Dolfins project

Climate change, green transitions and growth in an agent based integrated assessment model

Francesco Lamperti

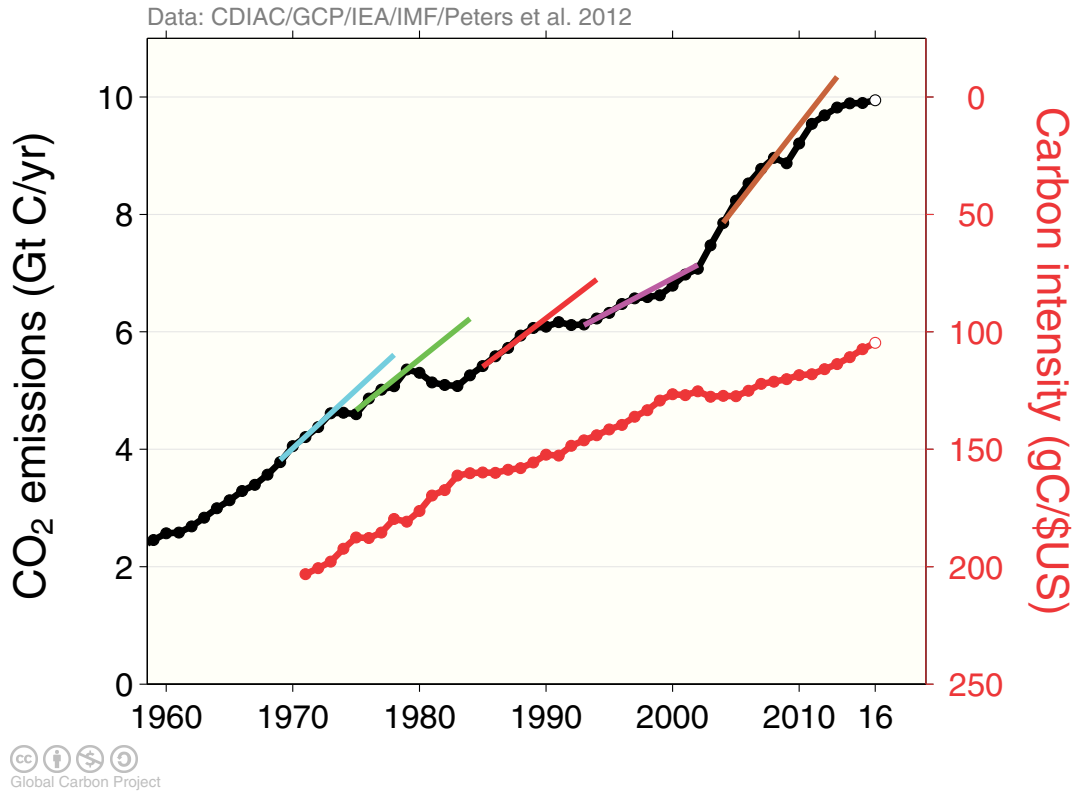
Scuola Superiore Sant'Anna (Pisa)
Fondazione Eni Enrico Mattei (Milan)

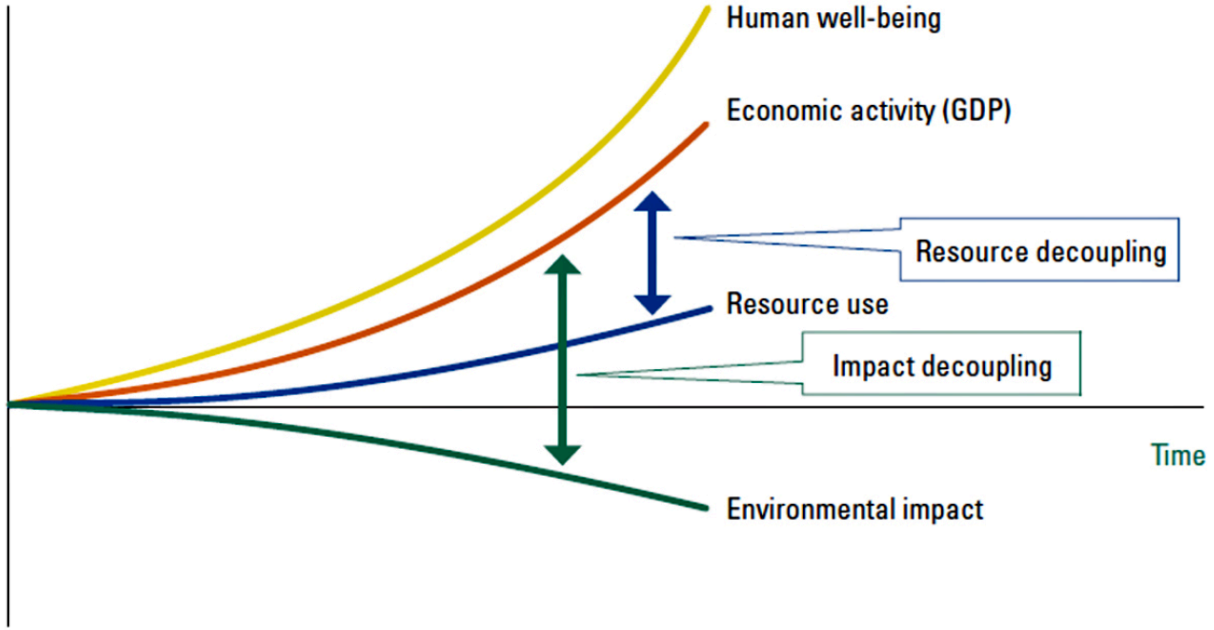
2nd FINEXUS Conference - Zurich

HORIZON 2020 European Commission Dolfins project

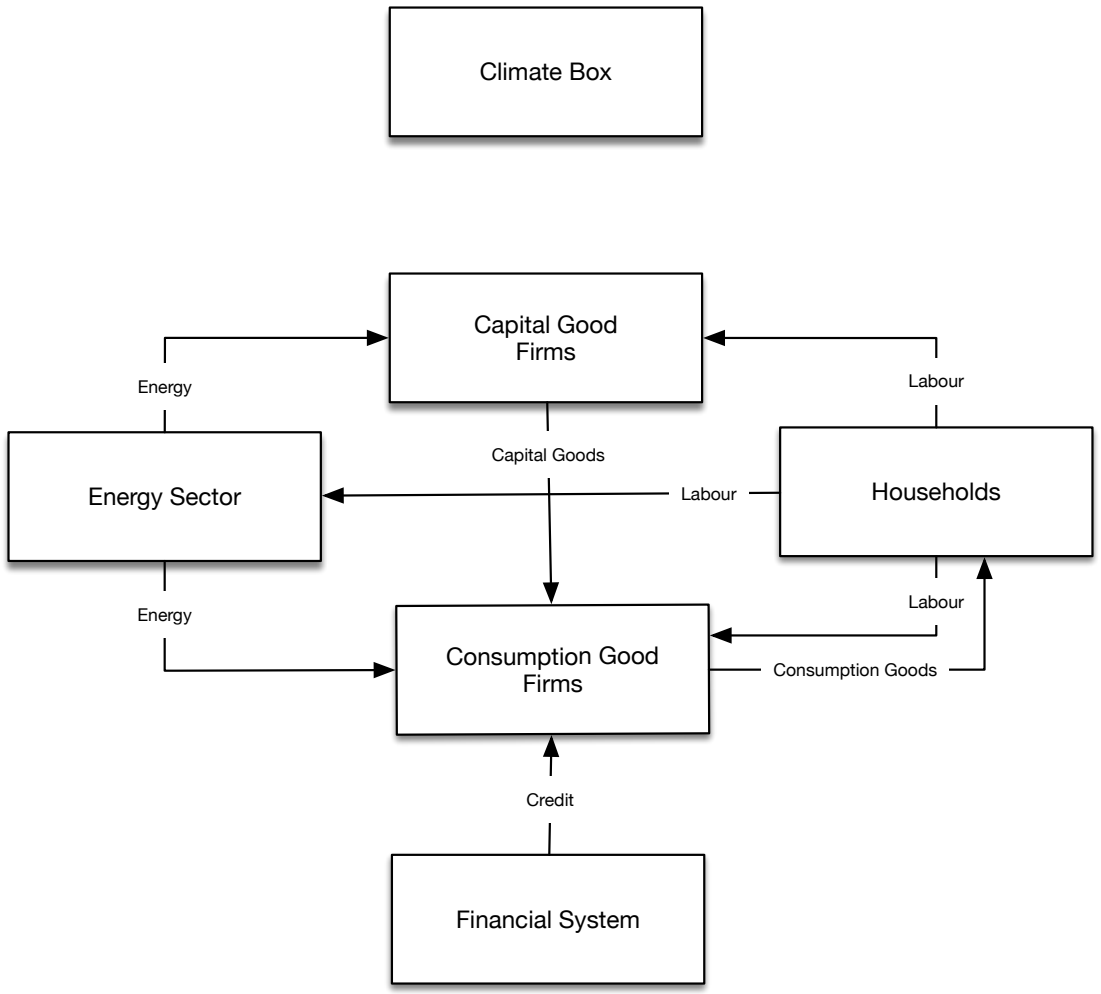
Growth, emissions and decoupling

- **Research Question**: how to move from a "business as usual" emission scenario (RCP 8.5) to a greener world?
- Both the use of resources (fossil-fuels) and the role of impacts should be carefully analyzed and disentangled





The status of modeling and the DSK model



Schematic representation of DSK model (Source: Lamperti et al. 2017)

- To provide credible recommendation, reasonable modeling approaches should be embraced
- Leading models in the field rely on simple general equilibrium economies, perfectly reallocating production factors in response to aggregate climate impacts
- This adds to a series of issues with their projections
  - **Underestimation of the damage**
  - **Difficulties in dealing with not-so-rare extreme events**
  - **Downsizing of the role of technical change**
  - **Complete overlooking of the financial system**
- We propose **an alternative modeling framework**, called **DSK**, which builds on an complex, agent-based economy endowed with a climate model.

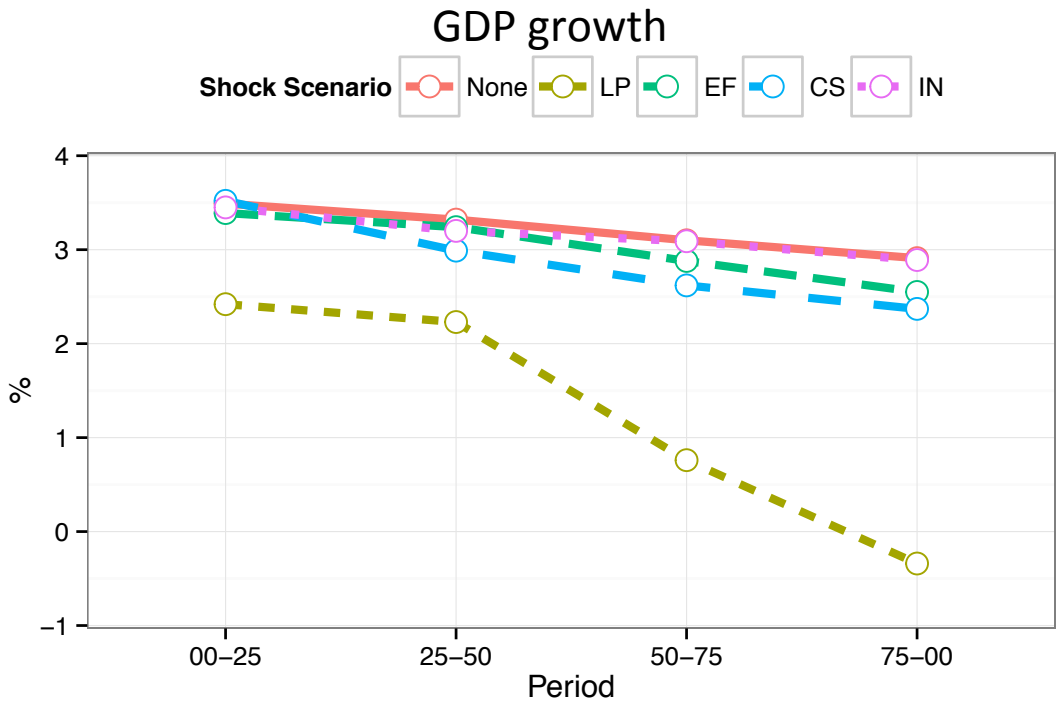
HORIZON 2020

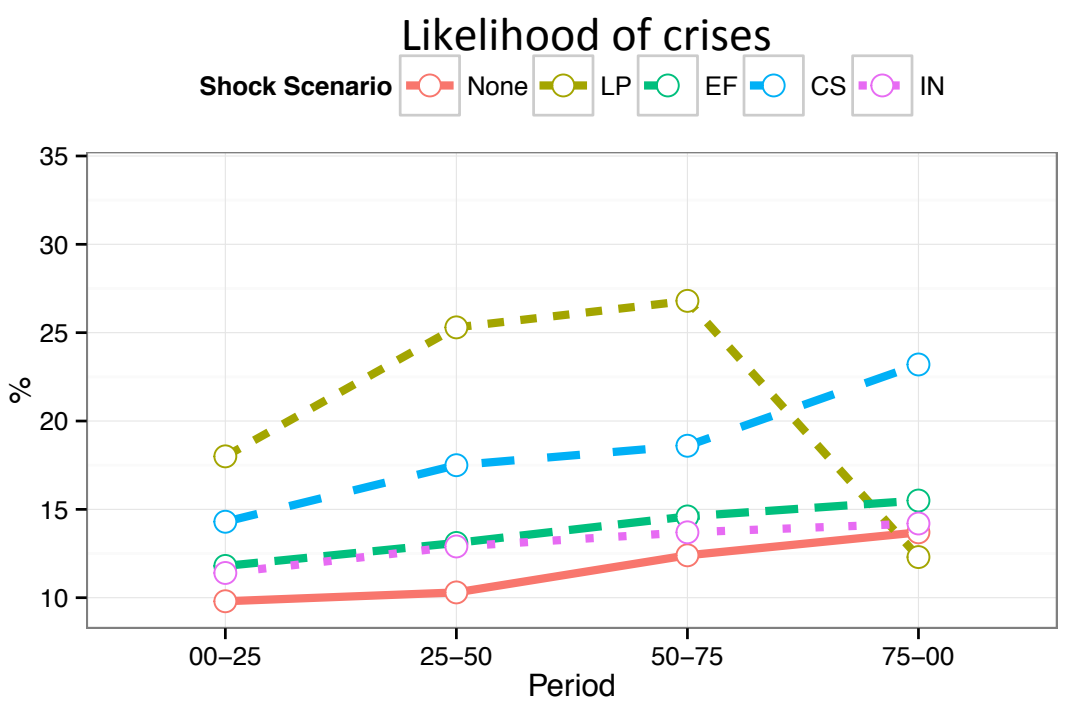
Results: climate impacts in a BAU scenario

1. **Aggregate climate impacts are heterogeneous and strongly dependent on the impact channel**

2. **Labour productivity** and **capital stock** shocks are **the most dangerous**, but generates different aggregate dynamics

3. Labour productivity shocks drive the economy toward stagnating growth and rising unemployment, while capital stock shocks create instability and boost macro volatility





Different shock scenarios: LP (labour productivity), EF (environmental friendliness), CS (capital stock), IN (inventories)

Results II: Climate change and sustainable transitions

4. **The model generates two statistical equilibria** (possibility of lock in green or brown technologies)

5. **Micro-shocks percolate through the economy** and amplify the aggregate damage

6. **Micro-shocks can increase or decrease the likelihood of a transition**, depending on the impact channel

Shock scenario:	Transition likelihood	GDP growth	Energy growth	Emissions at 2100
Aggregate output	18%	3.18%	3.09%	28.33
	(of which 83% before 2025)	(0.001)	(0.003)	(6.431)
Labour productivity	20%	1.30%	1.16%	25.70
	(of which 69% before 2025)	(0.002)	(0.003)	(4.921)
Energy efficiency	7%	3.12%	3.37%	40.64
	(of which 43% before 2025)	(0.001)	(0.003)	(3.872)

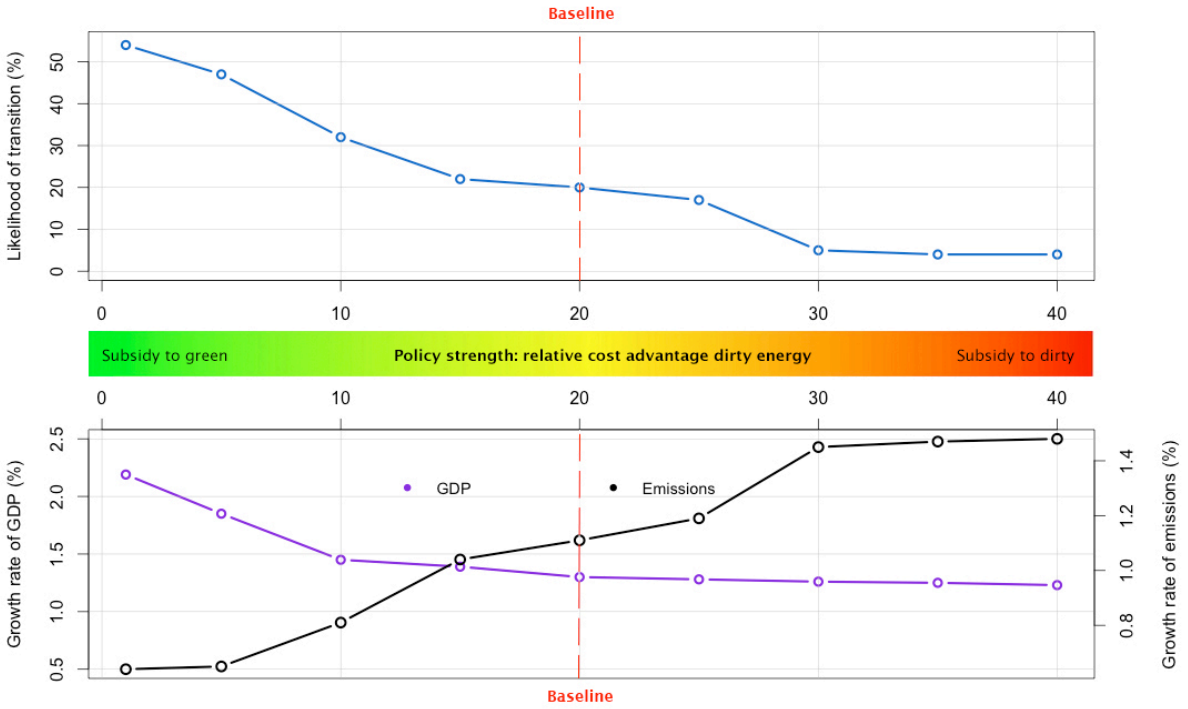
Results III: Policy Implications

1. **Energy policies** (fossil fuel taxes and feed-in tariffs) **affect the likelihood of a transition by modifying the cost structure of renewable energy technologies**;

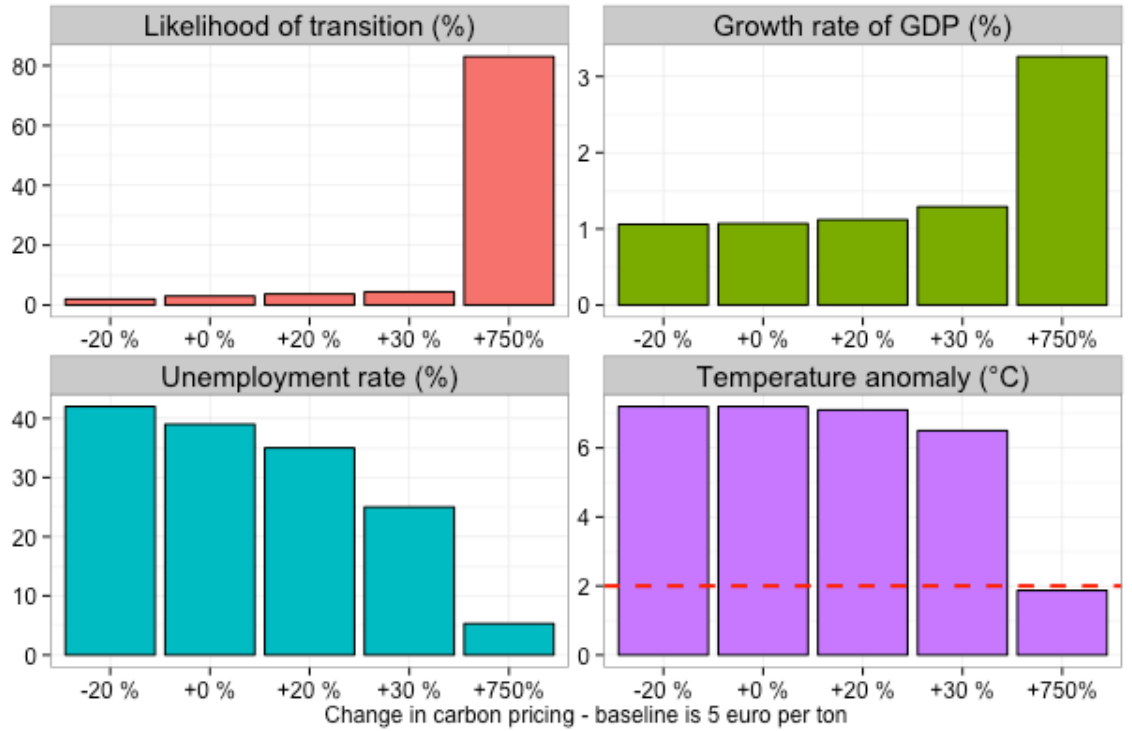
2. However, **the size of the intervention must be substantial and timely**

3. **Carbon pricing**, at current levels, **is close to useless in fostering a transition**.

Effects of energy policy



Effects of carbon tax



Thanks for your attention !

References:

- Balint, T., Lamperti, F., Mandel, A., Napoletano, M., Roventini, A., & Sapio, A. (2017). **Complexity and the economics of climate change: a survey and a look forward**. *Ecological Economics*.
- Lamperti, F., Dosi, G., Napoletano, M., Roventini, A., & Sapio, A. (2017). **Faraway, so close: coupled climate and economic dynamics in an agent-based integrated assessment model**. *Available at SSRN*.
- Lamperti, F., Dosi, G., Napoletano, M., Roventini, A., & Sapio, A. (2018). **An then he was a she: climate change and sustainable transitions in an agent based integrated assessment model**. *Forthcoming*.