Eurostat's activities related to carbon footprints

Official statistics' role and challenges
in producing and disseminating
consumption-based GHG emissions accounts and
derived carbon footprints indicators

Stephan Moll, Eurostat E.2

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Content

- Role of official statistics & challenges
  - concepts and methods
  - data production and requirements
  - data availability and quality
  - dissemination and data structures
  - communicating and narratives
- Eurostat's activities – overview and experiences
- Outlook

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Concepts & methods (1/4)

- Foundations:

  - system of national accounts (SNA)

  - system of environmental-economic accounting (SEEA)
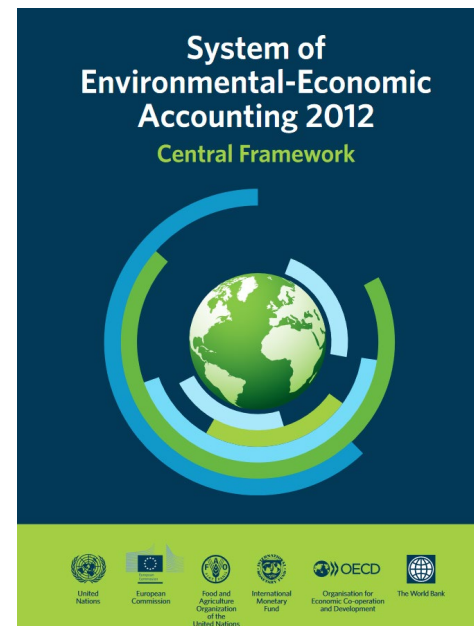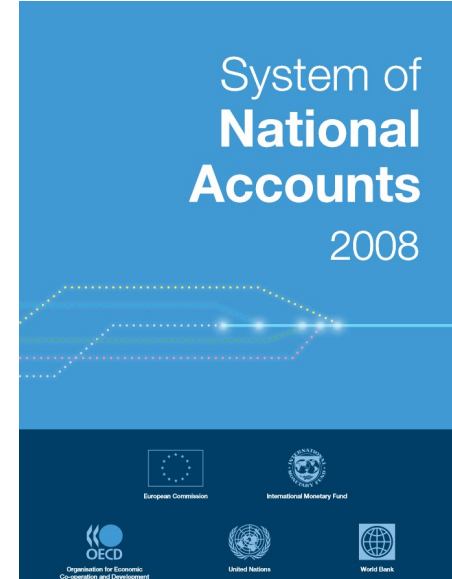
Concepts & methods (2/4)

- Definitions

  - Consumption-based environmental accounts estimate <u>environmental characteristics</u>

  - – occurring in both, the economy of the reporting geographical entity and abroad –

  - that are associated with the production of goods and services <u>delivered to final demand*</u> of the economy of the reporting geographical entity.

  ! additional environmental characteristics are associated with private households' activities

- Final demand of goods and services is a macro-economic metric defined in national accounts and includes final consumption expenditures by households, governments, and NPISH (P3), gross capital formation (P5), and exports (P6).2 types of modelling

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Concepts & methods (4/4)

- Types of modelling (level of macro-economic statistics)

  - coefficient-approach
    e.g. coefficients multiplied with trade vectors

  - single region input-output model extended by GHG emissions (SRIO)
    'domestic technology assumption'

  - multi-regions input output model extended by GHG emissions (MRIO)

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Data production & requirements (input-output modelling)

- Data requirements (pre-requisites)

  - Input-output tables / supply and use tables (IOT, SUT)

  - International trade in goods statistics (ITGS)

  - Greenhouse gas emissions accounts (GHG EA)

  - => sufficient granularity needed (e.g. ESA: 64 production activities and products)

- Data manipulations

  - Converting into 'basic prices'

  - Trade linking: eliminating trade asymmetries

  - ! GHG emissions accounts need to discriminate private households' direct emissions

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Data availability and quality (1/3) – statistics for modelling

- Input-output tables / supply and use tables (IOT, SUT)

  - Eurostat/ESS* – EU Member States + EFTA* + CC*

  - OECD – non-European OECD members

  - National statistical offices

- International trade in goods statistics (ITGS)

  - Eurostat/ESS* 'Comext' – EU Member States + EFTA* + CC*

  - UN Trade Statistics 'Comtrade' – worldwide

* ESS = European Statistical System

* EFTA = Norway, Island, Liechtenstein, Switzerland

* CC = Candidate countries: Turkey, Serbia, North Macedonia, Albania, Montenegro, Bosnia Herzegovina, Kosovo

Data availability and quality (2/3) – statistics for modelling

- Greenhouse gas emissions accounts (GHG EA)

  - Eurostat/ESS* – EU Member States + EFTA* + CC*

  - OECD – some OECD members

  - a few national statistical offices

  approx. 40-45

  - Estimates e.g. based on IEA* 'CO$_2$ from fuel combustion' (low quality)

* ESS = European Statistical System

* EFTA = Norway, Island, Liechtenstein, Switzerland

* CC = Candidate countries: Turkey, Serbia, North Macedonia, Albania, Montenegro, Bosnia Herzegovina, Kosovo

* IEA = International Energy Agency

Data availability and quality (3/3) – MRIO databases

- Inter-Country Input-Output (ICIO) tables – OECD

  - https://www.oecd.org/sti/ind/inter-country-input-output-tables.htm

- FIGARO – European Commissions (Eurostat & JRC)

  - https://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/figaro

- Global MRIO lab or GLEnvIOM (Eora, EXIOBASE, WIOD) – network of research institutes

  - https://ielab.info/analyse/ielab-global ; https://ielab.info/resources/135

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Dissemination and data structures – MRIO

- carbon footprint estimates resulting from MRIO modelling (=consumption-based accounts)

- … are multi-dimensional data cubes, and difficult to understand

- different data structures are used by various providers

- globally standardized data structure (SDMX) is available but hardly applied (not tested)

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Communicating and narratives – carbon footprints

- carbon footprint estimates resulting from MRIO modelling

- … are difficult to communicate

- Common narrative (macro-level):

- production-based CO_2-emissions versus consumption-based CO_2-emissions

- => balancing CO_2-emissions 'embodied' in imports and exports

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Eurostat's 'footprint' related work - overview

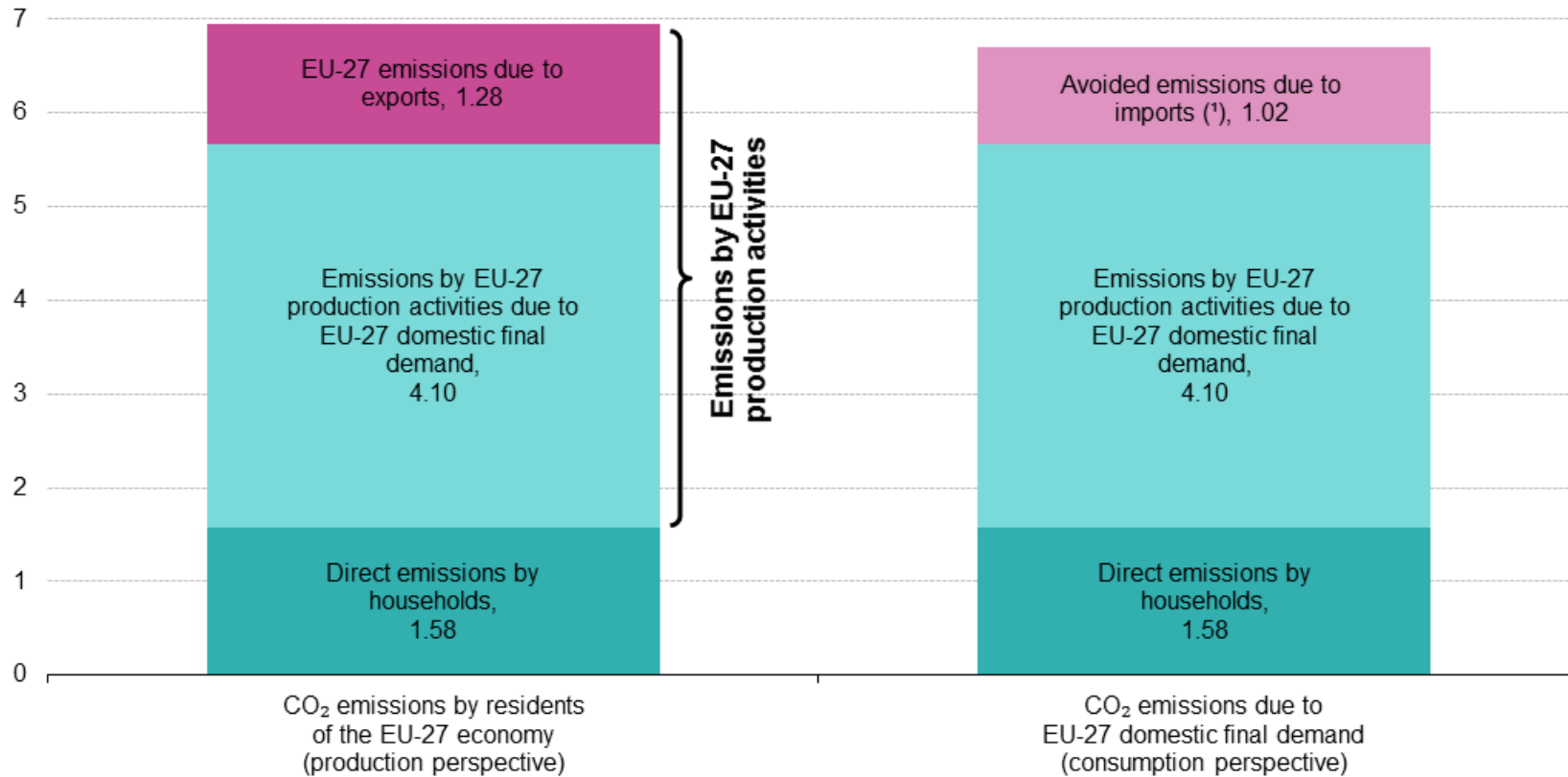|	Air	Material	Energy	Land
Variables	emissions of greenhouse gases, air pollutants	material extraction	domestic energy use	crop land, grassland, forest land
Geo resolution	EU	EU; 9 countries	EU	(EU)
Published	yes	yes	yes	not yet
Modelling approach	Single Region Input-Output (64 x 64); 'domestic technology assumption'	Single Region Hybrid Input-Output (182 x 182) amended by information on technology in rest of the world	Single Region Input-Output (64 x 64); 'domestic technology assumption'	technical coefficients, applied to apparent consumption of commodities from agricultural and forestry statistics

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Eurostat's estimate of EU's carbon footprint

- single region input-output model extended by GHG emissions (SRIO)

- fed with European ('official') statistics & reproducible (tool available)

- transparent as regards private households' direct emissions

- Domestic technology assumption:

  - export of embodied CO_2 should be okay (misses some imported embodied CO_2)

  - imports of embodied CO_2 represent 'avoided' emissions – not 'actual'

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Eurostat's estimate of EU's carbon footprint

CO_2 emissions — production and consumption perspective, EU-27, 2019
(tonnes per person)

EU-27 emissions due to exports, 1.28

Emissions by EU-27 production activities due to EU-27 domestic final demand, 4.10

Emissions by EU-27 production activities

Direct emissions by households, 1.58

CO_2 emissions by residents of the EU-27 economy (production perspective)

Avoided emissions due to imports (¹), 1.02

Emissions by EU-27 production activities due to EU-27 domestic final demand, 4.10

Direct emissions by households, 1.58

CO_2 emissions due to EU-27 domestic final demand (consumption perspective)

Notes: Estimates.
(¹) 'Avoided emissions due to imports' are based on the amount of carbon dioxide that would have been emitted in case the products imported would have been produced in the E-27 using EU-27 production technologies.
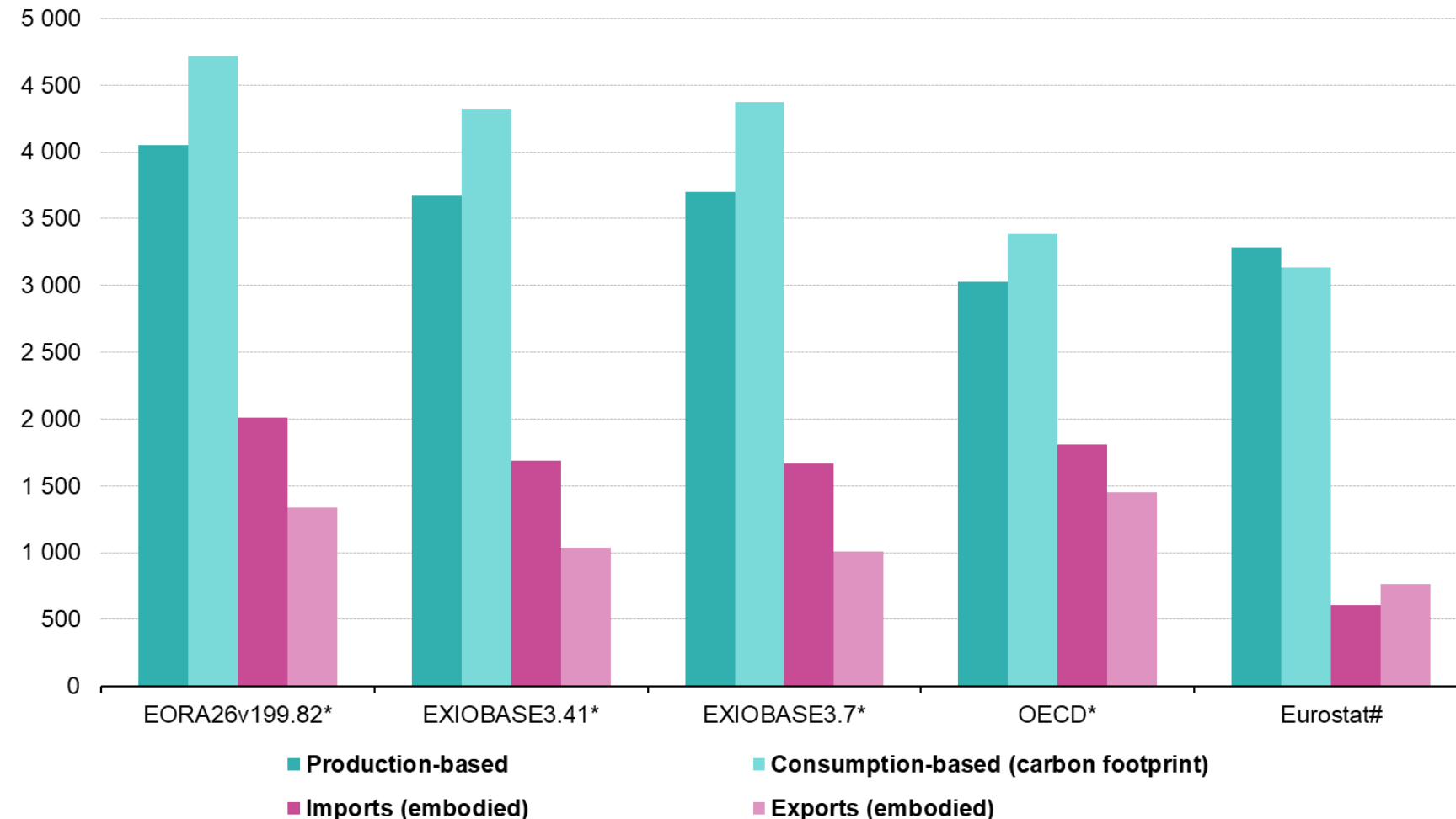*Source*: Eurostat (online data code: env_ac_io10)

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Eurostat's estimate of EU's carbon footprint

- Questions:

  - what are the 'actual' CO_2-emissions related to EU's imports?

  - existing MRIO models suggest rather high 'actual' (see next slide)

  - compare 'avoided' versus 'actual' CO_2-emissions related to EU's imports

  - how big is this gap?

  - what are the resulting narratives?

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Comparing estimates of EU's carbon footprint

CO$_2$ emissions EU27, 2015 (million tonnes)

Legend:
- Production-based
- Consumption-based (carbon footprint)
- Imports (embodied)
- Exports (embodied)

Categories: EORA26v199.82*, EXIOBASE3.41*, EXIOBASE3.7*, OECD*, Eurostat#

Sources: Environmental Footprints, OECD, Eurostat
Note: * Multi-regional IO model , # Single region IO model (domestic technology assumption)

Eurostat's estimate of EU's carbon footprint

- Next steps:

  - Estimate the 'actual' CO_2-emissions embodied in EU's imports and exports

  - using FIGARO model

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Summary

- Concepts to estimate consumption-based greenhouse gas emissions accounts by official statistics are available

  - first best method: MRIO   second best: SRIO

- High quality global data sets needed => not available

- Results and narratives might be less clear and simple than expected

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Conclusions

- National statistical institutes: to produce required statistics for models (SNA's input-output tables, SEEA's GHG emissions accounts)

- International statistical system: to establish institutional structures to integrate and compile global MRIO data sets (trade balanced)

- High potential for informing international climate policies

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Thank you

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