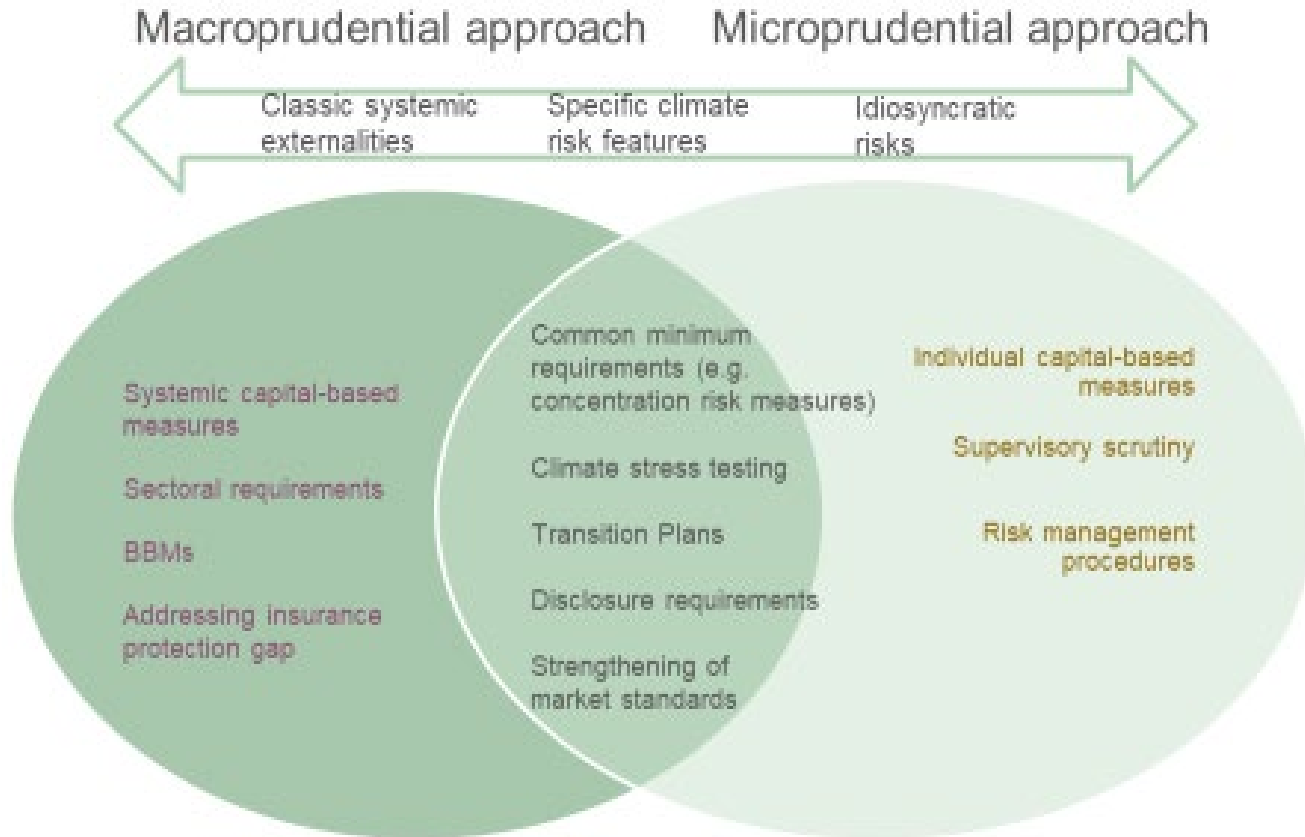


Features

- Climate scenarios** account for the interplay between **transition** and **physical risk** over next **30 years**
- Granular climate and financial information** for millions of corporates to which euro area banks are exposed via loans and security holdings
- New models** to capture climate risk transmission channels on firms' financials, on credit and market risk for banks

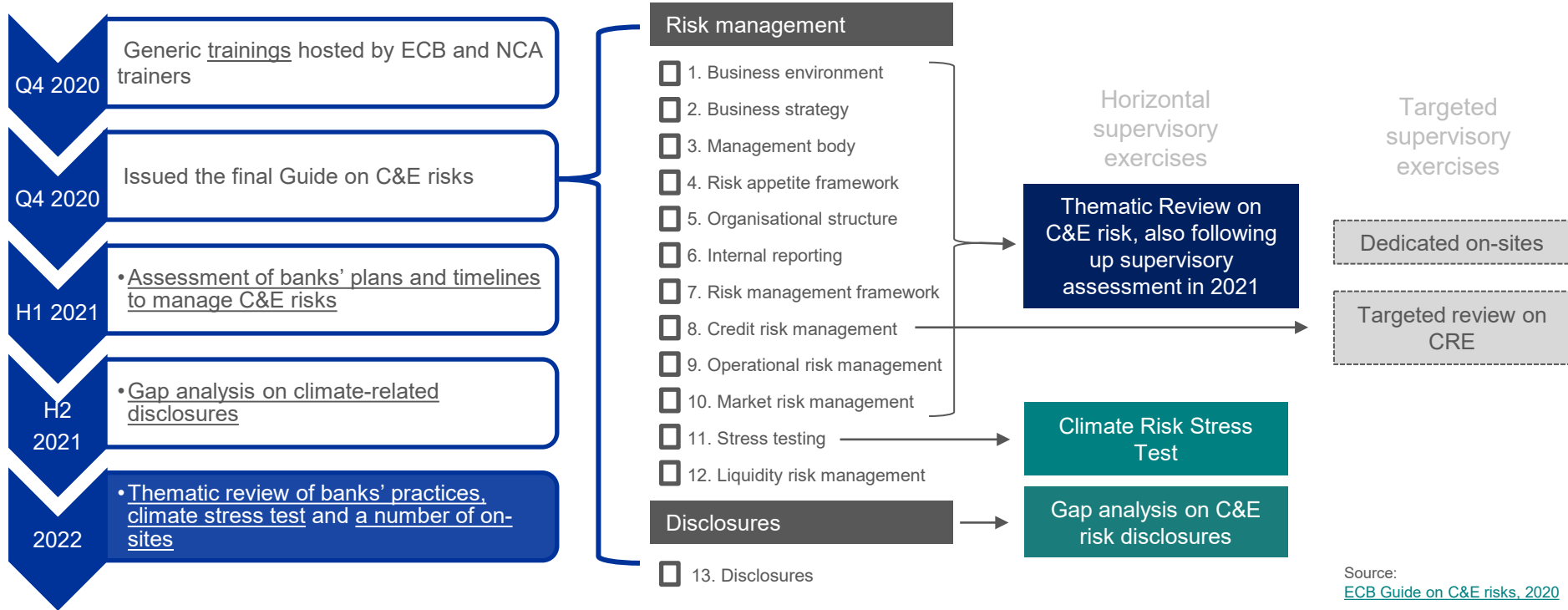


Rationale for micro- and macroprudential policy to address climate change



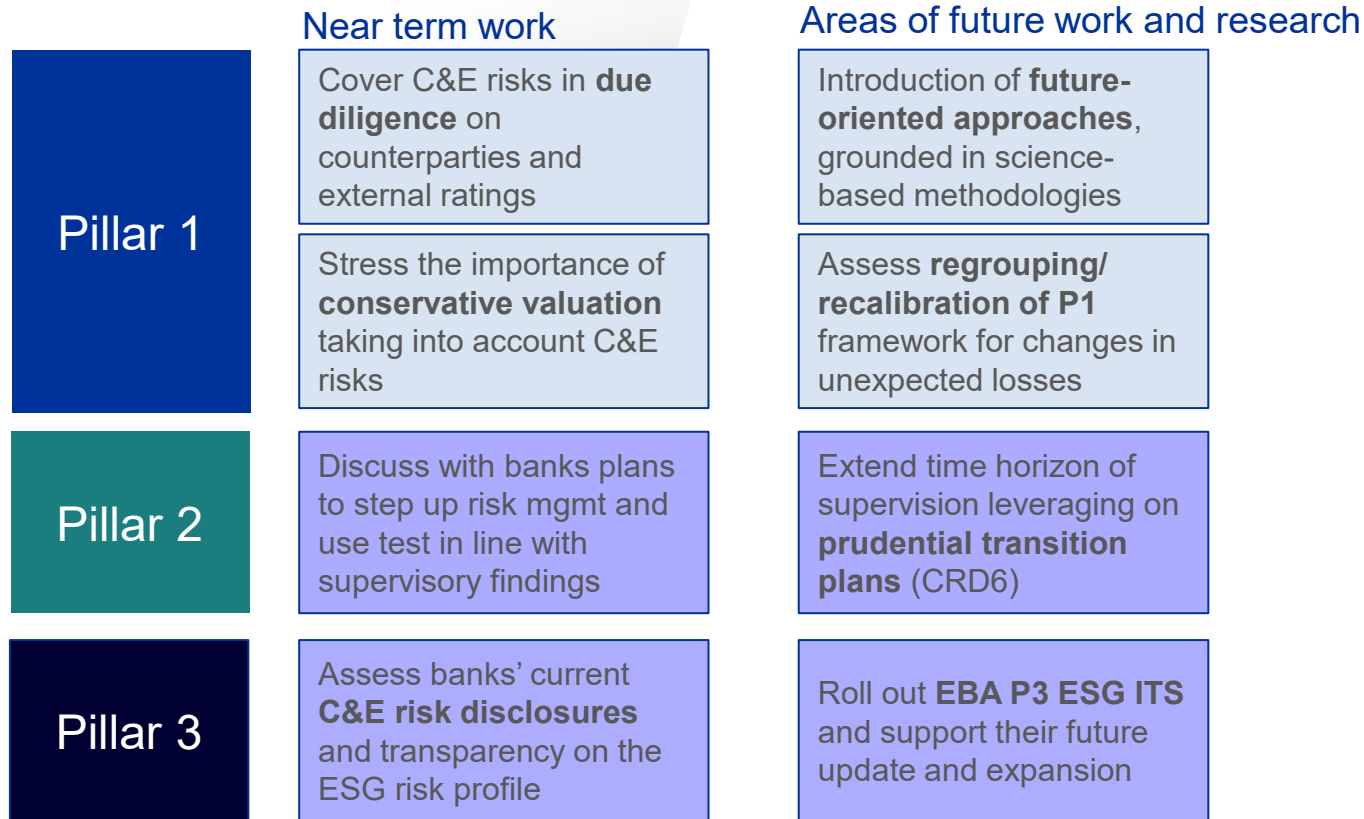
Climate risk a key priority for microprudential policy

- Overview of supervisory roadmap and further supervisory exercises performed in 2022



Climate risk a key priority for microprudential policy

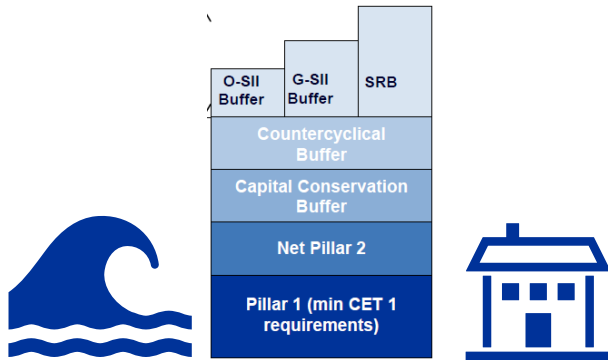
- Exploring C&E-related changes to the framework



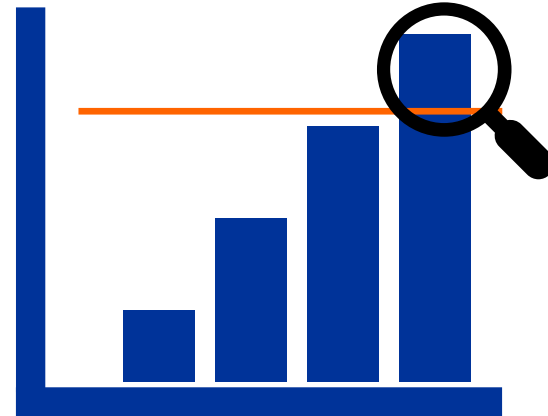
Macroprudential policy to address climate risks - elements for the way ahead

- Two existing instruments have considerable potential for adaptation

Systemic risk buffer



Concentration thresholds



3.

Technological innovation: risks, opportunities and policy response

Innovation: Challenges and the potential to benefit from disruptions

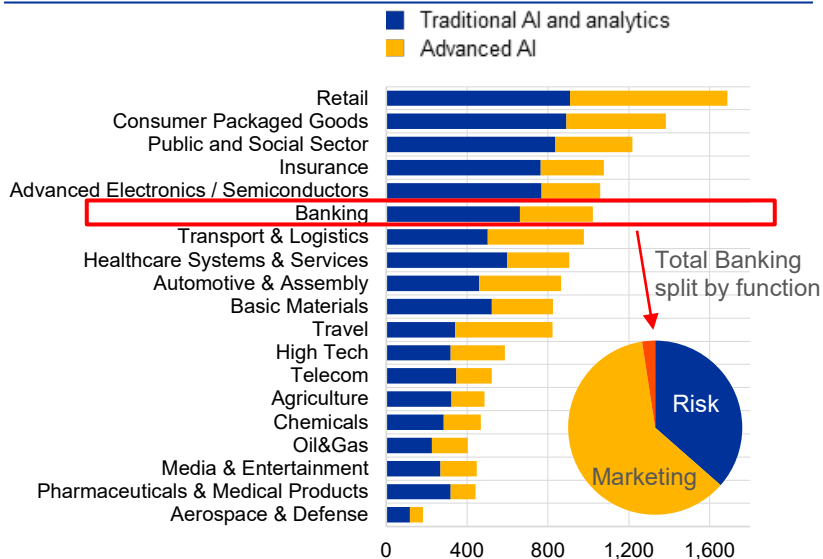
- **The world is changing** – the war in Ukraine, rising geopolitical tensions, accelerated deglobalization, and sustained supply chain disruptions are posing **new challenges also for banks**

- **Banks have the potential to manage the change** and benefit from
 1. **Artificial intelligence and automation**: advances in computing power, data volume, and connectivity are core components of the AI industrialisation from which banks can benefit
 2. **Cloud computing**: the cloud offers solutions to the upgrade of banks' (costly) legacy IT systems
 3. **Digital assets**: while 'crypto natives' have a first-mover advantage, banks could catch-up in a more mature and formally regulated market
 4. **Climate transition**: banks can benefit from the transition of established industries to Net Zero and build new "green" revenue streams

Artificial intelligence and analytics offers a large potential for economic value in banking

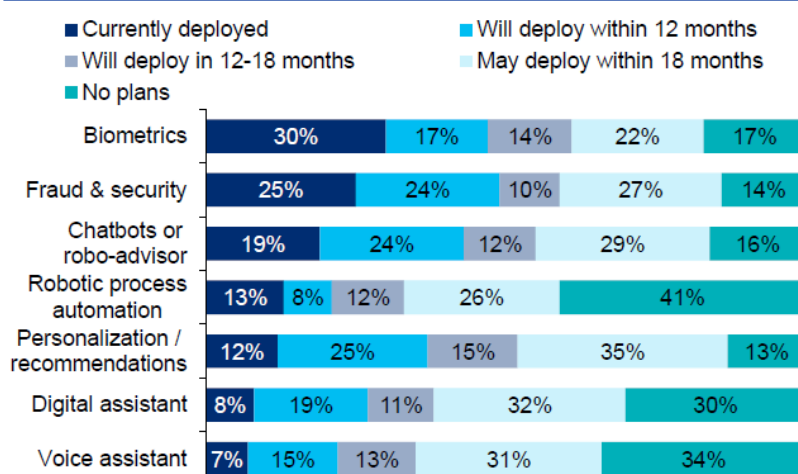
- Financial services is one of the leading early adopters of artificial intelligence
- AI can provide a competitive advantage for banks

Potential total annual value of AI and analytics Billion USD



Source: McKinsey.

AI solutions planned/deployed at US financial institutions Percentages



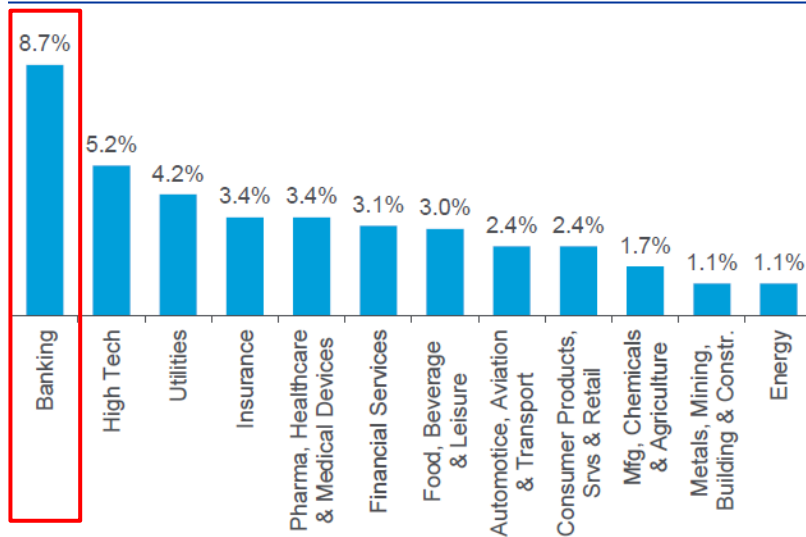
Source: BI Intelligence report titled "AI in Banking & Payments."

Cloud computing offers lower costs but comes with security issues

- IT expenses are notably higher in the banking industry due to an outdated IT infrastructure
- Banks hope to reduce IT costs when moving to the cloud but increase their dependency on third-parties

Median IT Expense

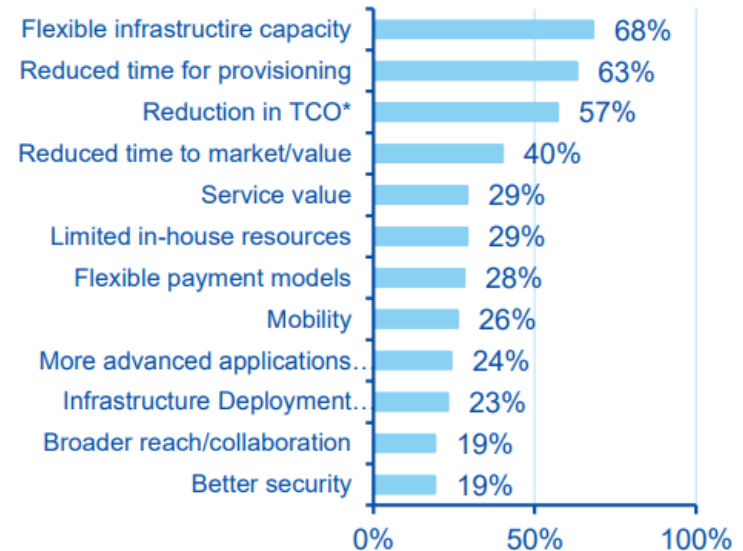
Percentage of business entity revenue



Source: Citi Research, CEB, CEB IT Budget Benchmark, Arlington VA.

Reasons for adopting cloud computing

Percentage of respondents



Source: CSA. Cloud Adoptions Practices & Priorities Survey Report.

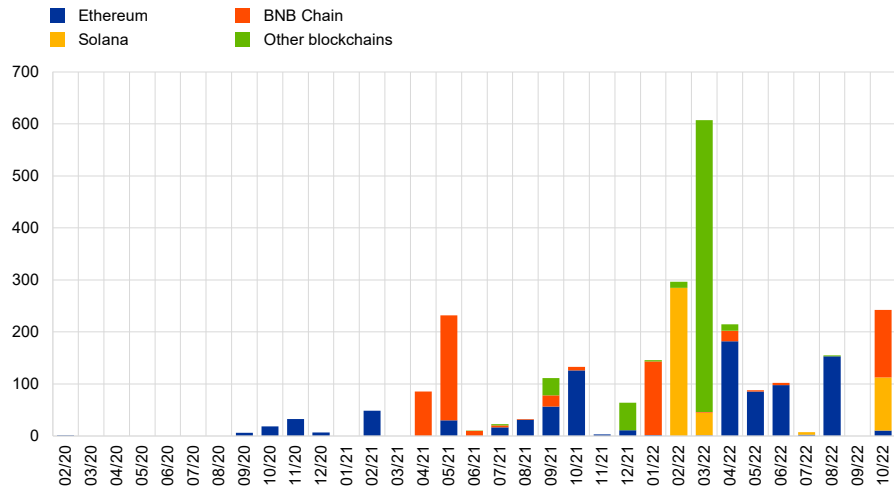
Notes: *TCO – Total cost of ownership.

Distributed ledger technology and digital assets have efficiency potential but come with risks

- DLT could offer benefits like lower costs or increased efficiencies, but also raises risks
- Banks' engagement with DLT and crypto-assets limited so far, but interest is increasing

Funds stolen through exploits by Blockchain

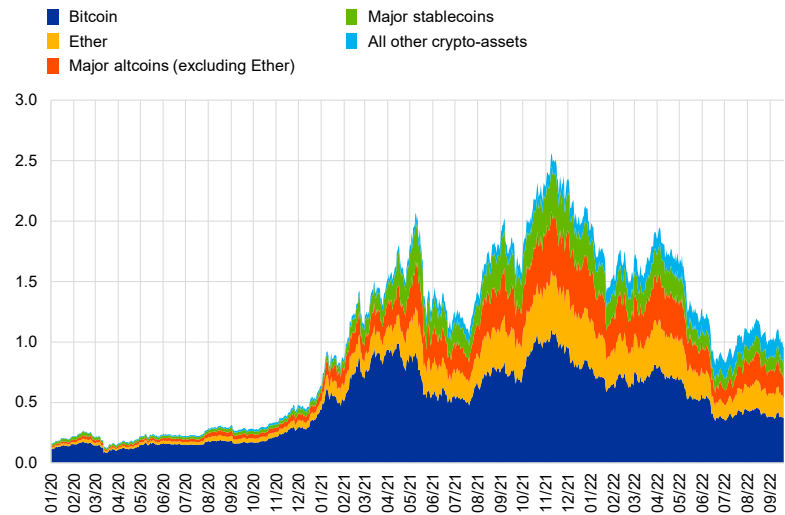
Feb 2020 – October 2022; € million



Sources: TheBlock and ECB calculations. Notes: Other blockchains include Polygon, Algorand, Avalance, Fantom, Gnosis Chain and Ronin. The monthly data are incomplete for October 2022.

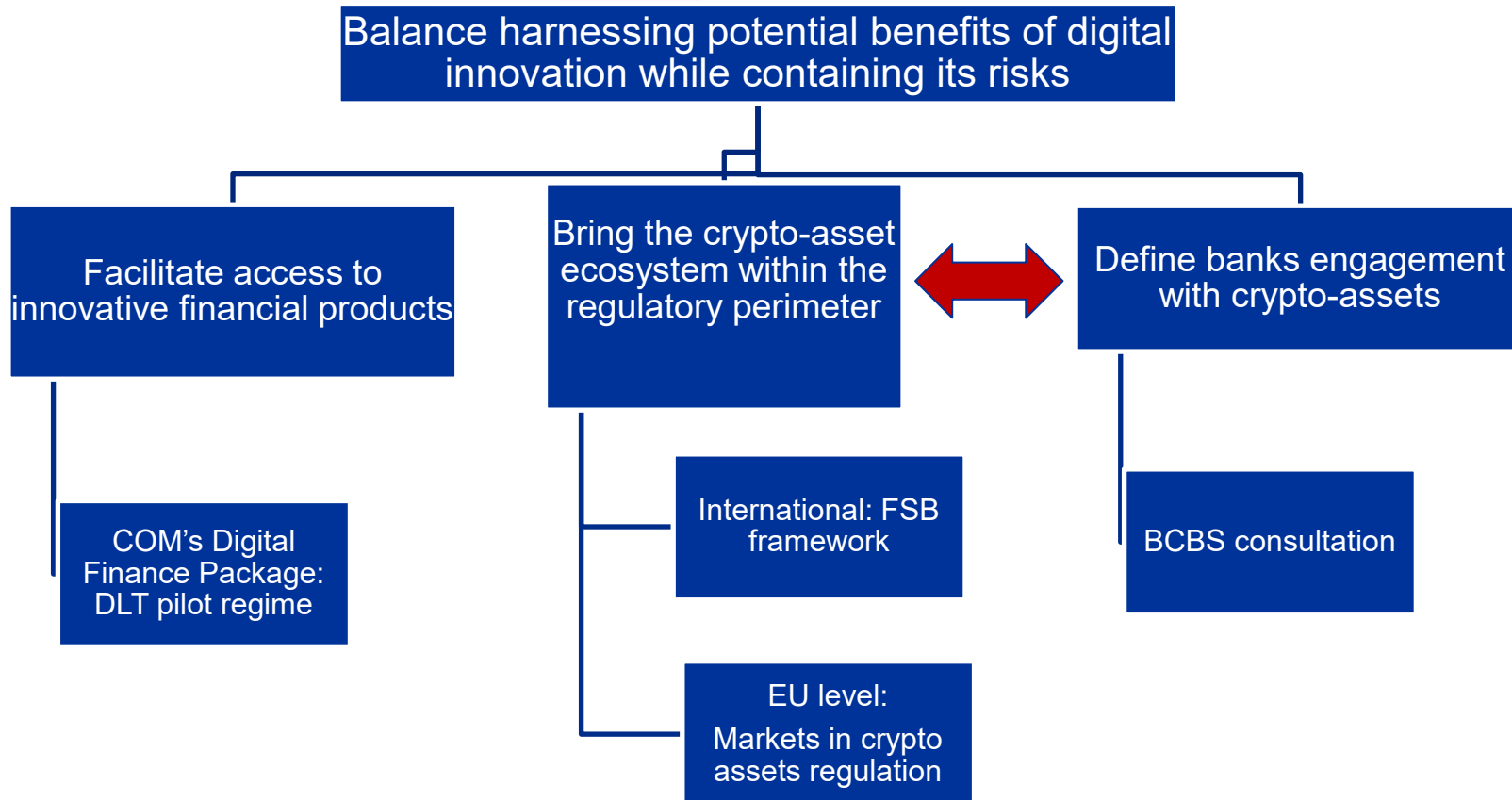
Market capitalisation of crypto-assets

Jan 2020 – Sept 2022; € trillion



Sources: Crypto Compare and ECB calculations.

Policy response for digital assets needs to balance potential benefits and risks

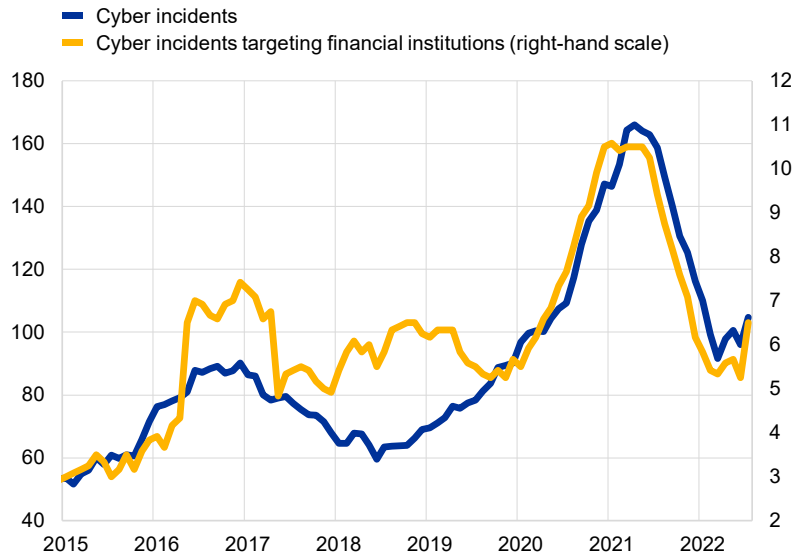


Cyber attacks have become more frequent

- Even before the pandemic, the number of cyber attacks was increasing ...
- ... and cyber activity seems to be driven by similar forces as political and economic policy uncertainty

Global cyber incidents, and cyber incidents targeting financial institutions

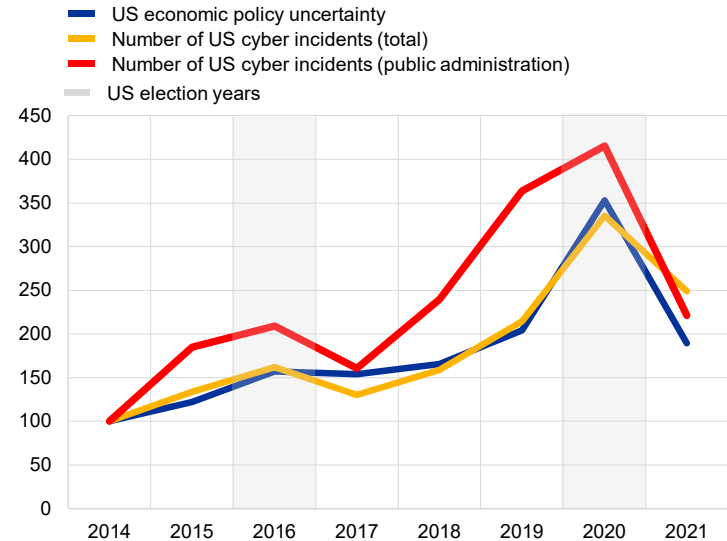
Jan. 2015 - Jul. 2022; number per month, 12m mov. avg.



Source: University of Maryland CISSM Cyber Attacks Database.

US economic policy uncertainty and number of cyber incidents

2014 – 2021, index: 2014=100



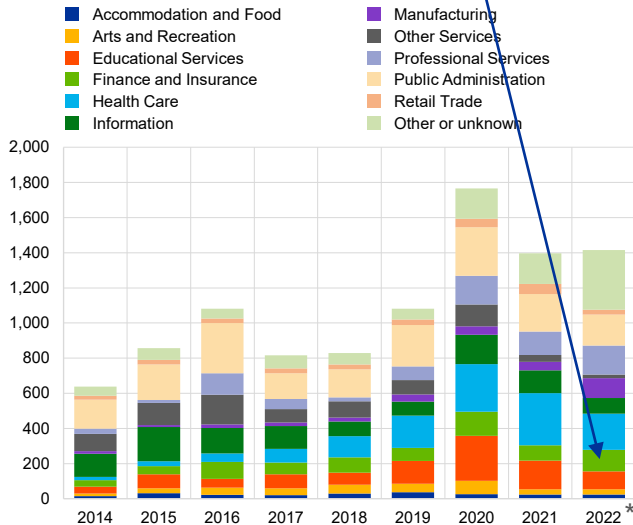
Sources: www.policyuncertainty.com and University of Maryland CISSM Cyber Attacks Database.

The financial sector is not the prime target of cyber attacks

- The majority of cyber attacks on the financial sector are exploitive and carried out by criminals
- Cyber attacks are mostly driven by financial motives, but protests by hacktivists have also played a role

Global cyber attacks by economic sector

2014-2022, number

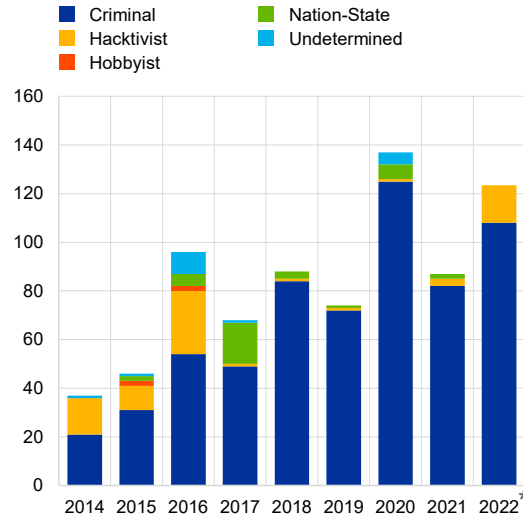


Sources: University of Maryland CISSM Cyber Attacks Database.

Notes: *2022 figures are annualised based on data available until July 2022.

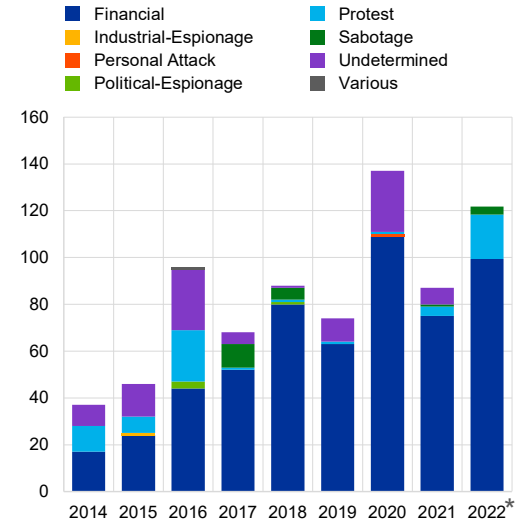
Cyber attacks on financial sector by perpetrator type

2014-2022, number



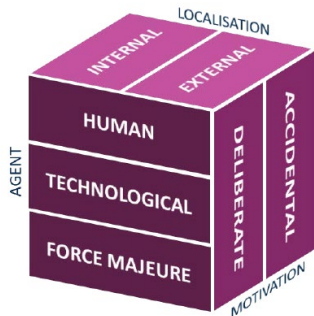
Cyber attacks on financial sector by motive

2014-2022, number

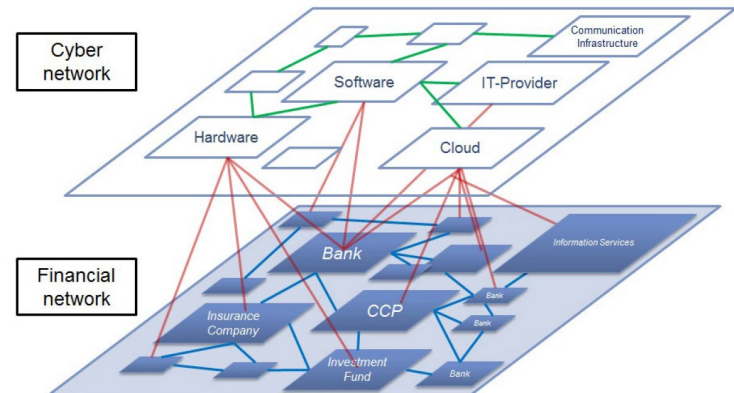


How cyber risk could matter for financial stability

- Reliance on **digitalisation** is increasing, also within the financial system...
- ... which gives rise to complex, multi-layered **interconnections** between the financial system, cyber networks/information and communication technology, and the real economy



Source: Ros (2020)

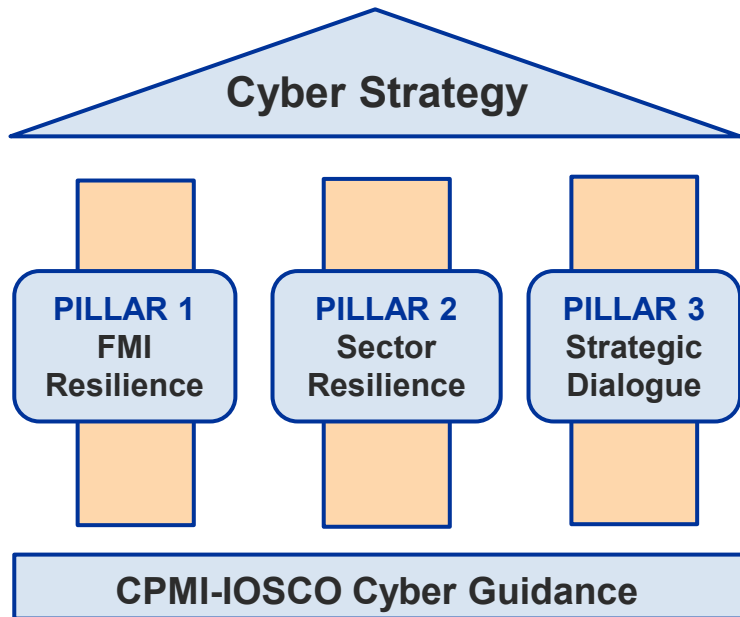


- Where, who, why ...
 - Many potential sources of cyber threats
 - Conducting of deliberate cyber attacks has become easier and cheaper over time

Different international and EU fora are working on cyber resilience

- **Work in international fora on a variety of cybersecurity and cyber resilience topics**
 - G7 Cyber Expert Group
 - Financial Stability Board
 - Basel Committee on Banking Supervision and Committee on Payments and Market Infrastructures
- **Work at EU level by European Systemic Cyber Group**
 - Pan-European systemic cyber incident coordination framework
 - Cyber resilience scenario stress testing
 - Identifying macroprudential tools

Eurosystem Cyber resilience strategy for Financial Market Infrastructures



The **Eurosystem strategy** for ensuring the cyber resilience of the financial ecosystem

Rolled out: 2017 – 2022
Eurosystem and national level



EUROPEAN CENTRAL BANK

EUROSYSTEM

The role for macroprudential policy in an evolving technological and climate finance landscape

EBA Policy Research Workshop -
"Technological Innovation, Climate
Finance and Banking Regulation"

26 October 2022

Cornelia Holthausen
Directorate General Macroprudential Policy and Financial Stability

