“Vertical Markets, Carbon Border Tax Adjustments, and ‘Dirty’ Inputs”

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Session 19: “Carbon Border Taxes and Agri-Food Trade: Should We Give a CBAM?”

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Background

- Copeland *et al*. (2022) stylized facts:
  - "Dirty" industries more exposed to trade than "clean"
  - "Dirty" industries located further upstream
  - Rich countries outsourcing GHG emissions
- Shapiro (2021) finds relationship between "upstreamness" and tariffs/NTBs, i.e., implicit subsidies to "dirty" upstream production
- EU implementing CBAMs linked to internal carbon price, targeted at "dirty" imported upstream products, e.g., iron and steel, aluminum, chemicals, fertilizers, and cement
- Concentrated industries: Demailly and Quirion (2008) (iron and steel); Fowlie *et al*. (2016) (cement); Sheldon and McCorriston (2017) (aluminum)

Vertical Market Structures

- **Multiple issues in analyzing CBAMs in vertical markets:**
  - **GHG emissions at successive stages, e.g., electricity generation and fertilizer production**
  - **Horizontal market competition, i.e., oligopolistic behavior/markups over marginal cost**
  - **Vertical market competition/successive oligopoly, i.e., double marginalization, pass-through and pass-back**
- **Approach: build successive oligopoly model incorporating trade/climate policy (Ishikawa and Spencer, 1999)**
- **Policy(ies): domestic carbon tax combined with CBAM targeted at embodied carbon in imports**

EU CBAM Mechanism

- EU has introduced "Fit for 55 Package" designed to meet 2030 target of reducing GHG emissions by 55% compared to 1990 (European Commission, 2021)
- Changes to EU's emission trading system (ETS) combined with CBAMs on defined imports:
  - Progressive reduction of free allowances to sectors with leakage risk, e.g., fertilizers
  - Importers of covered products required to purchase CBAM "certificates", price reflecting that of EU emission allowances, and surrendered to cover embodied emissions
- No refunds on exports – could undermine EU climate credibility and possibly inconsistent with WTO/ASCM

Economic/Legal Analysis of CBAMS

- CBAMs are adapted border tax adjustments (BTAs)
- Use of BTAs well-founded in international public finance literature (Lockwood and Whalley, 2010)
- Principle captured in WTO/GATT rules (Articles II and III): BTAs must be neutral in terms of trade impact, i.e., preserve competitive equality
- In principle, nothing to prevent application of BTA to intermediate input used in production of final product – see *US-Superfund* dispute (GATT, 1987)
- Poterba and Rotemberg (1995) and McCorriston and Sheldon (2005) evaluated neutral BTAs in this setting under perfect and imperfect competition

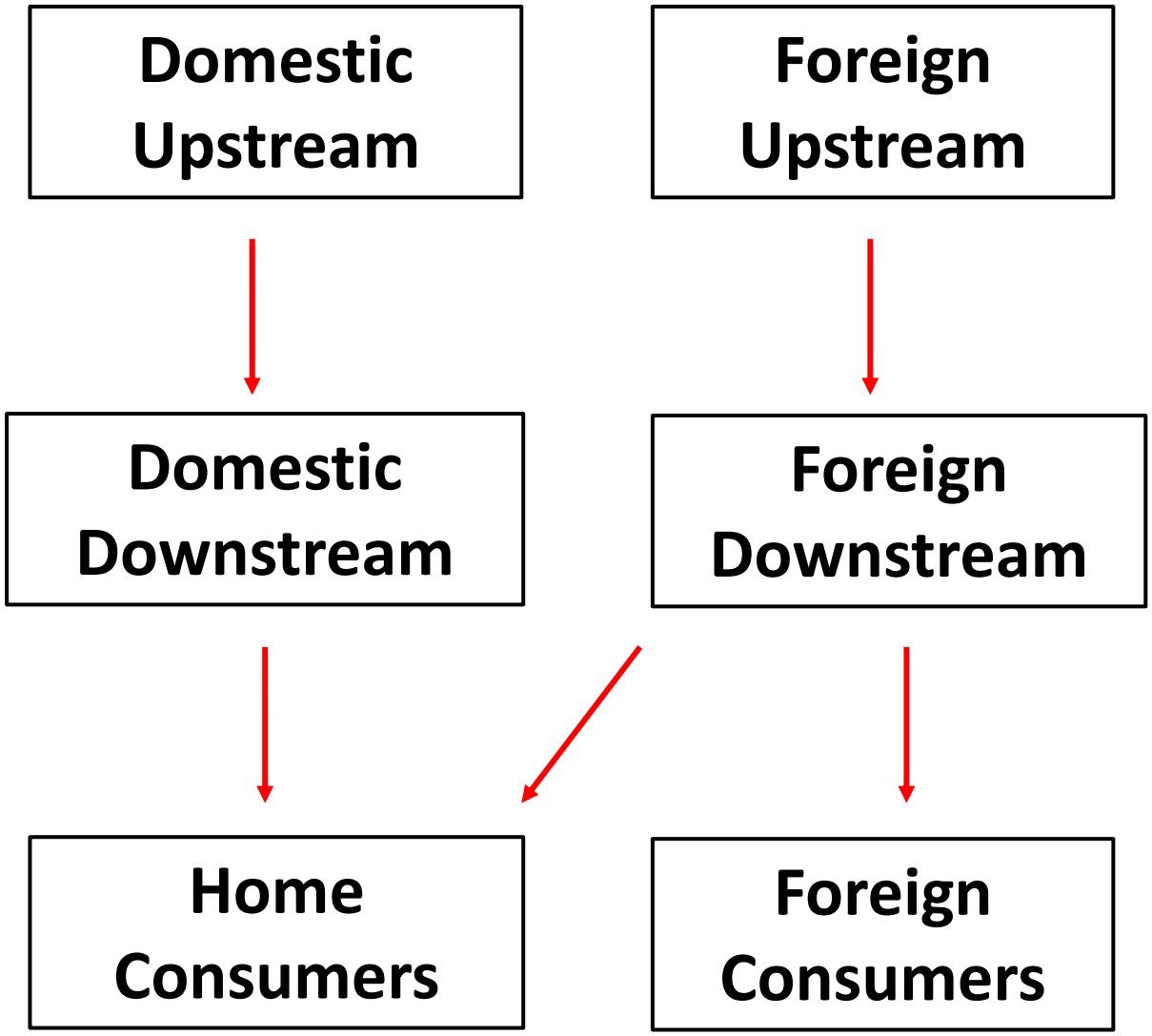
Economic/Legal Analysis of CBAMS

- Analysis of BTAs essentially about *competitive equality*, analysis of CBAMs focused on countering *leakage*
- Key idea: use CBAMs to shift terms-of-trade against countries not regulating GHG emissions (Hoel, 1996)
- Potential for CBAMs being "green protectionism"
- Staiger (2022) has interesting argument about adjusting existing tariff bindings for CBAMs – would require GATT Article XXVIII renegotiations
- Considerable discussion among legal experts about permissibility of CBAMs under WTO/GATT rules
- EU's proposal "possibly" inconsistent with GATT Articles I and II, and may compromise Article XX defense (Espa *et al.*, 2022)

Vertical Markets Model

- Analysis of CBAMs in multi-market setting – domestic and foreign country upstream production of intermediate (electricity) used in downstream production (fertilizer)
- Restrict analysis to downstream product being traded, i.e., foreign downstream product exported to domestic market (*Case 2*); home and foreign markets segmented
- Linear inverse derived demand system, home consumers treating domestic/foreign products as differentiated
- Leontief-type technology, ϕ is input-output coefficient
- Firm conduct parameter θ used to capture "intensity of competition" (Genoseve and Mullen, 1998; Weyl and Fabinger, 2013)

Vertical Market Structure (*Case 2*)



Vertical Markets Model (*Case 2*)

- **Equilibrium solution:**

$$\begin{bmatrix} E_1 & \phi^F K & 0 \\ \phi^D K & E_2 & (1+\theta^{U,F,F})c_P^F \varepsilon^{U,F} \\ 0 & (1+\theta^{U,F,H})c_P^F \varepsilon^{U,F} & E_3 \end{bmatrix} \begin{bmatrix} Q^{U,D} \\ Q^{U,F,H} \\ Q^{U,F,F} \end{bmatrix} = \begin{bmatrix} a_1^H - c_P^D \varepsilon^{D,D} - P_A^D \\ a_2^H - c_P^F \varepsilon^{D,F} - P_A^F - t^{CBAM} \\ a^F - c_P^F \varepsilon^{D,F} - P_A^F \end{bmatrix}$$

where:

$$E_1 = \left[\theta^F \chi_1 (1+\theta^{U,D}) + \beta^{U,D} c_P^D \varepsilon^{U,D} (1+\theta^{U,D}) \right]$$

$$\chi_1 = \left[b_1 (1+\theta^{D,D,H}) + \beta^D c_P^D \varepsilon^{D,D} (1+\theta^{D,D,H}) \right]$$

$$E_2 = \left[\phi^F \chi_2 (1+\theta^{U,F,H}) + \beta^{U,F} c_P^F \varepsilon^{U,F} (1+\theta^{U,F,H}) \right]$$

$$\chi_2 = \left[b_2 (1+\theta^{D,H,F}) + \beta^F c_P^F \varepsilon^{D,F} (1+\theta^{D,H,F}) \right]$$

$$E_3 = \left[\phi^F \chi_3 (1+\theta^{U,F,F}) + \beta^{U,F} c_P^F \varepsilon^{U,F} (1+\theta^{U,F,F}) \right]$$

$$\chi_3 = \left[b_2 (1+\theta^{D,F,F}) + \beta^F c_P^F \varepsilon^{D,F} (1+\theta^{D,H,F}) \right]$$

Vertical Markets Model: Example

- Across home and foreign markets: (i) symmetric market shares at each stage, and (ii) $\varepsilon^{U,D} = \varepsilon^{U,F}$, $\varepsilon^{D,D} = \varepsilon^{D,F}$

- Carbon prices $c_P^D \geq c_P^F$, and $t^{CBAM} = (c_P^D - c_P^F)$

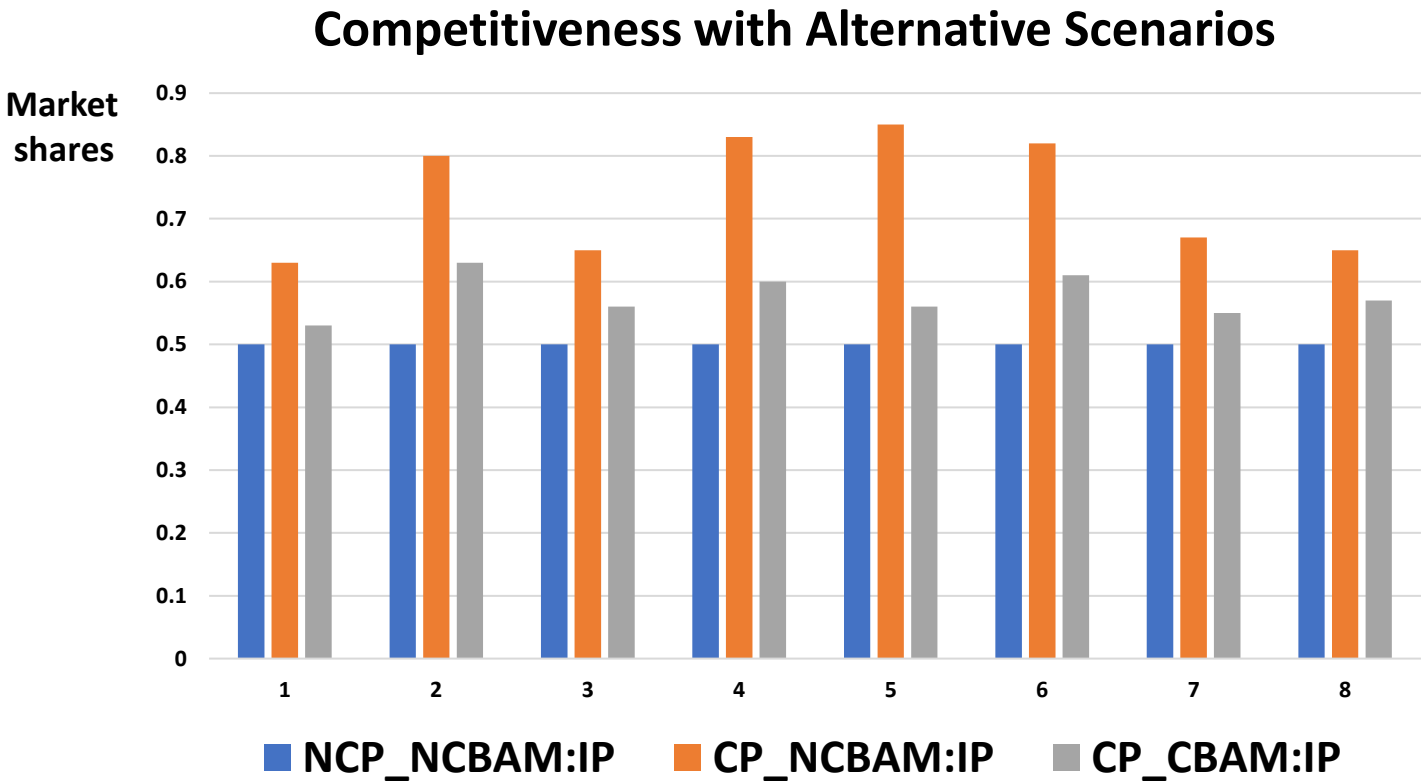
- Carbon leakage defined as: $\dfrac{\Delta Q^F - \Delta Q^D}{Q^F + Q^D}$

  (static oligopoly setting, i.e., no entry/exit of firms)

- Scenarios:

1. $\phi = 1; \theta = 1$	5. $\phi = 0.2; \theta^D = 0.2; \theta^U = 0.6$
2. $\phi = 0.2; \theta = 1$	6. $\phi = 0.2; \theta^D = 0.6; \theta^U = 0.2$
3. $\phi = 1; \theta = 0.5$	7. $\phi = 1; \theta^D = 0.2; \theta^U = 0.6$
4. $\phi = 0.2; \theta = 0.5$	8. $\phi = 1; \theta^D = 0.6; \theta^U = 0.2$

Competitiveness and CBAMs

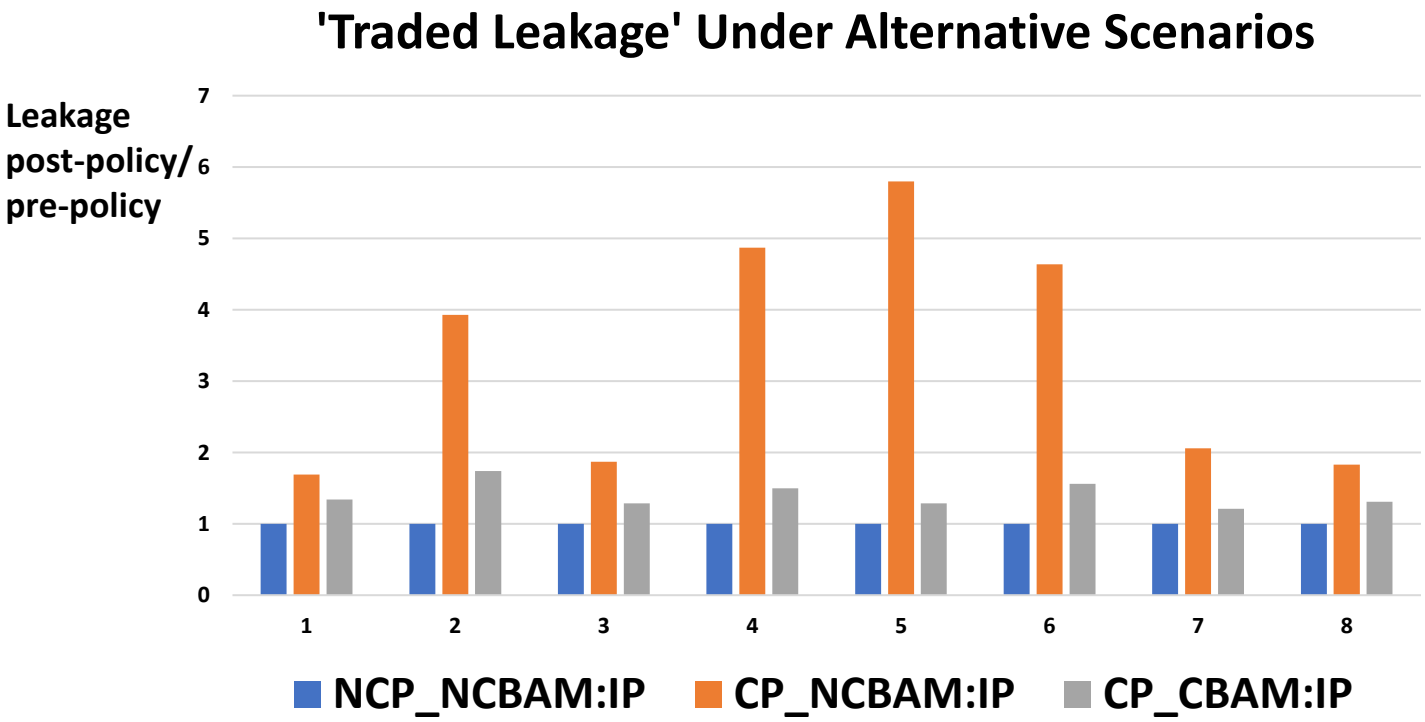


Domestic firms lose competitiveness with carbon price, not restored with CBAM

Input-output structure matters given downstream firms face higher intermediate costs with carbon price imposed upstream

Loss of competitiveness greater with more intense competition at each stage, but matters less than input-output structure and passthrough of carbon price

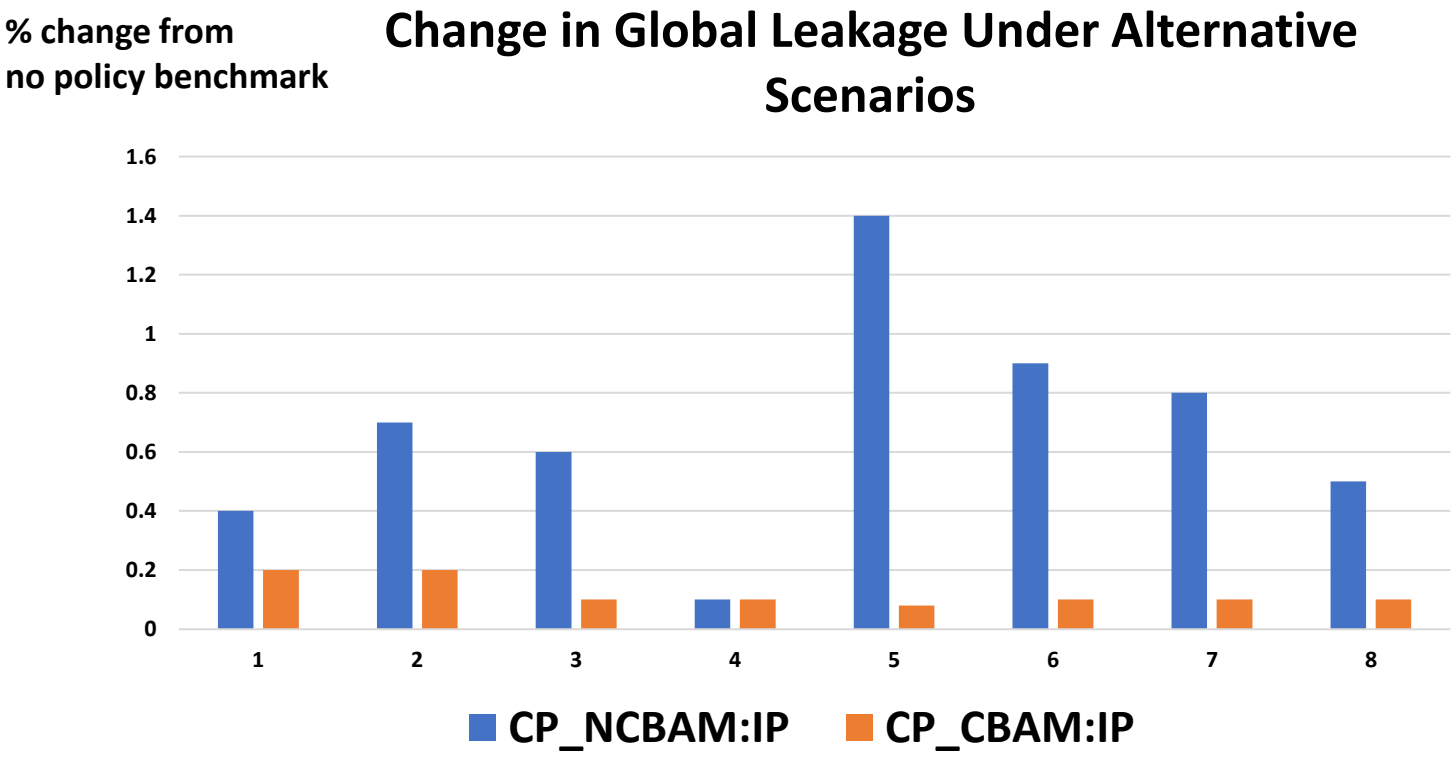
Leakage and CBAMs



Leakage here only due to home country trade in downstream product

Similar drivers, with input-output structure mattering most

Leakage and CBAMs



Changes in leakage relatively small due to (i) the rest of the world is large relative to imports by the home country, (ii) plus adding on rest of the world upstream emissions minimizes impact of changes in imports by home country

Summary and Conclusions

- Under revised EU climate policy, "dirty" industries will no longer receive free allowances, carbon leakage being targeted with CBAMs
- Repeated focus by EU Commission on challenge of extending CBAMs along complex value chains
- Objective in paper to start analyzing CBAMs in context of vertical market structures/imperfect competition
- Analysis important in several dimensions: complexity of value chains; successive oligopoly and pass-through/pass-back; definition of CBAMs
- Next step(s): expand vertical market structures beyond example, and calibrate with actual data