Neoclassical and heterodox modelling of low-carbon transitions

Emanuele Campiglio[1,2]

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[1]University of Bologna
[2]RFF-CMCC European Institute on Economics and the Environment

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- Climate change $\rightarrow$ Decarbonisation
  - Environmental pressures $\rightarrow$ Sustainability transition

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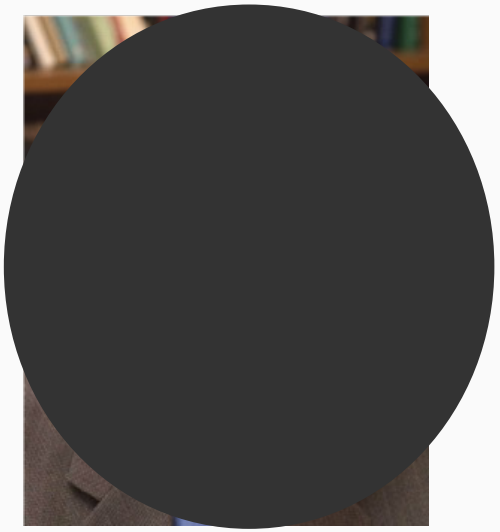
Two main research questions

- How to make the transition happen *rapidly*?
  - $\rightarrow$ How to finance the transition?
- How to make the transition happen *smoothly*?
  - $\rightarrow$ How to avoid macro-financial disruptions?

What tools do we have?

The climate economics 'mainstream'

- Nordhaus and DICE model (1992)
  - Aim: look for optimal transition paths with micro-founded models



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  - Foundations of IPCC scenarios
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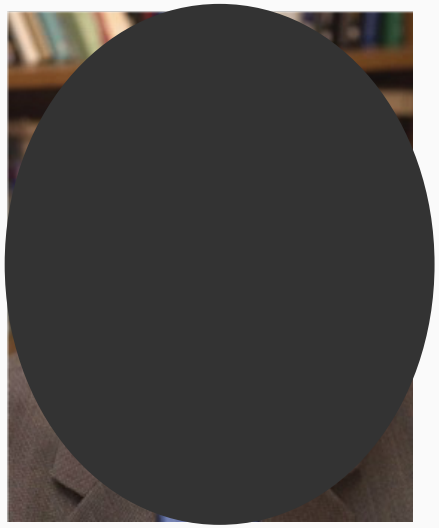

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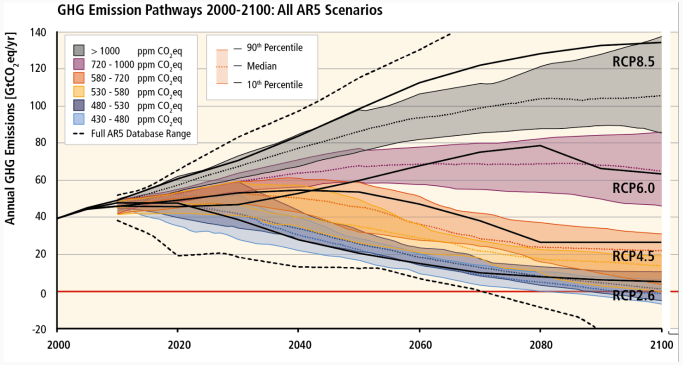

IPPC AR5 (2014)

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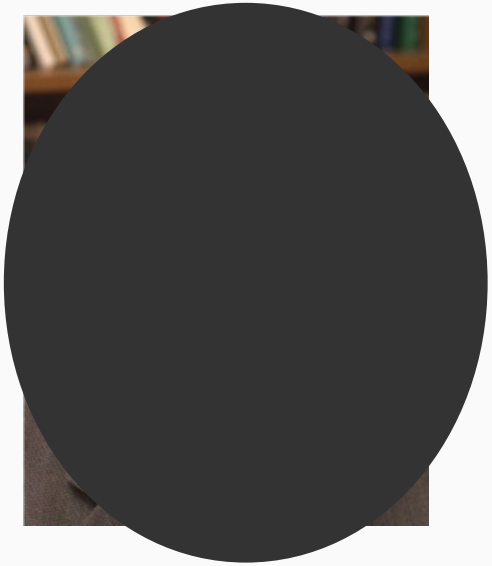

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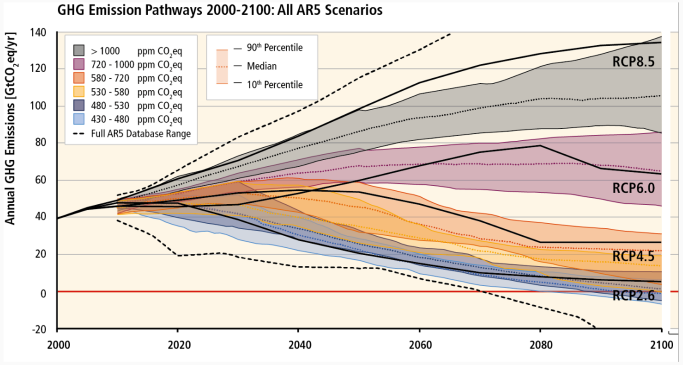

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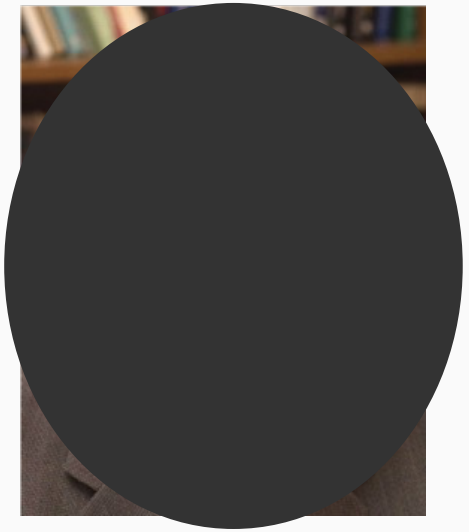
- Computable General Equilibrium (CGE) models
  - Multi-regional perspective



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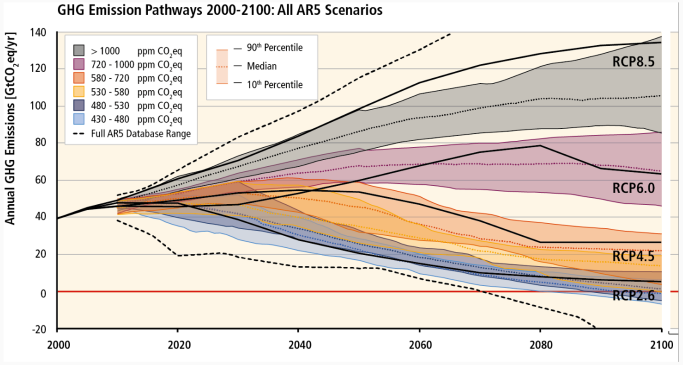

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  - GFC $\rightarrow$ Better understanding of financial dynamics needed
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- $\rightarrow$ **New research in development**

Four main approaches to tackle the issue

- Qualitative analysis of possible transition futures
  - Conceptual frameworks (e.g. Semieniuk et al. 2021) Details
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- Macro/transition modelling
  - Neoclassical (equilibrium) vs complexity (non-equilibrium) modelling Details

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- Financial macro (CAPM):
  - Climate+macro uncertainty (volatility, tipping points)
  - Green/dirty risk premiums (e.g. Hambel et al. 2020)

Complexity macro-financial transition modelling

- Stock-flow consistent (SFC) models
  - Balance sheets of institutional sectors + behavioural functions
  - Testing of policies (e.g. Dafermos and Nikolaidi 2021)
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- Diffusion models
  - Discrete choice theory, innovation (e.g. Mercure et al. 2012)
  - Heterogeneity without agents

What's missing?

A more nuanced theory of expectations

- Transition expectations key in defining transition pathways
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- Current approaches (+ exceptions):
  - Neoclassical: forward-looking, infinite horizon, representative + inter-temporal optimisation
  - Complexity: adaptive, 1-period horizon, heterogeneous + macro-econometric relations

Expectations: potential ways forward

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  - Heterogeneity of expectations increase in psychological time
  - Finite planning horizon and no optimisation
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- Ongoing work (with Lamperti, Terranova) Details
  - Diverse beliefs on credibility of policy commitment
  - Policy-makers default on commitments for high transition costs
  - $\rightarrow$ Policy volatility delays the transition via beliefs' switching

Inclusion of uncertainty

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  - Climate risks, tipping points
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- SFC/ABM:
  - Radical uncertainty, but no explicit treatment of uncertainty sources

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- Ongoing work (with Massoni, Trsek) Details
  - IO 'dynamic' setting (input substitution + demand effects + tax redistribution)
  - How does a 40$ carbon tax change GVC positioning?

Conclusions

- Multi-dimensional work on the macro/financial implications of low-carbon transitions
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- Several promising avenues:
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- Pluralism and cross-fertilisation needed
  - To each method its own

Thank you!

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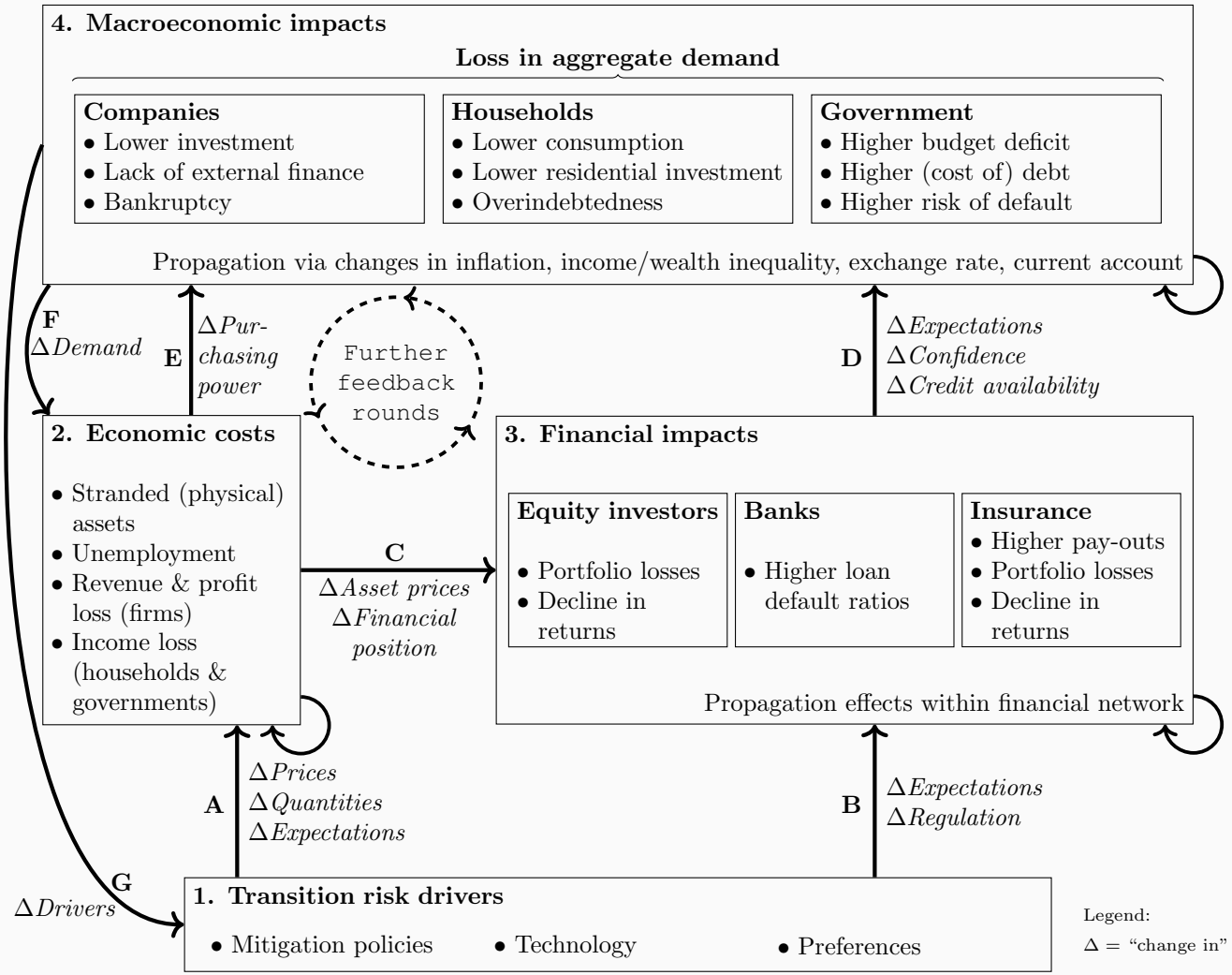
emanuele.campiglio@unibo.it

Presentation adapted from:
Campiglio and van der Ploeg (forthcoming on REEP)

Support slides

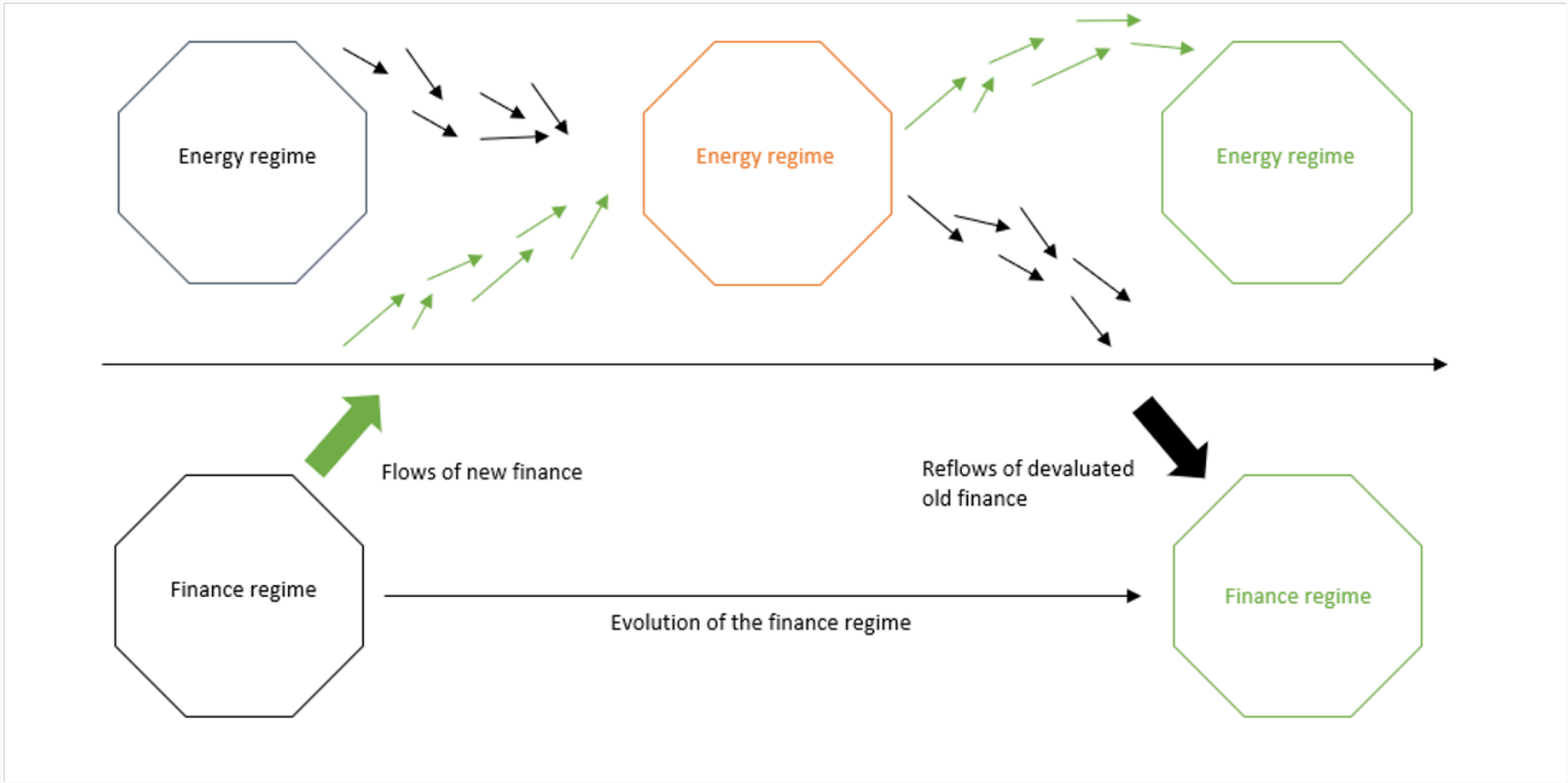
Low-carbon macro-financial transitions risks



Semieniuk, Campiglio, Mercure, Volz, Edwards (2021)

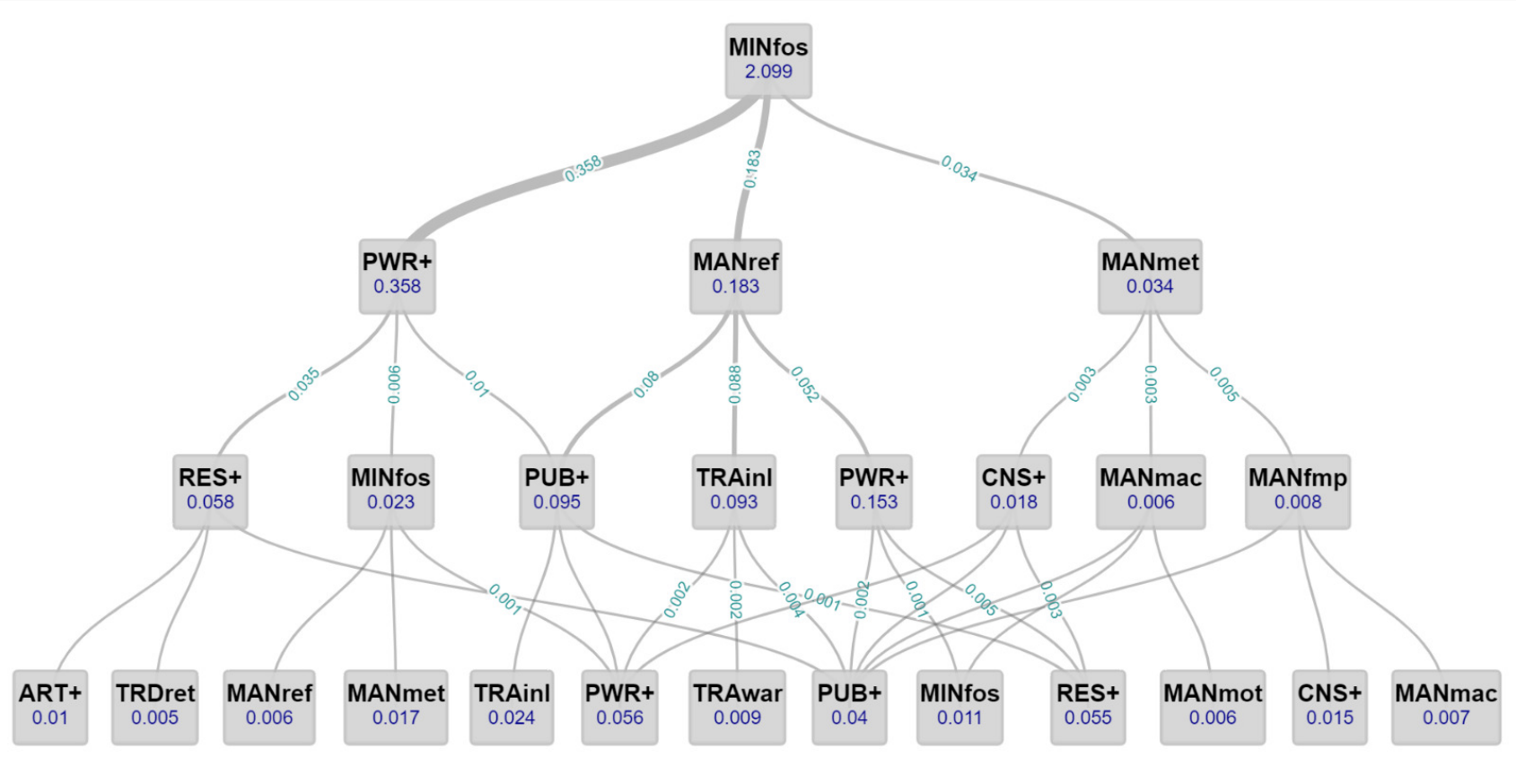
Back

Co-evolution of energy and financial regimes



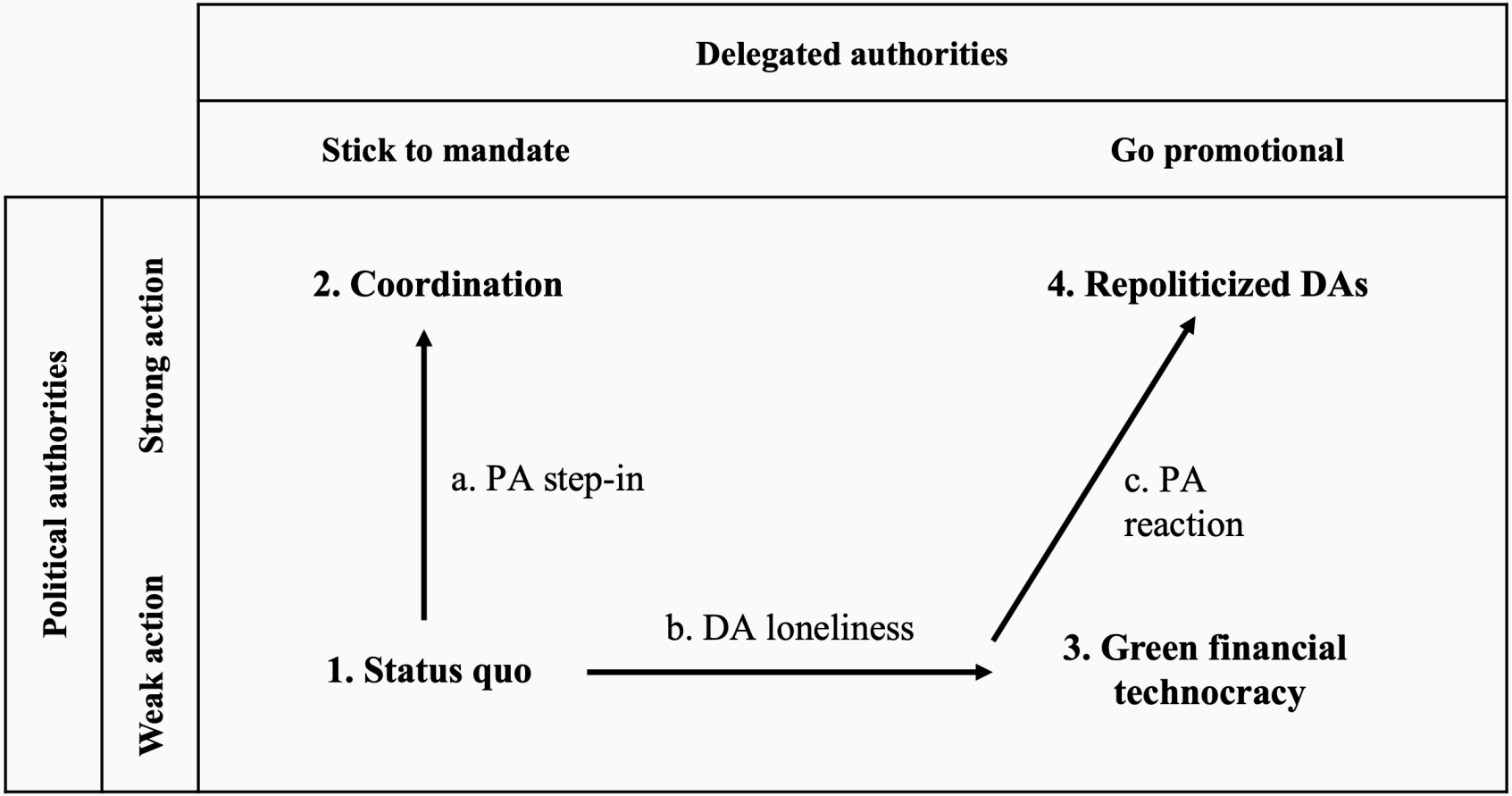
Campiglio, Deyris, Geels and Schroeder (in development) Back

Cascades of physical capital stranding



Cahen-Fourot, Campiglio, Godin, Kemp-Benedict, Trsek (2021) Back

Institutional scenarios in Europe



Baer, Campiglio, Deyris (2021) Back

Two main methodological avenues

	Equilibrium	Non equilibrium
Behaviour drivers	Intertemporal optimisation of a welfare function	Macro-econometric relations
Determination of output	Supply-driven: output (production) is allocated between different uses (consumption and investment) Y=AKL	Demand-driven: output (income) is determined by the expenditure desires (consumption and investment) Y=C+I+G
Expectations	Forward-looking expectations by rational agents	Adaptive expectations by agents in a context of deep uncertainty
Decisions	Rational	Routines in a context of deep uncertainty
Equilibrium	The system moves to an equilibrium state (balanced growth path)	There is not necessarily an equilibrium (cycles, emergent behaviours)
Money	Money as a 'veil' (banks as intermediaries)	Endogenous money (credit creation by commercial banks)
Modelling approaches	IAM, CGE, DSGE, CAPM	SD, SFC, ABM
Communities	Economics, Finance, Environmental/Energy Economics	Social sciences, Ecological/Evolutionary Economics

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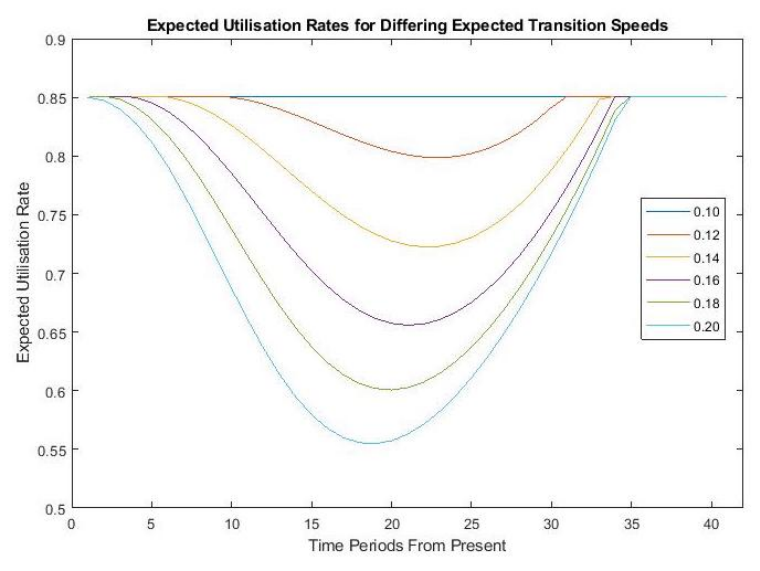
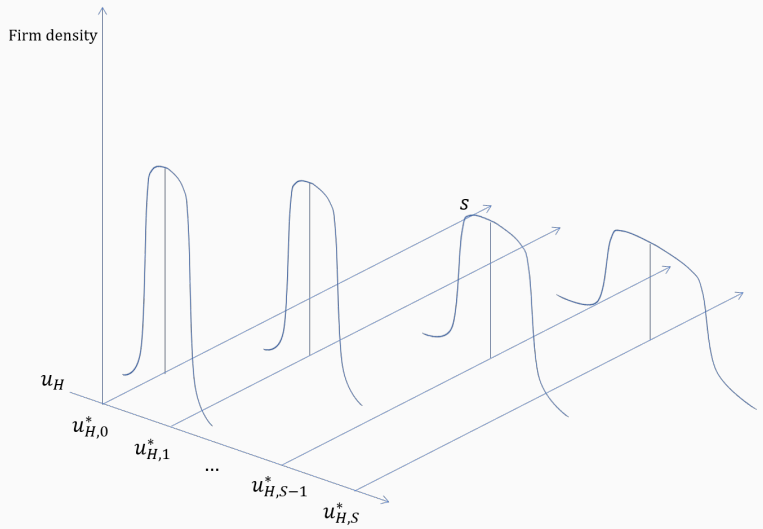
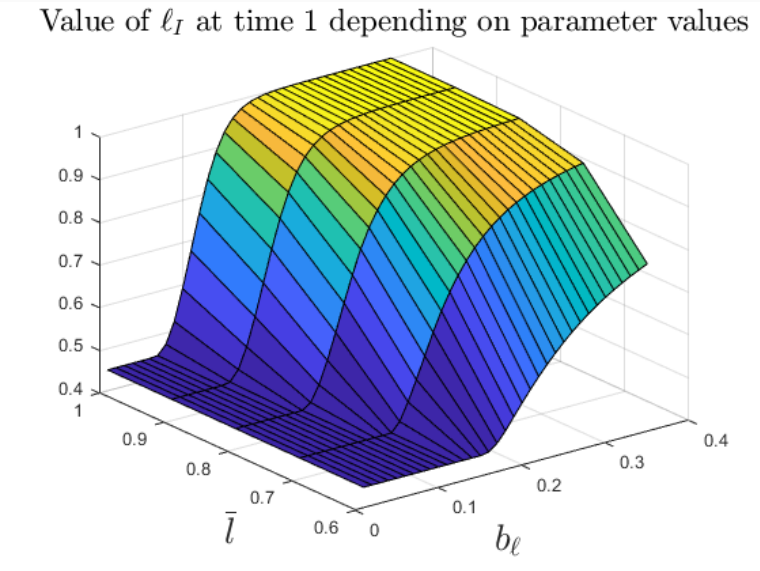
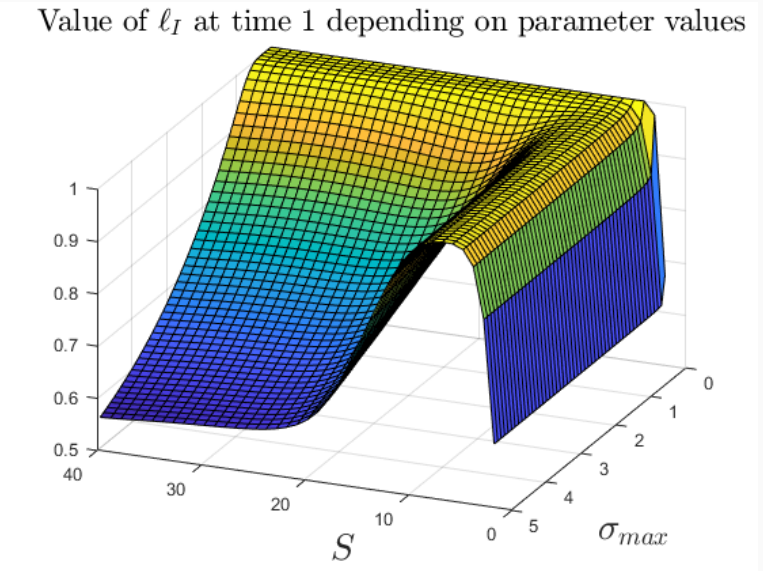
Expectations affect investment choices





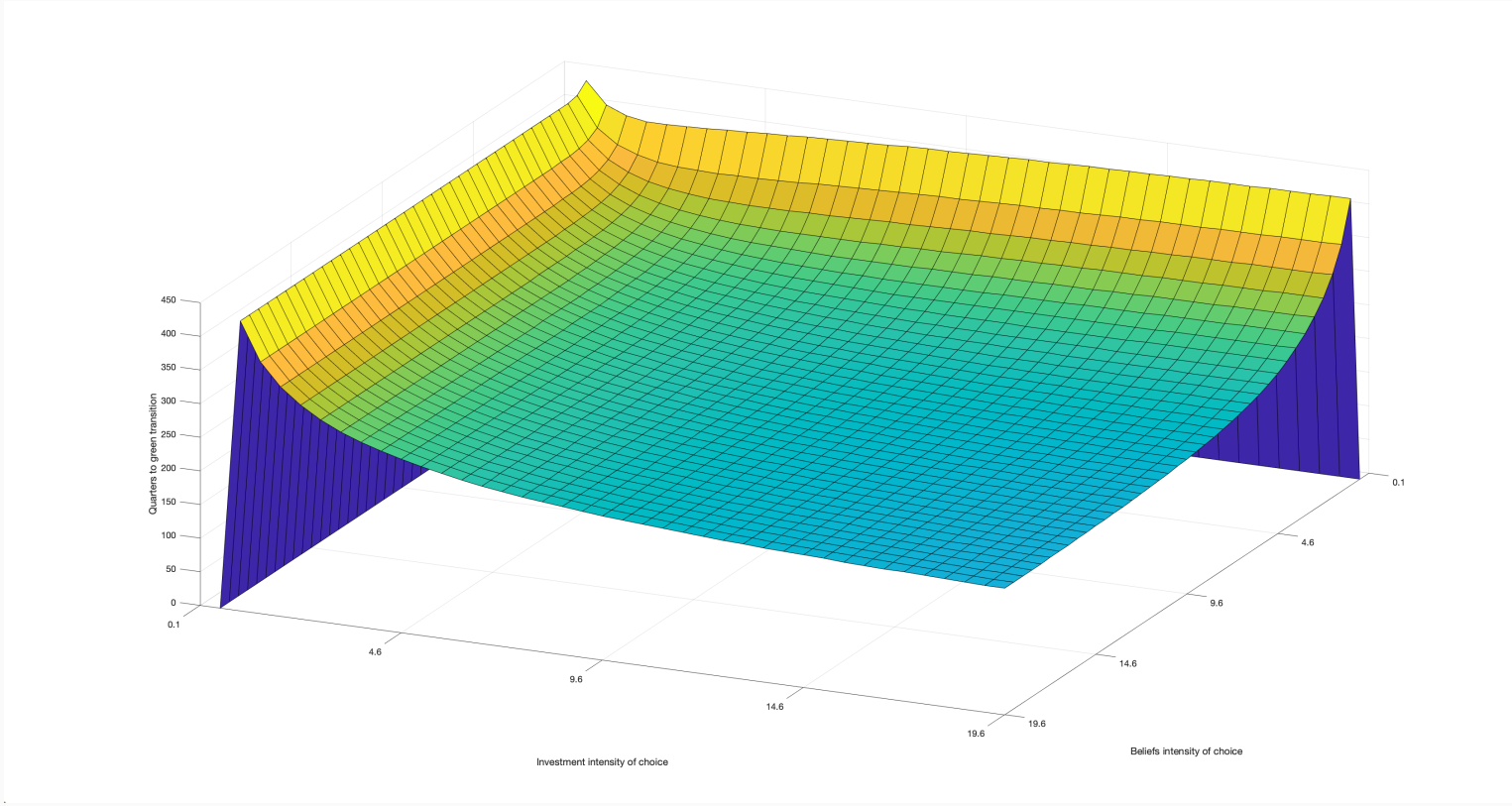




Cahen-Fourot, Campiglio, Daumas, Miess, Yardley (in development)

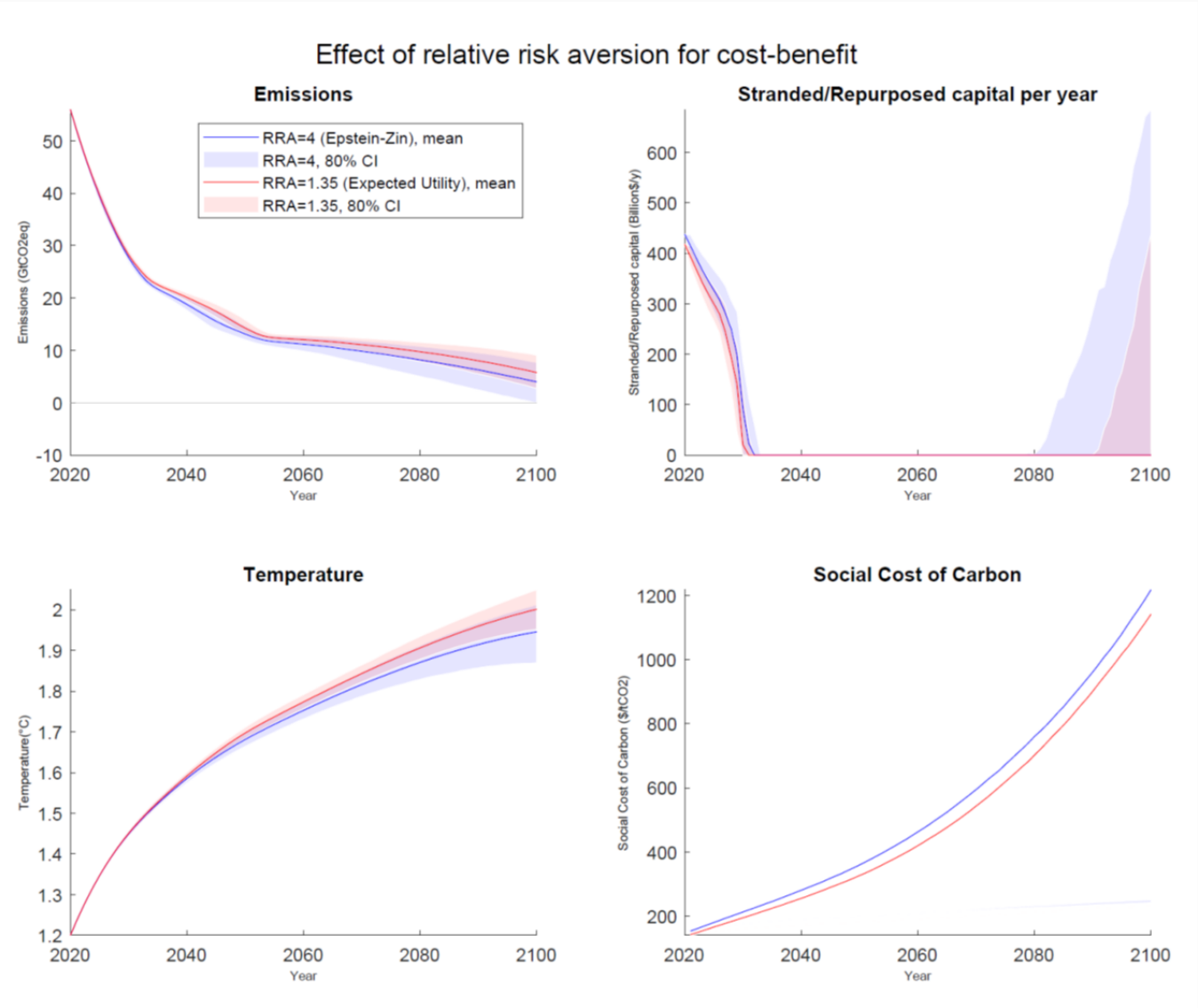
Back

Belief/investment switching speed affect transition duration



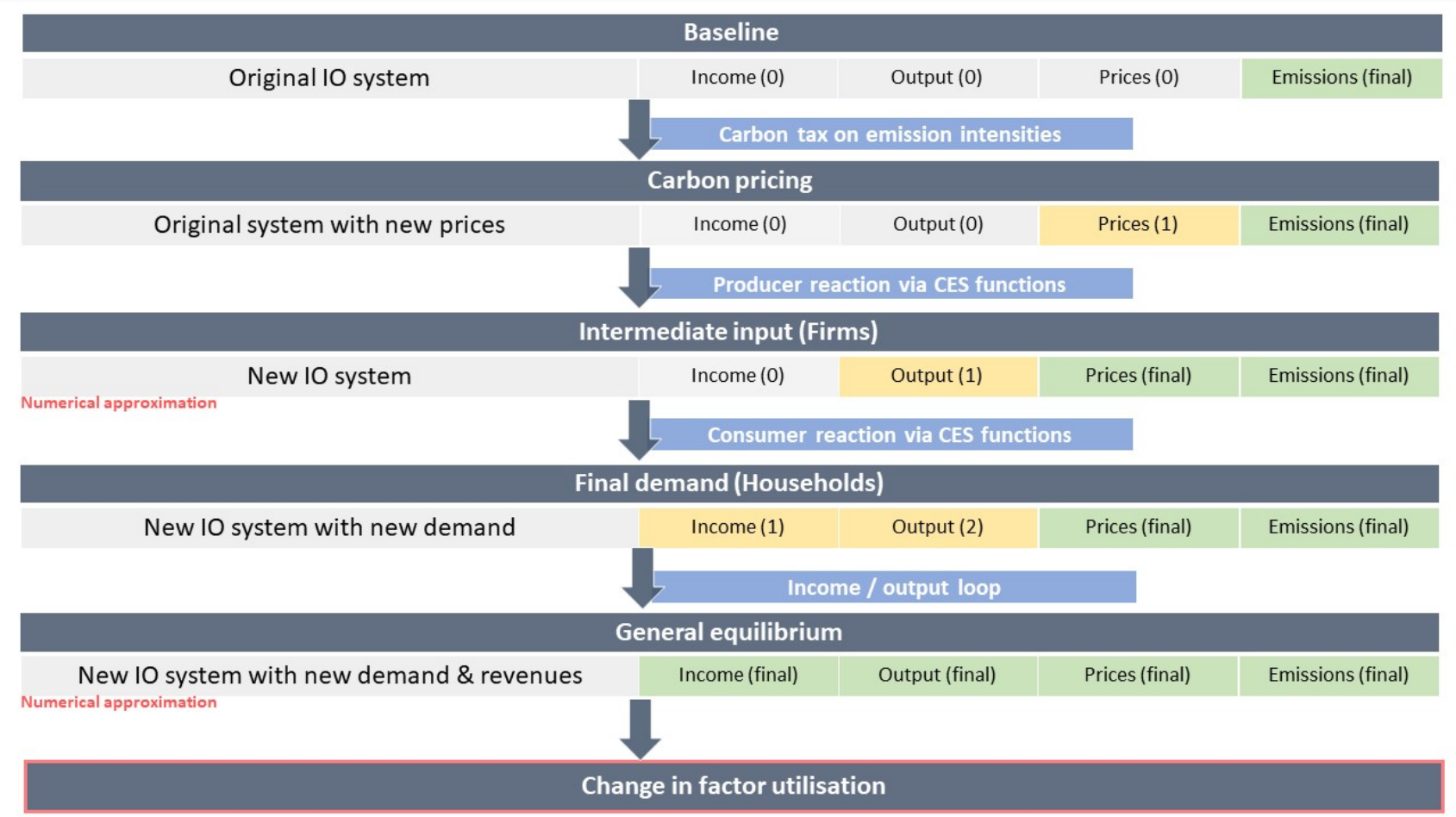
Campiglio, Lamperti, Terranova (in development) Back

Optimal transition pathways



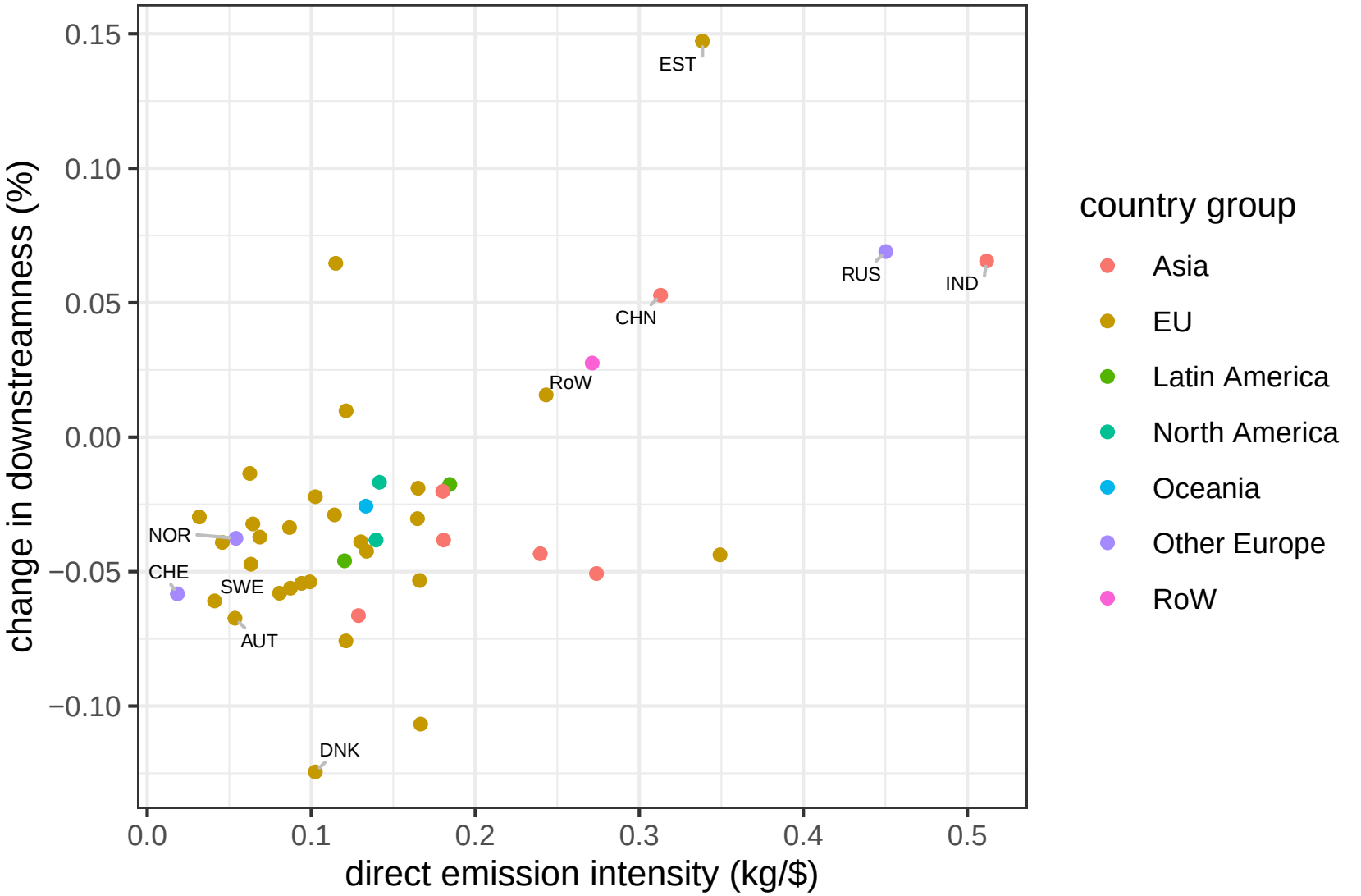
Campiglio, Dietz, Venmans (in development) Back

Carbon pricing and GVC positioning (I)



Campiglio, Massoni, Trsek (in development) Back

Carbon pricing and GVC positioning (II)



Campiglio, Massoni, Trsek (in development) Back