Carbon-CAP

Consumption-based Accounting and Policy

Getting carbon footprint accounts ready for the prime-time

Daniel Moran and Richard Wood

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Background

- Consumption based carbon accounting (CBCA)
  - 'carbon' = all GHGs from all sources
  - Ex post (retrospective) analysis
  - Can inform trade, structural, or purchase-oriented policy
- This session restricted to CBCA foundation, excluding forward looking/policy responses.
- CBCA comprises various approaches e.g.
    - Life-cycle assessment or coefficient based (bottom up)
    - Multi-regional Input-output (MRIO) analysis (top down)
    - Hybrids

Data challenges

Data	General issues
Input-output tables	Method of allocation – co-production in industries Level of disaggregation Monetary vs physical flows Industries producing for domestic vs export markets
Trade data	Asymmetry of trade data F.O.B. vs C.I.F. (treatment of transport margins) Tourist expenditure (residents abroad) International transport and bunkering
Emission data	Coverage – flaring, etc, combustion of biomass Treatment of international transport/bunkering

In general: Uncertainty data, or lack thereof

Adapted and Extended from Wiebe, K. (2014)

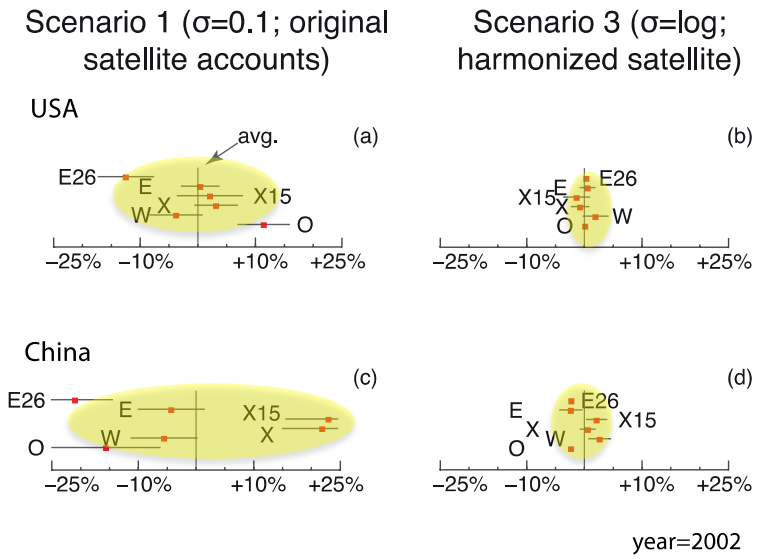
Recent studies on how & why CBCAs diverge:

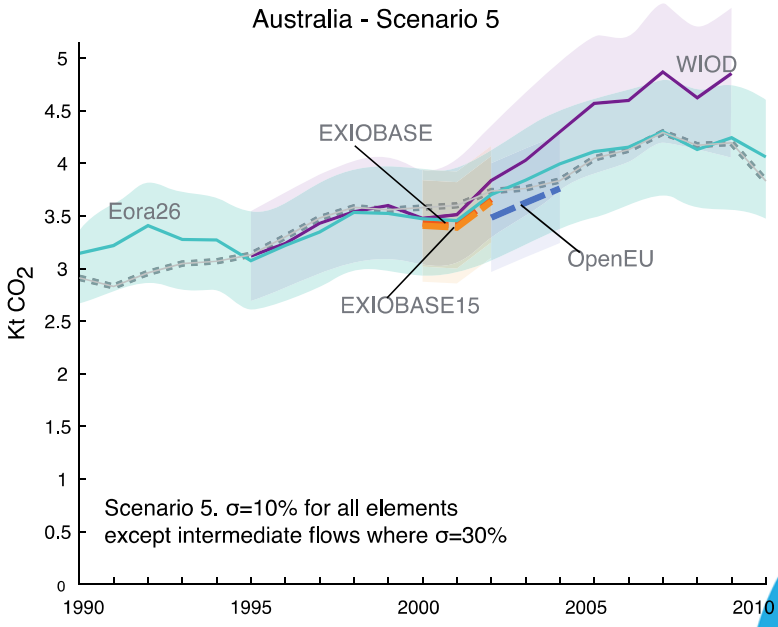
- Do results converge if we use a common co2 vector? And, using Monte Carlo analysis, do results agree to <1 StdDev?
  - Moran & Wood
- Comparing Eora v. GTAP: differences are due to economic structure & co2 vectors. Eora v. WIOD: differences are due to economic structure and final demand bundles. GTAP v. WIOD: overall, similar results.
  - Owen et al.
- For GTAP v. WIOD, just four countries, and three sectors, are responsible for 50% of the difference in results.
  - Arto et al.
- More disaggregation is always better, for environmental analysis.
  - Steen-Olsen et al.

Convergence?

Do results converge if we use a common co2 vector? And then do results agree to <1 StdDev?

- Moran & Wood 2014





Structural differences in CBCA

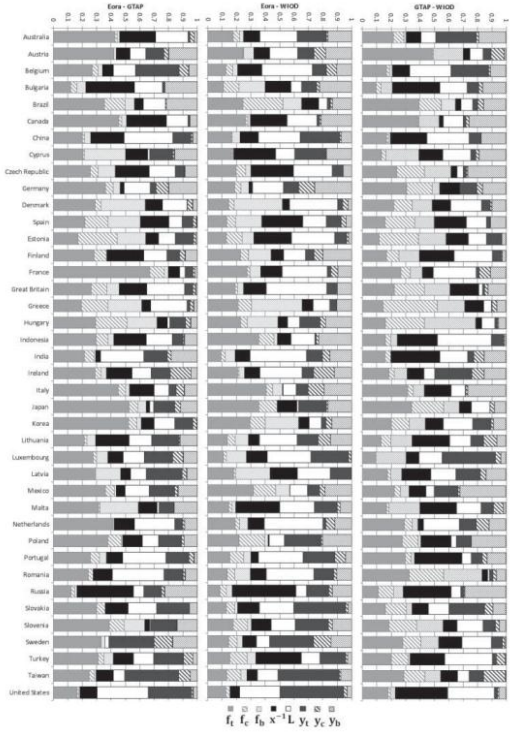
Eora v. GTAP: differences are due to economic structure & co2 vectors.

Eora v. WIOD: differences are due to economic structure and final demand bundles

GTAP v. WIOD: overall, relatively similar results

- Owen et al. 2014

FIGURE 4. Relative contributions of SDA components to the variation in consumption-based CO_2 emissions for individual countries as calculated by different pairs of MRIO database.



Key sectors:

For GTAP v. WIOD, just four countries, and three sectors, are responsible for 50% of the difference in results.

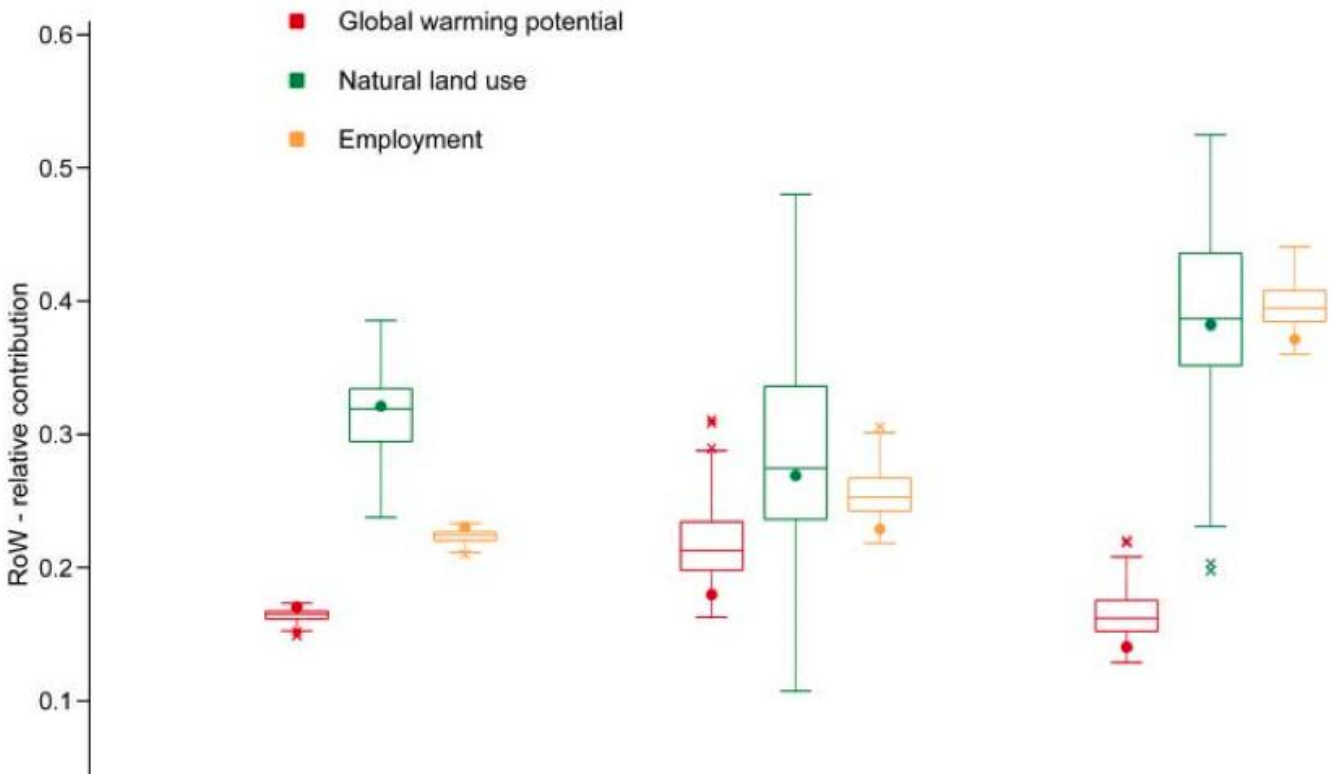
- Arto et al. 2014

- "On average, certain parts of both databases (e.g. intermediate uses and final demand) can be said to be similar for around 75% to 80%, with only a few elements in each part mainly driving the major differences."

- "The divergences in the datasets of four countries explain almost 50% of the differences in the CF (the USA, China, Russia and India)."

- "Industry-wise, 50% of the differences can be explained by the divergences in electricity, refining and inland transport industries."

Consumption Footprints vs Trade

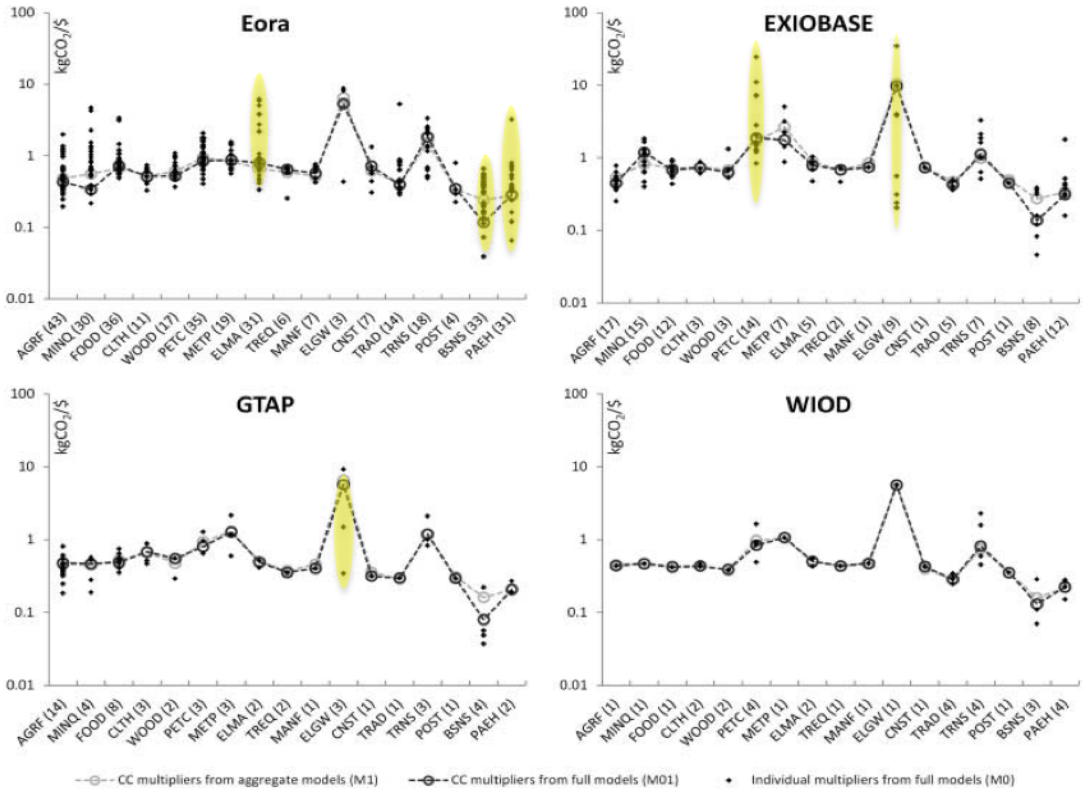


Disaggregation:

For environmental analysis, more disaggregation is always better

– Steen-Olsen et al. 2014

FIGURE 2. Aggregate versus original CO_2 multipliers (case of Australia).



Estimating Carbon footprints

- Carbon footprints are *estimated*, not based on empirical measurements
- *Accounting choices* are made in allocating measures of emission to downstream users/demand
  - constructing CBCA
- Long-term, we need a UNFCCC for CBCA
- Short-term, we need a error-budget for streamlining CBCA.

Focus Questions:

- In what applications are MRIOs ready to be used today?
- Is there consistency across CBCA results and can differences be explained?
- What future developments in MRIO models will improve robustness?
- How do MRIO model outputs integrate into existing model conventions for climate policy assessment?

Producing CBCA

- Convergence?
- Harmonisation?
- Transparency?
- Detail?
- timeliness?

Prof Erik Dietzenbacher

Scientific uses of CBCA

- Mitigation potential
- Forecasting consumption
- Physical drivers
- Robustness & Detail
- Hybridisation
- Evaluate Pilot projects

Dr Bastien Girod

CBCA for policy

- Ready for policy?
- A key performance indicator?
- Can we handle the Uncertainty?
- How far to go for consistency?
- Can we facilitate uptake?

Prof Jim Skea

Selected ICIO / MRIO databases and emission data*

Database	Emission data	Reference
EORA	EDGAR	Lenzen et al. (2012, 2013)
EXIOBASE / CREEA	Own calculations based on IPCC emission factors activity data, and adjusted IEA energy balances	Tukker et al. (2009, 2013), CREEA Deliverable 6.1
GRAM	OECD/IEA emissions from fuel combustion combined with IEA energy balances	Bruckner et al. (2012), Lutz & Wiebe (2012), Wiebe et al. (2012a,b)
GTAP	CDIAC and NAMEAs	Andrew and Peters (2013), Peters et al (2008, 2009, 2011, 2012), Peters and Solli (2010)
OECD-ICIO	OECD/IEA emissions from fuel combustion	Ahmad and Wyckoff (2003), Nakano et al. (2009)
WIOD	Own construction of NAMEA data based on EEA/EURSTAT or national NAMEAs, EDGAR, EXIOPOL (for international bunkers) and, in case no emission inventories were available, IEA energy balances combined with IPCC emission factors.	Timmer et al. (2012), Genty et al. (2012)

***From Wiebe, K (2014) - This overview is not complete. A more detailed discussion can be found in Murray and Lenzen (2013)**