

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

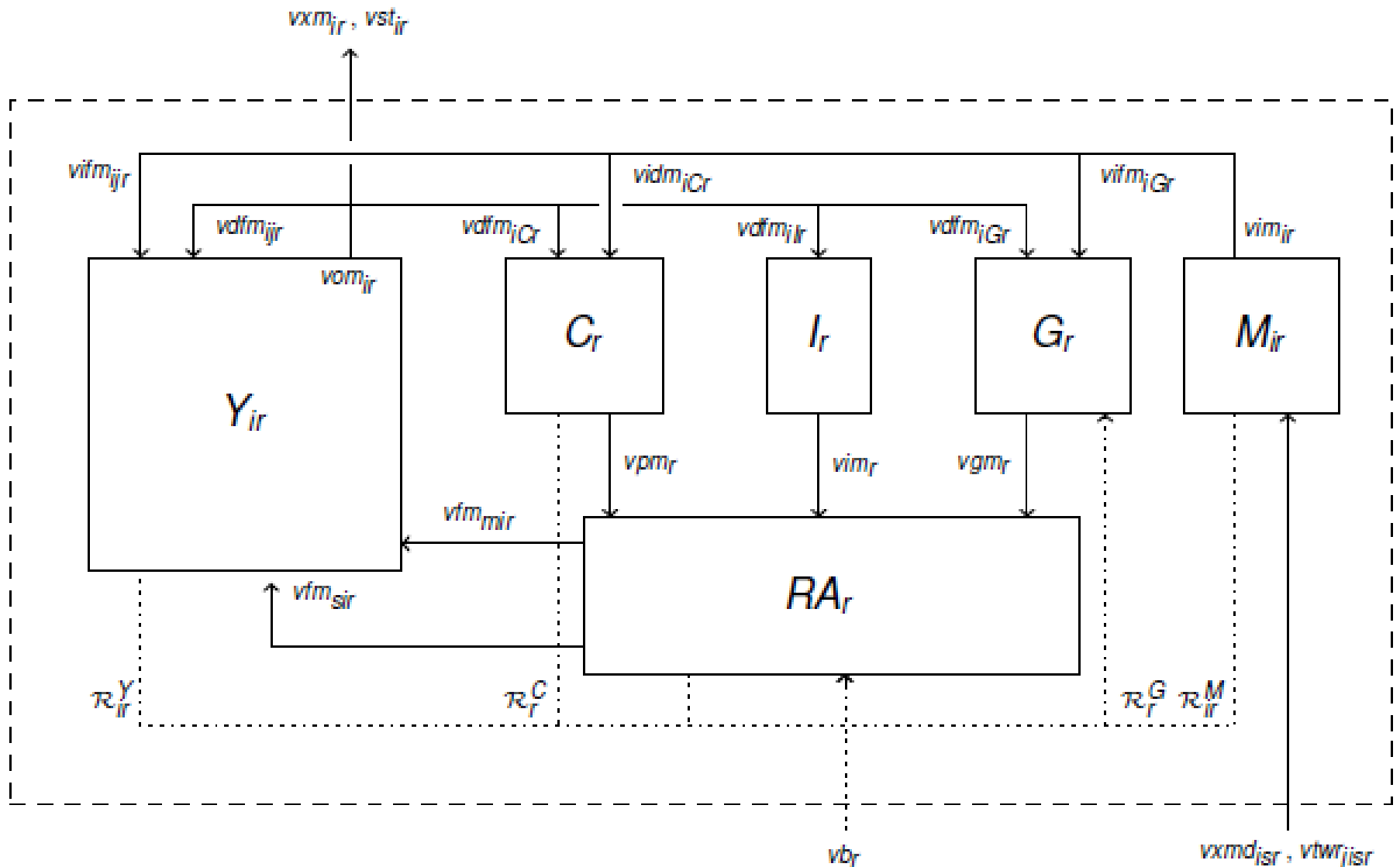
- **Embodied carbon intensity** (carbon footprint) is a measure of the average emissions generated directly and indirectly in production.
 - Direct - combustion of fossil fuels in production
 - Indirect - combustion of fossil fuels required to produce electricity (or any other good) that is used as an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

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

2 Imports

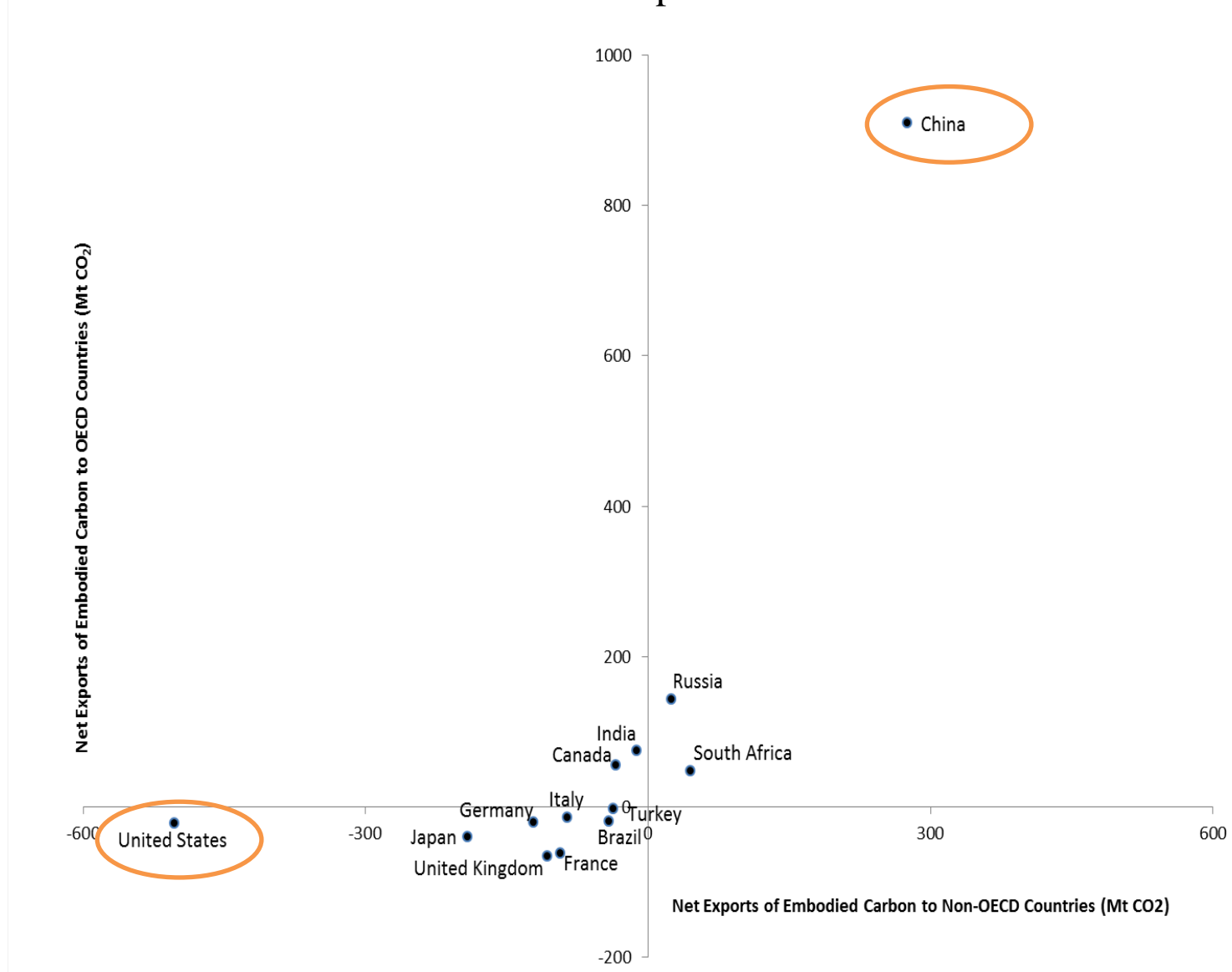
$$x_{ir}^m vim_{ir} = \sum_s x_{is}^y vxmd_{isr} + \sum_j x_j^t vtwr_{jisr}$$

3 Transport

$$x_j^t vtw_j = \sum_r x_{jr}^y vst_{jr}$$

MRIO Analysis

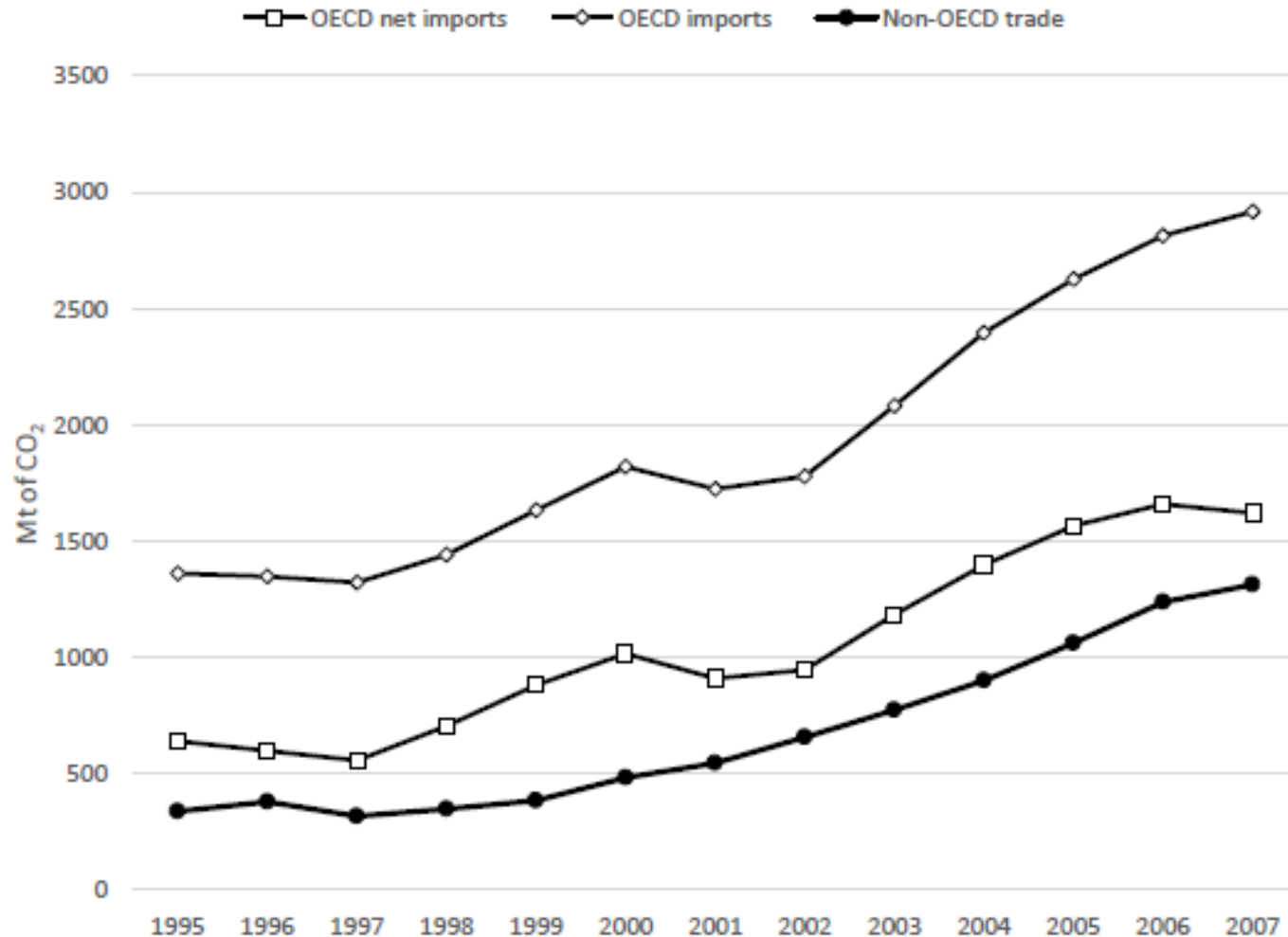
GTAP 2011: Emissions embodied in non-OECD exports to OECD = 13 % of all OECD emissions



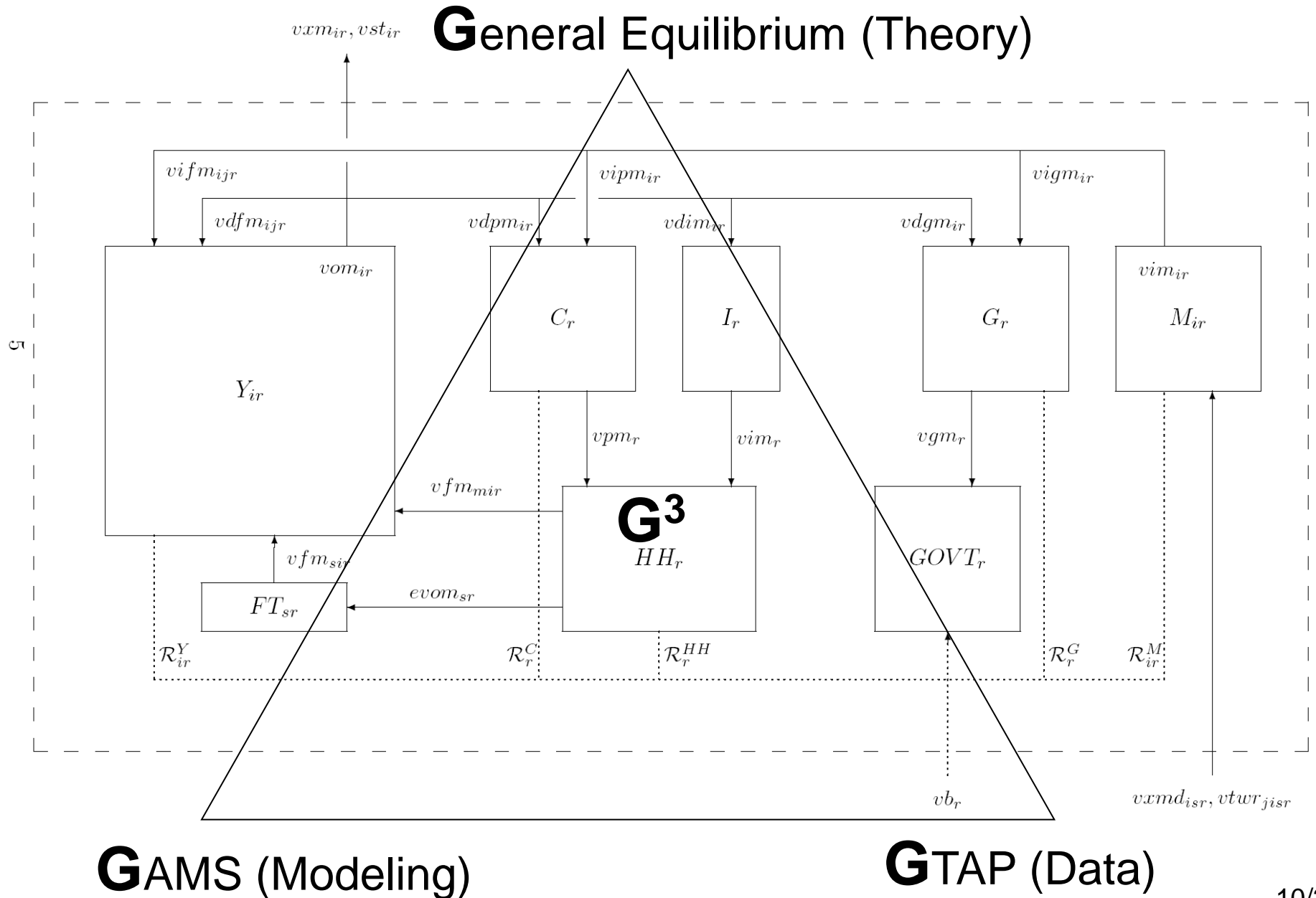
Source: Böhringer, Carbone, Rutherford (forthcoming), *Scand. J. Econ.*

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).



Reality Check: Quantitative Impact Assessment



Global Cost-Effectiveness

The scope for efficiency gains is limited.

Abatement coalition size	EU	Annex1&Russia
Leakage (%) without tariffs / with tariffs	23.9 / 18.1	11.8 / 8.1
Global cost savings with tariffs (%)	11.8	6.4

Source: Böhringer, Balistreri, Rutherford (2012), *Energy Econ.*

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

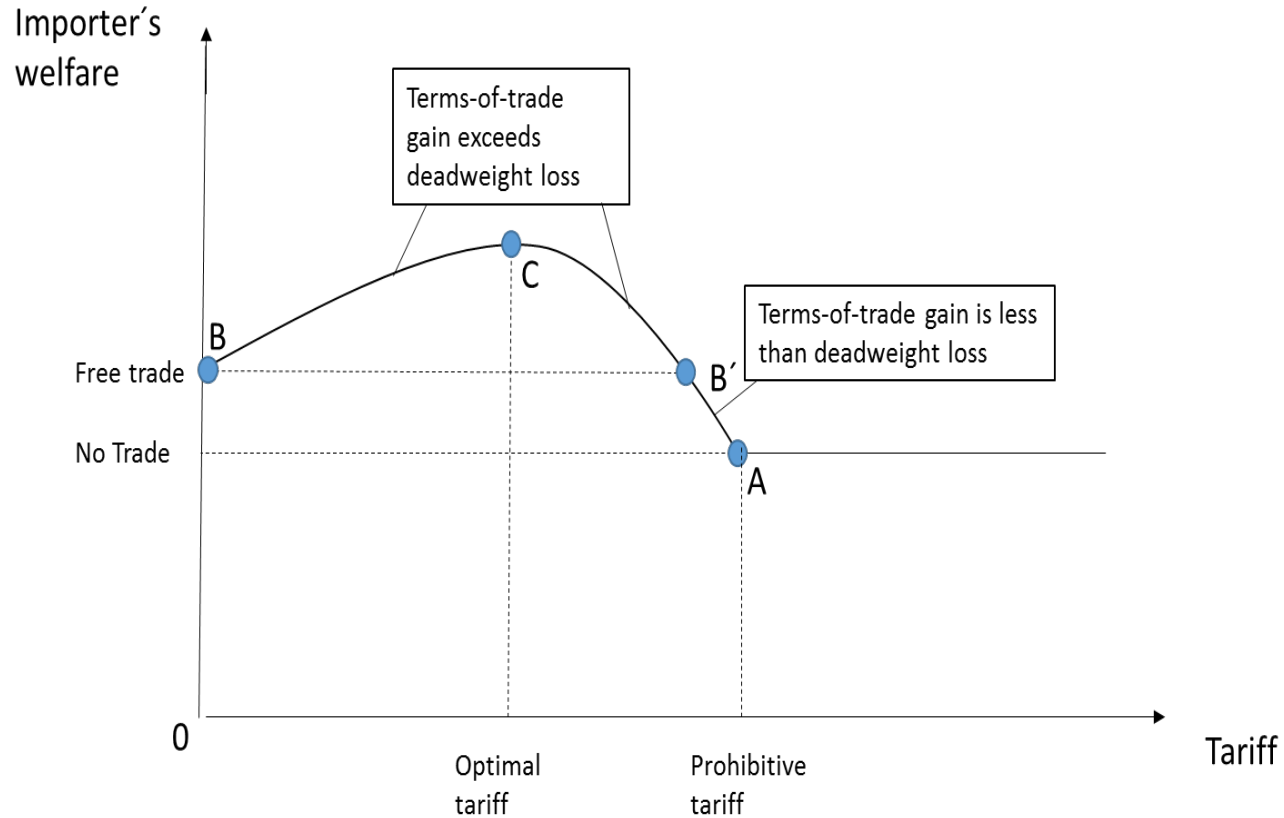
Global Cost-Effectiveness

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?

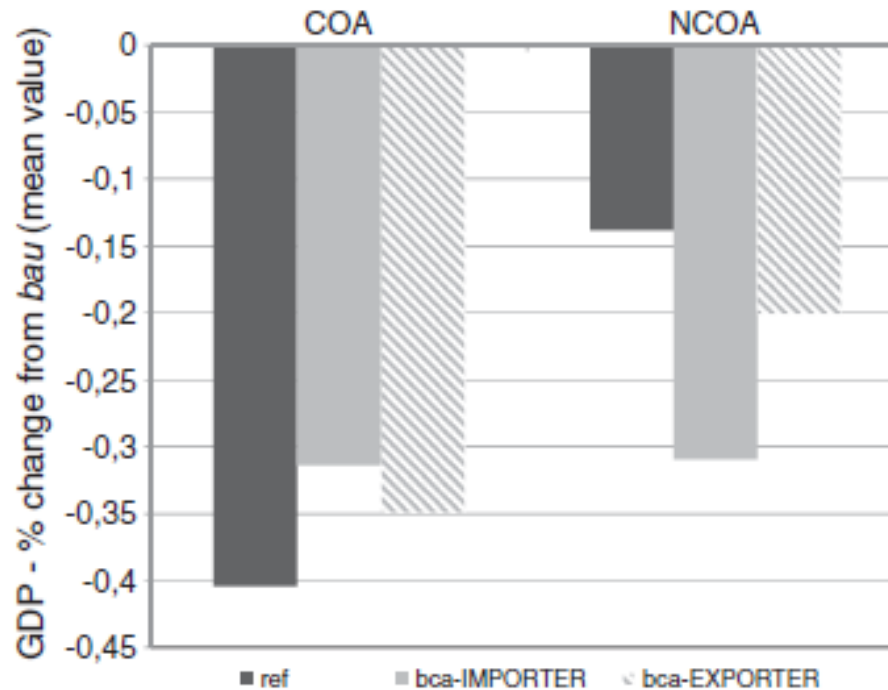


Fig. 8. Global economic impacts (in % GDP change from *bau*) for alternative uses of tariff revenues. IMPORTER: abating countries (COA) get tariff revenues; EXPORTER: non-abating countries (NCOA) get revenues.

Source: Böhringer, Balistreri, Rutherford (2012), *Energy Econ*.

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

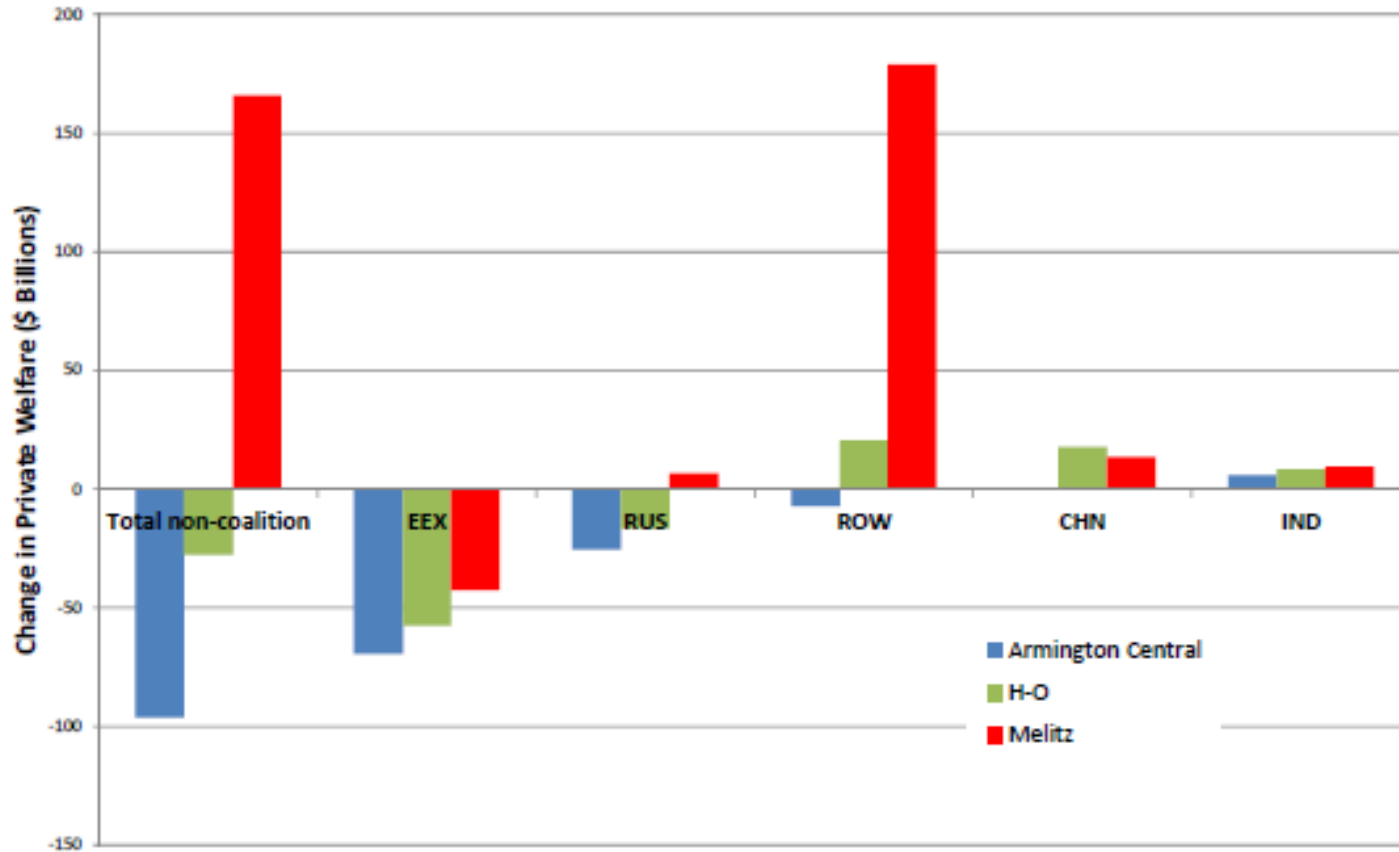
Cost Incidence Reconsidered

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)

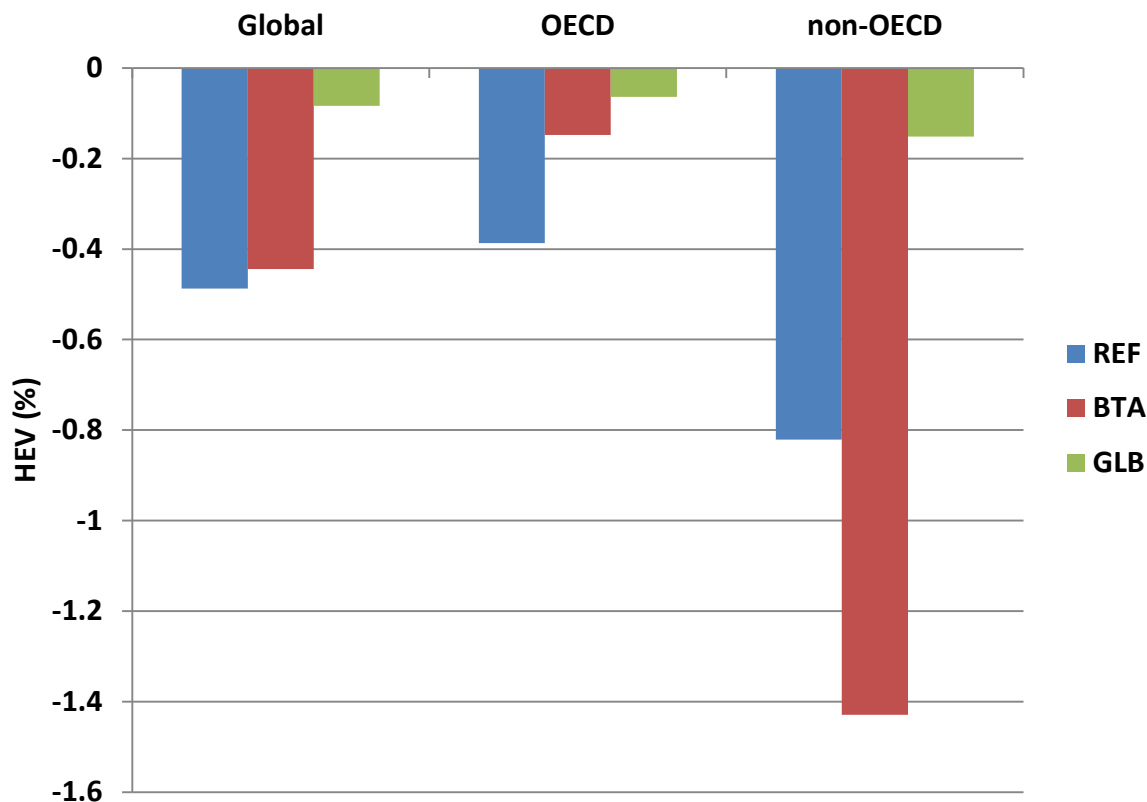


Source: Böhringer, Balistreri, Rutherford (2015), *UoO DP V-383-15*

- Alternative perspectives on the structure of international trade have important implications for the evaluation of climate policy.

Efficiency Can Relax Equity Concerns

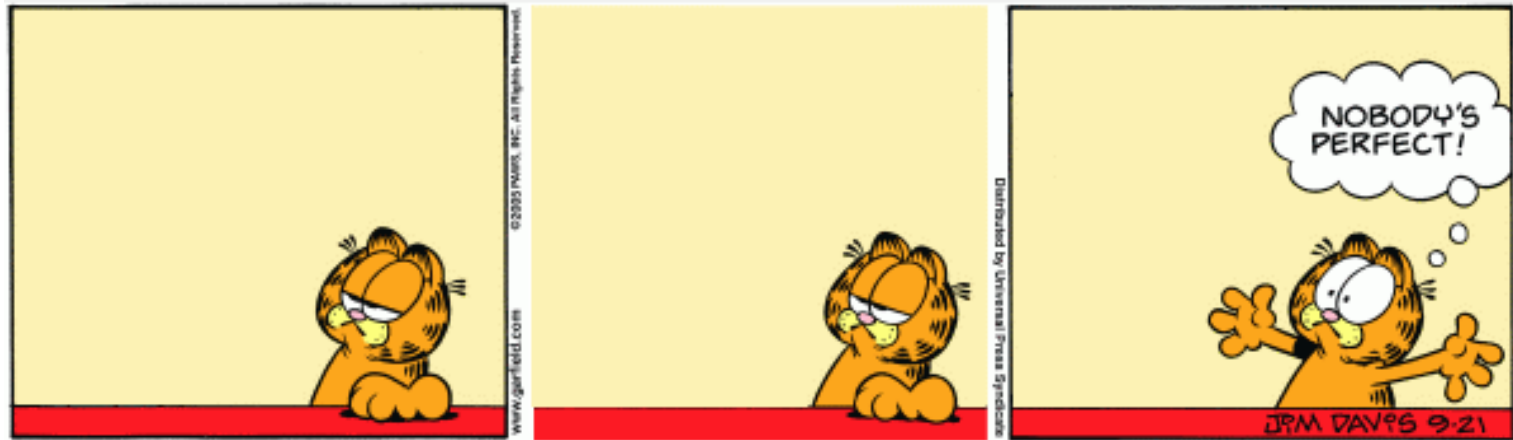
- OECD – 20% emission reduction vis-à-vis *BaU*:
 - *REF*: unilateral emission pricing
 - *BTA*: REF plus border tariffs on EITE industries
 - ***GLB*: Global emissions trading (non-OECD with *BaU* endowment)**



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!

References

- Böhringer, C., Balistreri, E.J. and T.F. Rutherford (2012). The Role of Border Carbon Adjustment in Unilateral Climate Policy: Overview of an Energy Modeling Forum Study (EMF29). *Energy Economics* 34. S97-S110.
- Böhringer, C., Lange, A. and T.F. Rutherford (2014). Optimal Emission Pricing in the Presence of International Spillovers: Decomposing Leakage and Terms-of-Trade Motives, *Journal of Public Economics* 110. 101–111.
- Böhringer, C., Bye, B., Faehn, T. and K.E. Rosendahl (2015). Targeted Carbon Tariffs. Discussion Paper 805, Statistics Norway.
- Böhringer, C., Balistreri, E.J. and T.F. Rutherford (2015)., Carbon Policy and the Structure of Global Trade. Discussion Paper V-383-15, Department of Economics, University of Oldenburg (UoO).
- Böhringer, C., Carbone, J.C., and T.F. Rutherford (2016), The Strategic Value of Carbon Tariffs. *American Economic Journal: Economic Policy* 8(1). 1–25.
- Böhringer, C., Schneider, J. and E. Asane-Otoo (2016). Trade in Carbon and the Effectiveness of Carbon Tariffs. Discussion Paper V–388–16, Department of Economics, University of Oldenburg (UoO).
- Böhringer, C., Carbone, J. and T.F. Rutherford (forthcoming). Embodied Carbon Tariffs. *Scandinavian Journal of Economics*.