



Carbon pricing and the elasticity of CO₂ emissions

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Ryan Rafaty, Geoffroy Dolphin and Felix Pretis

Climate policy is reaching a fever pitch in the year of COVID-19. The European Union and Japan have each announced ‘climate neutrality’ targets to reach net zero greenhouse gas emissions by 2050. South Korea and China have similarly announced ‘carbon neutrality’ targets to reach net zero CO₂ emissions by 2050 and 2060, respectively. President-elect Joe Biden’s climate plan will have the US join the international chorus and commit to net zero CO₂ emissions by mid-century.

But as the world’s direction of travel converges towards ‘Net Zero’, there is far less consensus regarding the policies that will be necessary to reduce emissions at the astounding scale and speed that is required. Pricing carbon dioxide (CO₂) emissions – whether via a carbon tax, emissions trading system, or some hybrid scheme – has been long been recommended as integral to reaching the world’s climate targets, but surprisingly little is known about the real-world performance of this core pillar of climate policy. This paper contributes to a fuller understanding of this question by empirically investigating the environmental efficacy of carbon pricing across five sectors for a panel of 39 countries from 1990 to 2016.

We aim to answer three questions: First, what is the effect of the introduction of carbon pricing on CO₂ emissions, irrespective of the level of the carbon price? Second, do higher carbon price levels lead to greater reductions in CO₂ emissions? Third, once a carbon price is set, what is the effect of subsequent year-on-year changes in the price level?

We answer each of these questions in turn, thus reporting three sets of estimated effects for each sector. We show that carbon pricing has reduced annual growth in emissions by roughly 1-2% relative to our estimated counterfactual, with an (imprecisely estimated) approximate 0.1% reduction in the growth rate of total emissions for each additional \$1/tCO₂. The response of emissions to a higher price level is imprecisely estimated in all sectors with the potential exception of manufacturing (with approximate 0.2% reductions per \$1/tCO₂). After



the carbon price has been introduced, each marginal price increase of \$1/tCO₂ has altered the growth rate of CO₂ emissions by -0.01% in the manufacturing sector, -0.2% for electricity and heat generation, -0.15% in buildings, -0.75% in road transport, and -0.15% for the economy as a whole.

Combining our empirical estimates of the effects of the introduction and subsequent increases of carbon pricing with scenarios of projected future emissions, we arrive at an important result: that carbon pricing at current observed levels even if implemented globally (or to a large share of world GHG emissions) is unlikely to achieve emission reductions at the scale and speed necessary to achieve the commitments of the Paris Agreement. Achieving the required emission reductions in line with the Paris Agreement requires global carbon pricing with near 100% emission coverage and in excess of \$110/tCO₂, which is roughly 50% higher than the highest existing average (emissions-weighted) carbon price, currently observed in Sweden.

Contact
Publication
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Geoffroy Dolphin – gd396@cam.ac.uk

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