ELECXIT: THE IMPACT OF BARRIERS TO ELECTRICITY TRADE AFTER BREXIT

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Overview

The United Kingdom decided in June 2016 to withdraw from the European Union, in the process now known as Brexit. The consequences of this exit, currently scheduled for March 2019, are difficult to assess because future relations with the EU are still to be negotiated between the EU and the UK. The UK government hopes to negotiate arrangements somewhere between continued membership of the European Single Market and a free trade agreement for goods and services. The European Commission’s negotiating position is that it will not be possible to have sector-by-sector participation in the Single Market.

This paper examines the longer-term (2030) consequences of the UK leaving the EU Single Market for electricity. Emphasis is placed on how Brexit may interact with national climate targets, the planned expansion of electricity interconnection and the integration of hydro-storage potential into the European energy system.

While Brexit might result in tariff and non-tariff barriers to trade in goods and services, the starting point for electricity trading is different:

1. It is unthinkable to bypass the EU (plus Norway and Iceland, both in the European Free Trade Association – EFTA) as the UK’s exclusive trading partner, since the construction of transmission lines to more distant countries would entail enormous costs, require long lead times and significant line losses.
2. Electricity generation has been subject to national sovereignty, and a wide variety of national policies, so far. But due to the requirements for continuous market clearing with considerable variability of the load and renewable generation, matching supply and demand is becoming harder, making market integration particularly valuable.
3. Northern Ireland, while part of the United Kingdom, shares a single electricity wholesale market with the Republic of Ireland. The UK government has committed itself to avoid a “hard border” between Northern Ireland and the Republic, and between Northern Ireland and the rest of the UK.

At present, several possible consequences of market disintegration for the electricity markets are under discussion. While it seems unlikely that import tariffs will be imposed, interconnectors cut or projects under construction halted, it is reasonable to assume that market rules and planned interconnection projects will be called into question. In particular, it is possible that Britain could leave the system of market coupling painstakingly adopted over the last decade, reverting to separate arrangements to decide interconnector flows, as happened before market coupling was adopted.

The European Commission's energy sector inquiry 2005/2006 - prior to the implementation of market coupling - provides clues to the functioning and costs of such a barrier to trade. Interconnector capacity was allocated before the wholesale markets had cleared and so “market participants … had to place auction bids for interconnector capacity based on expected wholesale market prices.” Anticipation errors due to a lack of market integration led to misallocations with a value of €64 million in 2004: the UK was importing power when its price was lower than that in France, or vice versa, and the interconnector was frequently under-used.

We analyse these scenarios of reversed market integration with a multi-country trade model. The model will be calibrated to forecast load and generation patterns for 2030, considering the widespread roll-out of low-carbon generation infrastructure. The high share of renewables and their spatial distribution will make spatial arbitrage particularly attractive and will increase the opportunity costs of barriers to increased integration.

Methods

First, a microeconomic model of decoupled markets between UK and France in 2004 is described. Due to different market closing dates in the UK and France, an early commitment and the anticipation of market prices is required to determine interconnector capacity demand. Therefore, the demand on the spot markets is not completely common knowledge at the time of tendering for interconnector capacity. Anticipation errors must be considered by traders when determining the demand for interconnector capacity. The according uncertainty is added to the load as a zero mean, normally distributed disturbance. Its variance is a measure for the extent of the trade barrier. It can be shown that if marginal costs are approximately linear with respect to installed capacities, certainty equivalency applies and therefore optimal trading under uncertainty equals perfect foresight trading.

Electricity generation and trading after Brexit in 2030 can therefore be modeled with the perfect foresight model DESSTINEE. DESSTINEE is a multi-country trade equilibrium model (Green and Staffell, 2014). It generates country-specific hourly load and renewable generation profiles from general scenarios and determines – also on an hourly basis – the equilibrium outputs and trade flows, for given thermal generation and interconnector capacities. Generation in each of the 9 model regions (for example, Germany is one region; another comprises France and the Benelux countries) follows a merit order stack. Inter-region flows are adjusted until adjoining regions have the same price (and marginal generation is shared between them in proportion to their capacity of that generation type) or until the interconnector capacity is fully used. To model the kind of trade barriers previously described, DESSTINEE was amended with an ex-post trade shock. The model is quantified with load data of the year 2010 and the variance of the disturbance term calibrated to fit the historic value of trade frictions between France and the UK described above: €64 million. While past work using the model has treated the British Isles as a single region, Ireland will be split from the UK so that the local impact of Brexit can be modelled.

Results

The standard deviation of the anticipation error was calibrated with DESSTINEE for the base year 2010 as 0.2 GW. We ran DESSTINEE for two levels of interconnector capacities between Britain and continental Europe (10 GW according to pre-Brexit expansion plans, and 5 GW on the assumption that some new build would be impeded) and both with and without price convergence (frictions in day-to-day trading based on that anticipation error) between the British Isles and EU-26. Preliminary simulations of the baseline scenario ('No Brexit Effect') with 60 GW wind and 25 GW solar in the UK in 2030, 10 GW transmission capacity and without fully integrated markets result in a higher average electricity price in France than in the UK. The average price difference implies net exports from the UK to France. The average price difference implies net exports from the UK to France. The focus of this work is not on the absolute predictions, however, but how they change with Brexit frictions – a "diff in diff" approach.

If the interconnector is insetad only increased by 5 GW and the markets are decoupled ('Large Brexit Effect') there is an overall loss of welfare of €1 billion. 70% of this stems from discarding 5GW transmission capacity and 30% from market decoupling. The short-term frictions have almost no effect on average prices as UK's electricity exports are frequently limited by the transmission capacity. In contrast electricity prices in the UK react to abandoning 5 GW of transmission capacity with a decline of €6/MWh, to the benefit of consumers, but the detriment of producers. A decline of prices of the exporting country is typical if trading in asymmetric markets is restricted.

Conclusions

We are not suggesting that abandoning the successful system of electricity market coupling is a likely outcome of Brexit, but wish to illustrate the costs of doing so. Preliminary results find that an abandoning of 5GW planned interconnector capacities and market decoupling might cause a loss in welfare of €1 billion. Two-thirds of these losses are caused by the reduction in interconnector capacity and one-third by market decoupling. So either friction contributes significantly to these losses in a scenario of 2030, while the impact of capacities is higher.

This is work in progress at the current time, and the benefits from greater security and avoided capacity investment will be calculated in more detail, together with winners and losers. Furthermore, we will verify the sensitivity of the results to a range of fuel and carbon prices (and possibly different renewables capacities) to represent both the status quo (UK Carbon Price Support vs EU ETS) and possible new policies and calculate total emissions and relate the ETS price to emissions within whatever area is covered by it in future.

Reference

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