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Measuring inefficiency in international electricity trading

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Interconnectors create value by enabling electricity imports from markets with lower prices as an alternative to higher-priced indigenous generation. While interconnectors have been used in Europe for decades, the EU's Integrated Electricity Market (IEM) was established in 2014 to allow electricity to be traded freely between member states, with markets coupled to improve the economic efficiency of the interconnector flows. Coupled markets are cleared simultaneously with transmission capacity allocated so that electricity flows from lower to higher priced zones until either prices equalise or interconnector capacity is fully used. By 2019, 23 European countries had coupled markets using the trading platform EUPHEMIA to ensure that total consumer and producer surplus is maximised. This has led to more efficient trading between multiple electricity systems, and substantial welfare gains.

In this paper, we systematically evaluate various metrics of day-ahead trading inefficiency for the first time. Existing measures of trading inefficiency fail to incorporate valuable information about the direction of flows or transfer capacity, so we devise two new measures of trading inefficiency. We propose Unweighted and Price-Weighted Inefficient Interconnector Utilisation indices to address these deficiencies. They are evaluated against existing metrics using a series of trading patterns and historical trading data. These metrics are substantially more accurate than existing ones and perform equally well whether or not markets are coupled. Our results show a substantial decrease in inefficient trading between Great Britain and both France and the Netherlands after the European Union's market coupling regulations were introduced in 2014.

The UK's foreseen withdrawal from the European Union is expected to result in Great Britain uncoupling from Continental electricity markets, with cross-border markets set to operate at different times. We therefore explore the potential economic losses of market uncoupling that might result from Brexit. We investigate the impact of uncoupling on net electricity imports, price differentials, trading

inefficiency, and the private and social value of the interconnectors to France and The Netherlands. This analysis will allow us to evaluate the reduction in inefficiency from market uncoupling and provide valuable insights on the potential impact of a no-deal Brexit on cross-border trade. Understanding the impact of market uncoupling should help to design policies that minimise likely welfare losses.

We find that uncoupling would lead to the electricity price differential between GB and France (Netherlands) rising by 3% (2%), net imports into GB decreasing by 3.3 TWh or 34% (1 TWh or 15%), congestion income decreasing by €23 million, or 11% (€7 m/yr, or 5%), and infra-marginal surplus declining by €4 million 1.6% (€2 m/yr or1.6%) of coupled congestion income. We also show that, should the EU decide to implement an equivalent carbon tax to GB's Carbon Price Floor, uncoupling impacts would be slightly magnified due to electricity prices converging (by about 1% of coupled congestion income).

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