



EUROPEAN CENTRAL BANK

EUROSYSTEM

Toward stress testing of climate-related risks

Katarzyna Budnik

European Central Bank

11/12/2019



Klimawandel Referat
Vienna

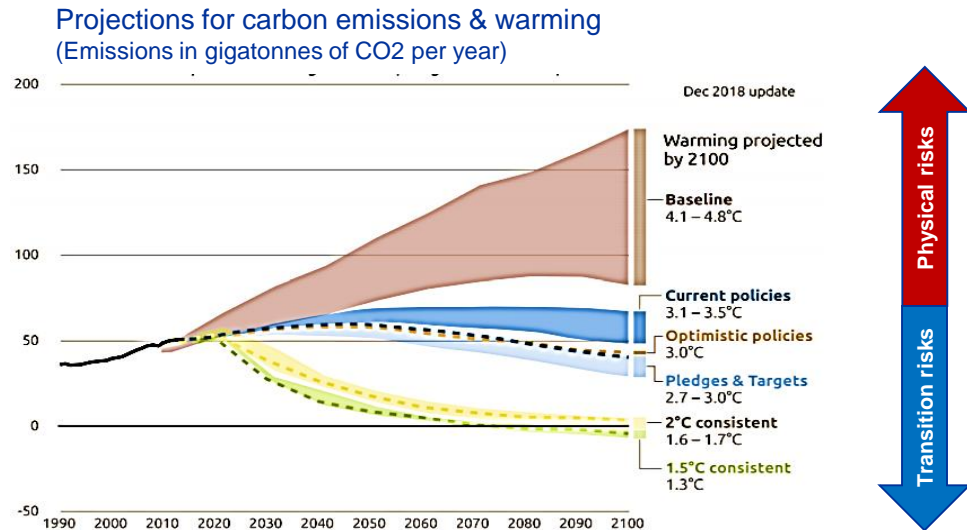
Why do macroprudential authorities care about climate risks?

The 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)

Two possible objectives

- **Shelter the stability of the financial system:** ensure that it can absorb losses stemming from physical risks
- **Ensure smooth transition:** so that the financial system is ready to face the transition to a greener economy, and potential policy changes



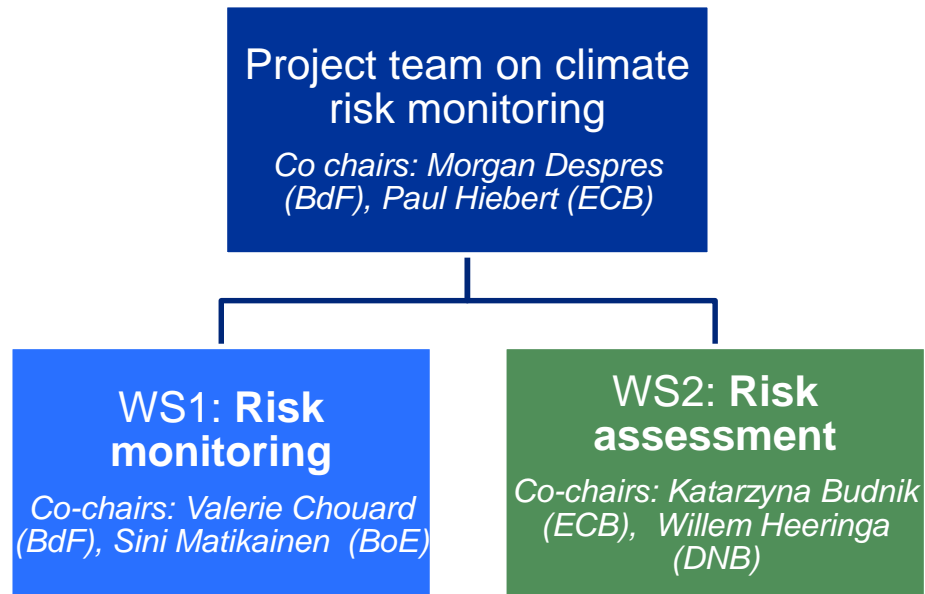
What can macroprudential authorities do about climate risks?

Policy toolbox

- **Monitor and assess** materiality
- **Communicate**
- **Propose and assess policies**, e.g. capital buffers

Project team on climate risk monitoring

- Joint initiative of **European Systemic Risk Board** and **SSM** Financial Stability Committee
- Groups experts from **European** central banks, supervisory authorities, EIOPA, EBA
- Set up early 2019, with the first report to be published by mid-2020

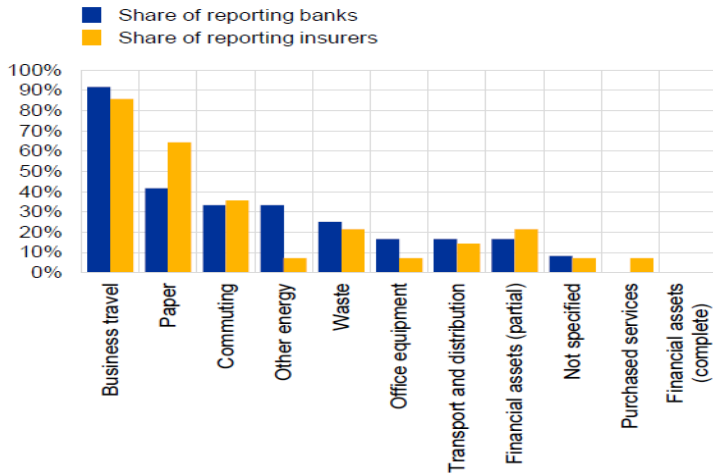


Monitoring: filling data gaps

Limited disclosure of scope 3 emissions by banks and insurers (emissions related to financial assets)

November 2019 FSR

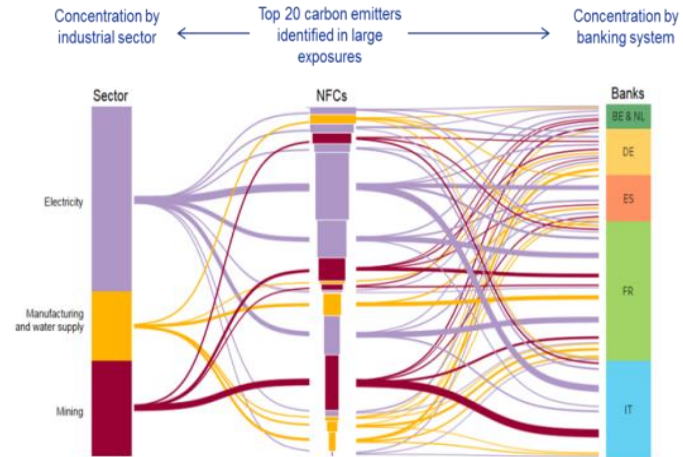
(2018, percentage of the financial institutions in the sample)



- **Matching** financial exposures to climate risk
- **Expanding** coverage to other databases

Large exposure data: banks report exposures to clients (or groups of connected clients) of at least 10% of eligible capital, or €300 mln

May 2019 FSR: an illustrative example



Clarifying reporting gaps by banks and firms

Stress testing: climate-related risks for financial sector

Two **sources of risks** for the financial sector:

- **Physical:** rising temperatures, sea levels, water pollution
 - Increased severity and frequency of natural catastrophes
- **Transitional:**
 - Policy actions that aim at mitigating environmental change
 - Technological changes

Transmission mechanisms to financial institutions:

- Credit risk via adjustment in asset quality
- Market risk via trading-book assets' revaluation
- Operational and reputational risk from investing in brown assets

'Pilot' stress test

Features of the pilot stress-test

Climate-related risks addressed	Transition risk
Scenarios	<ul style="list-style-type: none">• Adverse policy shock• Technology shock
Time horizon	5 years
Transmission mechanisms	<ul style="list-style-type: none">• Credit risk• Market risk• Amplification mechanisms
Institutional coverage	Largest SSM banks (91)
Geographic coverage	All euro area countries
Resilience metrics	CET1 ratio, loans to NFCs/households, GDP impact

Top-down macroprudential set-up

Climate-related risk (narrative)

Two sources of transitional risk, from DNB energy transition ST *

- **Policy shock:** abrupt implementation of policies reducing CO₂ emissions
- **Technology shock:** technological breakthroughs that boost the share of renewable energy in the energy mix

Mapping climate scenarios in macroeconomic conditions

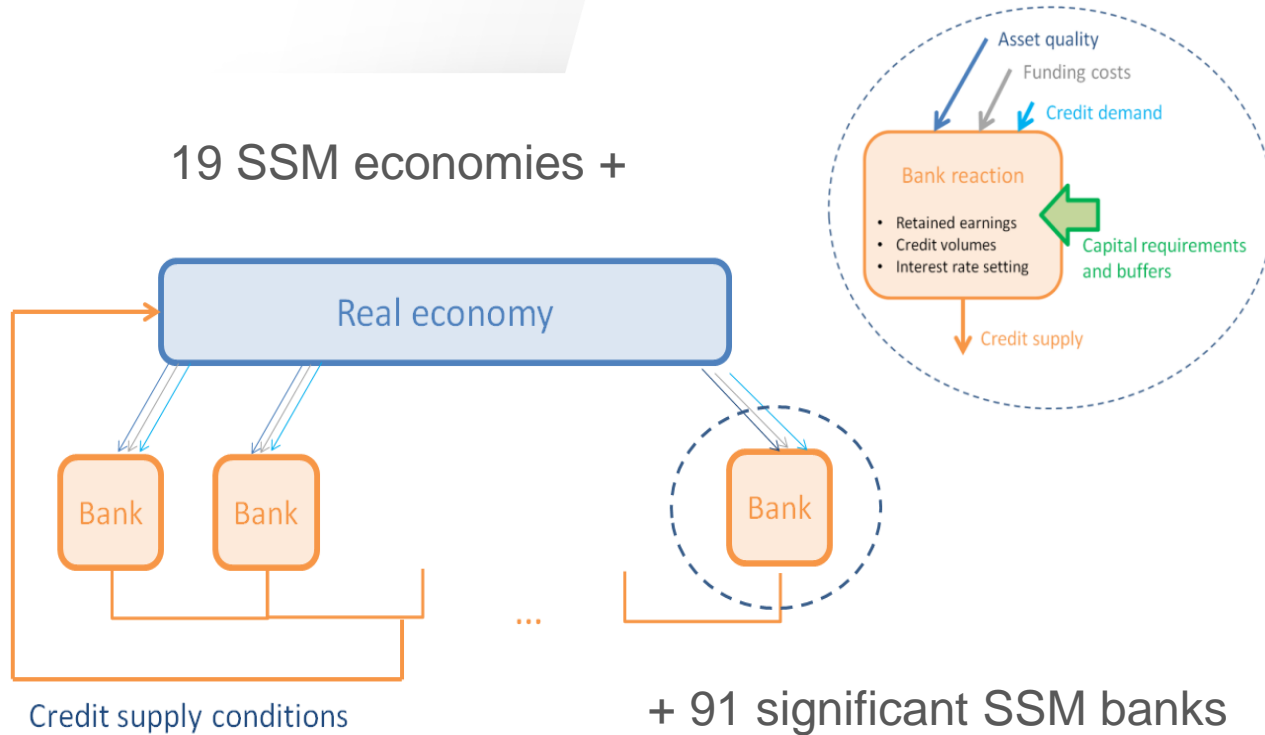
- **Baseline** scenario: transitional risk does not materialise (standard ECB forecasts)
- **Adverse** scenario: transitional risk materialises, and translates into macroeconomic conditions through NiGEM

Transmission to the financial sector

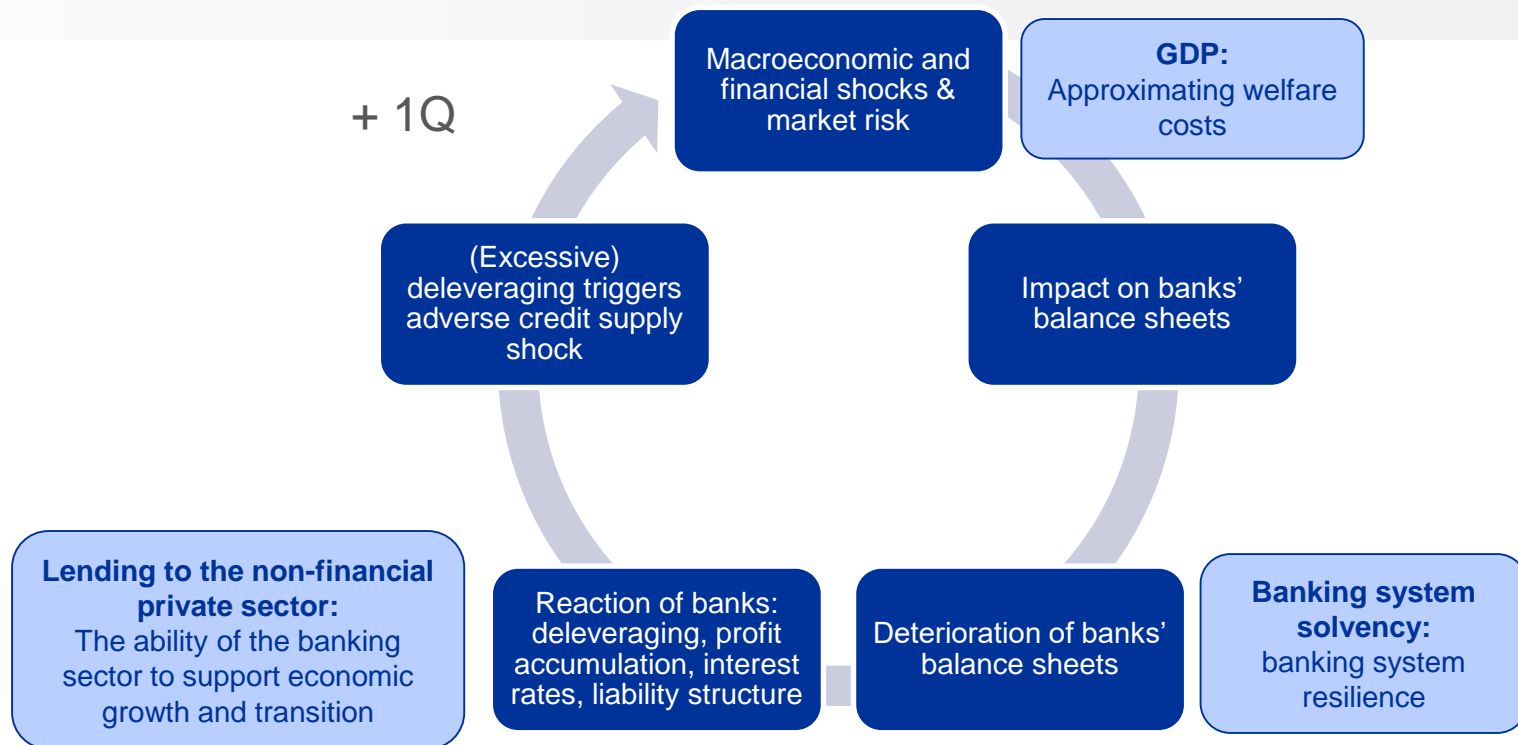
- **Market risk:** revaluation of banks' assets in the trading book (based on granular SHS data)
- **Credit risk:** economic conditions affecting asset quality
- **Feedback mechanisms**

* R. Vermeulen et al. (2016), *An energy transition risk stress test for the financial system of the Netherlands*, DNB Occasional Studies Volume 16 - 7

Macroprudential stress test model of the ECB (BEAST)*



Feedback loop



In-depth example: revaluation losses

Transition to low-carbon economy affects **differently** high and low carbon intense industry sectors

- Constructing **Transition vulnerability factors (TVF)** to estimate industry-specific losses based on their embodied (direct and indirect) CO_2 emissions
- Deriving industry specific-effects on equity and debt instruments
- Mapping of firm-level devaluations on issuer-level to bank exposures via SHS-G database

Just the beginning of a long journey

- The **pilot stress test** employs the state-of-the-art macroprudential model and rests on DNB experience with scenario design, but:
 - Misses the differences in banks' banking book exposures to carbon-intense industries
 - Abstracts from operational risk
 - Focuses on carbon emission policies
- The development of climate-risk stress testing hangs on **disclosure policies** i.e. ability to establish the mapping: *bank exposures - companies – emission intensity*
 - Other challenges involve:
 - lack of historical data on, e.g. probability of default of carbon-intense industries in times of the tightening of emission policies
 - designing plausible scenarios with physical risks

Stress texting with the focus on climate risks: mixed expectations

Stress testing ~ *crisis management*

The analysis of the ability of a financial institution or the system to withstand realization of adverse but plausible events, e.g. economic crisis

Scenario analysis ~ *strategic planning*

The analysis of the future by considering possible alternative outcomes ("alternative worlds"). One of the main forms of projection that presents several alternative future developments.

(Ultimately) different needs e.g.

- Horizon
- Acknowledging the role of technological progress and/or changing business models of financial institutions

Appendix

Climate-related scenarios

Adverse Policy shock scenario: *Policies designed to reduce CO₂ emissions are assumed to be implemented abruptly.*

- Positive oil price shock consistent with large increase in the carbon price
- Lower GDP
- Higher inflation
- Decrease in Stock prices and increase in interest rates

Technology Shock scenario: *Unanticipated technological innovations allow share of renewable energy to double in five years.*

- Initial boom in GDP followed by a growth slowdown due to write-offs
- Initial drop in stock markets followed by a recovery in the medium term
- Moderate macroeconomic impact with short-term losses but medium-term gains