

The Cost of Trade Distortion: Britain's Carbon Price Support and Cross-border Electricity Trade

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Unilateral carbon pricing by one country or region is likely to distort trade and give rise to carbon leakage. Regional schemes like the European Union's (EU) Emission Trading Scheme (ETS) partially mitigate this by agreeing a uniform carbon price for some industries (the covered sector responsible for about half the total EU's emissions). While this should reduce the distortions within the EU, it is still prone to leakage to the rest of the world. The main industries affected by carbon leakage are carbon-intensive traded goods such as steel, aluminium and cement. The electricity sector is, however, considerably more carbon intensive than these. In the EU-28 electricity accounts for just over 20% of total greenhouse gas (GHG) emissions, with very little decrease since 1990. The electricity sector is therefore of central importance when studying the impact of differential carbon prices. It has the added advantage that electricity is not widely traded outside the EU, but within the EU, Great Britain (GB) faces potentially a 13% import share. A study of differential carbon prices within EU's *Integrated Electricity Market* isolates the impact, and allows us to ignore the rest of the world, except for the impact on global emissions.

This paper develops a methodology for quantifying the impact of an asymmetric carbon tax on electricity trade within a closed region. The EU's *Third Electricity Package* required market coupling of interconnectors from 2014. Before market coupling traders had to buy interconnector volume and direction before knowing the market clearing prices, often resulting in inefficient trades. Market coupling ensured that interconnector capacity would be cleared at the same time as electricity markets, securing efficient trade. If prices can be equilibrated without violating capacity constraints, prices will be the same. Otherwise, trade will be set at full capacity and

¹ This paper substantially extends, updates and replaces the earlier EPRG WP 1918 *The Impact of Unilateral Carbon Taxes on Cross-Border Electricity Trading*

prices will diverge. We use GB's trade with France and The Netherlands as a case study.

In 2011, the UK Government enacted a gradually escalating Carbon Price Floor for fossil generation fuels. This came into effect in April 2013 in the form of a carbon tax (the Carbon Price Support, CPS, an addition to the EU carbon price) on generation fuels in GB (but not Northern Ireland). This paper takes GB as a case study and quantifies the costs and benefits of cross-border electricity trading between interconnected countries in the presence of the CPS (an asymmetric distortionary carbon tax). It quantifies the impact of the CPS on electricity prices, interconnector flows, congestion revenue. It also estimates the deadweight loss and carbon leakage. This has implications for the design and ideally harmonisation of the EU carbon tax to improve the efficiency of electricity trading.

Results

We estimate that over 2015-2018 when the CPS stabilised at £18 (€20) /tCO₂, the CPS raised the GB day-ahead price by an average of €11.43/MWh (about 28% of the GB wholesale price) allowing for replacement by cheaper imports. The CPS increased GB imports by 12.4 TWh/yr (about 4% of the GB annual electricity demand), thereby reducing carbon tax revenue by €101 m/yr (about 10% of the 2017 CPS tax receipts). The commercial value of interconnectors (measured by congestion income) increased by €153 m/yr (by 80% relative to the zero CPS case), half of which was transferred to foreign interconnector owners. The sum of the commercial value and the importer and exporter surplus is the social value of interconnector at €250 m/yr, but the asymmetric carbon taxes created deadweight losses of €80 m/yr. Therefore, the social value of interconnector under the asymmetric carbon tax is €170 m/yr. Also, about 4% of the global emissions reduction benefit of the CPS at €2 bn/yr. Increased French exports raised French prices by 3.5% and Dutch prices by 2.8%. Finally, about 1.3% of the CO₂ emission reduction is undone by France (-0.4% for The Netherlands), with a total monetary loss of about €18 m/yr.

Despite the fact that the CPS has distorted the cross-border electricity trading, it has significantly reduced GB GHG emissions from electricity generation. From 2015 to 2018, the share of GB coal-fired generation fell from 41% to 7%. On 21 April 2017, GB generation achieved the first ever coal-free day. When the UK introduced the CPF, the hope was that other EU countries would follow suit to correct the failures of the Emissions Trading System, at least in the electricity sector. The case for such an EU-wide carbon price floor is further strengthened by the desirability of correcting trade distortions.