ElecXit: The Impact of Barriers to Electricity Trade after Brexit

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The structure of global electricity supply has changed dramatically since the 1990s, especially in Europe. In this process the European Union followed its proven general principle of a cross-border internal market - the internal electricity market. For this purpose, the deregulation of national electricity markets was initiated in the 1990s, and since 2015 the vision of a cross-border market design has been largely implemented as the Electricity Target Model (ETM, ACER, 2015). In particular, market coupling implies that markets clear simultaneously and transmission capacity is automatically allocated so that electricity can flow from low- to high-priced areas until prices are equalized or the capacity is fully used. Trade between Member States is now only limited by capacity constraints of the infrastructure. To tackle this, the EU has set the goal to expand interconnector capacities to 10% of each national electricity generation capacity by 2020 and 15% by 2030.

Until recently, it seemed highly unlikely that the integration of the European electricity industry would be reversed, but the United Kingdom is in the process of leaving the EU. As part of this the EU and the United Kingdom are currently negotiating the conditions of this exit and their future relationship. The outcome of the negotiations is currently unpredictable given their breadth, depth and political circumstances.

The complexity of the negotiation is evident in the electricity sector. In addition to the institutions of electricity trading, or tariff and non-tariff trade barriers, any readjustment of the emissions trading system, Euratom regulation or the renewable energy directive might have indirect consequences for the electricity sector. Again, the result is not foreseeable. Nevertheless, Brexit scenarios have been developed to help stakeholders prepare and to underpin their bargaining positions. Two significant design principles and conclusions from them are presented as examples:

- A huge part of the Brexit scenarios builds on the UK Government's rejection of the jurisdiction by the European Court of Justice. A UKERC/Chatham House Report[1] suggests that the rejection of this institution excludes British actors from the institutions controlled by them, amongst others the single electricity market. In particular, UK electricity markets could not remain coupled with their continental counterparts.
- The resulting uncertainties about the profitability of trading and a reduction of EU funds could hinder the expansion of the trade infrastructure mentioned above from 4 to 10 GW by 2021 (UKERC, Chatham House), especially in the planning phase.
- The European Commission (Directorate-General Energy) published on 27/04/2018 a scenario for the case that negotiations would not succeed by the date of withdrawal. Then, the United Kingdom would become a 'third country' and 'EU rules in the field of energy market regulation will no longer apply to the United Kingdom'. As consequences of this, the Commission derives not only market uncoupling, but also the necessity to charge an interconnector usage fee for trade with the United Kingdom. Whether the latter equals a tariff is not yet obvious.

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See footnotes and end of text.

Although the EU approach sketches an extreme case, the fact that market uncoupling has been highlighted in both approaches and that the Chatham House Report considers a reduced expansion of the trading infrastructure possible has motivated us to focus on both as crucial Elecxit building blocks. But how do these very general Elecxit building blocks impact long-term welfare? To answer this question let's refer the background of market coupling:

As described earlier, day-ahead markets in France and the United Kingdom were not coupled in 2009, i.e. the market closing times differed by several hours. This forced traders to commit to trades only on the basis of anticipated market prices. Unavoidable anticipation errors made it impossible to have efficient trading in which either the capacity was exhausted or the price differences between the markets disappeared. This can be seen very well in the noisy trading pattern of price differences and capacity utilization in Figure 1. Not surprisingly market coupling eliminated this noise and a nearly ideal trade pattern emerged (Figure 2, 2017).

By comparing the observed noisy trade with a trade extrapolated to an ideally full capacity and by considering price adjustments, EU-wide welfare gains through market coupling on the day ahead markets have been

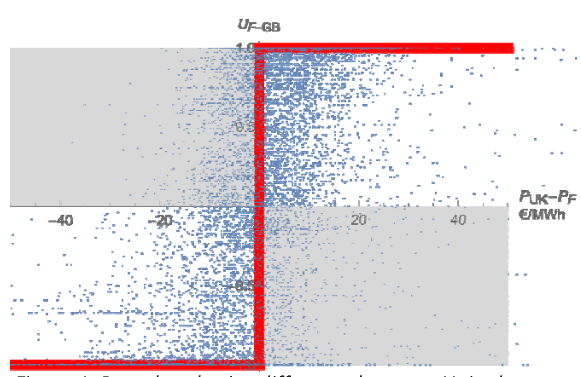

Figure 1: Day ahead price difference between United Kingdom and France [€] vs. interconnector utilization [-1,+1] in 2009. Positive utilization reflects electricity trade from France to UK; negative the reverse. The red curve indicates the efficient patttern.

estimated as 0.2-0.5% of the market value[2] (Newbery, Strbac and Viehoff, 2016).

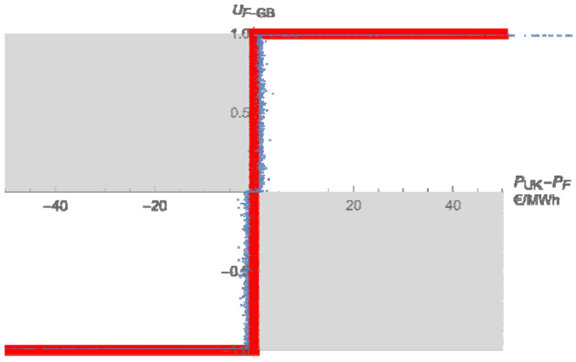

Figure 2: Day ahead price difference between United Kingdom and France [€] vs. interconnector utilization [-1,+1] in 2017. Positive utilization reflects electricity trade from France to UK; negative the reverse. The red curve indicates the efficient patttern.

To deduce long-term welfare effects of market uncoupling in the context of Elecxit one might be inclined to project this welfare gain of market coupling one-to-one into the welfare loss from market uncoupling, continuing into the future. But this would treat results from a snapshot during the transition towards a sustainable electricity system as giving long-term effects. To avoid this, we estimate the welfare effect for 2030, as representative for the long-term effect of Elecxit, because at that point in time, it can be expected that electricity systems are widely decarbonized and consolidated. However, the state of the system in 2030 renders an application of the welfare gains estimated for 2009 highly inaccurate, since:

1. Without market coupling trading decisions have frequently proved uneconomic but their impacts have been limited by small interconnector capacities (2GW between France and the UK in 2009). This would change as the UK's interconnector capacities may rise to 10 GW in 2021. This implies that the opportunity costs of market uncoupling in 2030 might exceed estimates of the benefits of market coupling in 2009.
2. The structure of electricity generation will change dramatically as more intermittent renewables will enter the market. The resulting uncertainty will make international coordination more valuable and a lack of coordination costlier.
3. Generation mixes will be adjusted to the higher share of intermittent renewable generation and a change in the load profile. These changes in national supply might also affect the sensitivity of the market price to traded electricity and thus alter the effect of reduced market coordination.

To take these changes into account we developed an equilibrium trade model with anticipation error and estimated its key parameters based on 2009 data. We could then simulate trade in 2030 with and without market coupling, considering scenarios that cover the changes in renewable and other generation, to determine the expected welfare losses of Elecxit.

For this purpose, we used load profiles from the DESSTINEE model based on the scenario ENTSOE 2030 vision 3 for the United Kingdom and France. Generation capacities and costs have been applied directly from the same scenario. As a reference, we embedded the 'Soft Elecxit' scenario, with an expansion of interconnector capacity to 10 GW (as planned today) and persisting market coupling. We compared this scenario with a 'hard Brexit' in which interconnector capacity drops to 5GW (so minimal expansion) and markets are uncoupled and determined the difference in market values of electricity.

We make the assumptions that renewables capacity will have doubled (thus increasing uncertainty) and that after the uncoupling, trade will be no more efficient than it was between France and the UK in 2009. Without the coordination of market coupling, both markets suffer from an information asymmetry so that participants have to form expectations, with the resulting anticipation errors and thereby inefficiencies.

Under these conditions, market uncoupling and limited interconnector capacity would increase the sum of generation costs in France and UK by 1.3% of the combined wholesale market value in France and Britain, compared to the case with coupled markets and an expansion to 10 GW of transmission capacity; 'soft Elecxit'. This apparently small percentage represents a loss of €500 million per year. Furthermore, expanding transmission capacity to 10 GW would only reduce costs by 0.1% of the combined market value, if de-coupled markets meant that the expanded capacity was not sensibly used. 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, when some people in the UK apparently still think[3] that failing to reach agreement with the EU on our exit would be a desirable outcome.

Footnotes

[1] "Following the UK's decision to leave the EU, it is still unclear whether GB will remain part of current and future market coupling arrangements. This is because these require the active collaboration of GB interconnection counterparts, and market coupling was mostly developed through European legislation (e.g., the European Network Codes on capacity allocation and congestion management (CACM), and on forward capacity allocation (FCA))."

[2] Newbery, D. M., Strbac, G., & Viehoff, I. (2016). The benefits of integrating European electricity markets. Energy Policy, 94 253-263. https://doi.org/10.1016/j.enpol.2016.03.047

[3] We use the term loosely.