ECONOMIC DEVELOPMENT, INTERNATIONAL TRADE AND IMPLICATIONS FOR ENVIRONMENTAL FOOTPRINTS

Sources of energy across income groups

- Energy is mainly derived from fossil fuels; renewable energy sources are negligible
- Energy use per capita and energy efficiency are highest in high income countries, which are netimporters of energy
- Biomass is an important energy source for low and lower-middle income countries



Scales for inventories per capita - 5.4t oileq. pc; for inventories per USD of value added - 1.02t oileq. per 1,000 USD of value added. Renew. stands for renewable energy (water, solar, hydro)

Environmental footprints across income groups

• High income countries are net-importers of resources; they have the largest consumptionfootprint for all resources but water (in agriculture)



Production in bars, consumption in dots. NR-Egy: energy sources except solar, wind, and hydro, LUSE: land-use, FRS: forest, WTR: water (agriculture), H: high income, UM: upper-middle income LM: lower-middle income, and L: low income countries. Relative to average world production

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SWITZERLAND'S SUSTAINABILITY FOOTPRINT

Implications of conversion metrics for aggregate CO_2 and CH_4 emissions footprints



Percentage change in aggregate CO₂ and CH₄ emissions of regions relative to the worldwide average change when using global warming potentials over 20 years (GWP₂₀) instead of global warming potentials over 100 years (GWP₁₀₀) to convert emissions to a common scale

The choice of alternative time horizons to calculate CO_2 equivalents (CO_2 eq) changes emission footprints. International climate agreements regulate aggregate greenhouse gas (GHG) emissions reported as CO_2eq . Regulation should address different GHGs separately.



Embodied emissions in bilateral trade flows

- embodied CH_{4}
- also a large net-exporter of embodied CO_2

- flows of embodied CH₄ emissions

Colors correspond to exporter. Imports with indentation. Mt of CO2eq (GWP100). AUS: Australia, EEU: Eastern European Union, CAN: Canada, KOR: Korea, JPN: Japan, BRA: Brazil, RUS: Russia, CHN: China, MEX: Mexico, ME: Middle East, FSU: Former Soviet Union, IND: India, IDN: Indonesia, SSA: Sub-Saharan Africa, RSA: Rest of South Asia

• High income regions are typically net-importers of embodied CO_2 and CH_4 while lower income regions are net-exporters Large producers of fossil fuels show high exports of embodied CO₂. large producers of livestock export big amounts of

• Imported embodied CO_2 emissions, across regions, mainly originate from China, which is the world's largest exporter and

• Imported embodied CH_4 emissions, across regions, mainly originate from China, the Middle East, and Sub-Saharan Africa, all of which are net-exporters of embodied CH_4 ; Russia exports a large amount of embodied CH₄ to the EU15

• Together, the EU15, the USA and China account for about half of the total CO_2 emissions embodied in trade flows; trade patterns of embodied CH₄ are more fragmented across regions and developing countries account for a larger share

• CO₂ emissions embodied in bilateral trade flows are closely related to bilateral trade volumes, whereas trade patterns in agricultural products receive more weight for bilateral trade

Environmental policy instruments

Types of policy instruments

Efficiency considerations

- uncertain

Instruments in international settings

Ratio of consumed to produced CO₂ and CH₄









• Instruments include price-type (e.g. taxes, charges, fees, tariffs, subsidies, deposit refunds), quantity-type (e.g. quotas, bans, technology- and performance standards) and soft instruments (e.g. information disclosure, labeling, nudging).

• They can be combined to increase efficiency

• Price instruments lead to efficient allocations under heterogeneous abatement costs. The specific price instrument (e.g. taxation vs. emission) trading systems) is secondary for efficiency, but may have distributional consequences

• Quantity instruments may be preferred if damage costs are high and the price-elasticity of pollution is low. Damage and abatement costs are often

 Border tax adjustments (BTA) deserve specific analysis in the context of international law

 Consumption-based instruments should be explored as alternative additional instrument

Data for 1997-2014

Consumption divided by production of CO_2 and CH_4 emissions. CO_2eq (GWP₁₀₀)

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