Alternative designs for tariffs on embodied carbon – a global cost-effectiveness analysis

by

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Research questions:

• How much can be gained in terms of cost-effectiveness through careful design of the system?
  – quantified in a global, static CGE model

• Is careful design costly in other senses (administrative, legal, political, distributional)?
  – information is mostly qualitative, but
  – the CGE analysis measures the maximum acceptable costs (administrative, legal, political) of moving to a less feasible regime for the sake of effectiveness.
Optimal carbon tariffs

- Hoel (1996): Optimal *unilateral carbon policy*
  - $t$ (unilateral carbon tax) = marginal utility of avoiding emissions domestically
  - $s_i$ (carbon tariff on good $i$) = marginal utility of reducing net imports
    Includes utility of terms-of-trade effects and emission reductions abroad

- Globally optimal carbon tariff (Gros, 2009):
  - Carbon tax in the coalition = $t$
  - terms-of-trade effects offset each other
  - $s_i$ (carbon tariff) = $t \frac{de}{dm_i} = \text{tax the marginal carbon content of net imports, i.e. the increase in emissions abroad (} e\text{) caused by the last unit imported (} m_i\text{). The change in emissions follows from all price- and quantity adjustments}$
How to operationalise carbon content?

IN THEORY (MAX. EFFECTIVENESS):
• Include all emission changes in the wake of changed import
• Make it firm-specific and dynamic (responsive to behavioural adjustments)
• Cover all import and export goods

IN PRACTICE (PRACTICABILITY CONSIDERATIONS) :
1. TECHNOLOGY BASIS; Industry- and country-specific or based on average carbon content (foreign or domestic)?
2. EMBODIMENT: Direct emissions, only, or including electricity-induced or all input-output effects?
3. COVERAGE: Only the most energy-intensive or all?

OUR HYPOTHESIS:
The closer to theory, the more effective – even in a realistic, imperfect world (CGE-modelled)

OUR QUESTION:
Are there important trade-offs between efficiency and feasibility?
Feasibility of carbon import tariffs

Legality:

• Consistent with WTO/GATT’s non-discrimination principles (Article I and III)?
  – Discriminates equal products - only production processes vary (foreign vs domestic)
  – Bureaucracy on border is trade barrier
• Two GATT clauses can allow for border measures for environmental reasons, but strict!
  – at odds with other concerns? necessary? other alternatives tried?

Practicability

• Administration & compliance costs likely increase with cost-effectiveness
• All designs can be based on official data -> avoid (rel. high) compliance costs of firms

Political/distributional concerns

• Strong EITE lobbyists in regulated countries
• Import tariffs may increase countries’ incentives to join coalition
• North-south distributional perspective (also in WTO)
• Risk trade wars or harm climate negotiations
# 54 scenarios for import tariff design
- compared to a reference with emission pricing, only (permit trade), cap 20%

<table>
<thead>
<tr>
<th>TECHNOLOGY BASIS of carbon content</th>
<th>EMBODIMENT of carbon metric</th>
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<tbody>
<tr>
<td>(sector-specific in all scenarios)</td>
<td>TOTAL: Fully embodied (input/output-corr)</td>
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<table>
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<tr>
<th>REGION: Region/country-specific</th>
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<tr>
<td>FOREIGN: Average non-coalition</td>
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<tr>
<td>DOMEST: Average coalition</td>
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**Coverage of products:**

- **EITE** sectors (chem, min, metals)
- All sectors

**Coalitions:**

- **EU**
- **A1** (Annex 1 excl. Russia)
- **CHI** = A1 + China
Embodied carbon in selected regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Direct</th>
<th>Electricity Domestic</th>
<th>Other Domestic</th>
<th>Other Imported</th>
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</thead>
<tbody>
<tr>
<td>World</td>
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<td></td>
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<tr>
<td>Brazil</td>
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<td>China</td>
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<tr>
<td>USA</td>
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Effects on carbon leakage
- Reference: The EU cuts 20% (allowance scheme)
- Carbon tariff on EITE (and adjusted EU-cap to maintain global emissions as in ref)
Global welfare costs

- Reference: The EU cuts 20%
- Carbon tariff on EITE (and adjusted EU-cap to maintain global emissions as in ref)
Distribution: Welfare costs of EU and non-EU

- Reference: The EU cuts 20%
- Carbon tariff on EITE (and adjusted EU-cap to maintain global emissions as in ref)

More dramatic for EITE: Can have *net* gain in EU, i.e. lost competitiveness in ROW
Conclusions

1) The hypothesis holds:
   – The operationalised regimes increase global welfare, and more so the more targeted and comprehensive

2) High embodiment and coverage important for effectiveness:
   – Input-output correction and foreign (average) carbon content info important
   – Offsets half of the carbon leakage
   – Save 13% of global costs (20% if all goods)
   – Comes at low administration costs? (official data)
   – But high legal and political costs…..

3) Is the least effective worthwhile?
   – Legal and distributional costs call for less targeted, domestic carbon content
     - keeps tariffs low (north-south, trade wars)
     - avoid product-discrimination (WTO)
   – However:
     - 6% fall in carbon leakage, only
     - 2% of the global costs saved
Thank you

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Read more:
SSB DP no. 682
CREE WP no 1/2012
CARBON LEAKAGE

Carbon Leakage (\%) = \frac{\text{Emission increase in other countries}}{\text{Emission cuts in regulating country}} \times 100\%

Typical findings in the literature:
- Carbon Leakage of 10 - 30%
- Falling with the size of the coalition

Two main channels:

**Competitiveness/trade effect:**
Energy-intensive, trade-exposed (EITE) firms in regulated countries move/lose market shares to competitors in non-regulated countries

-> Emissions are relocated (depend on effects on prices, elasticities, emission intensities)

**Energy market/price effects:**
Lower energy demand in regulated countries reduces world market prices of energy.

-> Energy demand abroad – and emissions - increase (supply responses counteract)

Typical finding: Energy market effect the stronger

Note: Carbon tariffs will only have *direct* influence on competitiveness effect