



EUROPEAN CENTRAL BANK

EUROSYSTEM

# Toward stress testing of climate-related risks

---

Katarzyna Budnik

European Central Bank

11/12/2019



Klimawandel Referat  
Vienna

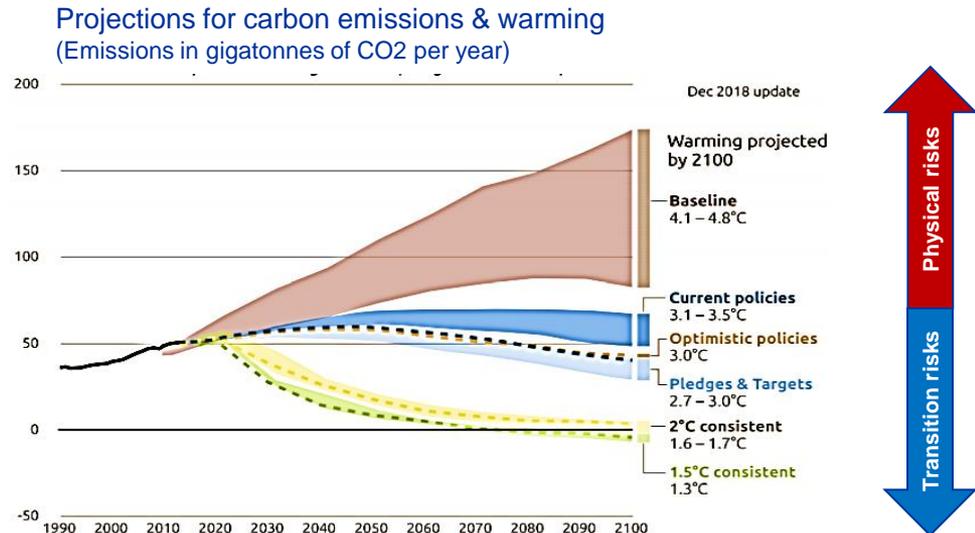
# Why do macroprudential authorities care about climate risks?

## 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



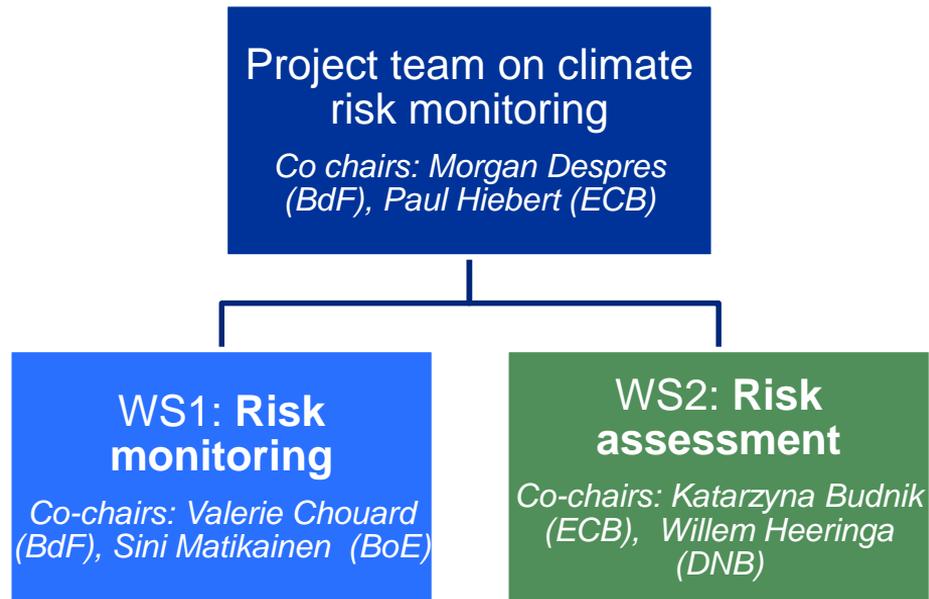
# What can macroprudential authorities do about climate risks?

## 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

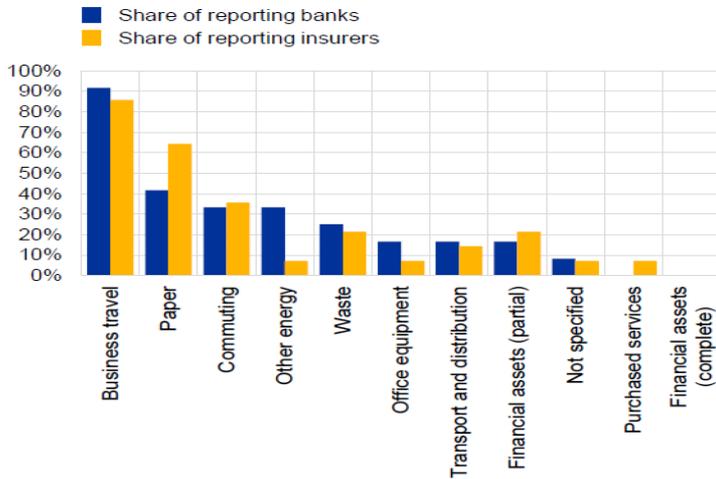


# Monitoring: filling data gaps

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

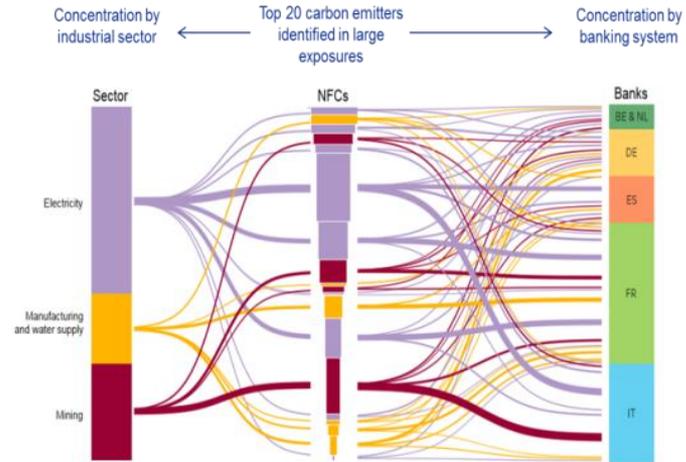
## November 2019 FSR

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



**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



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

**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

<b>Climate-related risks addressed</b>	Transition risk
<b>Scenarios</b>	<ul style="list-style-type: none"><li>• Adverse policy shock</li><li>• Technology shock</li></ul>
<b>Time horizon</b>	5 years
<b>Transmission mechanisms</b>	<ul style="list-style-type: none"><li>• Credit risk</li><li>• Market risk</li><li>• Amplification mechanisms</li></ul>
<b>Institutional coverage</b>	Largest SSM banks (91)
<b>Geographic coverage</b>	All euro area countries
<b>Resilience metrics</b>	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 CO<sub>2</sub> emissions
- **Technology shock:** technological breakthroughs that boost the share of renewable energy in the energy mix

## Mapping climate scenarios in macroeconomic conditions

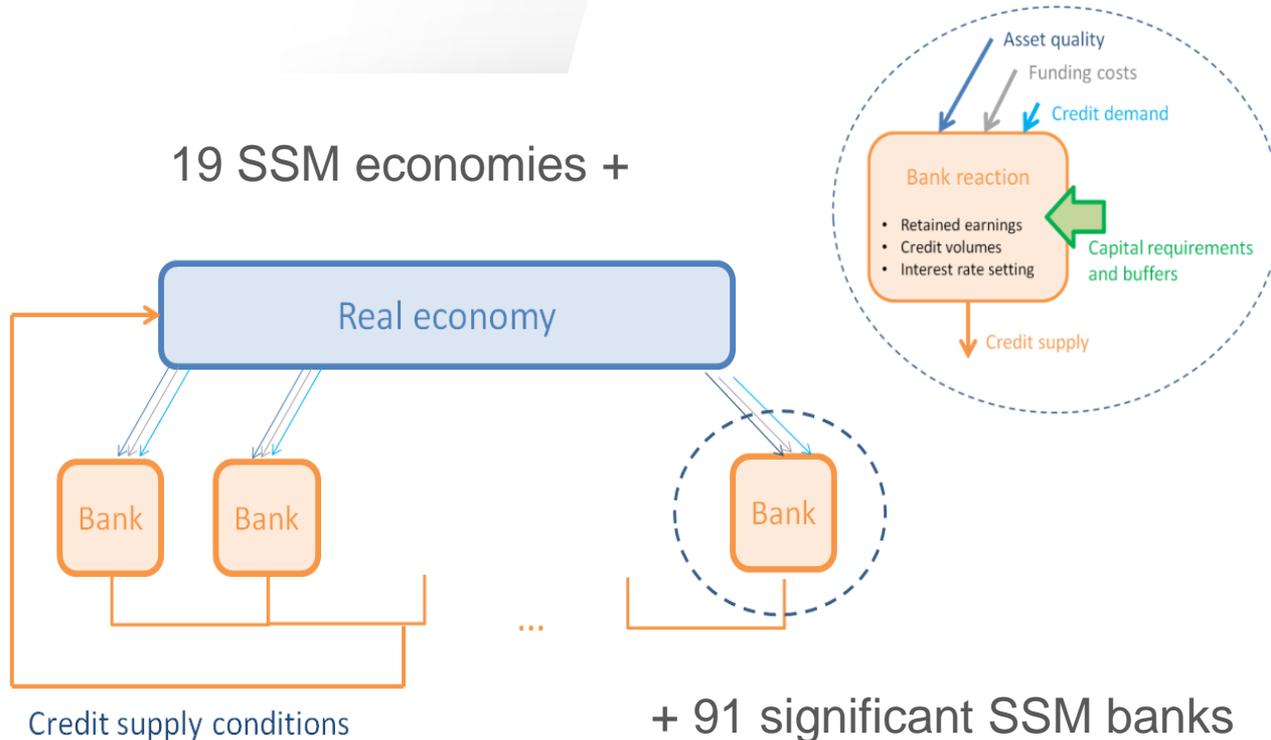
- **Baseline** scenario: transitional risk does not materialise (standard ECB forecasts)
- **Adverse** scenario: transitional risk materialises, and translates into macroeconomic conditions through NiGEM

## Transmission to the financial sector

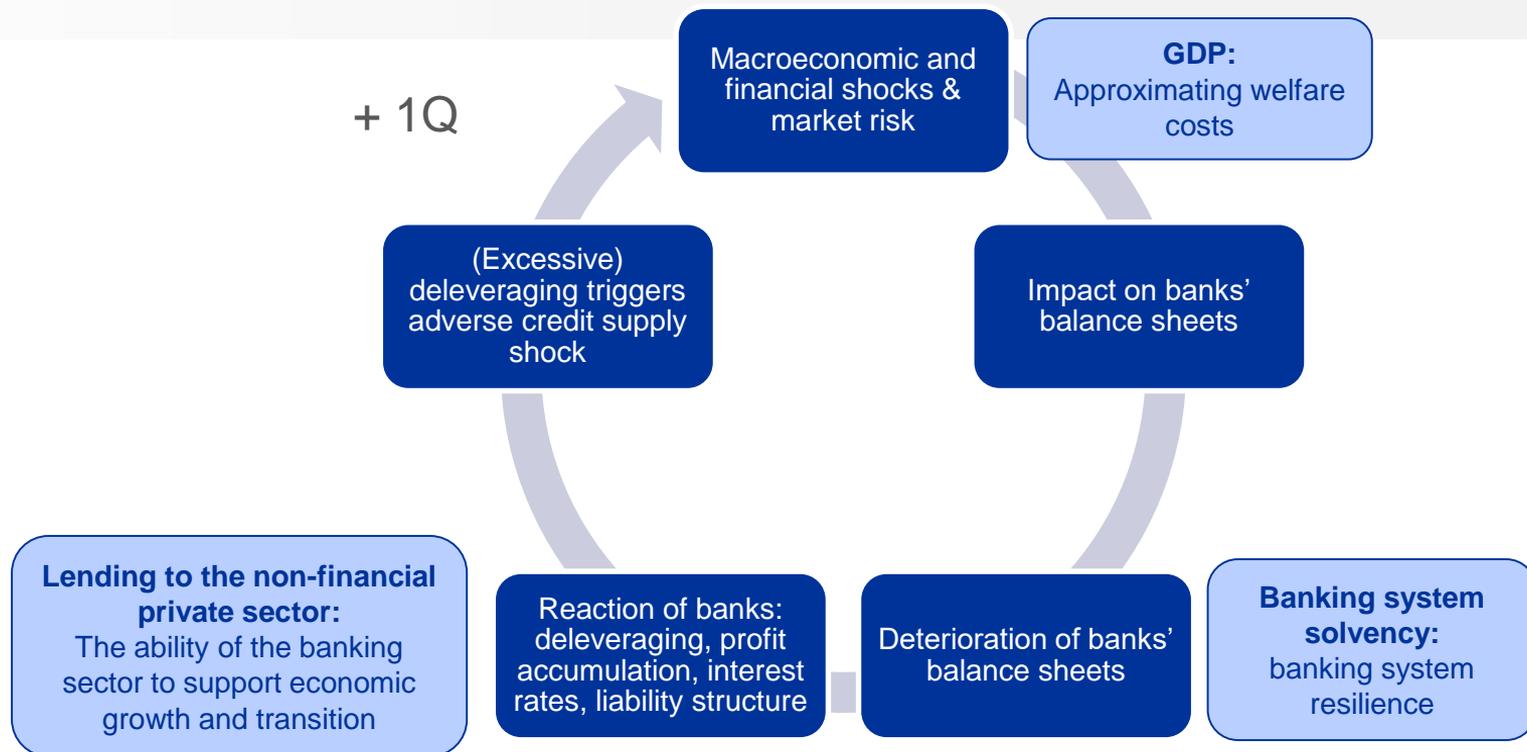
- **Market risk:** revaluation of banks' assets in the trading book (based on granular SHS data)
- **Credit risk:** economic conditions affecting asset quality
- **Feedback mechanisms**

\* 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 CO<sub>2</sub> 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