

Effects of Carbon Mitigation on Co-pollutants at Industrial Facilities in Europe

Klara Zwickl,^a Simon Sturn,^b and James K. Boyce^c

The combustion of fossil fuels simultaneously releases carbon dioxide (CO₂) and air pollutants such as sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulate matter (PM). More stringent climate policies therefore may generate air quality co-benefits, increasing the overall benefits from carbon mitigation. So far, however, little is known about the relationship between CO₂ and co-pollutant emissions at the point-source level.

Using European data on large industrial point sources from the European Pollutant Release and Transfer Register (E-PRTR), we estimate how changes in carbon dioxide emissions affect emissions of the three co-pollutants SO_x, NO_x, and PM₁₀. Our sample includes between 630 and 2,400 facilities for the years 2007 to 2015. We find substantial and statistically significant co-pollutant elasticities of about 1.0 for SO_x, 0.9 for NO_x, and 0.7 for PM₁₀. The energy sector is characterized by relatively high co-pollutant elasticities of 1.6 for SO_x, and 1.0 for NO_x and PM₁₀.

Identifying climate policy-induced changes in CO₂ emissions based on changes in regulatory stringency, we estimate co-pollutant elasticities in the electricity sector of 1.2 to 1.8 for SO_x, 1.1 to 1.5 for NO_x, and 0.8 for PM₁₀. Combining these results with co-pollutant damage costs obtained from the European Environmental Agency, we calculate the value of air quality co-benefits arising from one ton of CO₂ reduction in the energy sector. The monetized co-benefits (in 2005 EUR) range from 33 to 98 EUR/tCO₂ for SO_x, 9 to 24 EUR/tCO₂ for NO_x, and 4 to 10 EUR/tCO₂ for PM₁₀, with a joint magnitude of 46 to 132 EUR/tCO₂ for the three co-pollutants together. These air quality co-benefits are significantly higher than the European Environmental Agency's estimated climate damage costs of 10 to 38 EUR/tCO₂. These findings would justify substantially higher carbon prices based on co-benefits alone, independent of their climate benefits.

a Department of Socioeconomics, Vienna University of Economics and Business, klara.zwickl@wu.ac.at

b Department of Socioeconomics, Vienna University of Economics and Business, simon.sturn@wu.ac.at. Also affiliated with: Department of Economics, University of Massachusetts Amherst.

c Department of Economics and Political Economy Research Institute, University of Massachusetts Amherst, boyce@econs.umass.edu