Carbon Policy and the Structure of Global Trade
A Critical Appraisal of Carbon Tariffs

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Why is This Important?

- Paris INDCs: Global emission cap remains elusive.

- Developing-world emissions are large and growing rapidly.

- Carbon leakage and industry competitiveness are at the heart of the climate policy debate.
Embodied Carbon Tariffs

- **Embodied carbon intensity** (carbon footprint) is a measure of the average emissions generated directly and indirectly in production.
  - Direct - combustion of fossil fuels in production
  - Indirect - combustion of fossil fuels required to produce electricity (or any other good) that is used as an input in production

- **Carbon tariffs** discourage foreign emissions by pricing the emissions generated in the production of imported goods.
PROs and CONs

• The case for tariffs:
  – Support from literature on 2nd-best environmental policy
  – Marginal abatement costs are zero in unregulated countries.
  – **Empirically, emissions embodied in exports from non-OECD to OECD are large and indirect.**
  – A useful stick in policy negotiations

• The case against tariffs:
  – Blunt instruments when based on industry-average emissions
  – Re-routing of emission-intensive goods
  – “Back-door” trade policy
GTAP Data for MRIO Analysis
Variables in the MRIO Analysis

- $x_{gr}^y$: Carbon content of produced goods, $C$, $I$ and $G$.
- $x_{ir}^m$: Carbon content of imported commodity $i$ (weighted average)
- $x_j^t$: Carbon content of international trade services
Carbon Accounting

1. Output

\[ x_{gr}^y \cdot vom_{gr} = co2e_{gr} + \sum_i x_{ir}^m \cdot vifm_{igr} + \sum_i x_{ir}^y \cdot vdfm_{igr} \]

2. Imports

\[ x_{ir}^m \cdot vim_{ir} = \sum_s x_{is}^y \cdot vxmd_{isr} + \sum_j x_j^t \cdot vtwr_{jsr} \]

3. Transport

\[ x_j^t \cdot vtw_j = \sum_r x_{jr}^y \cdot vst_{jr} \]
MRIO Analysis

GTAP 2011: Emissions embodied in non-OECD exports to OECD = 13% of all OECD emissions

Source: Böhringer, Carbone, Rutherford (forthcoming), Scand. J. Econ.
MRIO Analysis

WIOD: Trade in embodied carbon has increased substantially over the last two decades (from Non-OECD to OECD but also within Non-OECD).

Source: Böhringer, Schneider, Asane-Otoo (2016), *UoO DP V-388-16*
Reality Check: Quantitative Impact Assessment

General Equilibrium (Theory)

GAMS (Modeling)

GTAP (Data)
Global Cost-Effectiveness

The scope for efficiency gains is limited.

<table>
<thead>
<tr>
<th>Abatement coalition size</th>
<th>EU</th>
<th>Annex1&amp;Russia</th>
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</thead>
<tbody>
<tr>
<td>Leakage (%) without tariffs / with tariffs</td>
<td>23.9 / 18.1</td>
<td>11.8 / 8.1</td>
</tr>
<tr>
<td>Global cost savings with tariffs (%)</td>
<td>11.8</td>
<td>6.4</td>
</tr>
</tbody>
</table>


- Industry-level tariffs do not provide direct incentives for emissions abatement at the firm level.
- Re-routing to countries outside the abatement coalition
Global Cost-Effectiveness

Can we improve substantially on global cost-effectiveness?

- **Firm-level tariffs** *(Böhringer, Bye, Faehn, Rosendahl (2015), SSB DP 805): No*
  - Re-routing remains a key problem.
  - Potentially large monitoring cost

- **“Optimized” tariffs** *(Böhringer, Carbone, Rutherford (forthcoming), Scand. J. Econ.): No*
  - Tariff rates must account for re-routing.
  - Tariffs on full carbon content can even induce global excess costs.

- **Strategic tariffs** *(Böhringer, Carbone, Rutherford (2016), Am. Econ. J. Econ. Policy): Yes/No*
  - Credible sanction for larger polluters such as China
  - But: Risk of detrimental trade war
Cost Incidence

Tariffs shift the burden of abatement to the developing world.

- Conflicts with Articles 4.8 / 4.9 of UNFCCC

- Scope for beggar-thy-neighbor policies
  (Böhringer, Lange, Rutherford (2014), *J. Public Econ.*
Cost Incidence

Can we attenuate the burden shifting?

- Transfer of tariff revenues to exporters reduces cost shifting.
- Yet – there remains a net cost burden to non-abating regions.

Cost Incidence Reconsidered

Alternative trade paradigms:

- **Heckscher-Ohlin** (1933)
  - Neo-classical trade in homogeneous goods
  - No cross-hauling of data (calibration to “net” trade)

- **Armington** (1969)
  - Trade in regionally differentiated goods
  - Goods can be exported and imported at the same time (cross-hauling)

- **Melitz** (2003)
  - Monopolistic competition (firm differentiation): competitive effects
  - Trade-productivity relationship
Cost Incidence Reconsidered

Figure 2: Non-coalition burdens across trade structures (Money Metric $B)

Source: Böhringer, Balistreri, Rutherford (2015), *UoO DP V-383-15*

- Alternative perspectives on the structure of international trade have important implications for the evaluation of climate policy.
Efficiency Can Relax Equity Concerns

- OECD – 20% emission reduction vis-à-vis \textit{BaU}:
  - \textit{REF}: unilateral emission pricing
  - \textit{BTA}: \textit{REF} plus border tariffs on EITE industries
  - \textit{GLB}: Global emissions trading (non-OECD with \textit{BaU} endowment)
Outlook: Post-Paris

• Carbon tariffs could do more harm than good.

• Some reasons to be more optimistic after Paris:
  – Climate action by all countries (INDCs)
  – Climate finance
  – Review and ratchet mechanism (“naming and shaming”)
  – Local air pollution and environmental Kuznets curve
“There is only one way to be perfect but many ways to be imperfect”
(P. Krugman)

Thank You For Your Attention!


