



EUROPEAN CENTRAL BANK

EUROSYSTEM

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*Disclaimer: The views expressed in this  
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not necessarily represent those of the ECB*

# Climate risk and financial stability

**Central Banking *Climate Risk Summit***

Frankfurt

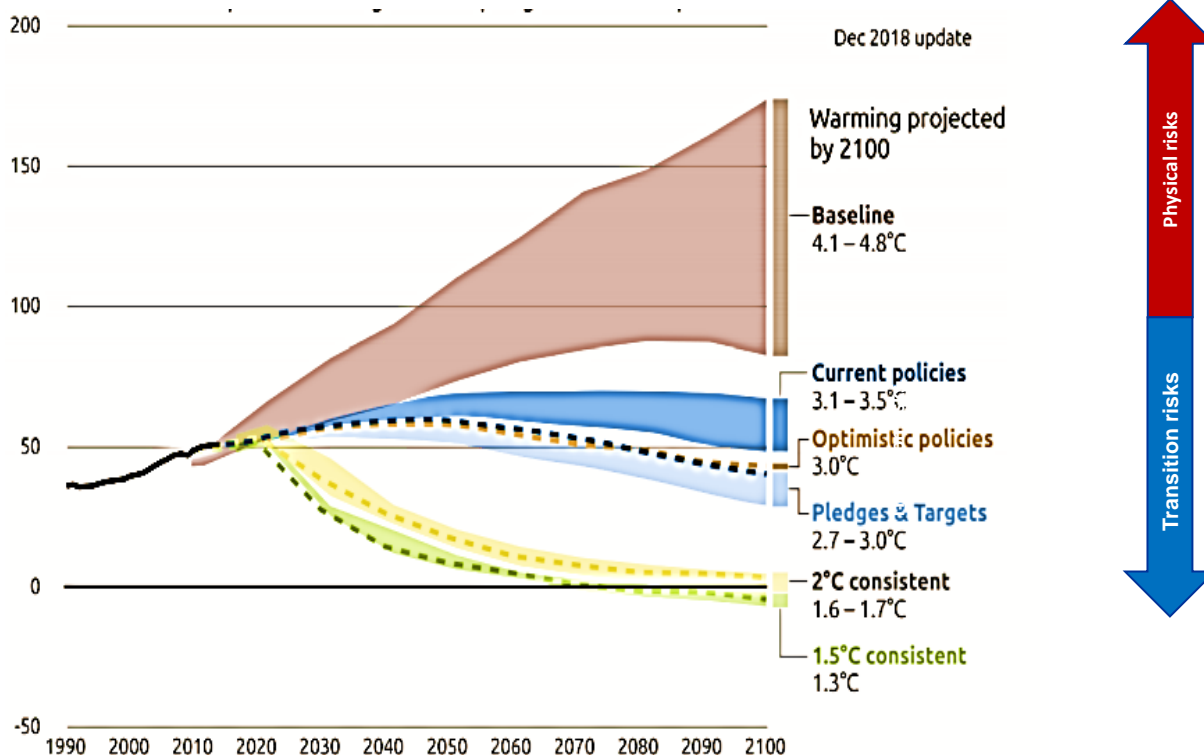
*12 December 2019*

# Macro-financial impact of climate change

## Highly uncertain but potentially disruptive impact from both physical and transition risks

- **Estimated costs of no action:** -10% GDP in 2100 (OECD); USD 20 trillion of stranded assets by 2050 (IRENA)
- **Investment needed to reach the Paris target** (global warming < 1.5°C) : USD 830 billion yearly until 2050 (IPCC, 2018)

Projections for carbon emissions & warming  
(Emissions in gigatonnes of CO<sub>2</sub> per year)



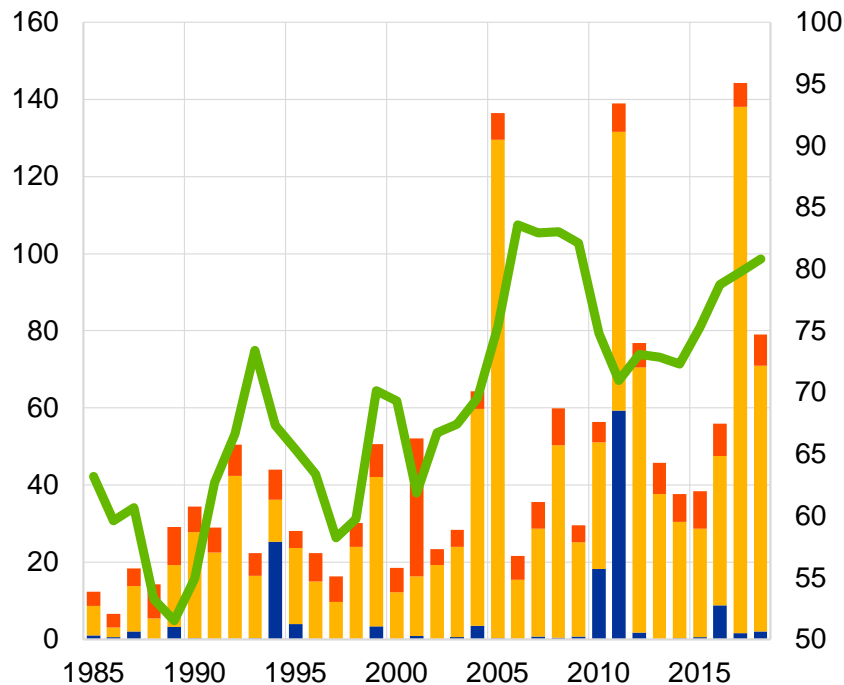
Source: Climate Action Tracker, Warming Projections Global Update, Dec 2018.

# Climate related loss events already on the rise

## Global insured catastrophe losses

left-hand scale: USD billions; right-hand scale: percentages;

- Earthquake/tsunami
- Weather-related catastrophes
- Man-made disasters
- % of weather-related catastrophes losses - 5-year moving average (right-hand scale)

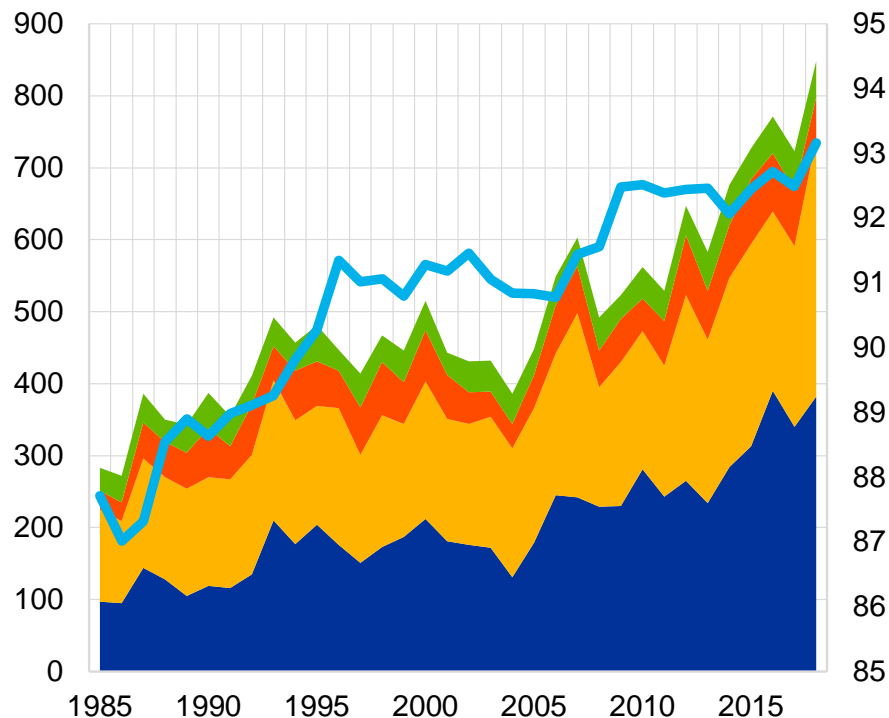


Sources: Swiss Re Institute, Munich Re NatCatService and ECB calculations.

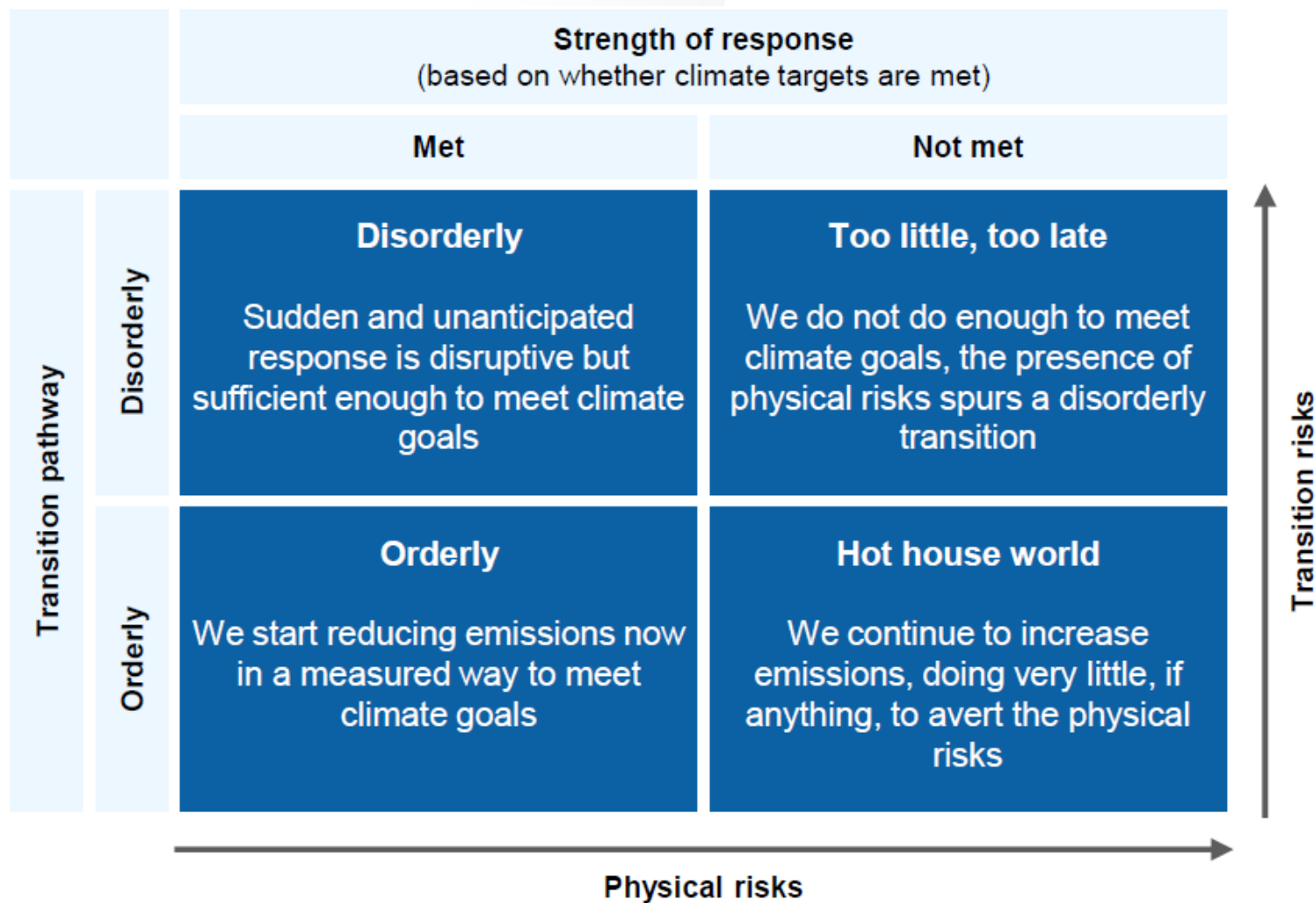
## Natural loss events worldwide

left-hand scale: number of events; right-hand scale: percentages

- Hydrological events
- Meteorological events
- Climatological events
- Geophysical events
- % of weather-related events - 5-year moving average (right-hand scale)



# Path dependence



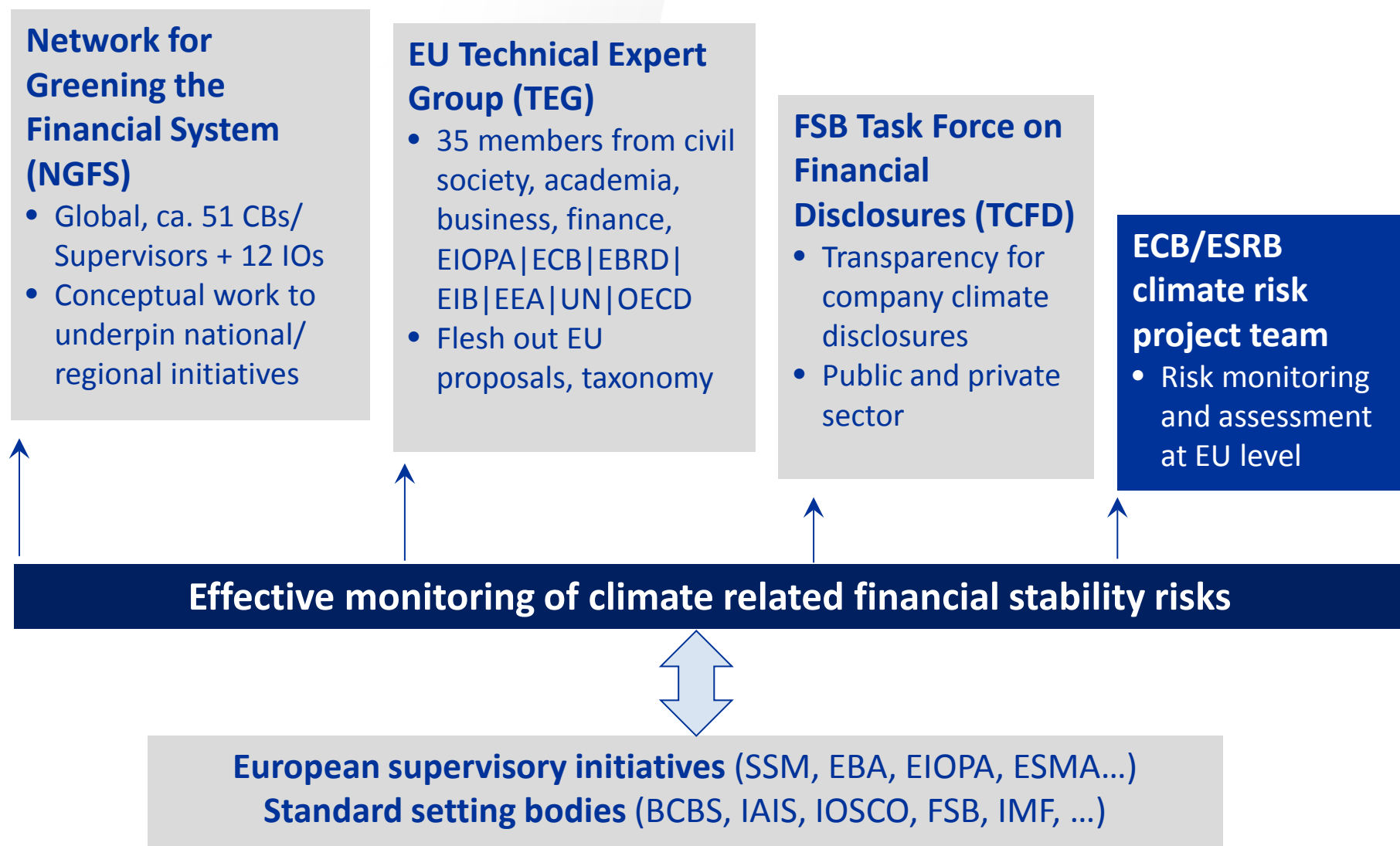
Source: NGFS: First comprehensive report, April 2019.

# Four strands of ongoing reflections

	2019 NGFS Recommendations	2018 EU Action Plan and regulatory proposals & ESRB proposals
<b>Monitoring climate-related risks</b>	Central banks and supervisors are encouraged to develop methodologies for measuring climate-related risks, including forward-looking scenario analysis and stress tests	The ESRB has proposed that the European Supervisory Authorities include climate risk scenarios in stress-test exercises, and is conducting analytical work on data and methodologies
<b>Developing taxonomies</b>	Regulators should develop taxonomies that aim to facilitate (i) financial institutions' climate risk management, (ii) assessment of the potential risk differentials between green and brown assets, and (iii) mobilisation of capital for green investments	The Commission has proposed a <b>regulation for an EU classification system of sustainable economic activity (taxonomy)</b> , which aims to help investors redirect capital towards green activities.
<b>Promoting disclosures</b>	Non-financial and financial institutions should adopt the FSB TCFD disclosure recommendations	The Commission has proposed a <b>disclosure regulation</b> and a <b>regulation for a low-carbon benchmark and a positive carbon impact benchmark</b>
<b>Incorporating climate-related risks into prudential frameworks</b>	Central banks and supervisors are encouraged to integrate climate-related risks into supervision, among other things, by (i) raising awareness and promoting climate risk assessment among institutions, (ii) setting supervisory expectations regarding governance and risk management, and (iii) potentially considering integrating climate risk into the prudential framework	In its Action Plan, the Commission states that it will explore the feasibility of the <b>inclusion of climate risks in institutions' risk management policies</b> and the <b>potential calibration of capital requirements for banks</b> as part of the CRR/CRD.

Source: ECB based on Network for Greening the Financial system (NGFS) and European Union action plan

# Complementary parallel initiatives



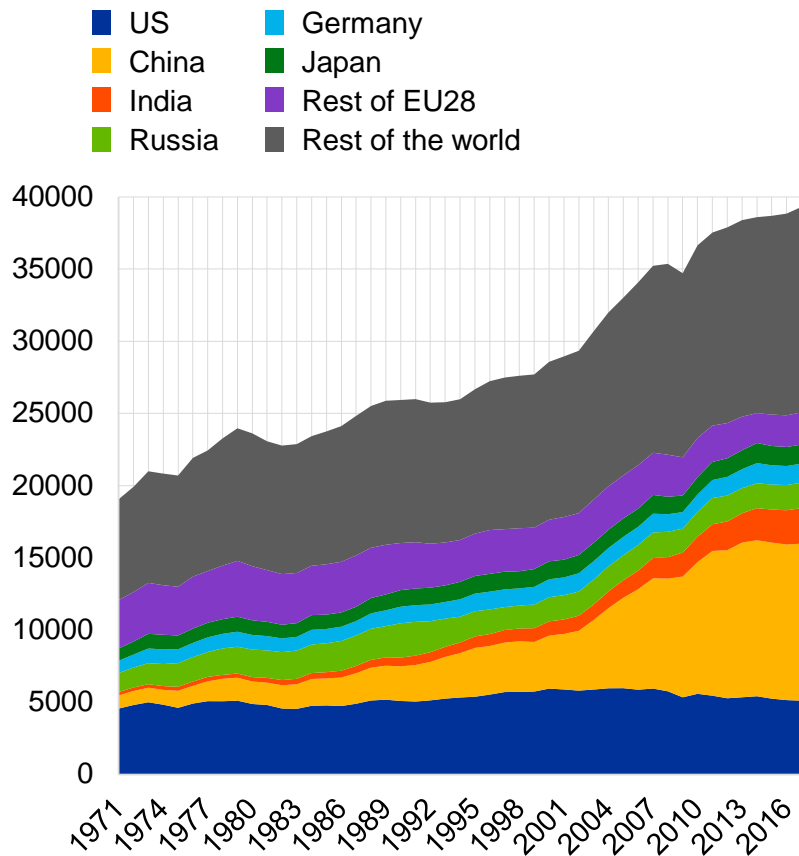
# Data for financial sector risk monitoring

Aggregation level	<i>Selected advantages</i>	<i>Selected disadvantages</i>
Country	<ul style="list-style-type: none"> <li>• Comprehensive</li> <li>• Suitable for monitoring country commitments</li> </ul>	<ul style="list-style-type: none"> <li>• Limited suitability for monitoring effects of climate change on financial exposures</li> </ul>
Sectoral	<ul style="list-style-type: none"> <li>• Comprehensive at NACE 2 level</li> <li>• Feasibility of scenario analyses</li> </ul>	<ul style="list-style-type: none"> <li>• Aggregation not based on climate metrics</li> <li>• Ignores firm-specific dynamics over time</li> </ul>
Firm	<ul style="list-style-type: none"> <li>• Allows for firm-specific climate metrics and dynamics</li> </ul>	<ul style="list-style-type: none"> <li>• Partial view on consolidated firm activities</li> <li>• Not encompassing (at least yet); incomplete corresponding climate data</li> </ul>
Activity	<ul style="list-style-type: none"> <li>• If possible to allocate an attribute for sustainability, allows monitoring financial flows to sustainable finance</li> </ul>	<ul style="list-style-type: none"> <li>• Difficulty of defining green vs brown assets</li> <li>• Relevance for financial stability depends upon impact on creditor hierarchy</li> </ul>

# Country-level perspective

## CO2 emissions over time

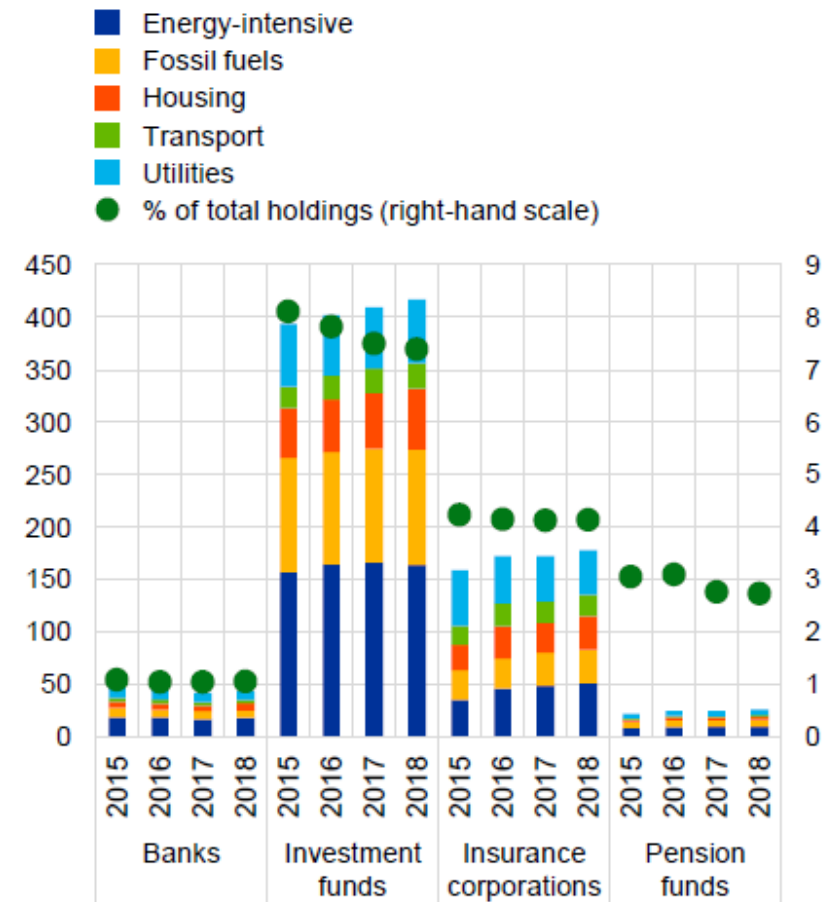
Thousands of tonnes



# Sector-level perspective

## Evolution of investment exposures to climate-sensitive sectors

left-hand scale: € billions; right-hand scale: % of total holdings

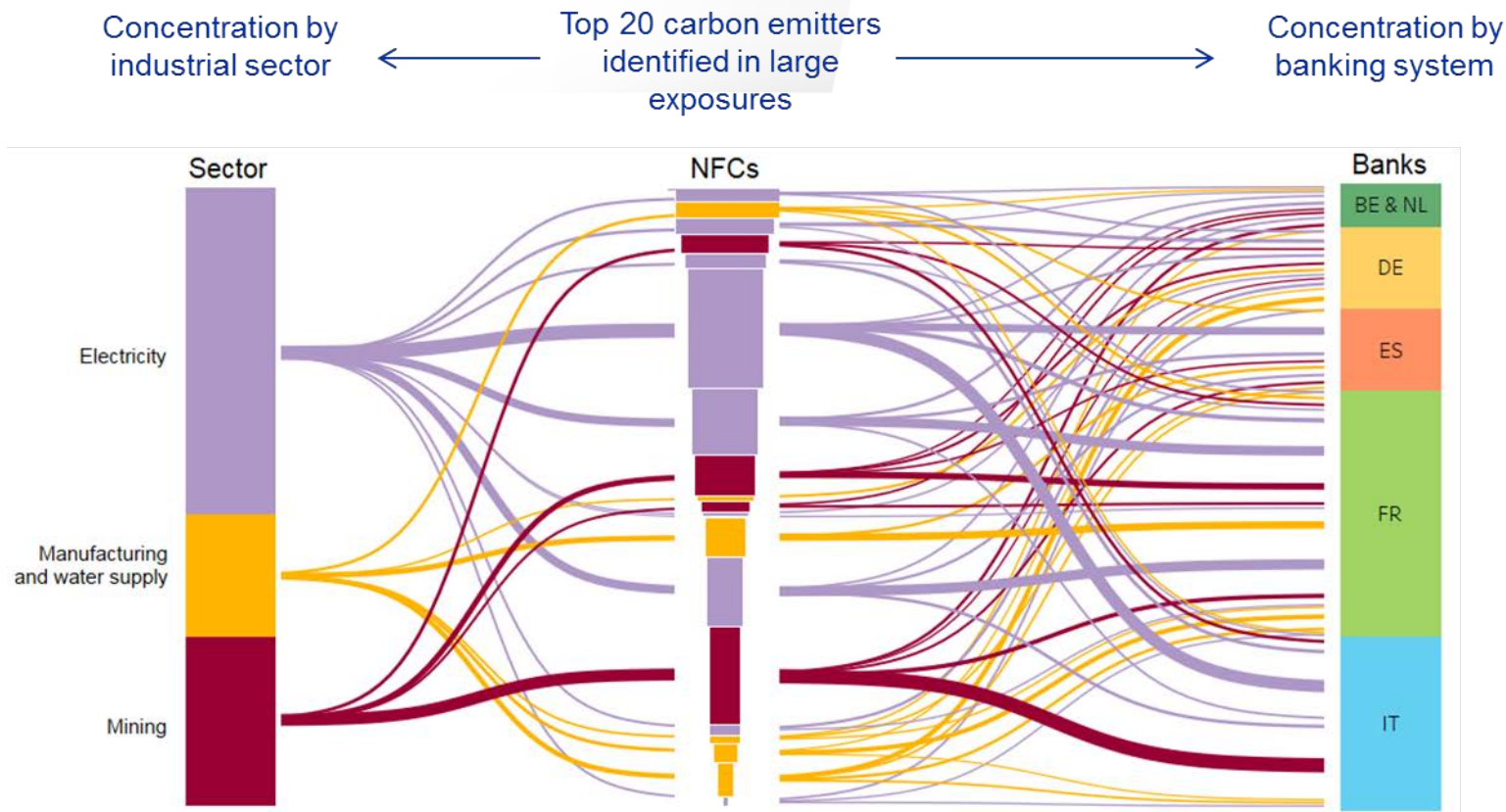


Sources: Sources: EDGAR, SUP. (LHS chart). RHS chart = ECB supervisory statistics, European Commission EDGAR dataset, Eurostat, ECB SHSS, ECB CSDB and ECB calculations. Notes: Left panel: the share of carbon emissions is calculated from Eurostat data on air emissions accounts by NACE activity, which cover the EU28, Turkey and Serbia. Electricity and gas supply also includes steam and air conditioning supply. Right panel: the classification of climate-sensitive assets follows the approach of Battiston et al. (2017). Sectoral holdings are classified according to the NACE categorisation in the ECB's Centralised Securities Database (CSDB).



# Firm- level perspective – *snapshot*

## Euro area banks' large exposures to firms with the highest carbon emissions



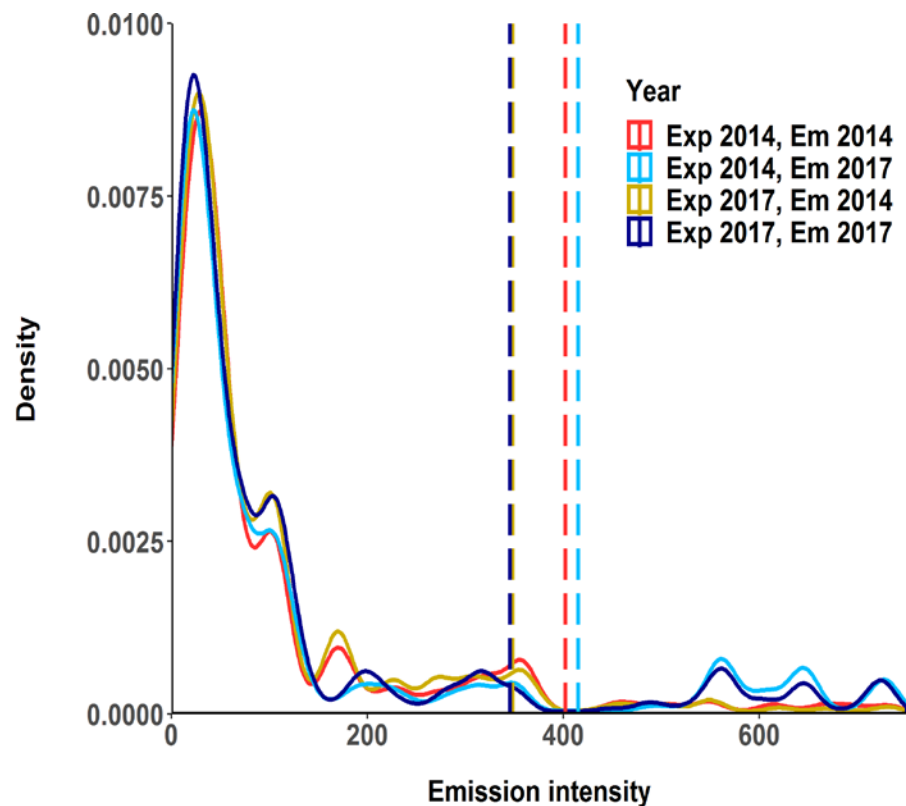
Sources: Thomson Reuters, ECB supervisory statistics (large exposures) and ECB calculations.

Notes: The top 20 carbon-emitting companies reported in the large exposures dataset. The companies are ranked in descending order according to their total carbon emissions over the last three years (middle bar); the height of the NFC (non-financial corporation) rectangles represents total loans extended to the respective corporation, whereas the width of the rectangles represents the carbon emissions of the corporation. The NFCs are classified according to the NACE categorisation (left bar). The country-bank column includes 29 banks (right bar).

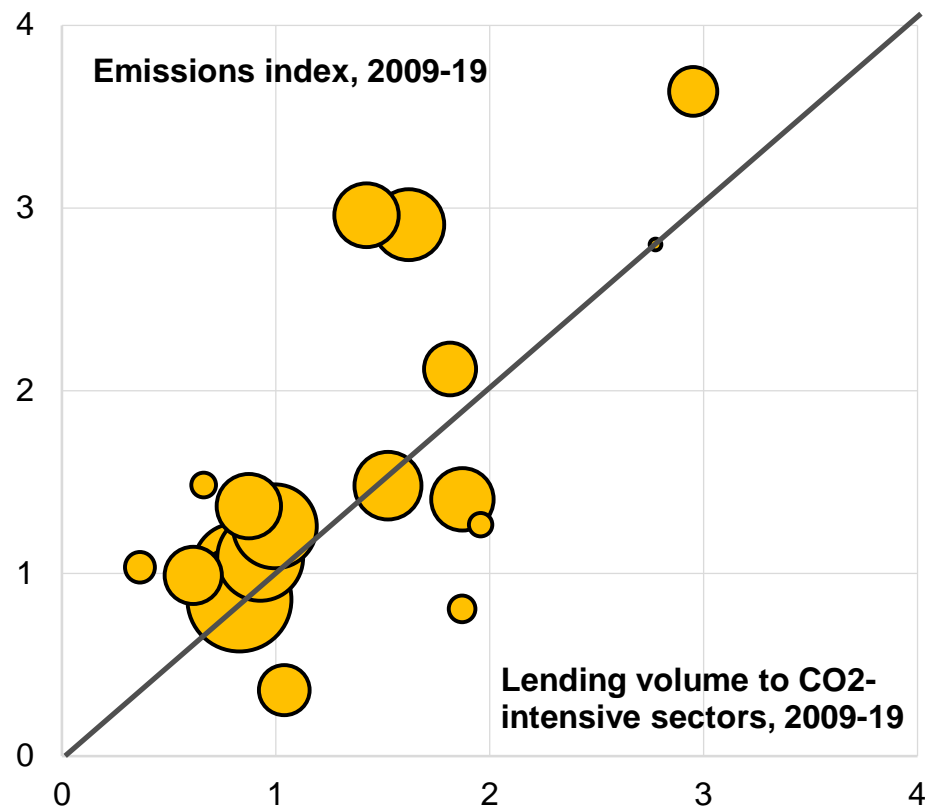
The chart is intended **only for illustrative purposes** and does not lend itself to firm conclusions. Large exposures data only constitute a fraction of total exposures, and the sample is further reduced by the voluntary nature of carbon emissions reporting by firms. The overall results may be overstated for concentrated banking systems.

# Firm- level perspective - *dynamics*

## Distribution of emission intensity for NFCs in the large exposures dataset



## Change in syndicated lending to high-carbon sectors and the related firm-specific emissions for the 19 largest euro area lenders

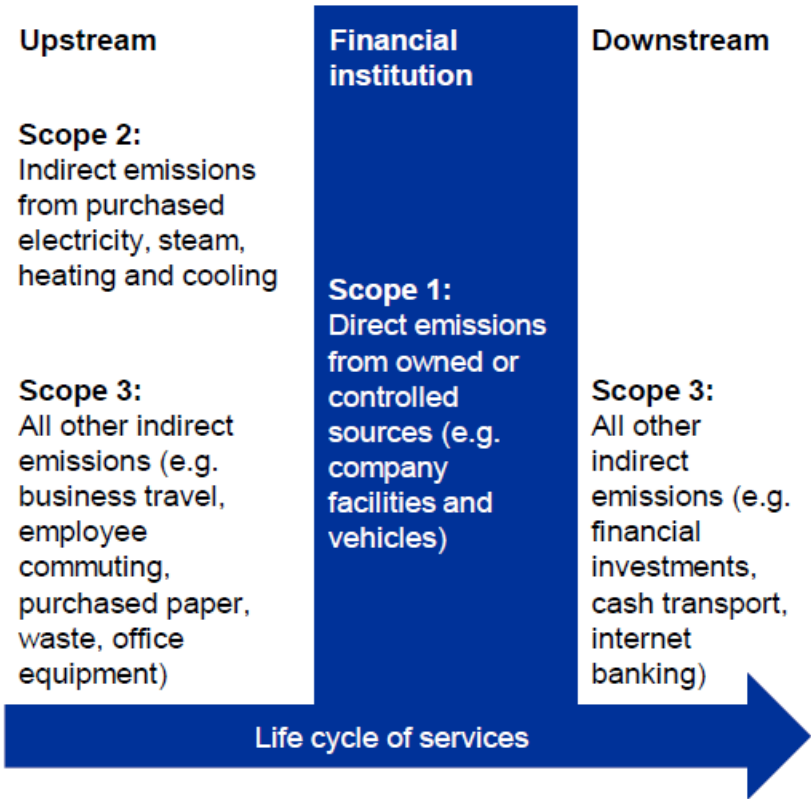


Sources: Dealogic, Refinitiv, ECB supervisory statistics (large exposures) and ECB calculations.

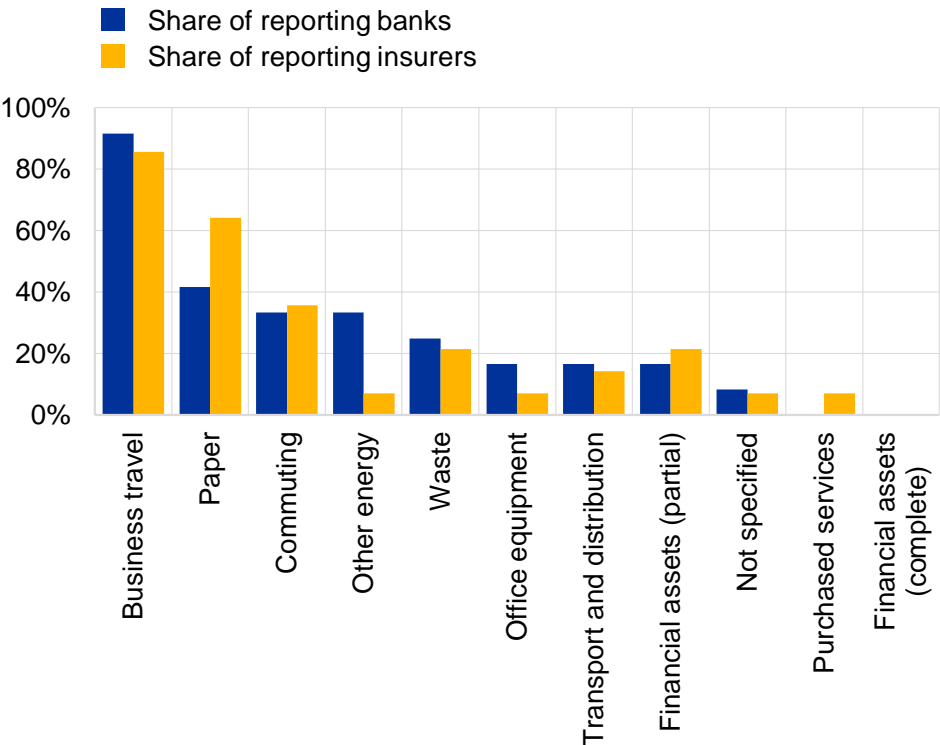
Notes: Left panel: Coverage for the emission intensity dataset is around €1.4 trillion (2,200 companies) of total NFC large exposures of €2.4 trillion (5,500 companies). Exp: exposures; Em: emissions. Right panel: Syndicated loans arranged by the 19 largest banks in the euro area. The size of the bubbles denotes the average size of lending to the high-carbon sectors in 2018-19. Both lending and emissions are expressed as four-year moving averages. The carbon-intensive sectors comprise chemicals, construction and building, machinery, metal and steel, mining, oil and gas, and utilities and transport.

# Incomplete reporting

## Typical items to be included in scope 1, 2 and 3 emissions reporting in the financial sector



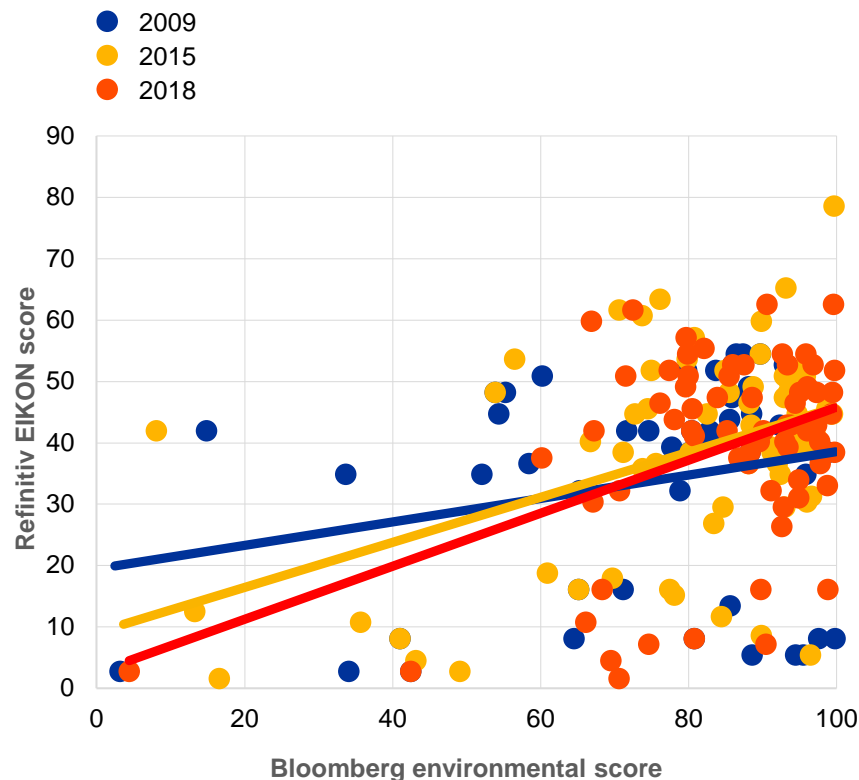
## Limited disclosure of scope 3 emissions by banks and insurers in the sample



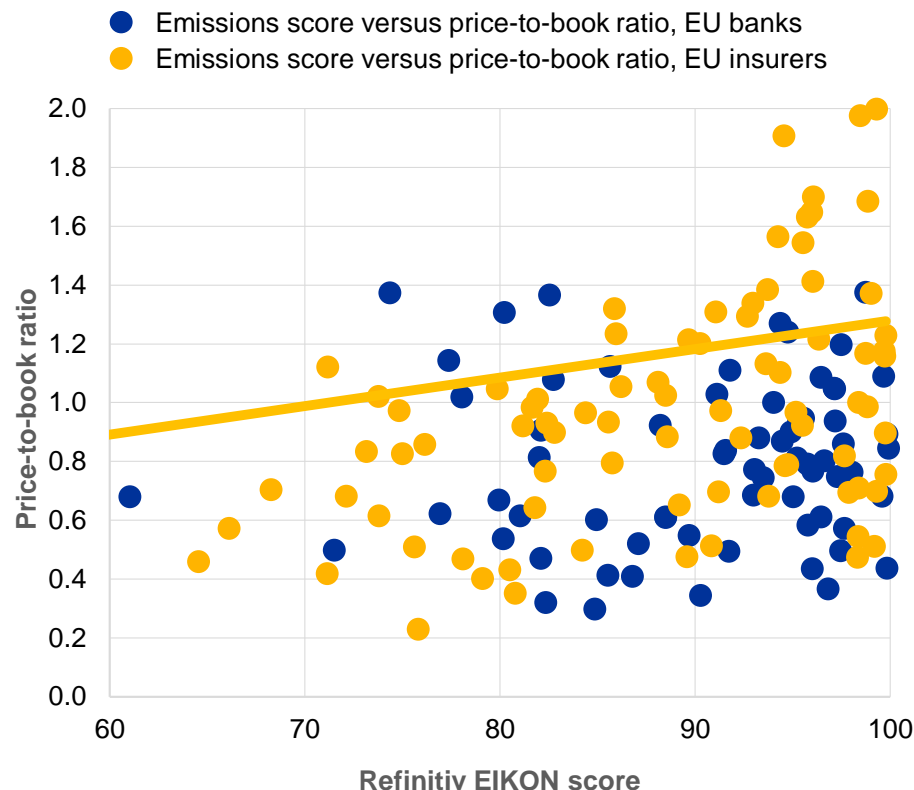
Sources: Greenhouse Gas Protocol, annual and sustainability reports of financial institutions and ECB calculations.  
Notes: The sample consists of the 12 largest banks and 14 largest insurers in the euro area. The partial reporting of financial assets under scope 3 refers to cases where a carbon footprint of some parts of the investment portfolio is made available, either as part of scope 3 emissions or separately

# Environmental market scores (currently) matter more for insurers than banks

## Correlations of environmental scores by Bloomberg and Refinitiv



## Environmental score and the price-to-book ratios of European banks and insurers

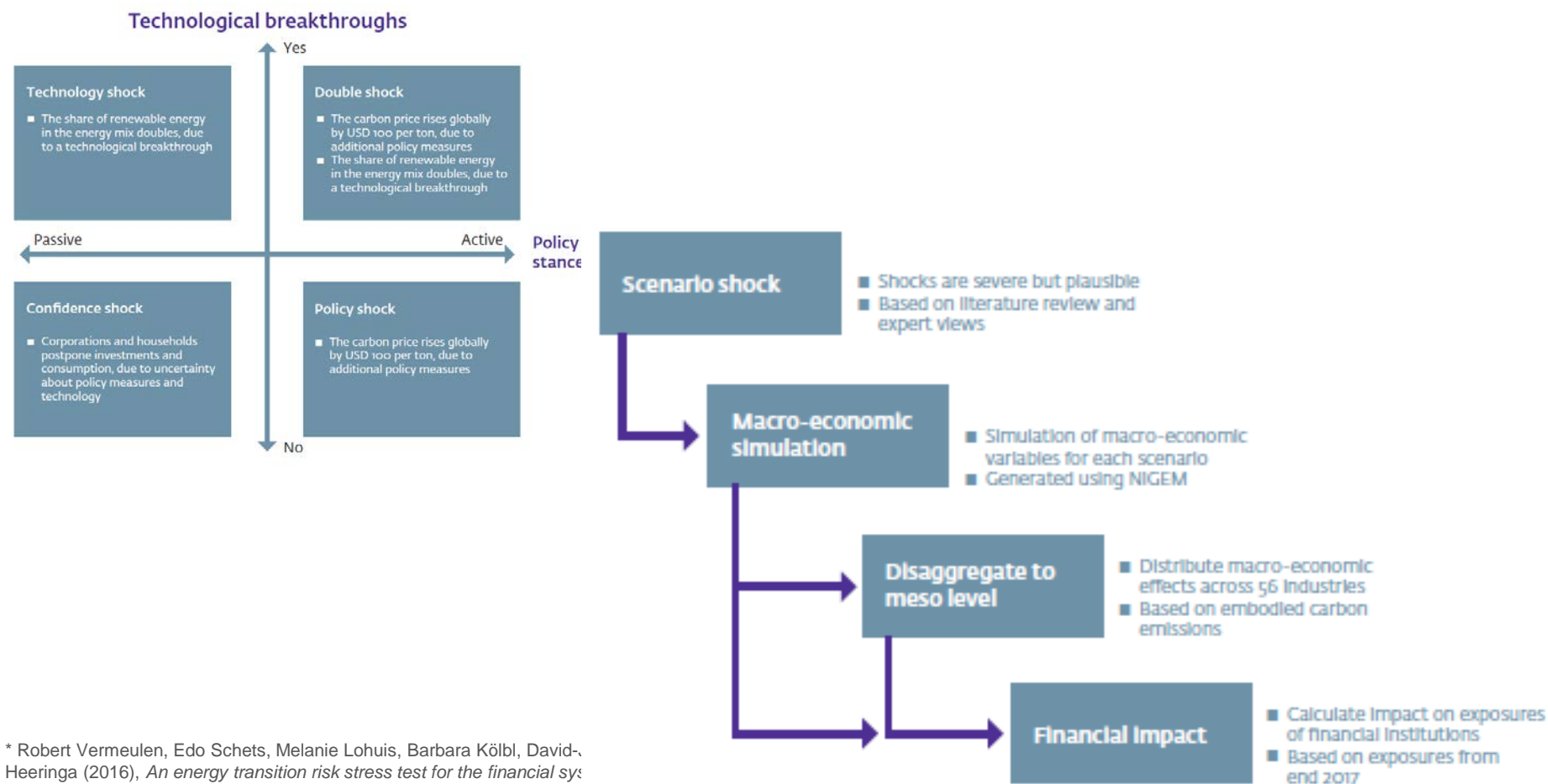


Sources: Bloomberg, Refinitiv EIKON, S&P Global Market Intelligence and Dealogic.

Notes: Left panel: The Bloomberg and Refinitiv environmental scores can take values between 0 and 100, whereby a higher value indicates a better performance in terms of environmental variables. Left panel: The full unbalanced sample consists of 49 banks and 23 insurers in the European Union and the United States. Right panel: The sub-sample used in the estimation consists of 16 EU insurers and 12 EU banks. Standards errors are clustered and robust. An Arellano-Bond estimator is used and controls include institution-specific variables (e.g. ROE, total debt, EBITDA, total expenses, total assets, dividend payout ratio, NPL ratio, Tier 1 capital ratio, solvency coverage ratio and premium growth when applicable) and market-specific variables (e.g. stock market volatility, long-term bond yields and GDP forecasts).

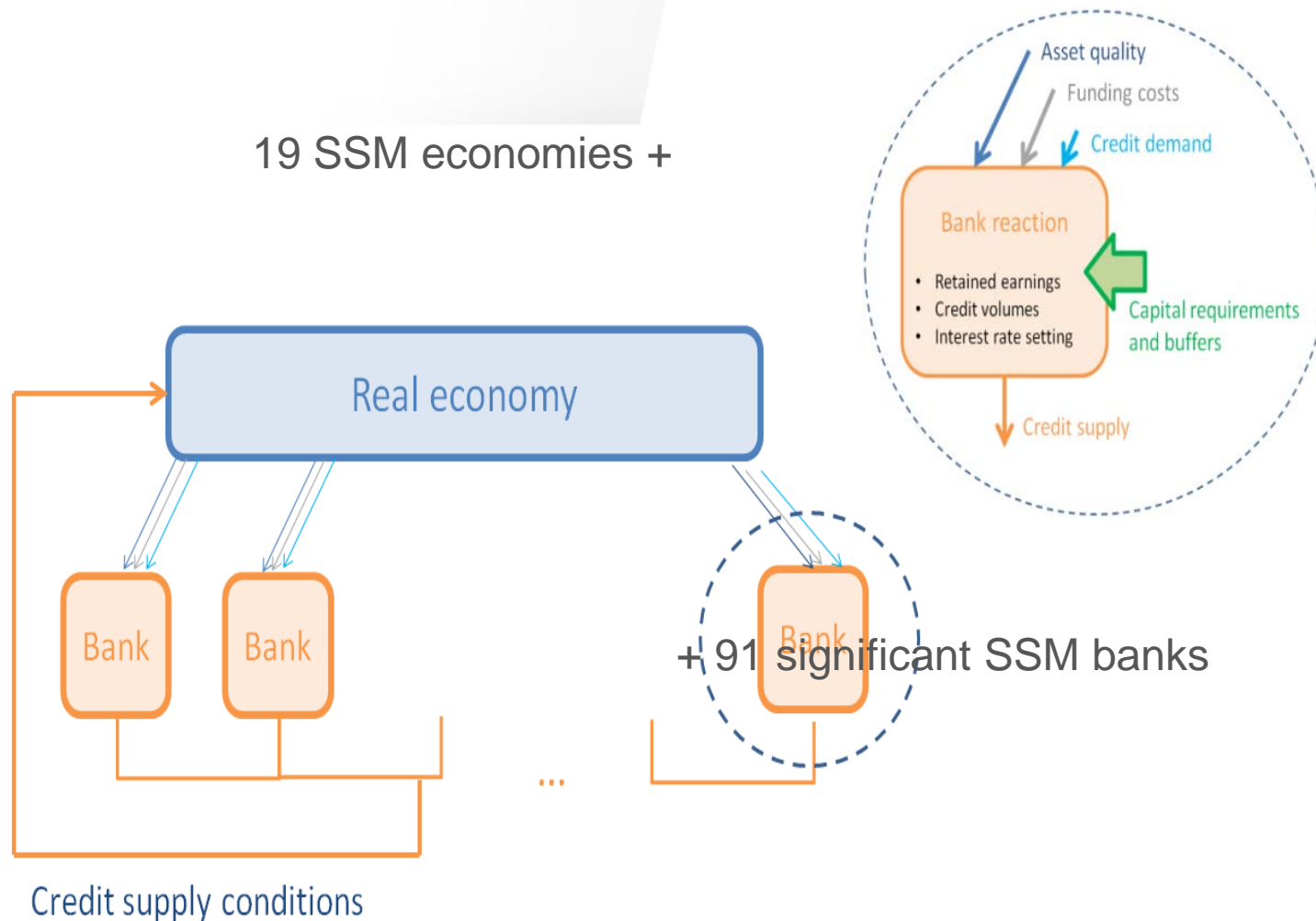
# Monitoring and assessing climate risk

Risk monitoring ...	... and risk assessment
<ul style="list-style-type: none"> <li>Exposures mapping (<i>direct</i> exposures)</li> <li>Amplifying features (<i>indirect</i> channels)</li> </ul>	<ul style="list-style-type: none"> <li>Climate change scenarios</li> <li>(Eventual) climate stress testing</li> </ul>



\* Robert Vermeulen, Edo Schets, Melanie Lohuis, Barbara Kölbl, David-Heeringa (2016), *An energy transition risk stress test for the financial system*; DNB Occasional Studies Volume 16 - 7

# The macroprudential stress test model of the ECB (BEAST)\*



Katarzyna Budnik, Mirco Balatti Mozzanica, Ivan Dimitrov, Johannes Groß, Ib Hansen, Giovanni di Iasio, Michael Kleemann, Francesco Sanna, Andrei Sarychev, Nadežda Siņenko, Matjaz Volk (2019), Macroprudential stress test of the euro area banking system, ECB Occasional Paper Series No 226 / July 2019

# Summary

## Climate risk relevant for financial stability

- Climate change may have significant impacts on the economy, both directly and indirectly through the actions taken to address it

## Four ongoing reflections

- Monitoring
- Taxonomy
- Disclosures
- Updating prudential frameworks