

Analysis of climate-related financial risks in macroeconomic models

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Policy Panel 1: Macroeconomic modelling of climate change: current situation and challenges

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Integrating climate-related financial risks into macro modelling: 4 approaches

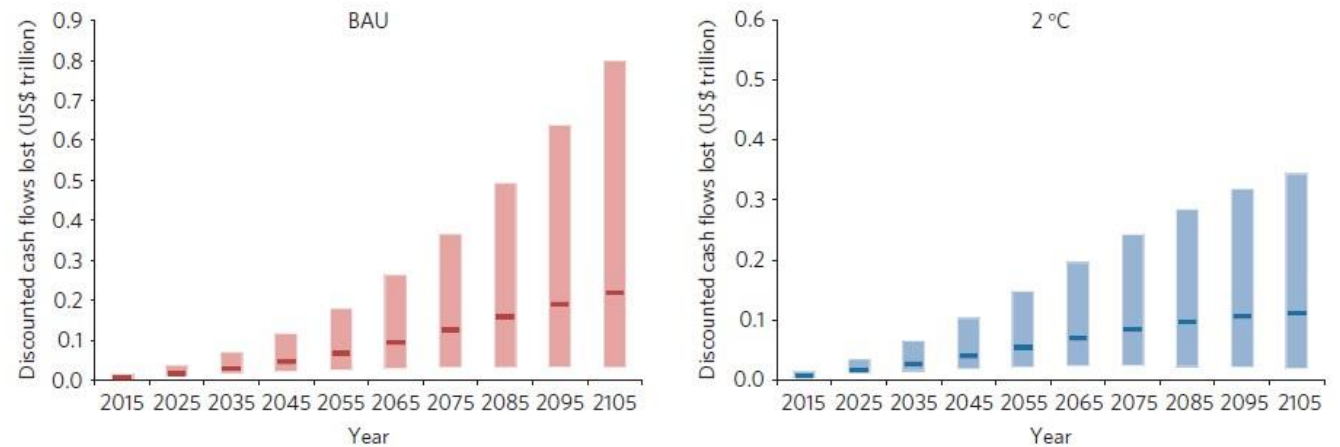
The recent literature on the macroeconomic modelling of transition and physical risks has primarily used 4 different approaches:

- 1) Integrated Assessment Models (IAMs)
- 2) Stock-flow consistent (SFC) models
- 3) Agent-based models
- 4) Combination of macro, sectoral and financial models

Approach 1: IAMs

Dietz et al. (2016) have developed a modelling framework in which the **DICE** model is accompanied by a **Value-At-Risk (VAR)** model that analyses the effects of physical risks on global financial assets.

The impact of climate change on discounted cash flows from the stock of global financial assets

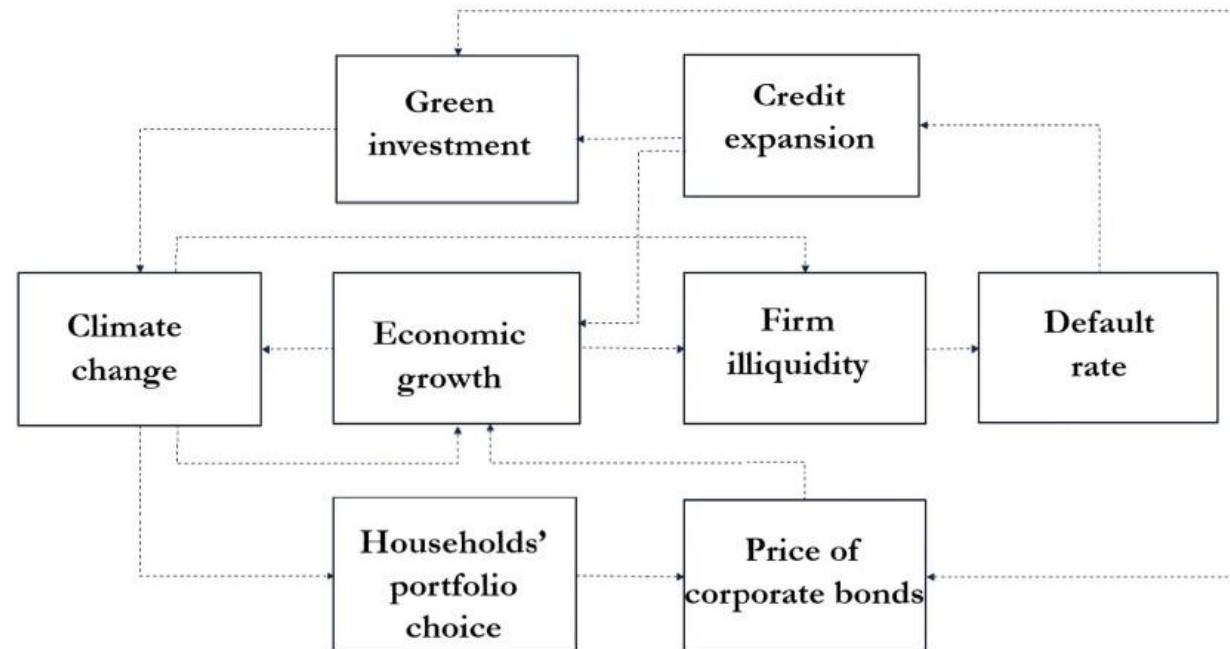


Source: Dietz et al. (2016)

Approach 2: SFC models

- In SFC models the interactions between the macroeconomy and the financial system are explicitly formulated.
- The **DEFINE** model (see Dafermos et al., 2018) is one of the **stock-flow consistent** (SFC) models that has been used to analyse the effects of climate change on the financial system.

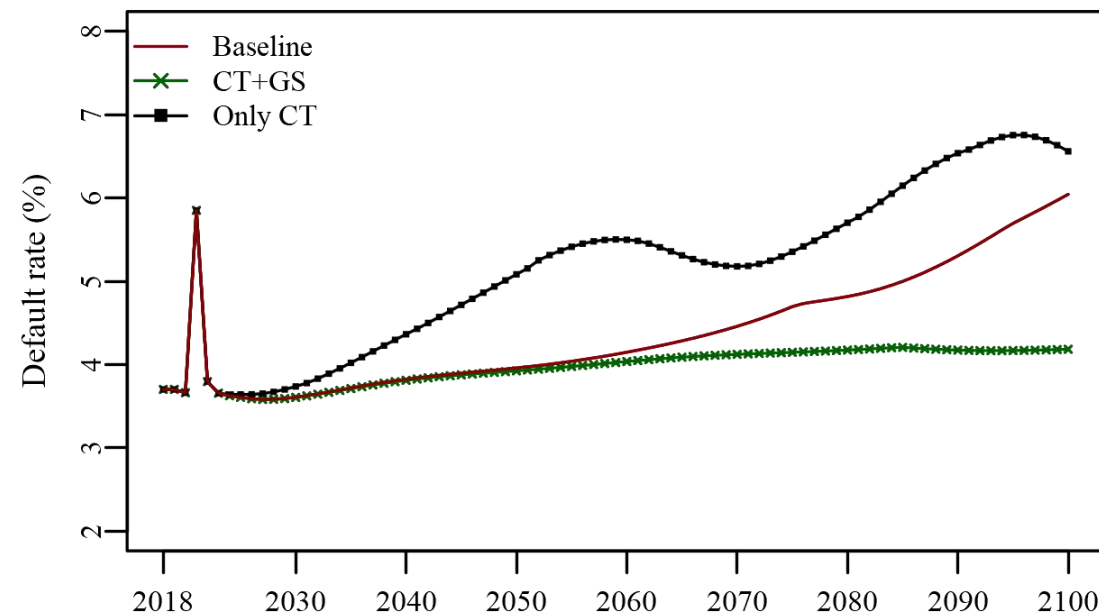
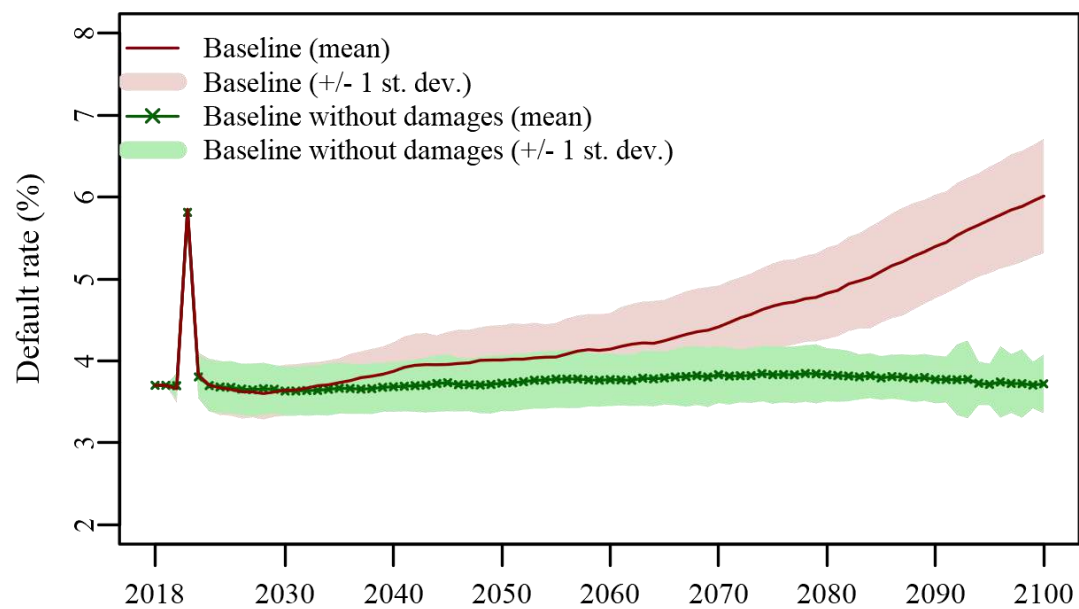
Key channels through which climate change and financial stability interact in the DEFINE model



Source: Dafermos et al. (2018)

Approach 2: SFC models

Rate of default on firms' loans in the DEFINE model

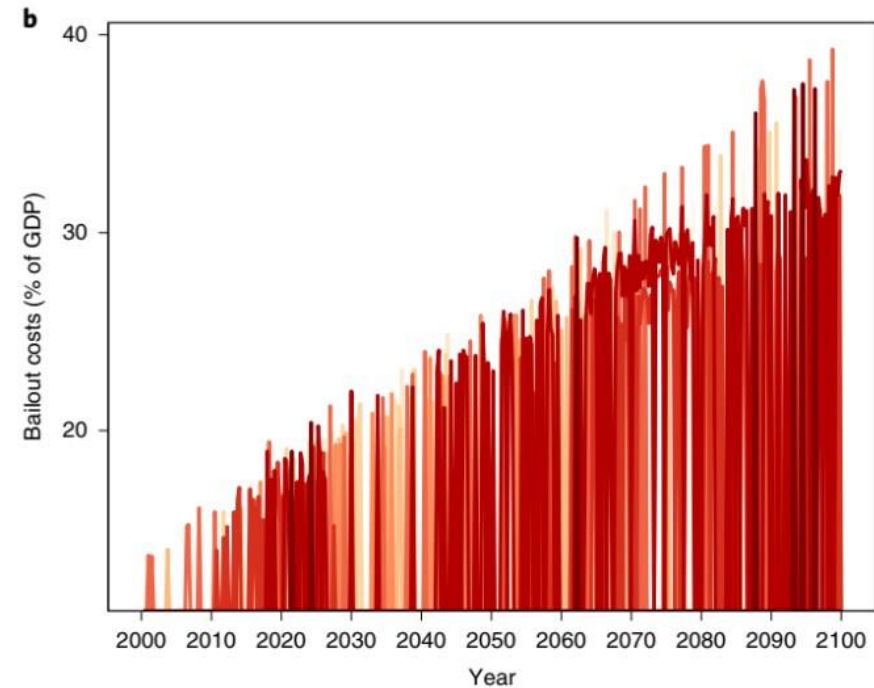


Source: Dafermos and Nikolaidi (2020)

Approach 3: Agent-based models

- Agent-based modelling shares many similarities with the SFC models.
- One of the key features of climate agent-based modelling is that climate damages (which affect physical risks) are **disaggregated**.

Bailout costs under business-as-usual scenarios

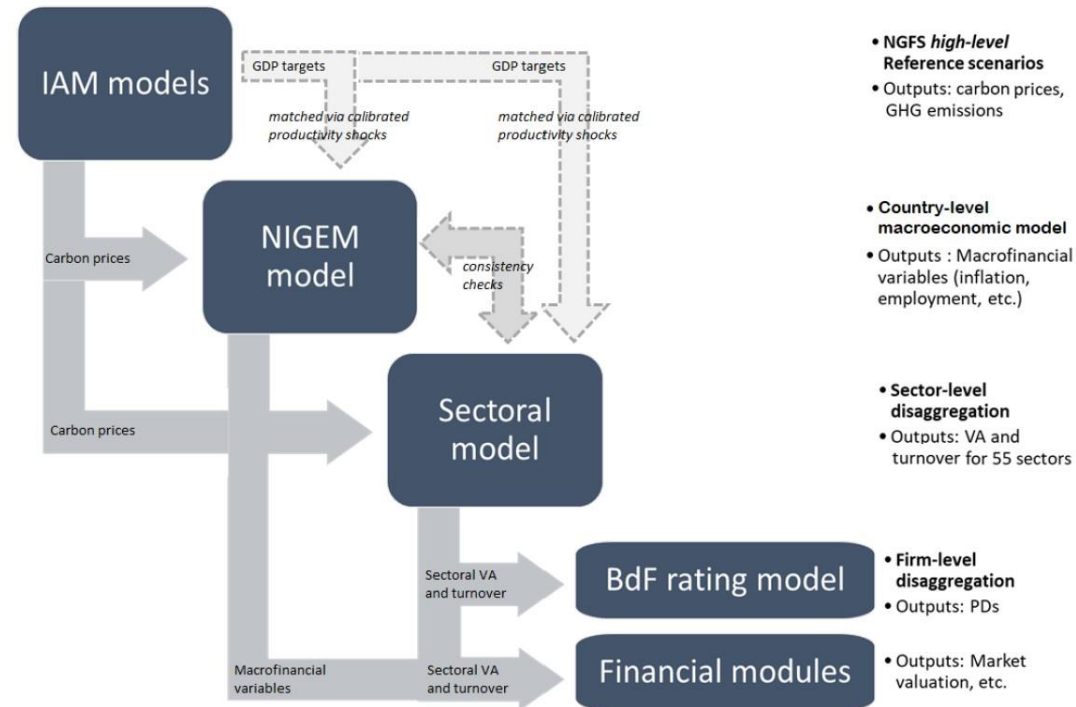


Source: Lamperti et al. (2019)

Approach 4: Combination of models

Architecture of the Banque de France stress test

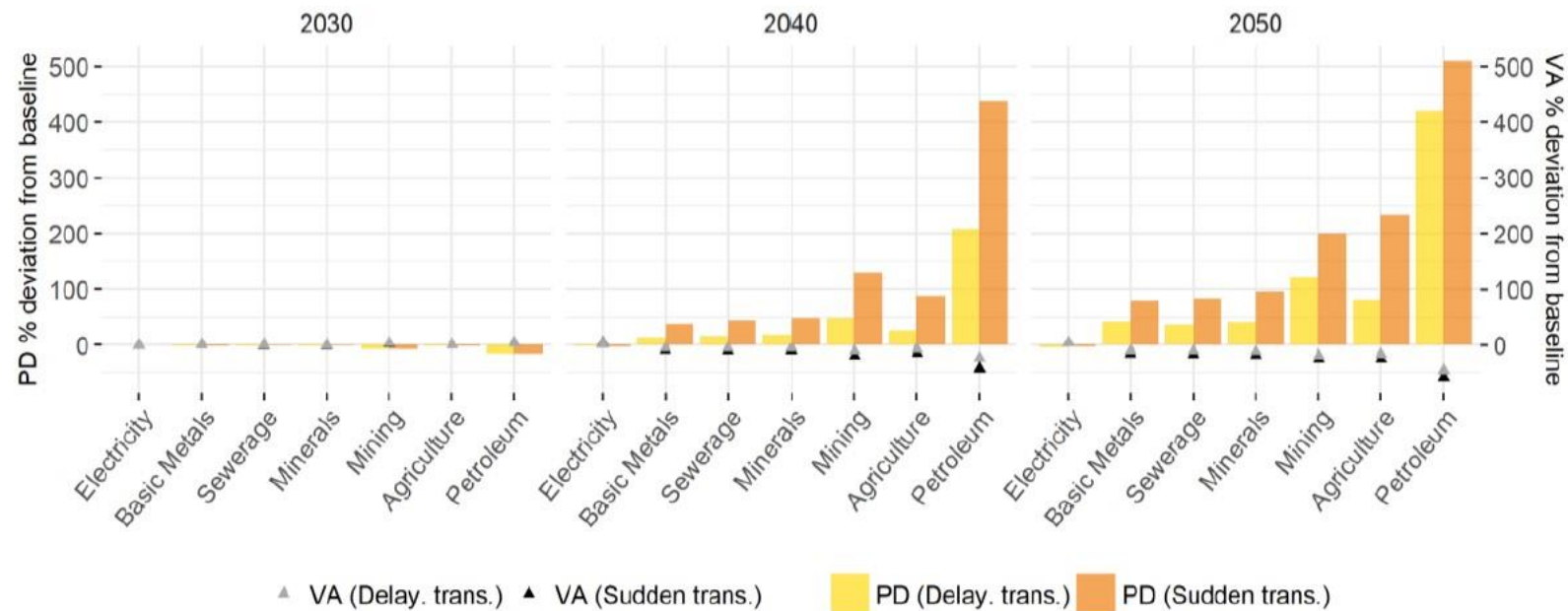
The Banque de France has recently developed a climate macro stress test framework that uses a combination of models



Source: Allen et al. (2020)

Approach 4: Combination of models

Probabilities of default and value added per sector



Source: Allen et al. (2020)

Key challenges

- **Data:** The development of a macroeconomic model that incorporates successfully all the aspects of climate-related financial risks requires detailed macroeconomic, financial and sectoral data that is not always available.
- **Scenarios:** The development of scenarios for climate-related financial risks is still at an early stage. There is a need to move beyond carbon pricing scenarios.
- **Modelling:** The empirical SFC and agent-based modelling of climate risks is at an early stage.
- **Uncertainty:** Both ontological and epistemological uncertainty make it impossible to quantify the climate risks successfully.