Market integration and wind generation
An empirical analysis of the impact of wind generation on cross-border power prices

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European electricity markets have become increasingly integrated in the past decade, as a result of improvements to market design such as the implementation of day ahead market coupling through implicit auctioning of transmission rights.

As a consequence, national policies which affect the generation mix can be expected to have a growing effect across borders on neighboring countries. Yet national policies to support some technologies remain poorly coordinated. The rapid growth of renewable energy generation has had significant effects on power prices in a number of European countries such as Germany. Electricity prices have become more correlated with wind intermittent production and more volatile.

The joint process of deploying renewables and integrating power markets raises a number of questions. There is significant literature that demonstrates that renewables affect power price level and volatility within a country. However, in the case of neighboring markets with market coupling, there is to our knowledge no research that investigates to what extend policies to support renewables on one side of the border do affect power price dynamic on the other side? Moreover, the effect of renewables does depend on the amount of physical cross-border capacity available. To what extent does an increase in interconnection capacity influence the effect of renewables on cross border prices, and what are the implications for the value of new interconnections?

This paper investigates these issues by considering the case of France and Germany. Wind installed capacity has grown dramatically in Germany over the past few years from 25 GW in 2010 to more than 45 GW by the end of 2015. France has seen a slower development of wind power with 4 GW installed in 2010 and 10 GW by the end of 2015. Moreover, France and Germany were among the 5 pioneering countries where market coupling was launched in 2011.

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With 4 years of empirical data, we investigate the effect of wind power growth in both countries on power prices both domestically and across the border. Using detailed order book data from the spot market operator, we also analyse the effect of intermittent wind generation for different levels of additional interconnection capacity between France and Germany.

We find that intermittent wind generation has a significant impact on electricity prices in both the domestic and the neighbouring market. In addition, we find that increasing the interconnection capacity between France and Germany would generate a transfer of the volatility generated by the domestic wind production to the neighbouring country's power prices. However, the analysis of the overall effect of an interconnection expansion shows that the transfer of wind –related price volatility is mitigated and even offset by the dampening effect of integrating the markets (resulting from larger demand and supply).

However, the analysis of the overall effect of an interconnection expansion shows that the transfer of wind –related price volatility is mitigated and even offset by the dampening effect of integrating the power markets (resulting from larger demand and supply). But even if the price variance is decreasing when interconnections are larger, the price variance is also more sensitive to the wind generation. This means that if Germany continues to massively develop intermittent renewables, the overall effect of an interconnection expansion could potentially overrun the positive effect of interconnecting markets for neighboring countries. Our findings therefore have important policy implications as they demonstrate the need to coordinate cross-border support policies of renewables and interconnection expansion in order to mitigate the impact on power prices.