Case study on the EDGAR report on the global greenhouse gas emissions

Chris-Gabriel Islam

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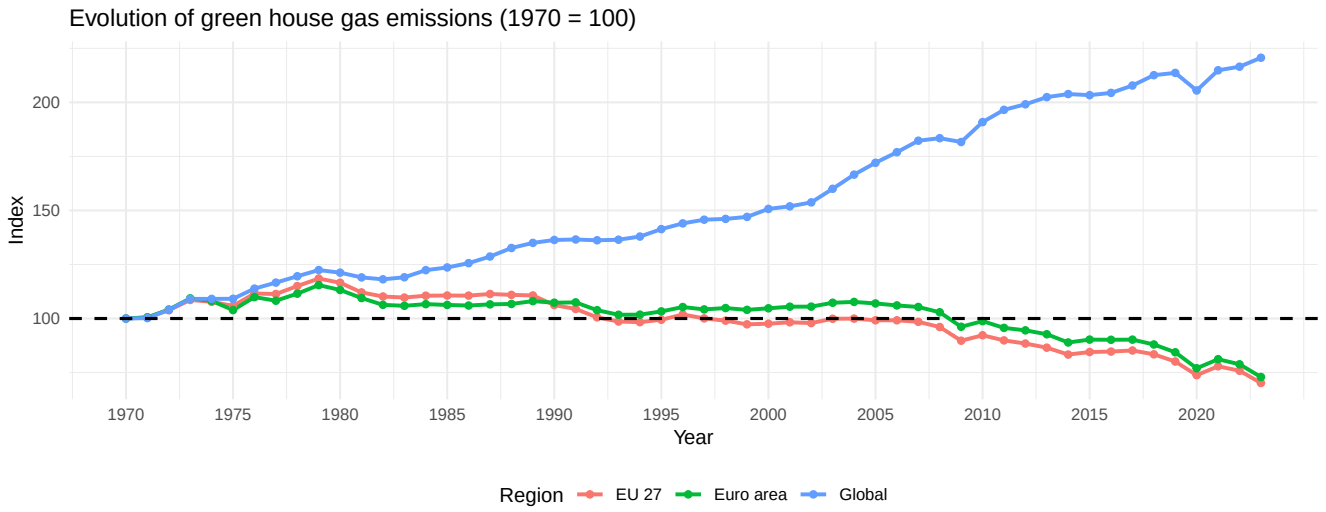
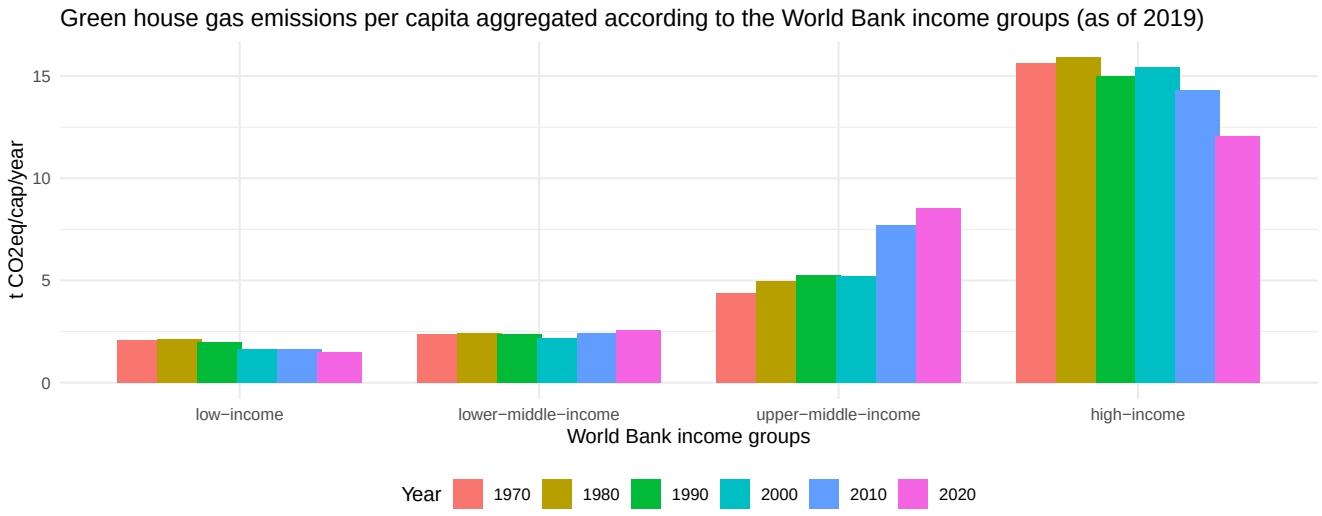
Chart 1



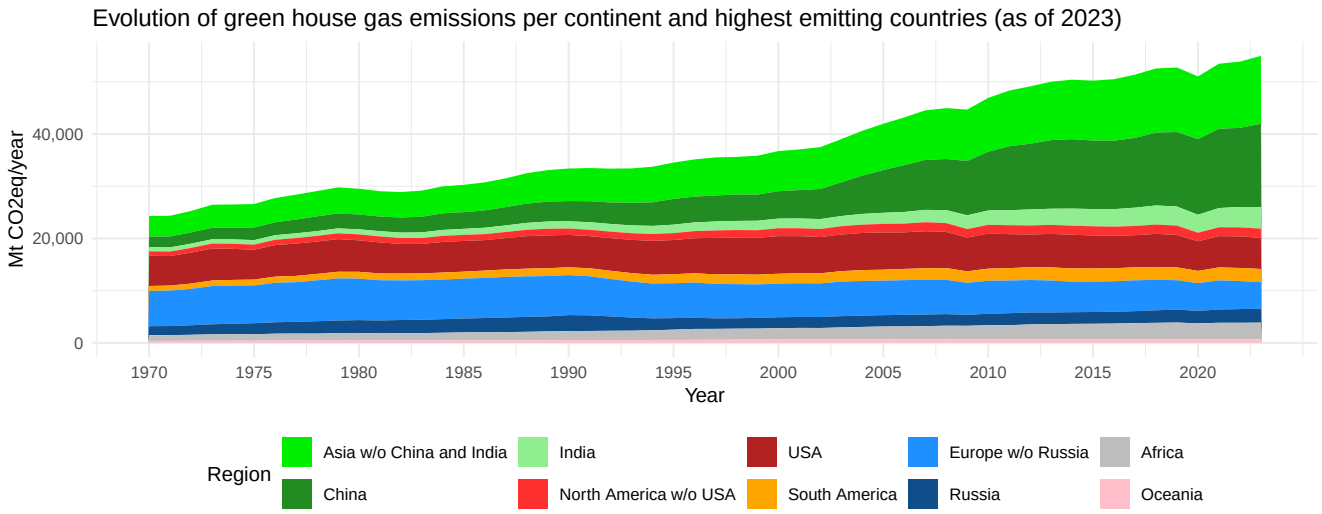
- **Global emissions growth**: The global green house gas (GHG) emissions show a steady increase from 24,003 Mt CO2eq/year in 1970 to 52,963 Mt CO2eq/year in 2023. This translates to an average increase per year of 2.28 %.
- **Stabilization and decline in European Union and euro area**: The European Union and the euro area show a relatively stable trend from 1970 to the mid-2000s, followed by a clear decline in emissions.
- **Divergence between global and European trend**: While global emissions continue to rise, European emissions have been decreasing since around 2005. In 1970, the countries that now comprise the euro area accounted for 13.89 % of global emissions; by 2023, this share had fallen to 4.59 %.

Chart 2



- **Gradual increase in upper-middle-income countries**: The upper-middle-income countries' emissions per capita show a noticeable increase over the decades from 4.36 t CO2eq/cap/year in 1970 to 8.55 t CO2eq/cap/year in 2020, narrowing the gap slightly with high-income countries.
- **Stability in low- and lower-middle-income countries**: The emissions per capita for low-income and lower-middle-income countries remain relatively low and stable from 1970 to 2020, reflecting minimal changes over time and not exceeding 2.5 t CO2eq/cap/year.
- **Highest green house gas emissions in high-income countries**: High-income countries consistently exhibit the highest greenhouse gas emissions per capita for the past decades. The gap to the other income groups persists over time, even though the emissions per capita decline.

Chart 3



- **Dominance of China in emissions growth**: China's greenhouse gas emissions have increased from 2,035 Mt CO2eq/year in 1970 to 15,944 Mt CO2eq/year in 2023, becoming a leading contributor to global emissions.
- **Steady contribution from the USA and Europe**: While the USA and Europe remain substantial contributors, their emissions have remained relatively stable or even have decreased slightly.
- **South America, Africa and Oceania**: All three continents show relatively low emissions contributions with gradual increases.

Process description

To create this PDF, I used Quarto, an open-source system for scientific and technical publishing. The ETL processes were written in R, and the formatting of the report was done in Markdown. The charts were created using the ggplot2 package. To ensure the report is fully reproducible, I set up a virtual environment with renv and used Git for version control. While the R code is hidden in the report, it's available on GitHub here (last retrieved 2025-01-27).

Details to Chart 1

Displaying nominal values in Mt CO2eq/year would have created a massive gap between the global line and the two lines representing the EU-27 and the euro area. This gap would have made it hard to identify trends for the latter two. To address this, I chose normalization, a common method for depicting trends. Note that the global trend includes not only the greenhouse gas emissions of all countries but also emissions from aviation and international shipping.

Details to Chart 2

Since the task description did not specify a particular time frame, I had to decide whether to present panel data or cross-sectional data. Panel data offers far more information than a single cross-sectional snapshot. To maintain clarity, I selected six equidistant years.

It is important to note that aggregation required special care. Simply averaging emissions per capita for countries within an income group would result in a biased outcome, as populations vary over time and across countries. To address this, I recalculated the population for each country and year by dividing emissions per capita by total emissions, then taking the inverse of that result. Additionally, the classification of income groups by the World Bank is not constant over time. Some countries, such as China, have moved from the one income group to another. To standardize the analysis, I fixed the classification to the year 2019, as this the latest year with complete data for all countries. After 2019, Venezuela's classification is missing from the dataset.

Details to Chart 3

Once again, the task description did not specify any particular time frame, so I aimed to include as much information as possible in the chart. To keep the visualization clear and organized, I focused on the four highest-emitting countries, displaying them as individual entities. For color coding, I used the same base color for each continent, with varying shades to differentiate the respective countries.