EMF24 Global Scenario Modeler Presentation
Insights from the IMACLIM model

Henri Waisman, Céline Guivarch, Adrien Vogt-Schilb & Jean-Charles Hourcade
(CIRED, France)

www.imaclim.centre-cired.fr
IMACLIM, an attempt to model 2nd best economies in a GE framework

- **Static Equilibrium (t)** under constraints
- **Dynamic sub-modules** (reduced forms of BU models)
- **Static Equilibrium (t+1)** under updated constraints

- Economic signals (prices, quantities, Investments)
- Technical and structural parameters (i-o coefficients, population, productivity)

**Hybrid matrixes in values, energy and « physical » content**
- Secure the consistency of the engineering based and economic analyses
- Explicit accounting of inertias on equipment stocks
- Technical asymptotes, basic needs

**Solowian growth engine in the long run but transitory disequilibrium**
- Unemployment, excess capacities
- Investments under imperfect foresight (informed by sectoral models)
- Trade and capital flows under exogenous assumption about debts
Why was it so hard to run EMF24 scenarios with IMACLIM?

- For a category II scenario (-50% in 2050), typical cost profile of IMACLIM scenarios: high transition costs with moderate LT losses and possible benefits

- Emission trajectories differ in EMF 24 = far stronger reductions in the LT
  - only the most optimistic of the abatement scenarios could be run with our current (conservative?) technological assumptions
  - in other scenarios the technical asymptotes and basic needs were constraining

- Three changes to run the abatement scenarios
  - low basic needs and technical asymptotes
  - non-price induced policies in transportation (automobile, air)
  - sequestration in degraded lands to relax CO₂ constraint
Why so high carbon prices?

*In category II scenarios*, carbon prices
-- increase fastly over the first decades
(strong signals needed to wake up the half deaf),
-- then stagnate or even decline after 2030 (LBD)

*In EMF scenarios*, the long run constraints govern the LT increase of carbon price
- Decreasing efficiency of the carbon price when the asymptotes are approached
- Decreasing GDP losses per unit of tax increase (tax revenues returned to the economy) = only ‘frictional’ GDP losses

The role of technologies
- CCS crucial over the LT
- with CCS, energy efficiency matters for the transition but CCS becomes some form of substitute in the long term
From carbon price profiles to GDP losses, the mechanisms at play

- **Causal chain of GDP losses:**
  
  higher energy prices, higher production costs, lower terms of trade for the most impacted economies, lower purchasing power of households (higher energy bills and higher prices of imported goods + lower wages), lower domestic demand

- A catchy way of representing the mechanisms at play (prior to trade effect and technical change)

\[
\frac{\Delta Q}{Q_0} \approx -\frac{1}{\alpha} \cdot \frac{z_0}{1-z_0} \cdot \frac{e \cdot C I_E}{\omega_0 \cdot I} \Delta \tau_E
\]

  The rigidity of labor markets
  small wage-curve elasticity means high cost

  The ratio “energy (carbon) vs. salaries”.
  High energy intensity means high cost

- Over the long run, GDP losses may decrease over time depending on a tradeoff
  - Benefits from ITC that decrease energy intensity and correct sub-optimalities of baseline scenarios (peak oil)
  - Necessity to increase carbon tax rates
From carbon prices to GDP losses

Regional distribution of GDP losses
- in the transition: moderate in OECD countries, high in China (energy-intensive)
- in the long term: continuous increase of GDP losses

Without:
- Compensatory transfers to dev. countries
- Local fiscal policies
- « deus ex machina » technology (alternative tech. availability changes LT costs)

Climate objective and coordination:
- 450ppm needs a fast decarbonization which comes at a very high transitory cost (inertia and imperfect foresight)
- G8: very high transitory cost (OECD) but recovery after 2050 (dev. countries)
- Long term: similar efforts in all scenarios
Pending questions for further analyses

- The role of the emission time profile (RCP emissions) : when flexibility and transition costs

- Sensitivity tests about technological assumptions (cost-potential after 2050) because they determine the nature of the constraint over the long term

- Tests of the role of non price induced policies (in transportation and infrastructures) and of alternative assumptions about consumption patterns