EMBODIED EMISSIONS IN FRENCH TRADE UNDER NATIONAL CLIMATE CONSTRAINTS FOR A LOW CARBON SOCIETY

Gaëlle LE TREUT - CIRED
Antoine Teixeira - CIRED
The key role of emissions in trade under constrained national efforts for mitigation

- Carbon ‘leakage’: a remaining issue
  - A global agreement but national mitigation plans
  - Contrasted level of ambition
The key role of emissions in trade under constrained national efforts for mitigation

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  - Contrasted level of ambition

- Different scopes of inventories to be highlighted

TERRITORIAL-BASED EMISSIONS
Direct measures and technology-oriented inventories
General greenhouse gas emissions and removals taking place within national territory and offshore areas over which the country has jurisdiction (IPCC, 2006)

CONSUMPTION-BASED EMISSIONS
Indirect “measures” and emissions embodied to international trade
Methods: embodied emissions in bilateral trade, multi-regional input-output

PRODUCTION-BASED EMISSIONS
Consistent with System of National Accounts description, and economic sectors (IOT)
Methods: each energy purchases associated to a quantity of emissions
Objectives

- Analysing wide implications of French decarbonization scenarios in the mid-term to long-term

  Consistency between

  - Macroeconomics
  - Competitiveness
  - CO2 emissions regarding different inventories

- Implementing boundaries conditions

  To what extent France's mitigation objectives may impact its external trade both in economic or emissions terms?
IMACLIM-FR: a hybrid CGE model in open economy

Simultaneous equilibria in monetary and physical units (Mtoe, tons of steel, tons of cement)

- 10 income classes
  - Prices, Incomes
  - Final demand

Production system

- Payroll & other taxes
- Transfers

Public administrations

Limited adaptation capacity (technical constraints)

Equilibrium unemployment (constraint on the adjustment of wage)

Rest of the world
- Flows of products & funds

Limited adaptation capacity (technical constraints & basic needs for energy)

International trade competitiveness function of the production costs

Public finance modalities (A tax and benefit system with multiple objectives)

Exports
- Imports

Hosted on Github

Articulation with an Input-Output Analysis

**PRODUCTION-BASED EMISSIONS**

- Input Output table in Emissions (MtCO2)
  - **Emissions intensities from IPCC**
  - \( \text{Emiss}_{ij} = \beta \cdot Q_{ij} \)

**CONSUMPTION-BASED EMISSIONS**

A “unilateral multi-regional” IO approach

- French partners specificities by sectors

  **A “quasi-closed” economy**

  - Exports are not re-imported
  - Imports are used for French consumption and/or re-exported

From statistical information available

**Step 1**

- Matrix of unit prices (value/Mtoe)

**Purchases**

- \( \text{V}_{ij} = P_{ij} \cdot Q_{ij} \)

**Input Output table in volume (Mtoe)**

**Import purchases**

**Domestic purchases**

**Input Output table in volume (Mtoe)**

**Matrix of unit prices (value/Mtoe)**
Production-based vs. Consumption-based accounting system at base year (2010)

Emissions due to
exports
72
Emissions due to
domestic final
collection
187
Households direct
emissions
127

Production-based accounting

MitCO2

386

IAMC Conference, Sevilla – November 2018
Production-based vs. Consumption-based accounting system at base year (2010)

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Sectoral decomposition of emissions embodied in international trade at base year (2010)
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## Two mitigation scenarios with a two-step resolution 2030 and 2050

### A common national context

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### NDC Scenario

- Gain in domestic energy efficiency
- Policy design: 
  - Constant carbon tax recycled into labour tax (100€/tCO2)

### DM Scenario

- Toward carbon neutrality: 
  - Higher gain in energy efficiency
  - Higher carbon tax (225€/tCO2 in 2030 and 600€/tCO2 in 2050)
  - Increase of existing tax for energy sectors in 2050
- Lower global GDP growth than NDC scenario
- Evolution of all import prices and lower energy intensities for the RoW
## Two mitigation scenarios with a two-step resolution 2030 and 2050

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### NDC Scenario

**Gain in domestic energy efficiency**

**Policy design**

- Constant carbon tax recycled into labour tax (100€/tCO2)

**International context and boundaries conditions**

- Global GDP growth
- Evolution of primary energy import prices & energy intensities

### DM Scenario

**Toward carbon neutrality: Higher gain in energy efficiency**

**Higher carbon tax (225€/tCO2 in 2030 and 600€/tCO2 in 2050)**

+ increase of existing tax for energy sectors in 2050

**Lower global GDP Growth than NDC scenario**

**Evolution of all import prices and lower energy intensities for the RoW**
Evolution of Production-based vs. Consumption-based emissions inventories
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Evolution of Production-based vs. Consumption-based emissions inventories

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NDC scenario: +64%
DM scenario: +99%

NDC scenario: +81%
## Sectoral insights of CO₂ net imports

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- Increases of domestic prices relative to world prices lead to competitiveness losses
- Increases of investment needs for construction
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- Higher competitiveness losses in DM scenario both in 2030 & 2050
- A fast improving of RoW Emissions intensities in 2050 leads the better situation in CO2 emissions embodied in French imports
Preliminary conclusions and perspectives

- A methodology that allows at the country-scale and under national climate constraint
  - keeping an economy-energy consistent analysis with all the feedbacks of a climate policy
  - while tracking the carbon embodied in imports through specific boundaries conditions

- Further analysis
  - Sensitivity analysis:
    - International system of prices
    - Feedbacks on external trade -> on carbon footprint
  - Contrasted scenario: ‘reindustrialisation’ of France and impacts on external trade

- Policy design
  - Implementing a cap on carbon embodied in imports (implicit constraint on external trade balance)
  - Border tax adjustment
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Thank you for your attention

Work in progress – Any comments
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