

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

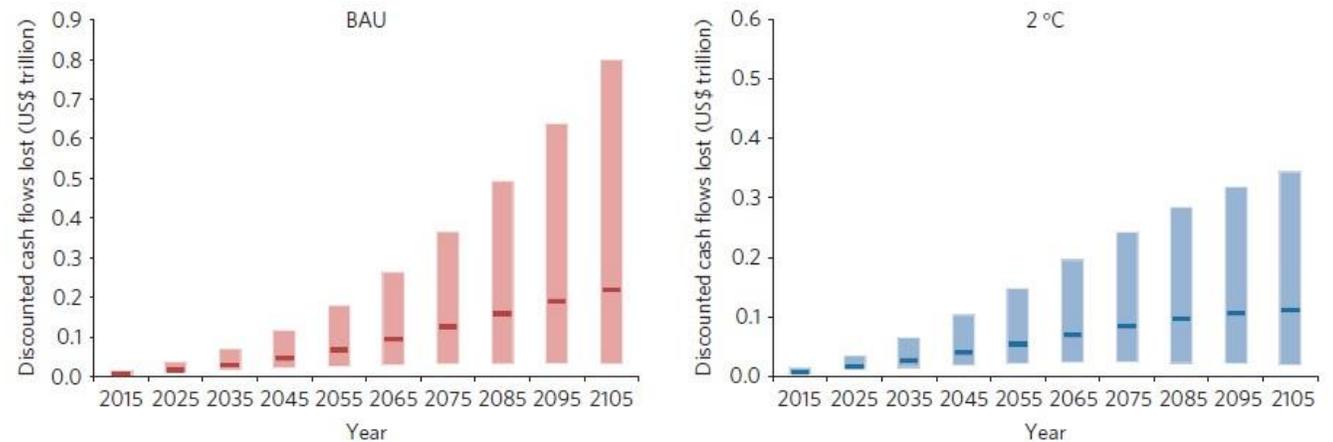
The recent literature on the macroeconomic modelling of transition and physical risks has primarily used 4 different approaches:

- 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.

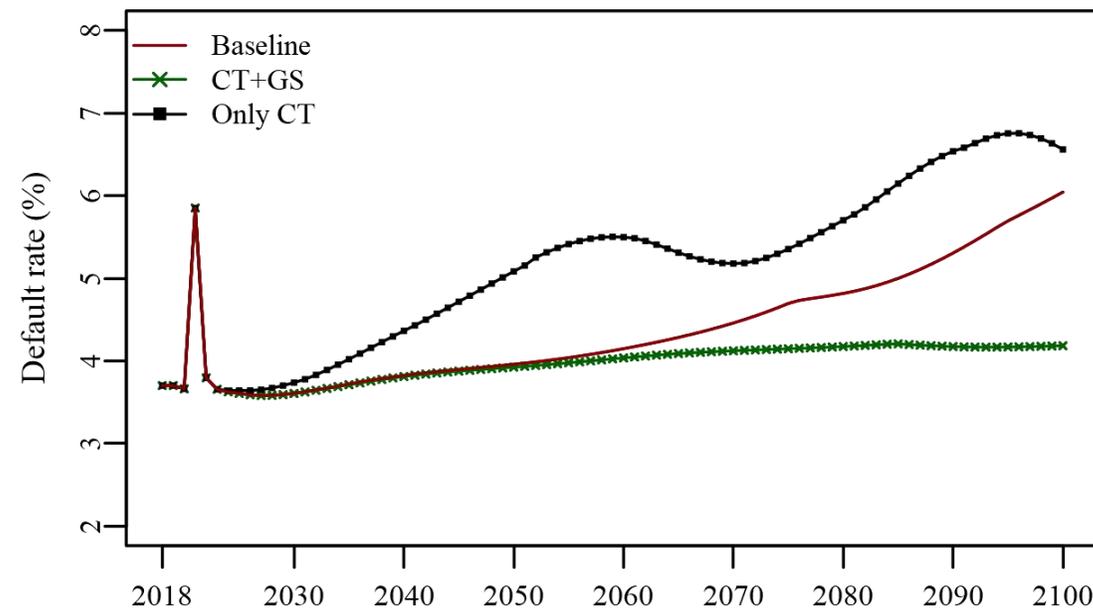
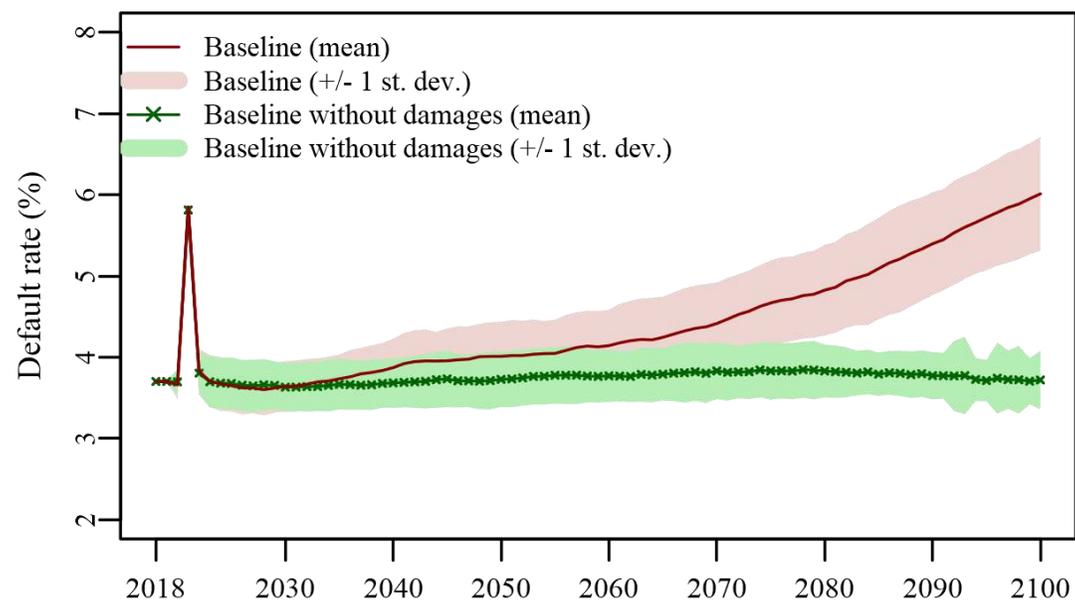
The impact of climate change on discounted cash flows from the stock of global financial assets



Source: Dietz et al. (2016)

Approach 2: SFC models

Rate of default on firms' loans in the DEFINE model

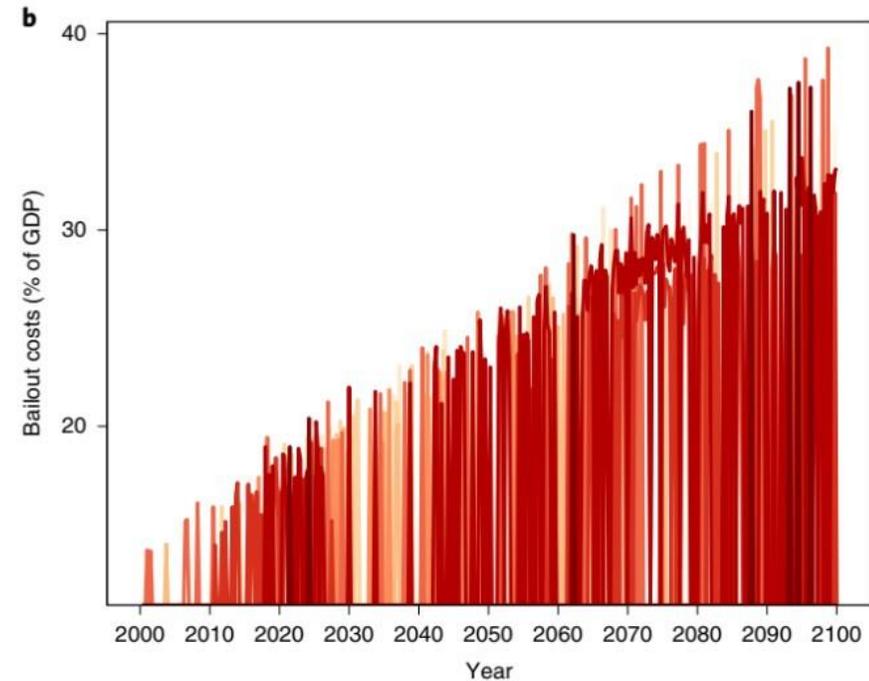


Source: Dafermos and Nikolaidi (2020)

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

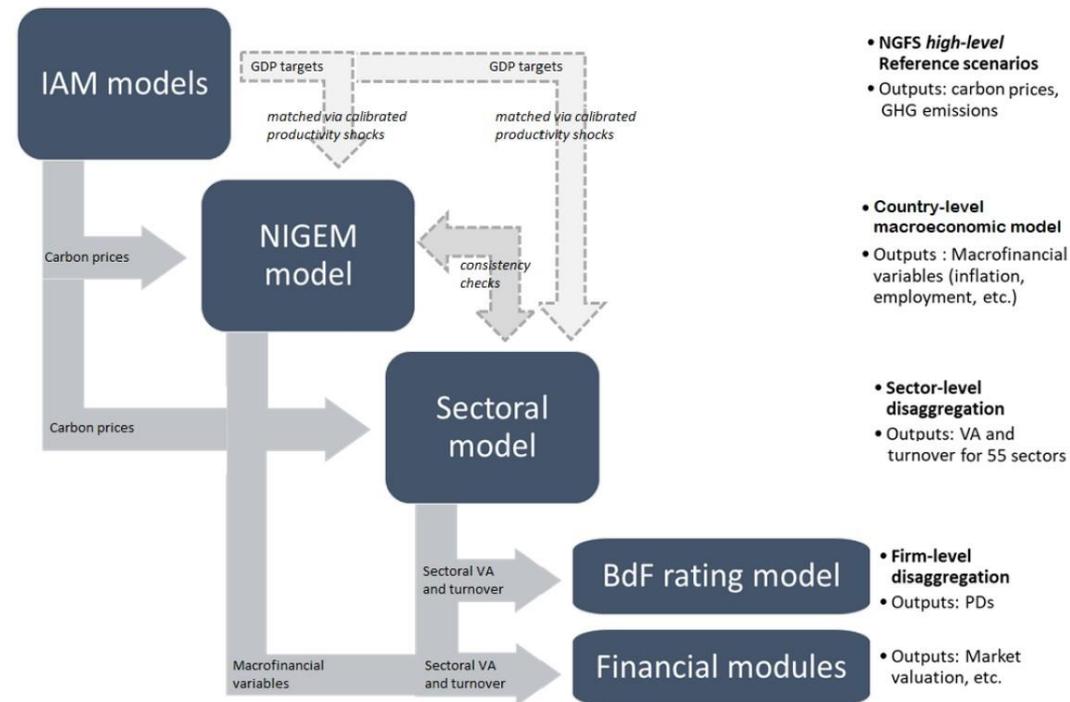


Source: Lamperti et al. (2019)

Approach 4: Combination of models

Architecture of the Banque de France stress test

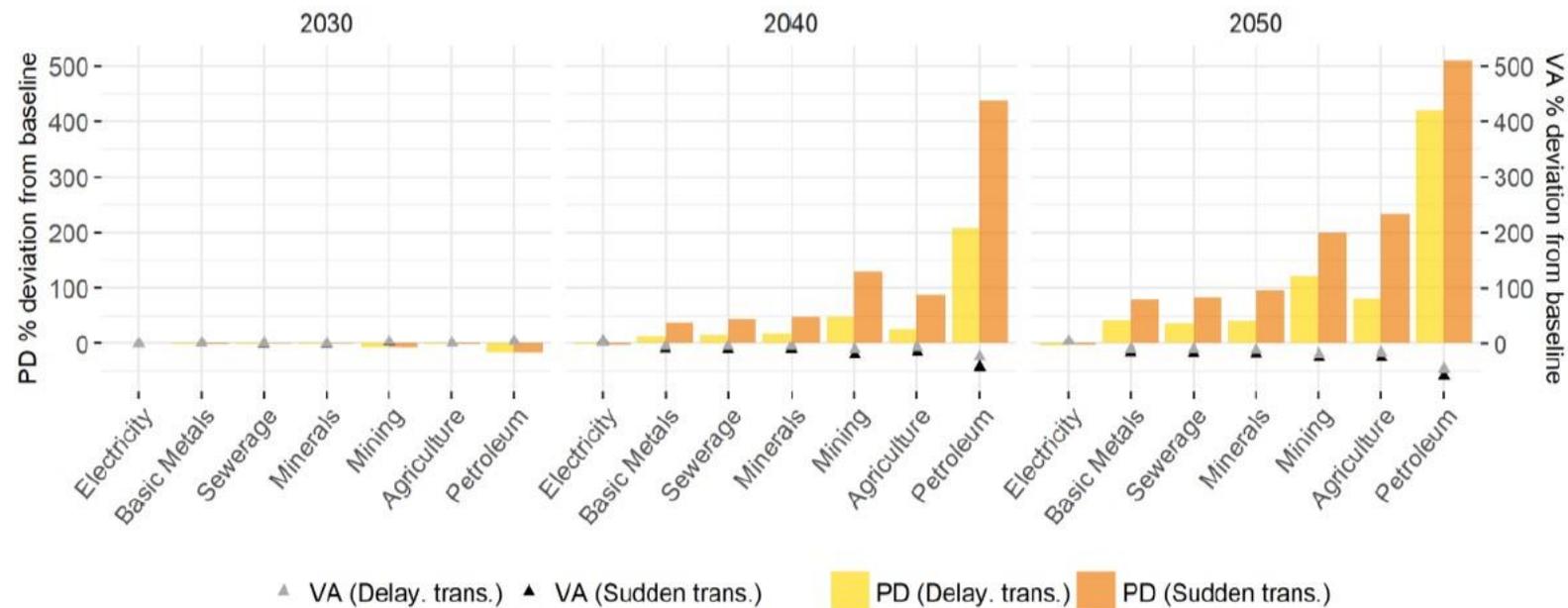
The Banque de France has recently developed a climate macro stress test framework that uses a combination of models



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.