



EUROPEAN CENTRAL BANK

BANKING SUPERVISION

Climate risk stress testing at the ECB/SSM

ESCB/SSM Social
Dialogue meeting
(in SSM composition)

11 March 2021

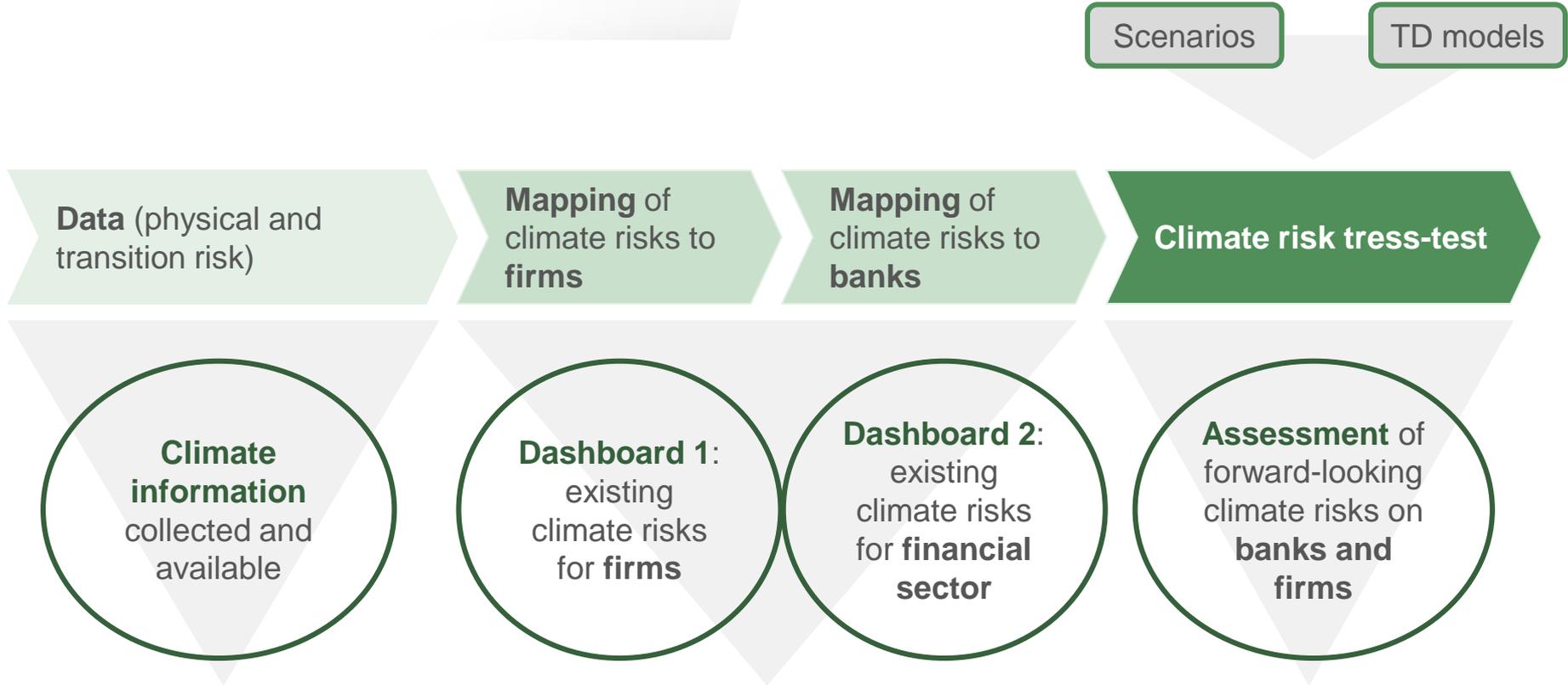
S. Alogoskoufis, DG-MF/ Stress Test Modelling Division



Overview

- 1** Macprudential climate risk stress test
 - 1.a** Scenarios
 - 2.b** Climate exposure metrics
 - 3.c** Impact on broader ECB climate work
- 2** SSM supervisory exercise
- 3** NCAs and climate risk
- 4** Social impact

Climate risk analytics is a comprehensive exercise



Main features of ECB climate-risk stress-test

Top-down

- Exercise relying on data, assumptions and models developed by ECB staff
- Homogeneous and consistent assessment of climate-risk for all institutions in sample

Counterparty-level

- Extremely granular modelling relying on counterparty-level data for each institution in sample
- Precise assessment of climate-related risks for all institutions in sample

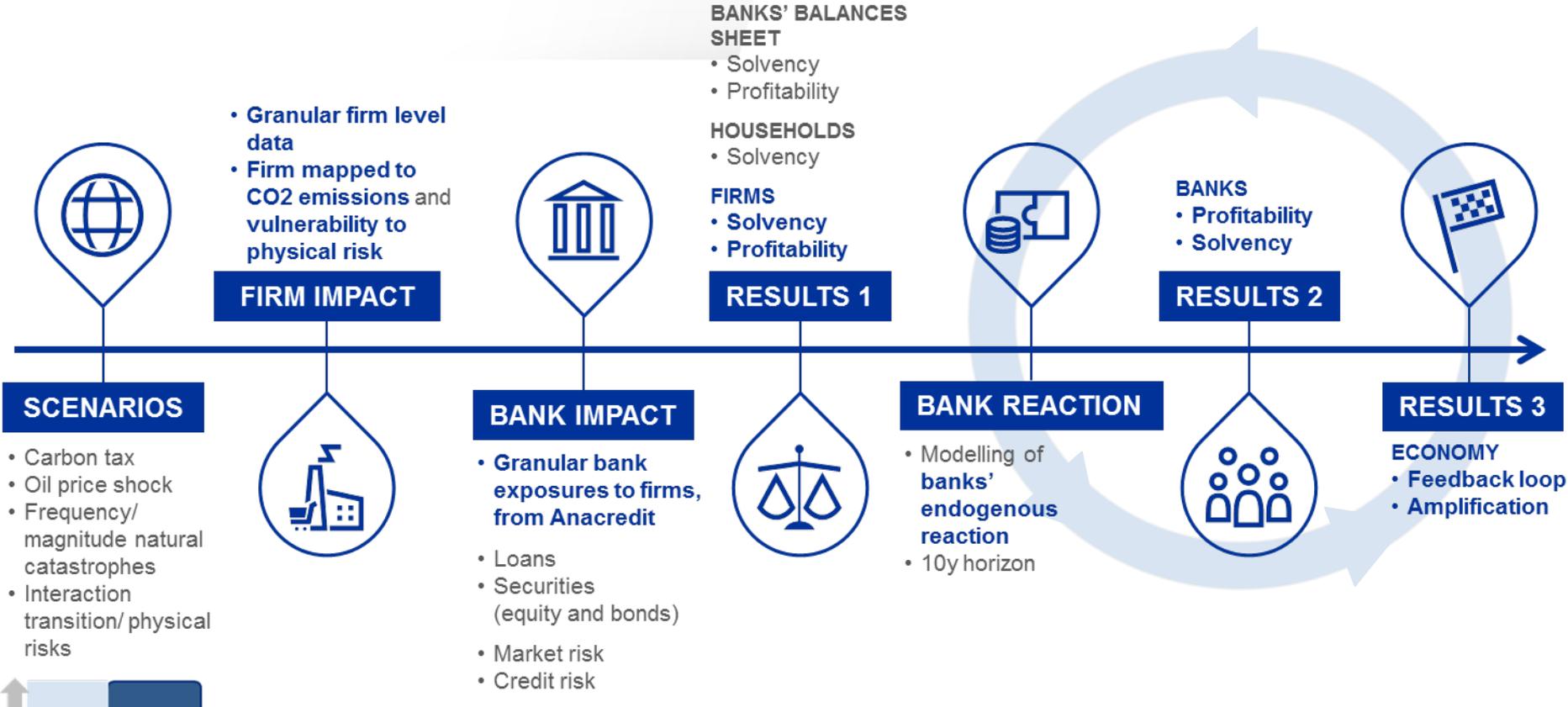
Economy-wide

- Also considers the systemic dimension of climate-related risks through the quantification of second-round effects on the real economy
- Complete assessment of climate-related risks for all institutions in sample and the overall economy, to identify structural vulnerabilities and potential disruptions of financial markets

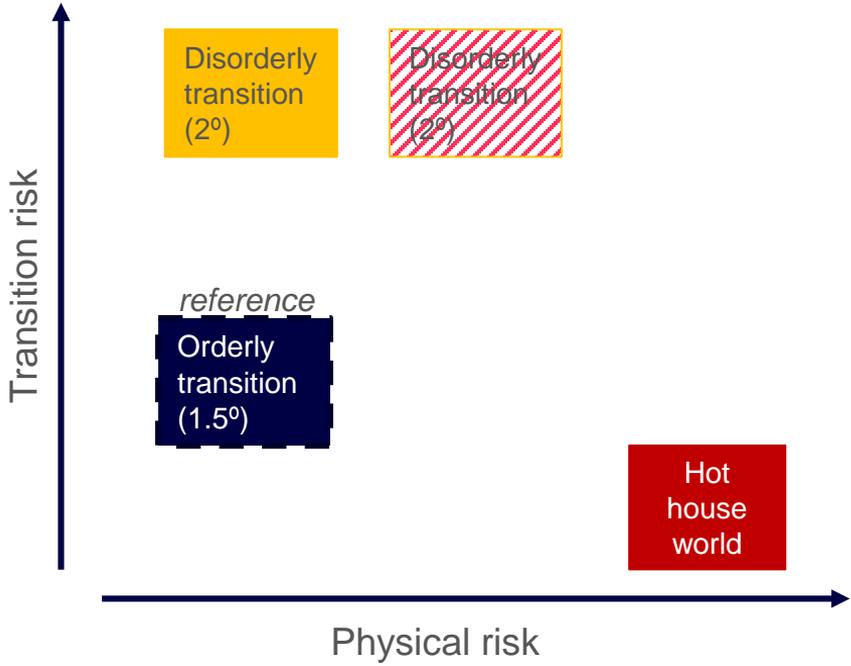
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Schematic view of the climate-risk stress-test



Four scenarios

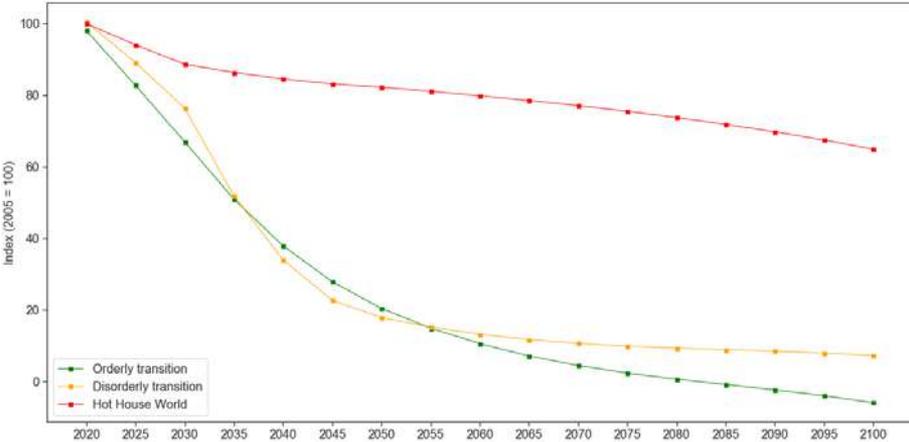


Expected impact

- Orderly transition with limited physical risk**
 Early and effectively implemented policies
 Limited costs associated with the transition and limited costs from damages from physical risk
- Disorderly transition with limited or high physical risk**
 Delayed and/or ineffective policies implemented
 High costs associated with the transition and limited or high costs from damages from physical risk
- Hot house world with extreme physical risk**
 No new policies implemented (only current policies)
 Very limited costs associated with the transition but extremely high costs from damages from physical risk

Preliminary overview of the scenarios: focus on Europe

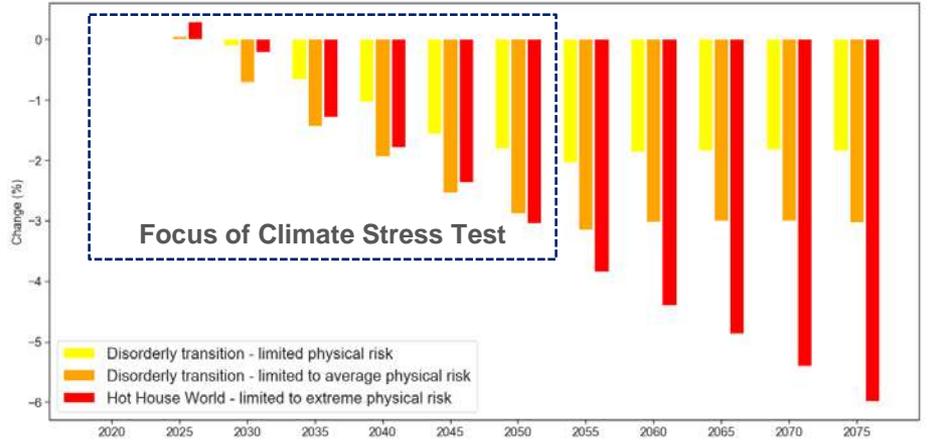
GHG net emissions



Source: ECB calculations on NGFS references scenarios (2020)

- **GHG emission reductions in Europe** reflect current policies (decreasing even in hot house world)
- **Orderly transition** is the **first-best** option, while hot house world is the worst option especially in long run
- Disorderly transition (with limited physical risk) has limited advantages with respect to policy inaction, and only until 2030
- **Costs of the transition are more than compensated from reduced damages from physical risk in the medium-to-long run**

GDP deviation from orderly transition scenario (%)

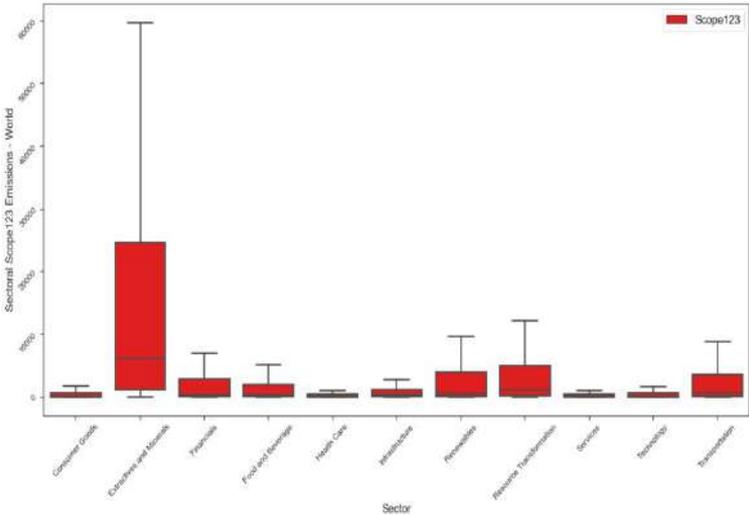


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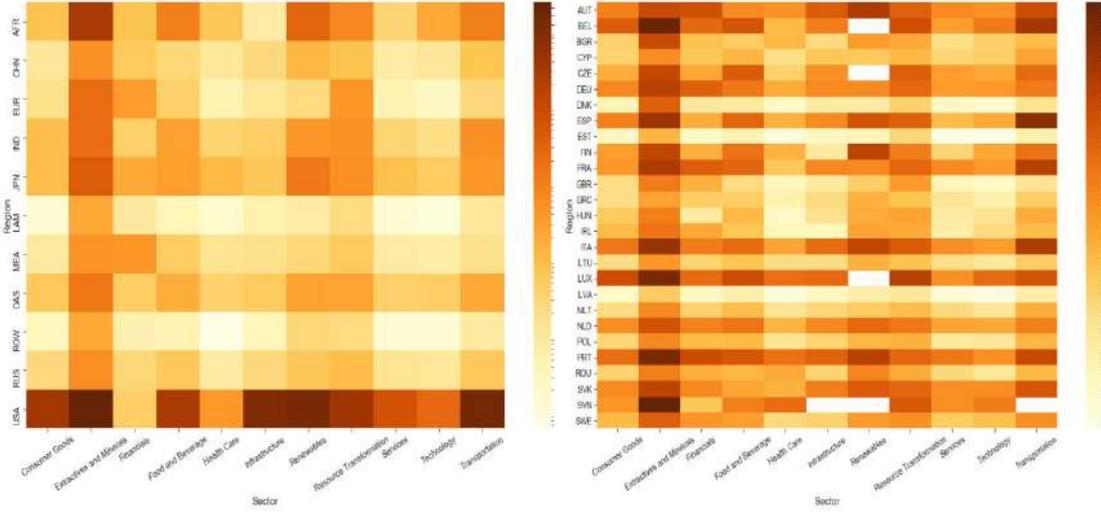
Overall sample composition: GHG emissions

Emissions by sector



Source: ECB calculations on Urgentem data (2018)

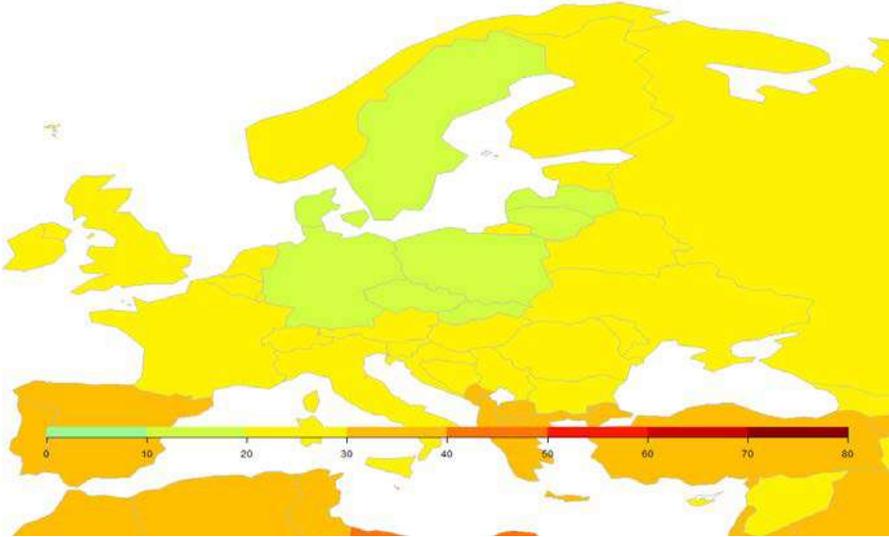
Emissions by region-sector: worldwide and Europe



- **Highest emitting sectors** are extractive activities and resource transformation
- Comparing different regions worldwide, **USA is emitting more** than other geographical areas in the same reference sector
- Geographical differences within Europe are more limited

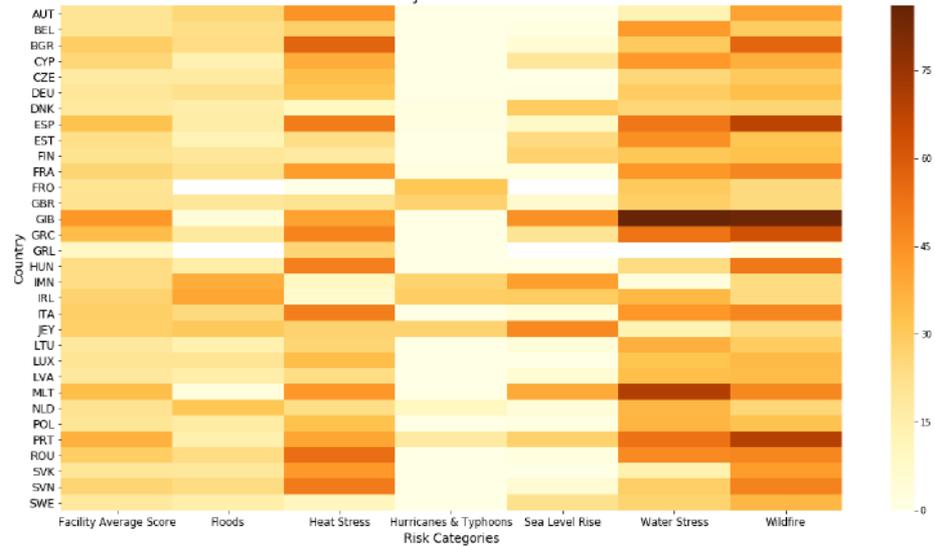
Damages from physical risk in Europe

Physical risk intensity (country average)



Source: ECB calculations on 427 data (physical risk scores are forward looking and reflect intensity and magnitude of natural catastrophes over a 30y horizon). Data are provided at the address level, in these charts aggregated at country level

Different sources of physical risk



- **South European** countries on average **more subject to physical risk** than north-European countries
- Exposure to extreme weather events depends on location. Firms not located in vulnerable areas **have very little or no exposure** to physical risk. Important to focus on vulnerable locations

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Input to other ECB efforts on climate

- The economy-wide climate risk stress test will help inform other ECB business areas and their work on sustainable finance
- **Climate risk monitoring:** Innovative metrics developed for the purposes of the stress test will enhance the ECB's monitoring of the impact of climate change to the European financial system
- **Macroprudential policy:** Results of the stress test will make it possible to assess the impact of potential regulatory and policy measures aimed at mitigating climate change
- **SSM Supervisory climate risk stress test**

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The SSM will conduct a supervisory stress test exercise in 2022

The supervisory climate risk stress aims to...

- i. Provide a **deep-dive** on banks' internal **stress test practices**;
- ii. Assist banks in building a **robust** climate stress test framework;
- iii. Provide a **horizontal overview** of the SSM banks' approached to addressing climate risk;
- iv. Provide insights on both **physical** and **transition** risk vulnerabilities.

The exercise contributes to the society's debate via...

- i. Raising **banks' awareness** on climate risk;
- ii. Enhancing the **availability of data and information** on this new and evolving risk area.

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ECB compared to BdF and BoE approach

	ECB	BdF-ACPR	BoE
Approach	Top-down	Bottom-up (voluntarily) Scenarios, second round and harmonisation centralised	Bottom-up (large firms) Scenarios, second round and harmonisation centralised
Scope: institutions	Banks	Banks and insurance	Banks and insurance
Scope: reference area	Worldwide firms Euro area banks	France	UK
Time horizon	30 years: 2020-2050	30 years: 2020-2050	30 years: 2020-2050 (but physical risk up to 2080 anticipated to 2050)
Publication	Static: in 2021Q2 Dynamic: in 2021Q3	End of 2021Q1	2022
Risks	Transition + physical	Transition + physical	Transition + physical
Data granularity	Firm-level assessment for NFCs; Country-level assessment for HHs	Sectoral (55)	Firm-level assessment for NFCs Country-level assessment for HHs and sovereigns
Transmission channels	Credit + Market risk	Credit + Market + sovereign risk Assets + liabilities for insurance	Credit + Market + sovereign risk Assets for insurance
Scenarios (all from NGFS)	4 (reference + 3 adverse)	3 (reference + 2 adverse)	3 (no reference scenario specified)

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Broad impact of stress test results

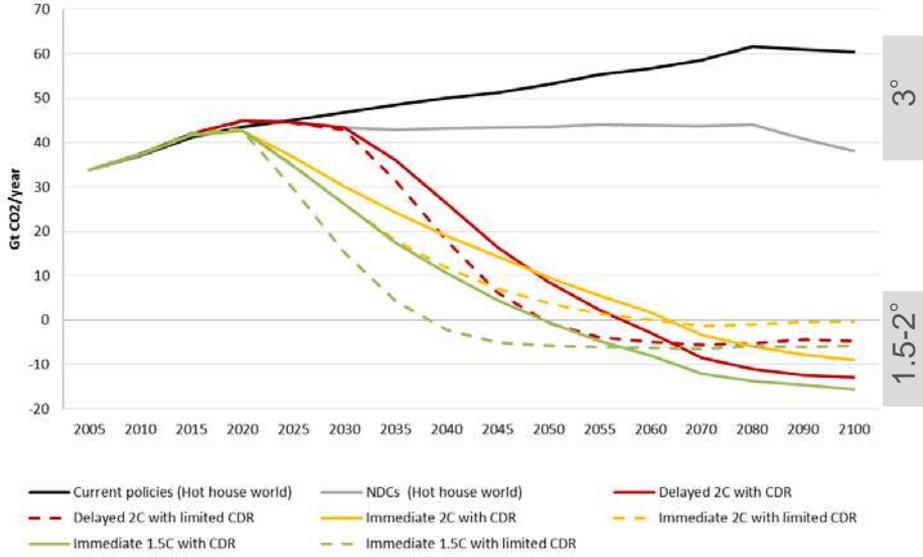
- Climate risk is a very nascent field, where both public and private institutions have lots of **ground to cover in terms of identifying and assessing the risks**
- Innovative method developed for the economy-wide climate risk stress test will help **advance climate risk management practices** for the financial sector globally on:
 - Revealing and filling **data gaps**
 - Mapping scenarios to identify **trade-offs between the costs of policy action and inaction**
 - **Identifying and measuring transmission channels** of both physical and transition risk
 - Modelling financial **losses from natural catastrophes** for the corporate sector, depending on their geographical location and forward-looking scenarios
- Furthermore results from the ECB's stress test will:
 - Shed light on the **exposure of European financial institutions** to climate risk
 - Inform public debate and policymakers on the potential consequences of climate risks, pointing towards an **urgency for immediate climate action**

Background slides

Fighting climate change urges immediate action

The Paris Agreement [...] aims to strengthen the global response to the threat of climate change [...] including by holding the **increase in the global average temperature to well below 2 °C** above pre-industrial levels and pursuing efforts to **limit the temperature increase to 1.5 °C** above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change;

Projected impact of CO2 emissions on global warming



Hot house world:

Limited policy action

- significant global warming
- significant physical risk

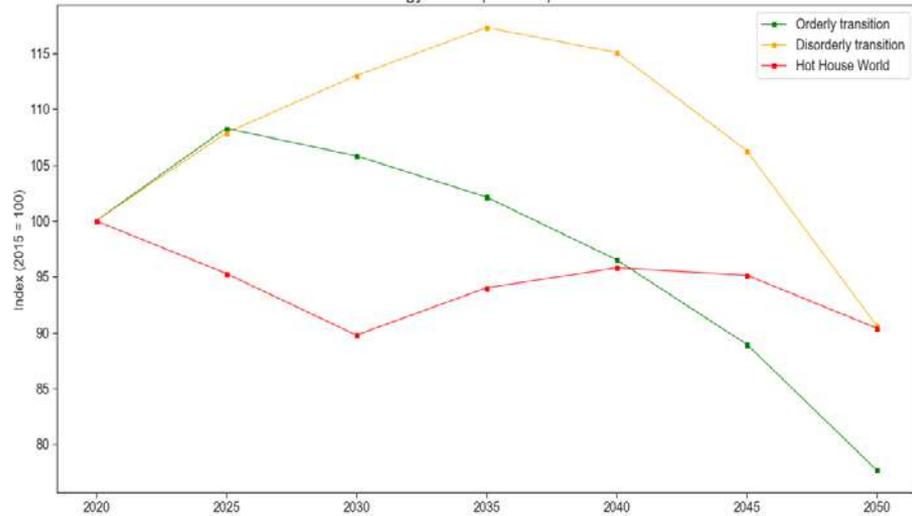
Orderly or disorderly transition

Sufficient policy action to meet Paris targets

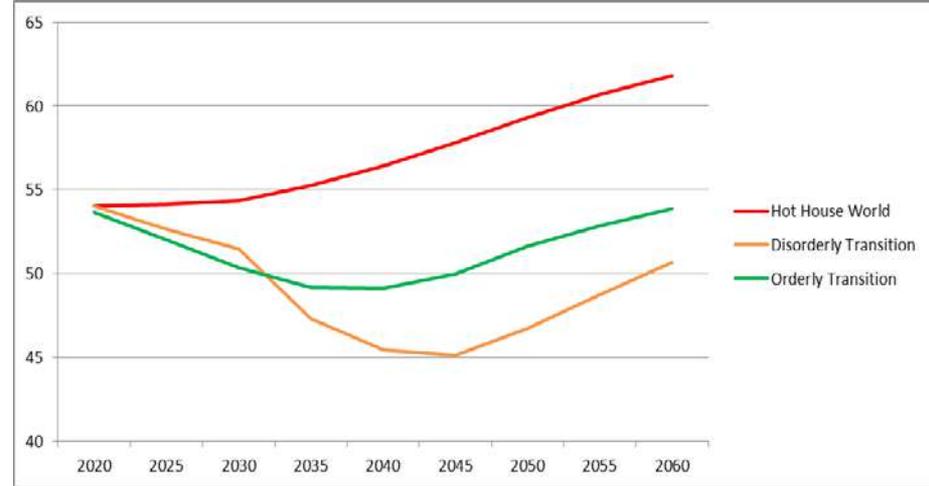
Source: ECB calculations on NGFS references scenarios (2020)

Preliminary overview of the scenarios: Energy price and consumption

Europe: Energy price (index)

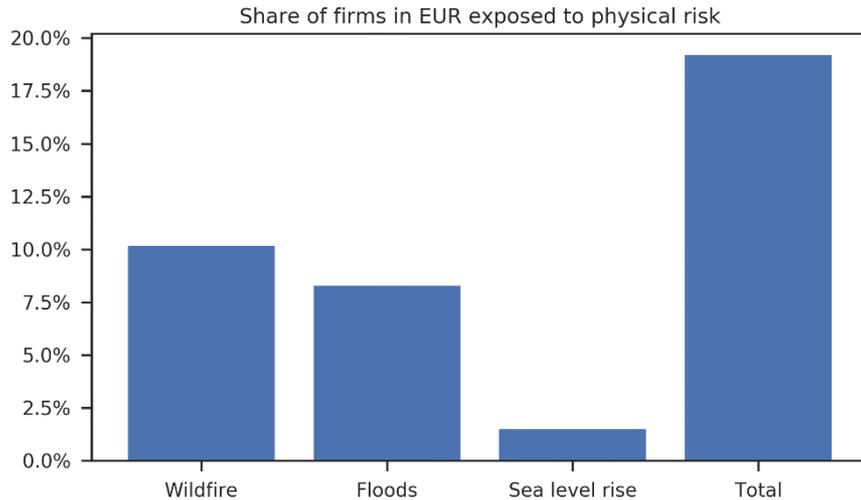


Europe: Energy consumption



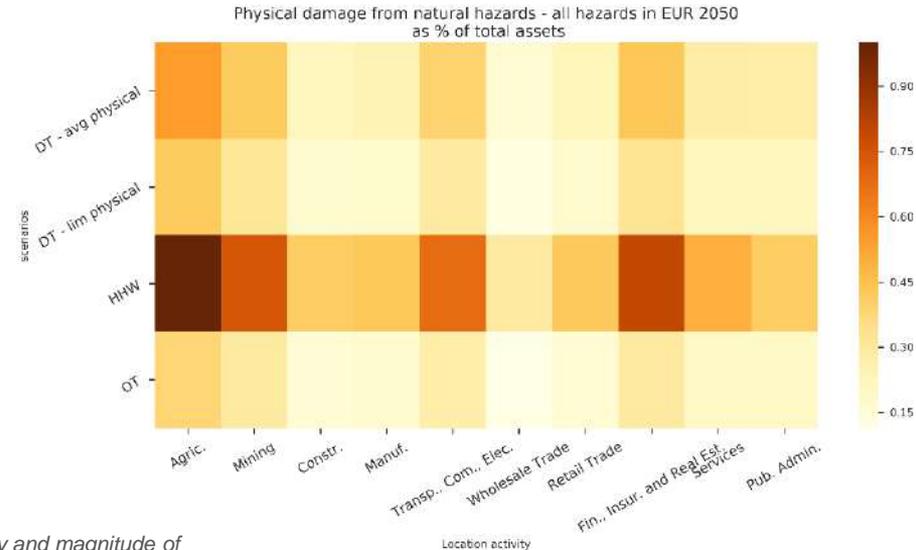
- **Technological progress especially in Europe** ensures that, in the orderly transition scenario, green energy is produced at a lower cost and energy prices eventually become cheaper than in the HHW scenario
- **Energy consumption is lower in the disorderly transition scenario**, mainly driven by higher energy prices

Sample composition



Source: ECB calculations on 427 data (physical risk scores are forward looking and reflect intensity and magnitude of natural catastrophes over a 30y horizon). Data are provided at the address level, in these charts aggregated at country level

Sectoral breakdown of highly exposed firms

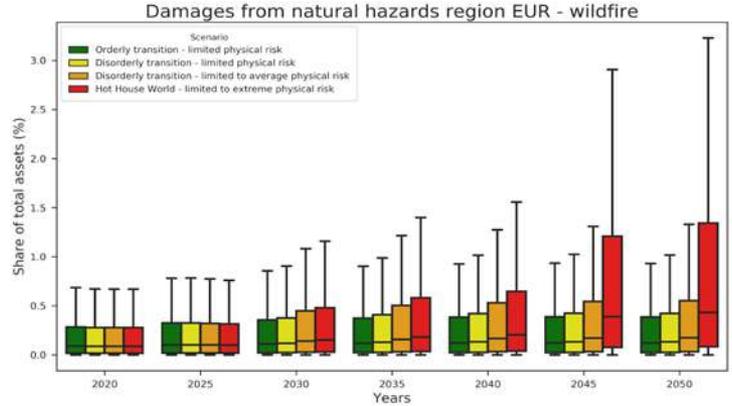


- We select firms that have more than **1% probability** in a given year to be hit by wildfire, river or coastal flood: these firms correspond to 20% of the entire sample of European firms
- Across all countries the **agricultural sector** is expected to suffer the most, especially in the HHW scenario

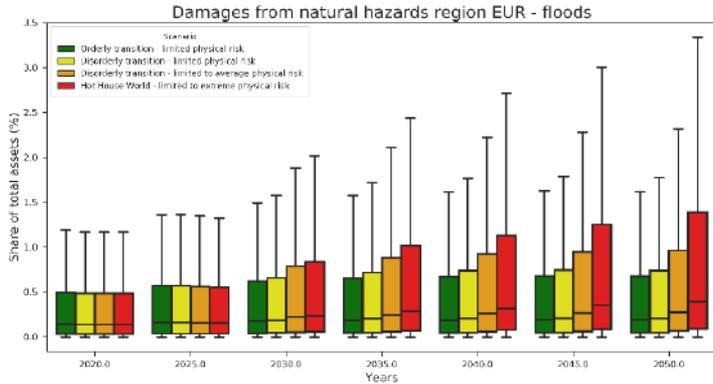
Expected losses by hazard type: high physical risk

- In the HHW scenario yearly expected damages to **physical capital are higher** across all hazard types
- The effect is **amplified for the outliers** in the distribution
- **Floods and wildfires** have the **most destructive potential** in terms of damages to physical capital

Wildfire



Floods



Sea level rise

