Decoupling in the EU

- **Absolute decoupling**: Environmental indicators fall while economic indicators rise in absolute terms. **Relative decoupling**: Environmental indicators fall at a faster rate than economic indicators. In 2014, absolute decoupling was achieved, where global carbon dioxide (CO₂) emissions remained constant while global GDP increased.

- The EU is the third biggest emitting region following China and the United States. In the EU energy use and production-based CO₂ emissions in the EU have remained relatively stable since 2006 even showing some decline (Figure 1) (OECD 2002).

- Decoupling analysis is usually restricted to Energy use and CO₂, which does not fully highlight the relationship between GDP growth and environmental damages. Different pollutants could follow substantially different patterns.

- We analyze trends across 6 aggregated sectors (Electricity, Manufacturing, Transport, Agriculture, Services, Other) and 6 environmental indicators including 4 pollutants: Energy Use and CO₂ emissions, Sulphur Oxides (SO₂), Nitrogen Oxides (NOₓ), Ammonia (NH₃), and Particulate Matter (PM₁₀).

- OECD defines decoupling as

\[ \Delta t = \frac{E_t}{Y_t} - \frac{E_{t-1}}{Y_{t-1}} \]

Or the change in one unit of environmental indicator relative to economic indicator Y. In the absence of any decoupling, \( \Delta t = 0 \). A value of \( \Delta t = 1 \) implies perfect decoupling. Negative values, \( \Delta t < 0 \), imply coupling.

The Data

- World Input-Output (WIOD) database from 1995-2008 (Timmer et al. 2015)
  - Detailed sectoral Input-Output accounts
  - Satellite accounts: Air use, emissions
  - Eurostat database for real output indicators and other missing values

- Both datasets are homogenized from NACE rev 1.1 to NACE rev 2 and converted to 6 broad sectors - Electricity, Manufacturing, Transport, Agriculture, Services, Other.

- Figure 2 shows trends across top two emitting countries (Germany and France) and top two emitting sectors (Electricity and Manufacturing) across the six environmental indicators.

- To analyze whether decoupling trends increased or declined, we investigate two sub-periods 1995–2001 and 2001–2008.

- Figure 3 shows broad decoupling indicators across the 6 environmental indicators for the six sectors across the full sample and the two sub-periods.

The Analysis

- Figure 4 shows various decoupling states based on Tapio’s definitions.

- Figure 5 highlights changes in decoupling states across countries between the two sub-periods for the two highest emission sectors.

- Figure 6 displays the full data set for all the decoupling states (shown in shades of green) across all the countries, environmental indicators, and time periods.

- To understand the differences in patterns across the two sub-periods we look at the environmental policy stringency (EPS) indicator developed by Botta and Kozluk, 2014) using the following distributive lag egression estimation:

\[ \log(E_{it}) = \beta_1 \log(Y_{it}) + \sum_{j=2}^{4} \beta_j EPS_{it-j} + \alpha_t + \gamma_i + \epsilon_{it} \]

- Results in Figure 7 show no pre-existing trends exist but there are statistically significant effects of environmental policy stringency. The effects take two to three years to fully materialize.

References:
