Integrating European Electricity Markets – what impact for consumers and producers?

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Introduction

On October 1st 2018, Ireland was one of the final countries to integrate with the EU internal energy market (IEM) and switched to a new market (ISEM) due to the need for additional precautions as a result of the small isolated nature of the synchronous system.

The integration of the old all-island electricity market (SEM) with European electricity markets was expected to increase the use of the interconnector with Great Britain and 'deliver increased levels of competition which should help put a downward pressure on prices as well as encouraging greater levels of security of supply and transparency' (EirGrid, 2016). With the integration of the Irish market (ISEM), the IEM now comprises 20 countries, with 38 interconnectors and a total generating capacity of over 3,000 TW, see Figure 1. Ireland provides a case study as a natural experiment with which to test economic theory relating to the benefits of integration through interconnection, regional electricity trade, and market rule changes for consumers, producers and markets.

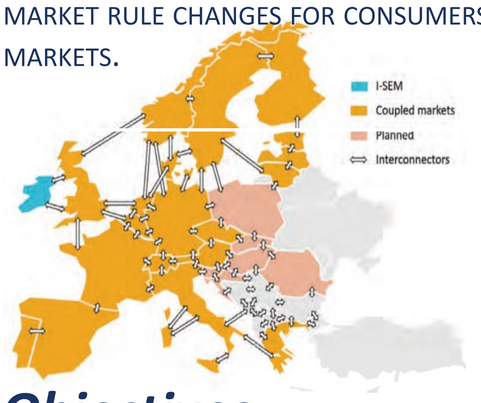


Figure 1: Interconnection across the EU (EirGrid, 2016) http://www.eirgridgroup.com

Objectives

To objective of this analysis is to test economic theory on the value of electricity market integration. We examine the following questions:

- Does integration into larger markets lower electricity prices? For whom?
- Does integration to the European market increase interconnector trades and is it more efficient?
- Has the ISEM enabled an increase in the share of renewable electricity due to more efficient trade?

Methodology

Data is from the ENTSOE Transparency Platform for the period 1st January 2015 until 3rd December 2019.

We initially carry out two OLS estimations with day ahead prices and imports as the dependent variables. We estimate separately day ahead price and import models with all variables estimated as logs.

Price model:

$$P_t = \beta_0 + \beta_1 W_t + \beta_2 D_t + \beta_3 Pk + \beta_4 M + \beta_5 (Pk * M)$$

Imports model:

$$I_t = \beta_0 + \beta_1 W_t + \beta_2 D_t + \beta_3 \frac{P_{1t}}{P_{2t}} + \beta_4 M + \beta_5 Pk + \beta_6 (Pk * M)$$

$$N+ = \sum(P(IE) - P(GB) > 0 \& Imports > 0) + \sum(P(IE) - P(GB) < 0 \& Imports < 0)$$

Where:

- P_T= day ahead electricity price
- W_T = Wind generation
- D_T = system demand (net wind)
- Pk = peak (6pm-10pm) or off-peak dummy
- M = ISEM dummy
- t = hour
- I= Imports
- i = 1=GB; 2 = Ireland
- N+ = incidence of efficient trade flows

Results

Figure 2: Day-ahead wholesale electricity prices: January 2015-December 2019

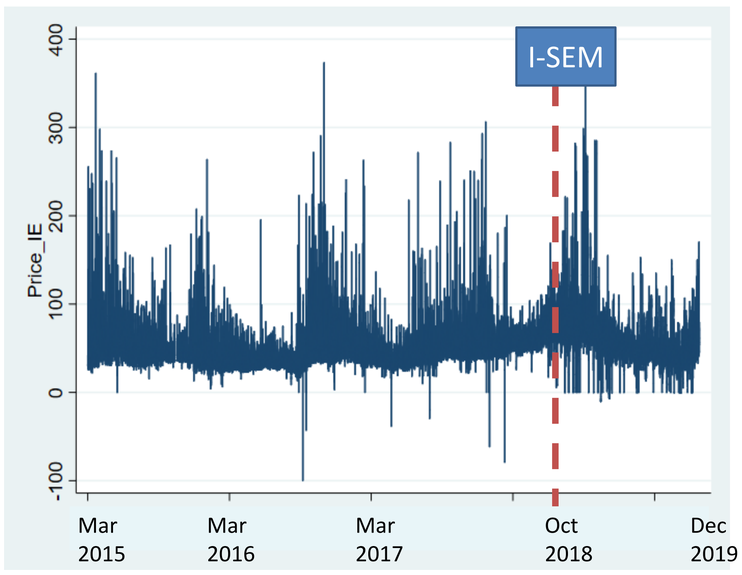


Table 1: Impact of ISEM on wholesale day-ahead electricity prices (all logs)

Price	Basic OLS model	With ISEM	ISEM interaction
Wind production	-0.064***	-0.077***	-0.077***
System demand	0.588***	0.523***	0.522***
Peak period	0.188***	0.199***	0.177***
ISEM		0.169***	0.158***
ISEM*peak			0.070***

* p<0.10, ** p<0.05, *** p<0.01

Figure 2 shows the evolution of day-ahead **prices** in the Irish wholesale electricity market over the period Jan 2015 to Dec 2019. At first glance there do not appear to be major differences between prices in the old and new markets, however in the last 6 months of the ISEM prices seem to be settling to a lower level. The OLS results of the impact of ISEM and peak periods combined with net market demand and wind generation in Table 1 show that while wind continues to have a negative impact on prices, the ISEM has not had the desired effect of reducing prices overall. However, this will need to be revisited with longer ISEM time series and more detailed modelling.

Figure 3: Pre-ISEM Imports vs IE-GB price difference

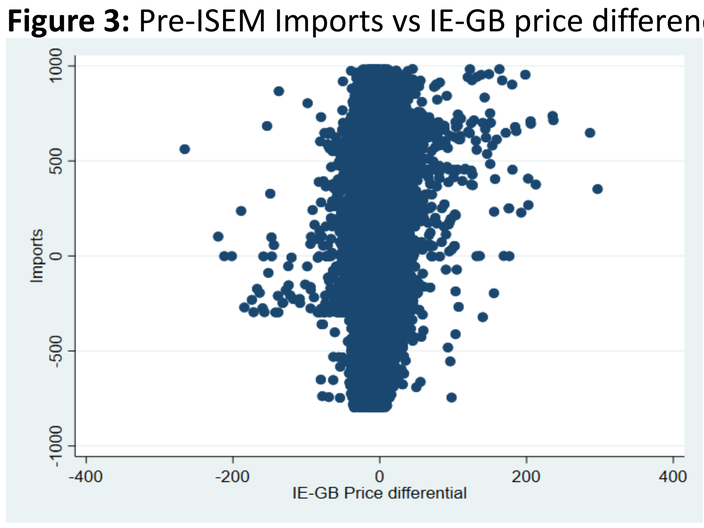
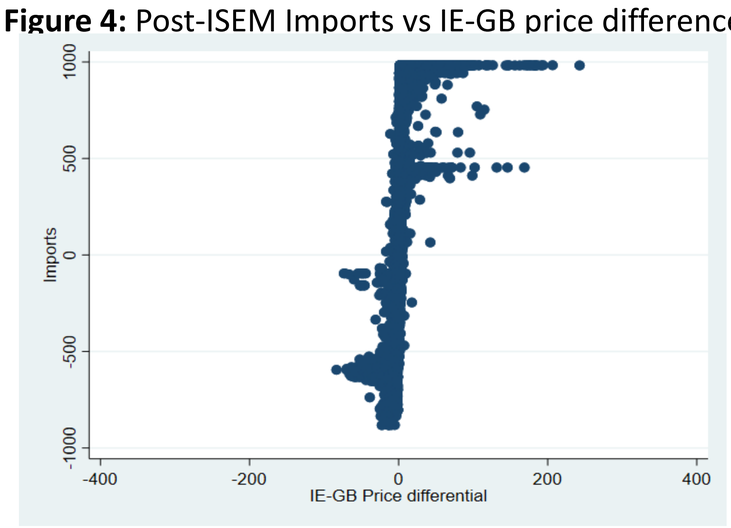


Figure 4: Post-ISEM Imports vs IE-GB price difference



Figures 3 and 4 show the change in **imports** that have occurred between the old SEM and the new ISEM market. Interconnectors operate efficiently when exports occur during a negative price differential between Ireland and Great Britain (top left quadrant) and the reverse for imports (bottom right quadrant). We see in Figure 3 that trade often occurred in the 'wrong' direction in the SEM , while the ISEM trade flows are better aligned with prices (Figure 4).

Table 2: Impact of ISEM on incidence of efficient trade flows

N+	Basic model	ISEM effect	ISEM and peak	Interaction
Wind	0.055***	0.025***	0.026***	0.025***
Demand	-0.515***	-0.574***	-0.611***	-0.584***
Market		0.370***	0.371***	0.354***
Peak			0.075***	
PeakMarket				0.084***
R2	0.06	0.17	0.17	0.17
N	35154	35150	35150	35150

* p<0.10, ** p<0.05, *** p<0.01

In Table 2, the incidence of trades in the direction of price differential is modelled as a function of the underlying variables and ISEM. Increased wind generation raises the incidence of efficient trades, while higher demand in the Irish market lowers efficiency, as a rule. The ISEM has increased the incidence of efficient trades, as was already visible in Figs 3&4. Peak periods appear to have a significant impact on the efficiency of trades but are relatively small. Further estimation shows that the volume of trades has increased by approx. 37% as a result of ISEM but further analysis is needed.

Conclusions

The findings suggest that the effect of integrating the Irish electricity market into the European market is most noticeable in the volume and direction of flow of electricity trades to the GB market. Less evidence is visible of the impact on day-ahead prices so far. Further work will be undertaken to develop a robust analysis of the price development, including the use of a longer dataset and the development of a counterfactual price model using synthetic controls based on Spain and Portugal.

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