



LUND
UNIVERSITY

New Carbon Footprints for More Effective Climate Policy

ASTRID KANDER

ULVÖN 17 JUNE 2015



-
- A. Kander, M. Jiborn, D. Moran, T. Wiedmann: "National greenhouse-gas accounting for effective climate policy on international trade" *Nature Climate Change*, 9 March 2015 | DOI: 10.1038/NCLIMATE2555

Problem

- How to allocate responsibility for CO₂-emissions between countries that trade with each other.
- A key issue in international climate negotiations:
 - Consumer or producer responsibility in carbon accounting and allocation of abatement burdens?

A simple principle

- National carbon accounting should reflect how activities within a country affect global emissions: Actions that contribute to reduced global emissions should be credited, and actions that increase them should be penalized.
- Essential if carbon accounting is to provide accurate guidance for global and national climate policy
- Not satisfied by the two most common accounting methods

Three conditions

1. *Sensitivity*: should be responsive to factors that nations can influence, such as
 - level and composition of consumption
 - domestic carbon efficiency.
2. *Monotonicity*: Countries should not be able to reduce their national carbon footprints by acting in ways that contribute to increased global carbon emissions.
3. *Additivity*: sum of emissions for all countries should equal global emissions.

Production based accounting (PBA)

- Each country accounts for emissions that occur (physically) within its territory
- Used for national reporting under UNFCCC
- Problem: countries may reduce their domestic emissions by shifting carbon-intensive production abroad – carbon leakage.
- => Does not satisfy the simple principle:
 - violates conditions 1 and 2 (but satisfies 3).

Consumption based accounting (CBA)

- Each country accounts for emissions that were caused by production of goods that are finally consumed within its territory.
- Also called carbon footprints
- Include emissions embodied in imported goods (M), subtract emissions embodied in exported goods (X):
- $CBA = PBA + M - X$
- Input – output analysis to track emissions through the value chain

Problems with CBA

- Does not credit countries for cleaning up their export industries
- Punishes some types of international trade that may contribute to global emissions reductions by exploiting comparative advantages with regard to carbon efficiency.
- Does not satisfy simple principle:
 - violates 1 and 2 (but satisfies 3)

Our solution

- **Technology-adjusted consumption based accounting (TCBA):**
 - incorporate emissions embodied in trade, but also adjusts for technology differences (differences in carbon efficiency) in export sectors between countries.
 - thereby more correctly reflects how national policy changes affect total global emissions.

Carbon footprints with a twist

- $CBA = PBA + M - X$
- TCBA uses a similar formula, but with a twist: rather than using the domestic carbon intensity of the producer country when export-related emissions are subtracted, TCBA uses the average carbon intensity on the world market for the relevant sector.

Carbon footprints with a twist

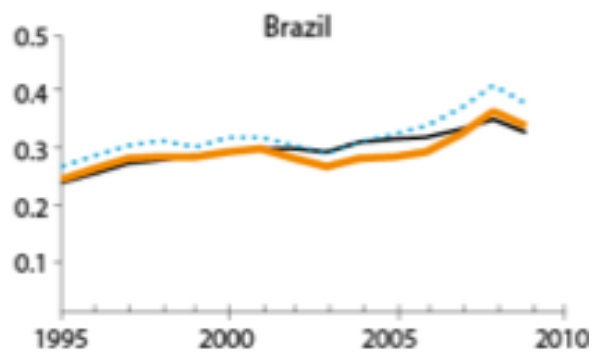
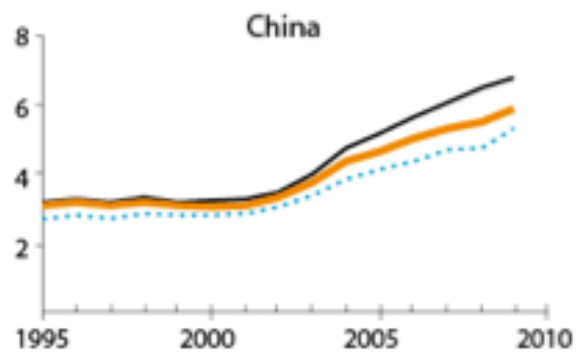
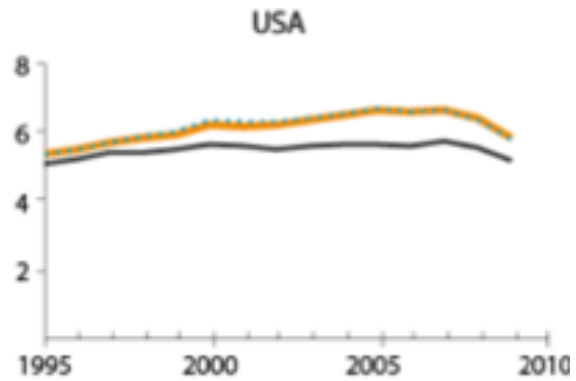
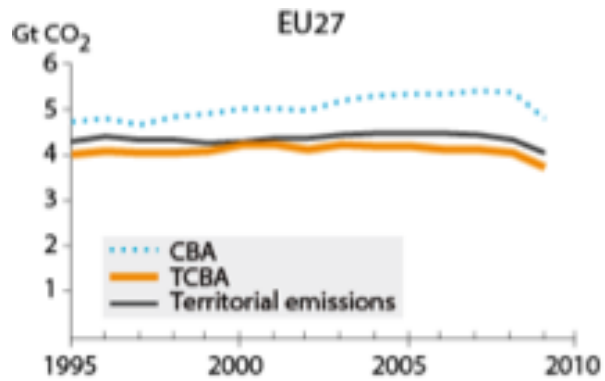
- Let D =domestic emissions factor, F =emissions factor of foreign producer country, W =average emissions factor on world market. Then:
- $CBA = PBA + M_F - X_D$
- $TCBA = PBA + M_F - X_W$

Motivation

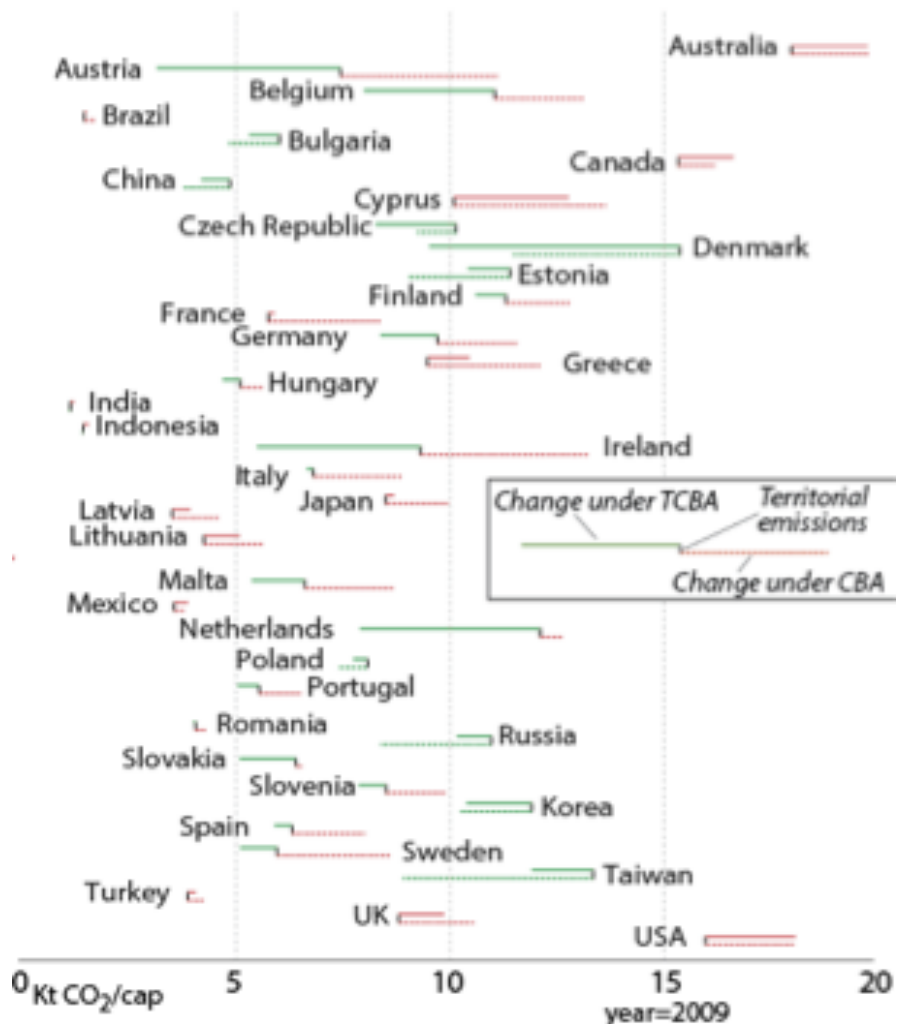
- If carbon footprints are to reflect the effects of local actions and policies on global emissions, we must consider not only how a certain exported commodity was actually produced, but also what alternative production it replaces.
- The most plausible assumption is that, in the absence of the export, some other producer would have supplied a similar commodity, with the probability for each alternative producer being equal to its share of the global market.
- Given this assumption, we show that TCBA satisfies the simple principle

Results

- We used a global multi-regional input-output table (WIOD) to compute the TCBA for 40 countries 1995-2009.
- Comparing the results to those of PBA and CBA, it is found that TCBA changes the levels and trends of many regions of the world, but not in a way that systematically benefits either developed or developing regions



Change from territorial to CBA and TCBA accounting



TCBA Footprint

