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Deliverable D4.1

EU ETS Impact Indicators and Technical Note

Deliverable Number	D4.1
Lead Beneficiary	EUI
Deliverable Name	EU ETS Impact Indicators and Technical Note
Type	DATA — data sets, microdata, etc.
Dissemination Level	PU - Public
Due Date (month)	12
Work Package No	WP4

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Issue Record

Planned delivery date	31.12.2023
Actual date of delivery	12.04.2024
Status and version	Final, version 1

Version	Date	Author(s)	Notes
1	12.04.2024	Marie Raude, Matteo Mazzarano, Simone Borghesi	

EU ETS environmental and economic indicators

The full dataset can be accessed via the EUI research repository Cadmus: Raude, M., Mazzarano, M., Borghesi, S. (2024). EU Emissions Trading System sectoral environmental and economic indicators. EUI, RSC, Research Data: https://hdl.handle.net/1814/76817

Technical note illustrating the methodology

Context

Following a Technical workshop on Environmental and Economic Impact Indicators held on 26 September 2023,[1] five indicators were developed to provide information on the economic and environmental performance of sectors covered by the European Union's Emissions Trading Scheme (EU ETS). The main objective of these indicators is to track the evolution of regulatory environmental and economic coverage at the sector level. Doing so generates new insights into the coverage of the EU ETS, a key EU climate policy aimed at reducing Greenhouse Gas Emissions (GHG) cost-effectively. The focus of the dataset is to have an overview of trends across sectors.

The two environmental indicators reported are total emissions and emissions coverage ratio. The three economic performance indicators are coverage ratios for the number of employees, operating revenue, and tangible assets. All five indicators are reported yearly at the sector level. The definitions and data sources are provided below.

Data sources

The raw data used to estimate the indicators was collected from the following sources:

- *EUTL*: European Union Transaction Log data parsed by Jan Abrell (https://www.euets.info/)
- *EDGAR*: Emissions Database for Global Atmospheric Research (https://edgar.jrc.ec.europa.eu/dataset_ghg80)
- *JRC-EU ETS-FIRMS*: Firm-level data in the EU ETS (https://data.jrc.ec.europa.eu/dataset/bdd1b71f-1bc8-4e65-8123-bbdd8981f116)
- *Orbis*: Orbis Bureau Van Dijk database (https://www.moodys.com/web/en/us/capabilities/company-reference-data/orbis.html)

Description

1. Environmental indicators

The indicators are estimated from 2008 to 2020.[2] We do not include emissions from 2005-2007 due to the lack of reliability of the emissions reported in the EUTL. Indeed, the 2005-2007 period corresponds to the system's trial period, and inconsistencies were flagged by the research community concerning verified emissions reported by the regulated installations.

Indicators are reported for three categories of activities: Electricity and Heat, Petroleum and Coke, and Manufacturing Industries and Construction. These three broad categories are defined according

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[1] We thank Jan Abrell, Giovanni Marin and Ulrich Wagner for presenting their work. We are also grateful for their and the workshop participant's input in orienting our work. More information on the workshop can be found here.

[2] Emissions of installations are available until 2023 on EUTL but total EU-level emissions are only available until 2020 on EDGAR.

to the activity codes reported in EDGAR, which rely on the IPCC sector definition.[3] Together, the three sectors account for more than 94% of the emissions in the EU ETS.[4]

The sectoral activity of installations in the EU ETS can be deducted using the leakage assessment of the European Commission. This assessment is carried out to identify industrial installations at significant risk of carbon leakage and to identify how to support their competitiveness.[5] The NACE codes for each installation are directly reported in the *nace_id* variable in the installation table of the European Union Transaction Log (EUTL) data.[6] Based on the reported NACE code, installations belonging to one of the focus sectors were flagged according to the correspondence table below (ref. Table 1).

Sector name	EDGAR code[7]	NACE code[8]
Electricity and Heat	1.A.1.a	35
Petroleum and Coke	1.A.1.b; 1.A.1.c	19
Manufacturing Industries and Construction	1.A.2; 2.A.1; 2.A.2; 2.A.3; 2.A.4; 2.B; 2.C	7 ; 8 ; 10 ; 11 ; 12 ; 13 ; 14 ; 15 ; 16 ; 17 ; 18 ; 20 ; 21 ; 22 ; 23 ; 24 ; 25 ; 26 ; 27 ; 28 ; 30 ; 31 ; 32 ; 41 ; 42 ; 43

Table 1: Correspondence table[9]

To estimate the sectoral emissions coverage ratio, the information on total emissions (including emissions of installations not in the scope of the EU ETS) needs to be retrieved. We rely on the Emissions Database for Global Atmospheric Research (EDGAR).[10] EDGAR provides emission estimates at the country and sector level using a methodology consistent with the Intergovernmental Panel on Climate Change (IPCC), which ensures a homogeneous methodology for estimating emissions across countries. It is thus preferred over the emissions data found on Eurostat, which aggregates national reports relying on country-specific definitions.[11]

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[3] The IPCC activity classification can be found here.
[4] Based on own estimation using emissions reported in the EUTL data.
[5] More about carbon leakage can be found on the European Commission's website. Access here.
[6] We rely on the data parsed by Jan Abrell. It includes the NACE codes of each installation using the carbon leakage lists of 2015 and 2020. Access here.
[7] EDGAR reports emissions using the IPCC 1996 and 2006 codes for the specification of the sectors. Access documentation here.
[8] Statistical classification of economic activities in the European Community. Access documentation here.
[9] This correspondence table was inspired from the works of Dechezleprêtre et al (2023).
[10] EDGAR is a global database of anthropogenic emissions of GHG and air pollution on Earth. Access here.
[11] Eurostat collects air emission accounts yearly according to sector. Concepts and principles are defined at the national level. Access documentation here.

Name	Definition	Database source	Notes
EUETS_ emissions	Sector-level emissions of the EU ETS regulated sectors (tCO2e). The sum of total verified emissions grouped by sector.	EUTL.	Emissions reported by installations are reported in *Verified emissions*, a variable in the compliance table.
Emissions_ coverage_ ratio	Share of total emissions regulated by the EU ETS per sector (%). The ratio of sectoral EU ETS emissions (as estimated above) over the total reported sectoral emissions.	EDGAR.	Emissions from Carbon Dioxide (CO2), Nitrous Oxide (N2O) and Perfluorocarbons (PFCs) are aggregated to match the EU ETS GHG coverage scope. Specific data file names are: - IEA_EDGAR_CO2_1970_2022.zip. - EDGAR_N2O_1970_2022.zip. - EDGAR_F-gases_1990_2022.zip. EUETS_emissions values are converted from tCO2e to GgCO2e to match the unit used in EDGAR.

Table 2: List of environmental indicators, data sources and notes

1. *Economic indicators*

The indicators are estimated from 2013 to 2022, starting at the beginning of Phase 3 of the EU ETS and spanning until the most recently available data.

The analysis of economic data of companies in the EU ETS is limited by the fact that firms are not directly apparent in the EUTL data structure. The connection between regulated firms and the EU ETS accounts operating installations cannot be inferred directly (Letout, 2022). To identify the pool of compliance firms in the EU ETS, we thus rely on the EUTL-to-firm mapping provided by the JRC. The mapping is useful for finding firms regulated by the EU ETS on the Orbis database. The Orbis database contains information on firms, including ownership structure and economic and financial performance.

Indicators are reported for six categories of activity: Electricity and Heat, Petroleum and Coke, Chemicals, Basic Metals, Paper and Pulp, and Non-metallic Minerals sector (ref. Table 3). These categories correspond to the firms' NACE codes, as reported on Orbis. Note that as compared to the environmental indicators, we are able to provide more granular information on economic coverage for firms in the manufacturing and construction sector, by providing information of coverage in specific manufacturing industries.

Sector name	NACE code[12]
Electricity and Heat	35
Petroleum and Coke	19
Basic Metals	24
Chemicals	20
Pulp and Paper	17
Non-metallic Minerals	23

Table 3: Sector definition

The data manipulation steps are common for the three indicators estimated. It involves the following 5 steps (in parenthesis the name of the database used to carry out the specific step):

1. Identify the list of active EU ETS installations (EUTL).

Create a yearly pool of active EU ETS firms. An installation is considered active for a given year when it reports positive verified emission levels for that year.

2. Consolidate this list to get firm-level data (EUTL, JRC-EU ETS-FIRMS).

Using company registration number as a key variable to join both datasets.

3. Retrieve economic data of EU ETS firms (Orbis).

Identify the yearly pool of EU ETS active firms on Orbis. Retrieve the yearly estimates of Operating Revenue, Employees and Tangible assets. The yearly estimates are summed at the sector level.

4. Retrieve sector-level economic data (Orbis).

The denominator of the three ratios is estimated by retrieving the economic data for all firms in Orbis for sectors of interest and summing it per sector. We also consider the geographical scope of the EU ETS. To ensure scope coherence we only include firms located in countries where the EU ETS is in place.

5. Estimate the coverage ratios.

The coverage ratios are estimated using the straightforward ratio definition, such that:

$$Employees\ Coverage\ Ratio_{s,t} = \frac{Total\ Number\ of\ Employees\ in\ regulated\ firms_{s,t}}{Total\ Number\ of\ Employees\ in\ the\ sector_{s,t}}$$

where *s* and *t* are the subscripts for *sector* and *year* respectively. The same formula is used to estimate the coverage ratios for Operating Revenue and for Tangible Assets.

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[12] Statistical classification of economic activities in the European Community. Access documentation here.

Name	Definition	Database source	Notes
Employees _coverage _ratio	Share of total employees in EU ETS firms per sector (%). The ratio of total employees working in all firms regulated by the EU ETS over the total number of employees in the sector.	EUTL, JRC-EU ETS-FIRMS, Orbis.	In Orbis, *Number of employees* refers to the total number of employees included in the company's payroll.
Operating_ Revenue_ coverage _ratio	Share of EU ETS Operating Revenue per sector (%). The ratio of total operating revenue of EU ETS firms over the total operating revenue in the sector.	EUTL, JRC-EU ETS-FIRMS, Orbis.	In Orbis, total *Operating Revenue* refers to the sum of net sales, other operating revenues and stock variations.
Tangible_ assets_ coverage _ratio	Share of EU ETS tangible assets per sector (%). The ratio of total tangible assets of EU ETS firms over the total tangible assets in the sector.	EUTL, JRC-EU ETS-FIRMS, Orbis.	In Orbis, *Tangible assets* refers to all tangible assets such as trucks, machinery, office furniture and buildings.

Table 4: List of economic indicators, data sources and notes

General comments

One caveat of the indicators estimated is that the installation activity type is self-reported in the carbon leakage assessment file. There may be some misalignment between the activity reported by the installation and the activity code used at the EU level to estimate total sectoral emissions. This can happen when firms belong to a sector due to their overall activity but still have some installations in other sectors.

Another point to keep in mind is missing data. The missing data for estimating the environmental indicators is very low: 99% of the installations' emissions are assigned to a sector annually.

For economic information, the number of missing information is more important. This is particularly true for years before 2013, for which the economic data reported on Orbis is incomplete. We thus only report the indicators starting 2013. Another source of uncertainty lies in the match between the EUTL installations and the Orbis firms. For detailed information on the data coverage, refer to the Excel sheet *NAs*.

References

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