Università Ca'Foscari Venezia

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Impacts of low-carbon transition policies across the Italian economy and financial system

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Assessment of climate impact, physical and transition risks
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Overview

- We analyze the impacts of **transition policies and physical risk** on Italian economy and financial system.

- To do so, we use the **EIRIN** Stock-Flow Consistent macro-financial model and an **online tool** that includes simulation results.

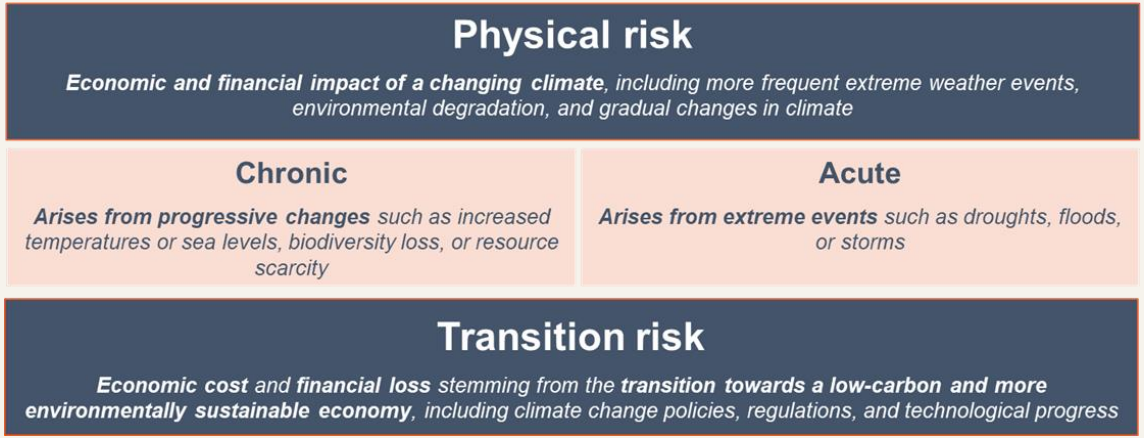
- Italy faces significant challenges related to climate change, including increasing trend in frequency and intensity of extreme weather events.

- As part of EU, Italy committed to **reduce its net greenhouse gas emissions** by at least 55% by 2030, compared with 1990 levels (European Climate Law, Fit-for-55).

- The **National Climate Change Adaptation Plan**, approved by the Ministry of the Environment on December 2023, aims to guide the country in managing the impacts of climate change.

Climate physical and transition risks

- There is a growing need to understand how climate-related risks will unfold in the future. This involves two main dimensions:
  - **Physical risk**: What should we expect if climate change is not mitigated?
  - **Transition risk**: What would be the impacts on economy and finance of delayed and more stringent climate policies?



Source: ECB Guide on climate-related and environmental risks (2020)

Climate risks in Italy

- Climate-related risks are particularly relevant for Italy due to:
  - **High exposure** to climate acute physical risks
  - Low disaster insurance protection coverages and one of the largest disaster risk **insurance protection gaps** in the EU (ECB-EIOPA, 2023)
  - **Limited spending capacity** for mitigation and adaptation investments
  - High **government investment** needed to partly offset the contraction in private sector investment due to higher carbon taxation required to meet Paris Agreement targets (Aiello et al. 2024, Bank of Italy)

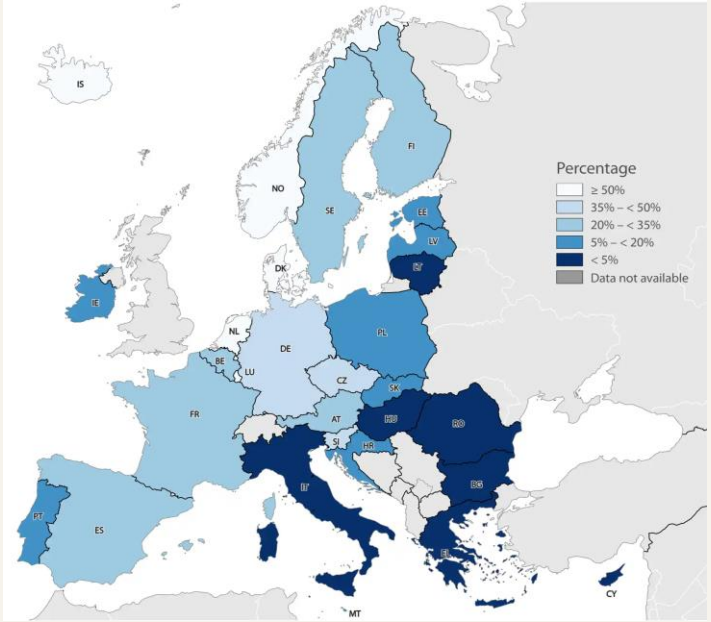


Figure: Average share of insured economic losses caused by weather-related events in Europe (EIOPA - EEA)

Increasing impacts of natural disasters in Italy

In Italy, climate-related natural disasters such flooding, droughts and heatwaves are highly relevant:

- **Flooding**: Extensive damage to infrastructure, agriculture, and capital, leading to economic losses and displacement of people (e.g., floods in Palermo in July 2021, in regions of Liguria and Piedmont in 2021, in Emilia Romagna in 2023). Estimated annual damage due to floods in Italy: 645-989 million EUR (Alfieri et al., 2016).

- **Droughts**: Crop failures, reduced yields, and increase the competition for water resources. In Italy, droughts can have significant and far-reaching economic impacts, particularly in the agricultural sector. Forecasts of drought in the late 2020s and early 2030s pose a substantial threat to this sector (Rubinetti et al., 2020).

- **Heatwaves**: implications for human health and labour productivity, particularly for vulnerable populations such as the elderly and those with pre-existing health conditions. Key economic sectors of the country, such as tourism and agriculture, are particularly exposed to heatwaves.

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EIRIN: a macro-financial model to study climate risks and the low-carbon transition in Italy

- EIRIN: open economy model with a limited number of heterogeneous agents and sectors of the real economy, public and finance (Monasterolo & Raberto, 2018; Gourdel et al., 2024).
- Well-established model used by central banks and financial institutions (e.g. ECB, World Bank) to complement standard approaches for climate analyses

Key characteristics:

- Stock-Flow Consistency ensures impact traceability
- Agents formulate decisions based on adaptive expectations: key in the context of the transition
- *Both real and monetary flows* for integrating impacts of monetary policy channels in the economy
- Analysis of transmission channels through which climate impacts propagate (direct, indirect, cascading impacts)
- Drivers of non-linearity and amplification effects of climate impacts

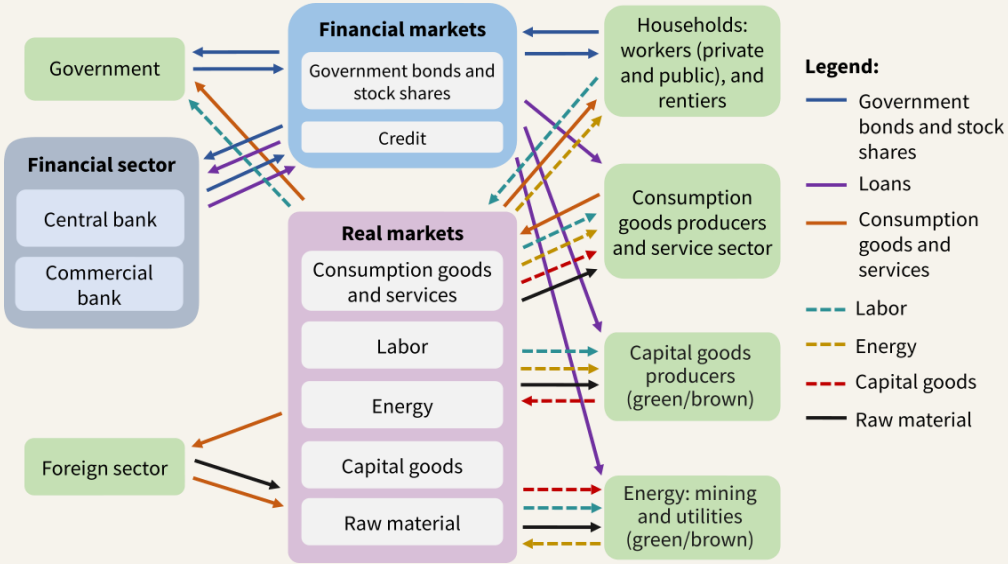


Figure: interactions of agents and sectors in EIRIN through real and financial markets.

Towards an interactive model website

- We develop an online platform that includes simulation results of the EIRIN model: macro-financial variables by climate scenarios (including NGFS), country, time, etc.
- **New model application to Italy**: explores the dynamics of low-carbon transition
- Website includes:
  - *Home:* landing page,
  - *Publications*: summary of papers based on EIRIN,
  - *Projects*: description of projects that funded/used the model,
  - *Applications*: results for different countries/regions,
  - *Technical documentation*: sections of the documentation
- The model documentation is also available in PDF format

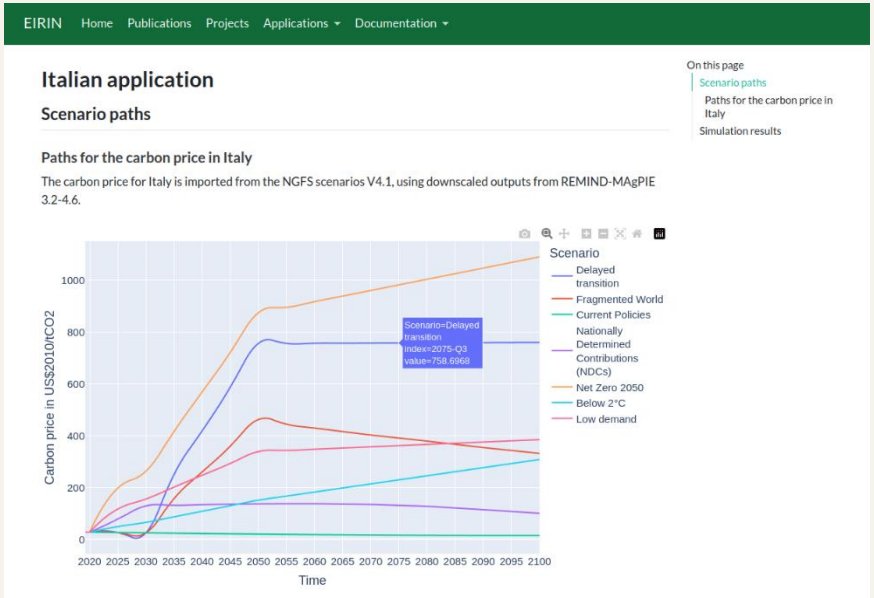


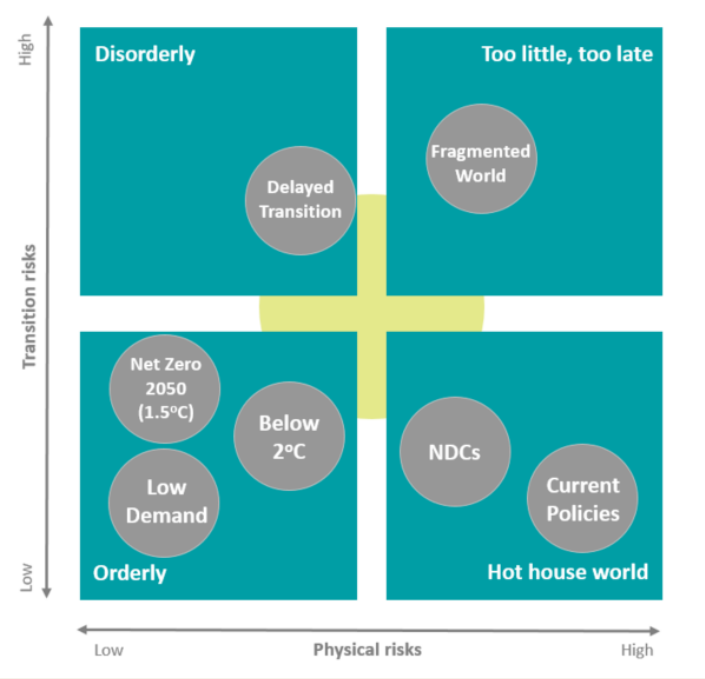
Figure: Screenshot of the website with the chart of carbon price trajectories for Italy

NGFS transition scenarios

- To explore the impacts of low-carbon transition policies across the Italian economy and financial system, we use seven scenarios from the **Network For Greening the Financial System** (NGFS)

- The combination of physical and transition risk in the different scenarios can be represented in **four quadrants**.

- EIRIN uses as inputs and constraints some of the output variables from the NGFS scenarios (e.g. carbon price) and derive macroeconomic and financial variables (e.g. GDP).



NGFS scenarios framework in Phase IV, four quadrants (NGFS, 2023).

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Transition scenarios in Italy

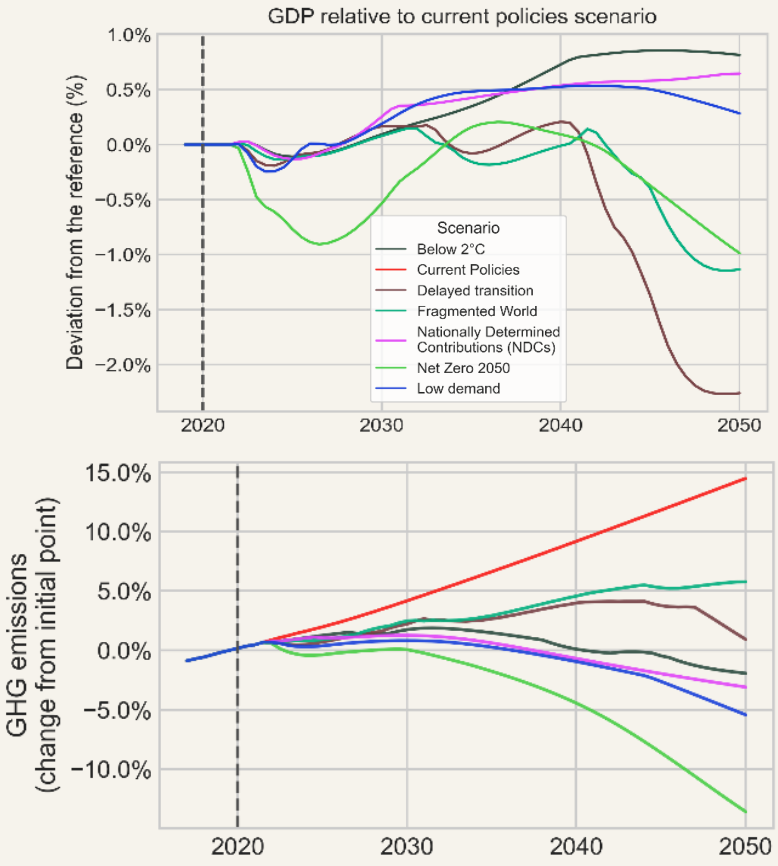
Specification:

- We calibrate the model on national economic and financial data of Italy.
- We use seven scenarios from the fourth vintage of the NGFS.

Results:

- **Net-Zero** scenario leads to **higher GHG emission reduction** and slight decrease in GDP compared to current policies (initial private investment reduction reflecting higher carbon price)

- **Delayed transition** scenario is characterized by a sudden increase in the carbon price, which leads to a late decrease in emission and sudden **decrease in GDP** (higher transition risk)



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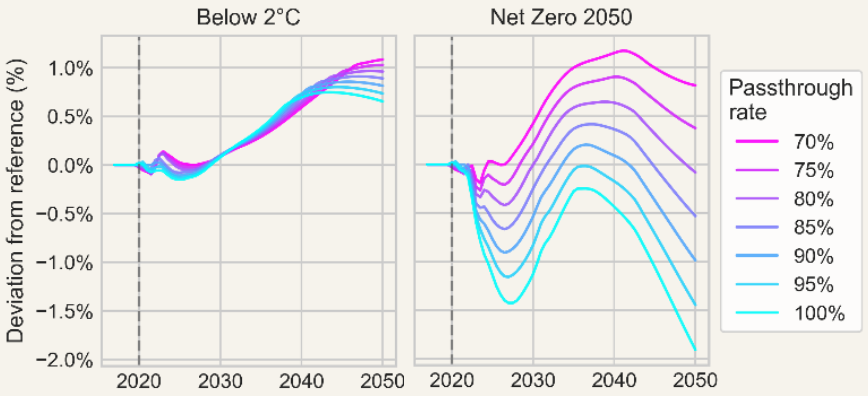
Transition scenarios in Italy: The role of carbon price pass-through

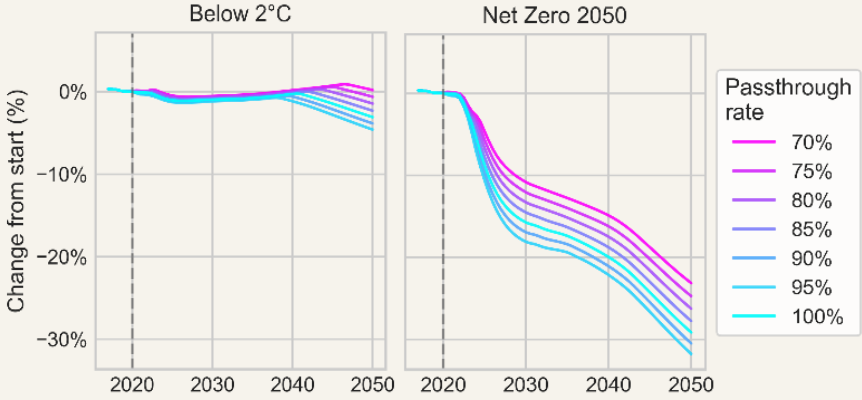
Specification:

- Carbon price **pass-through** refers to the way businesses transfer the costs they incur from carbon pricing (like carbon taxes or emissions trading schemes) to their customers
- Higher values of pass-through rate mean higher goods and services prices



Results:

- The pass-through matters mostly when the carbon price reaches high values (Net Zero scenario)
- Higher pass-through leads to lower GDP (higher prices lead to less consumption).
- GHG emissions mostly affected by GDP



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Transition scenarios in Italy: The role of government subsidies

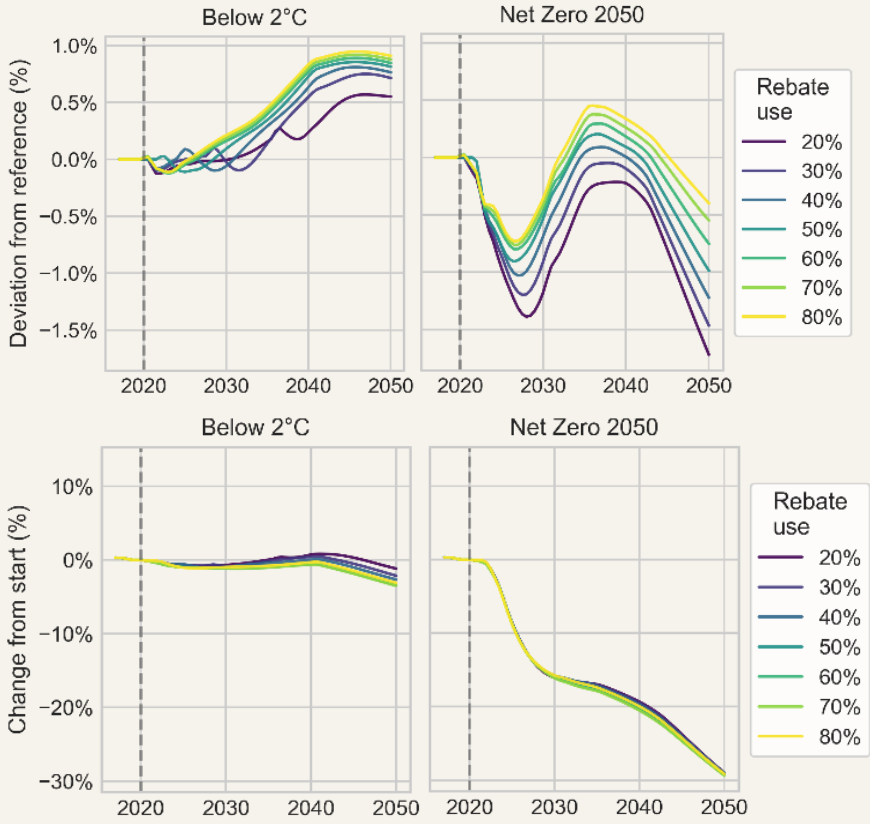
Specification:

- The rebate use represents the share of the revenues from the carbon tax budget used for green subsidies.
- Higher share of rebate use are associated with higher government subsidies to purchase green capital.

Results:

- **Higher government subsidies mitigate the costs of transition**, leading to higher GDP and slightly lower GHG emissions (co-benefits).

- Government can foster low-carbon transition, enabling faster and more equitable progress toward sustainable development goals.



Impact of physical risk in Italy

- We investigates scenarios in which **extreme climate events** might prevent the Italian economy from fully recovering within a short to medium-term span (reverse stress-test).

- We consider the impact of a representative natural hazard that enters the economy by **destroying productive capital**, thus reducing production (direct impact), since the capital is an input factor for firms. We simulate an event leading to a capital stock destruction of maximum 15% in four quarters.

- In addition to the natural hazard, we take into account also the **financial conditions in the aftermath of the shocks**. In particular, we consider scenarios in which the banking sector is constraining credit in the year following the shocks.

- We assume that the banking sector provides only a share of required credit by the firms, which need to borrow to invest and recover from the capital losses.

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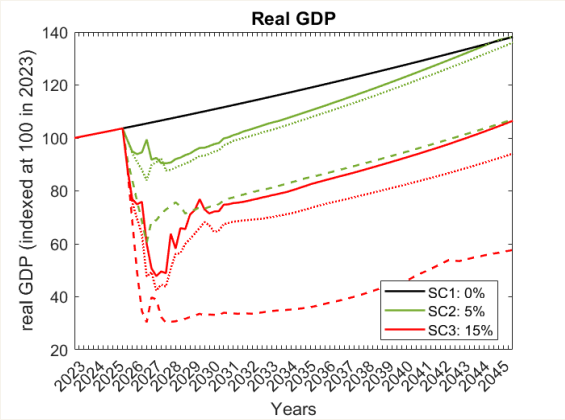
Impact of acute physical risk in Italy

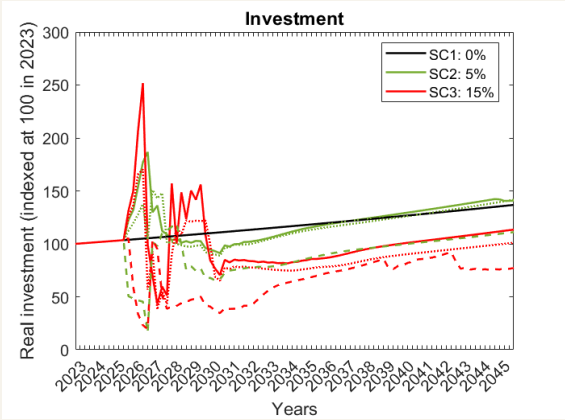
Specification:

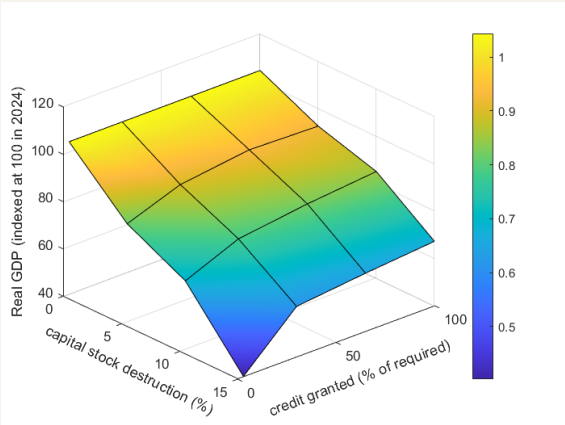
- Green line: 5% capital stock destruction. Red line: 15% capital stock destruction.
- Solid lines: scenario without credit constraints. Dotted lines: scenario including 50% of credit constraints. Dashed lines: 100% of credit constraints.

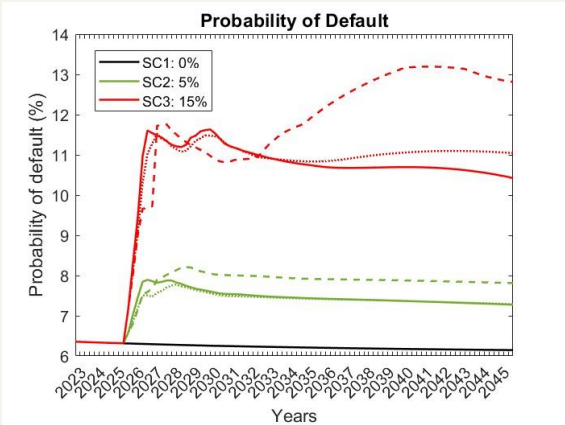
Results:

- The adverse effects of natural hazard on the economy and finance escalate non-linearly with increased capital stock damage.
- Permanently subdued GDP when credit constraints become an insurmountable barrier for businesses.









Conclusions:

- An orderly transition can lead to **co-benefits in Italy** (in terms of GDP and GHG emissions) in the mid-term. In contrast, a disorderly transition worsens the economic performance and financial stability

- In the context of low-carbon transition, **Government investment has to rise** to partly offset the contraction in private sector investment due to higher carbon taxation

- Severe impact on capital stock potentially caused by climate tail risks can lead to sustained economic setbacks in the absence of adequate **adaptation and mitigation strategies**.

- The role of financial policy in times of crisis is crucial to avoid persistent negative effects on the economy, highlighting the importance of **forward-looking financial policies** that not only address immediate recovery needs but also **build resilience against future risks**

- The case of Italy, with its high vulnerability to climate-related hazards and financial constraints, exemplifies the urgent need **for integrated approaches that address both climate risks and financial resilience**.

Thank you for your attention

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