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Competition and the Single Electricity Market: Which Lessons for Ireland?

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Abstract: This paper examines the redesign of the Irish Single Electricity Market in order to comply with the European Target Model for electricity. In particular, this work focuses on the challenges raised by the high concentration in the generation sector which exists in the Irish electricity market.
We examine the theoretical and empirical conditions under which forward markets promote competition in the spot and retail markets; in addition, we investigate the impact of concentration in the market on the new capacity payment mechanism.
In order to ensure a competitive outcome for consumers, the regulatory authorities should continue to regulate the directed forward contracts made by the dominant firm; moreover, our analysis suggests that the regulator should extend regulation to the price and quantity which the dominant firm bids for holding new reliability options.

Keyword(s): Competition; Forward electricity markets; Capacity payments; Single electricity market

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1 Introduction

The creation of the European Single Electricity Market has been a stated aim of the European Union (EU) in order to promote efficient trading in electricity. The framework for the EU internal market is contained in the Third Energy Package, which came into effect in March 2011, along with a detailed set of directives designed to put the single market in place[1].

As a consequence of the Single Market design, all EU member states are expected to comply with the European Target Model for electricity trading[2]. While the European Target Model concerns itself primarily with efficient trading between price zones via electricity interconnection, there are several features of the Irish single electricity market (SEM) which render it incompatible with the European Target Model at present (Gorecki, 2013). The SEM is therefore currently undergoing a process of transformation in order to integrate fully with the European Target Market and is expected to comply fully by the end of 2017. The regulatory authorities have released decision documents on the high level design of the Integrated Single Electricity Market (I-SEM) and a consultation process on the detailed design of the I-SEM is ongoing. As well as introducing different trading platforms in order to enable coordinated scheduling of flows over interconnectors, there is a significant redesign of the SEM's capacity payment mechanism. This paper examines several aspects of the SEM redesign which are of concern, particularly considering the high level of supplier concentration which exists in this market.

The paper is structured as follows. Section 2 introduces the Irish electricity market and the possible changes. Section 3 presents a review of the literature relating to forward markets and competition and provides a summary of the conditions under which forward markets can enhance competition in spot markets. Section 4 considers the proposed changes for the SEM and outlines potential pitfalls and concerns. Section 5 considers the new proposed capacity payment mechanism for the SEM and Section 6 concludes.

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[1]See Directive 2009/72 on common rules for the internal market and Regulation (EC) 713/2009, which established the Agency for Cooperation of Energy Regulators. On the transition from regional to single market see `http://ec.europa.eu/energy/sites/ener/files/documents/2010_gas_electricity_markets.pdf`.

[2]See Newbery (2006) for a summary on how many markets in Europe have evolved to satisfy these liberalisation requirements.

2 The Irish electricity market: transition to the Single European market

2.1 The current Single Electricity Market (SEM) design

The Single Electricity Market (SEM) of Ireland, through which electricity on the systems of the Republic of Ireland and Northern Ireland is traded, has been in place since the 1st of November 2007. It is a single cross-border market which takes the form of a centrally-scheduled gross pool. The market was established due in part to requirements of the European Commission that electricity markets across Europe undergo a process of liberalisation and regulation (European Commission, 1996).

At present, the SEM's wholesale electricity market is a gross mandatory pool with a single System Marginal Price (SMP) in each period. Plants bid in the day-ahead market and are called to generate on a merit-order basis until the production is enough to service existing demand, after accounting for each plant's technical constraints. The SMP is based on a market schedule that does not account for transmission constraints. If transmission constraints arise in the real time market, plants that are constrained off still collect the SMP for that period but have to return the equivalent of the costs they did not incur, based on their bids. Plants that are called to generate even if they were not included in the unconstrained market schedule will be compensated for their generation costs, but do not receive that period's SMP. The regulatory authorities monitor the market through the Market Monitoring Unit. Power plants are required to bid their short run marginal costs, comprising fuel, carbon and variable operation and maintenance costs, in line with the bidding code of practice (available from the regulator's website: `www.allislandproject.org`), based on day-ahead spot prices. Total energy payments and constraint payments in 2014 came to €2.2bn[3].

The SEM also has a capacity payment mechanism which is, in the parlance of the regulators, a price-based mechanism (CER and NIAUR, 2014). A capacity 'pot' is set each year and distributed between all generators; in 2014 this pot was €556m. The determination of the size of the pot is designed to mimic the inframarginal rent required to allow an otherwise marginal unit to recoup its capital costs. The pot is therefore determined based on the capital costs of generation units, their expected profits from the energy market, and the total system demand requirement.

[3]Full details available at `http://www.sem-o.com/pages/MDB_ValueOfMarket.aspx`

The structure of the SEM at the moment promotes competition, as highlighted by Malaguzzi Valeri (2009). The regulation and the bidding code of practice, along with constraint payments which are based on the differences between expected and actual dispatch, have ensured that wholesale prices have remained at a competitive level from the market origin. The capacity payment mechanism also cannot escalate beyond a competitive level as the pot is set administratively. This is in spite of the presence of a dominant firm, the legacy monopolist. One potential weakness of the SEM however is the level of competition in the retail market where links between generators and suppliers are still present; in particular, the dominant firm is a vertically integrated utility. The presence of vertical integrated utilities may weaken the competition in the retail markets if there are no liquid and transparent forward market or if the retail prices are not regulated, as highlighted by Helm (2015).

The new design for SEM should take all these aspects into account, delivering competitive outcomes for both wholesale and retail prices.

2.2 Proposed Integrated Single Electricity Market (I-SEM) design

There are several criteria against which the success of the I-SEM can be judged, including static efficiency, dynamic efficiency and integration with other EU electricity markets. In order to bring about a welfare-enhancing outcome, the I-SEM design should at a minimum maintain the positive aspects of the SEM to date, which include the competitive prices which have prevailed in the spot and capacity markets. Consumer welfare could be enhanced by extending these competitive outcomes to the retail market. The main challenge for I-SEM, as is the case at present in the SEM, is high supplier concentration and potential market power.

The proposed structure of the I-SEM includes a forward market of financial trades only, and an exclusive but not mandatory day-ahead market. The exclusive nature rules out self-scheduling by generators and precludes physical forward contracting. The non-mandatory nature means generators may participate only in the intraday or in the balancing market if they desire. This design may be intended to facilitate renewable generators taking advantage of more accurate forecasts closer to realtime[4]. Generators submit their bids day ahead according to the EUPHEMIA algorithm, which does not allow three-part bids

[4] At present, forecasted wind may be far from the realised outcome. Using SEMO data, calculations by the authors show wind discrepancies between ex ante and realised values of up to -1082.444MWh between 2008 and 2012.

of the kind that exist in the SEM at present. Once a market-clearing schedule is arrived at, intraday trading will take place through which market participants can adjust their positions until an hour before real time, at which point the balancing market operates. The detailed design regarding market scheduling and constraint payments has not been decided. However the intricacies of scheduling are unlikely to have a major effect on final consumer prices, as these are typically determined on the basis of forward contracts entered into by supply companies.

3 Forward contracts and competition in electricity markets

Market power concerns often arise when there is a dominant firm, as in the case of the SEM. Efficient and liquid forward markets can prove an effective method of mitigating market power concerns in spot and retail markets. Furthermore firms which have committed to providing electricity on the forward market have an incentive to produce this electricity, thereby providing a signal similar to that provided by an effective capacity market. This section reviews the theoretical literature on the links between forward and spot market competition; moreover, we present how this link has manifested in some European and American electricity markets.

The focus on forward markets in the I-SEM design is not surprising. As stated by Mahenc and Salaniè (2004), *"there's a widespread presumption among economists that forward trading is socially beneficial"*. Uncertainty, risks of high price volatility and the presence of market power are the most common arguments used to justify the promotion of forward trading. Electricity markets, characterised by a homogeneous product and robust forward markets are a good case study to assess the impact of forward physical and financial liquidity on competition.

The creation of the conditions for a liquid forward market are strongly related to other aspects of the market structure, such as the presence and the usage of interconnectors and the vertical integration of generation and energy supply companies. The SEM committee in the high-level design decision paper CER and NIAUR (2014) has established that *"forward market in the I-SEM will only have financial trading instruments for within zone trading. These financial trades are expected to be in the form of contracts for differences struck against [...] the day-ahead market."*

The forward contracts in the I-SEM, as in any market, can play an important role in mitigating market power in the spot market and guaranteeing a competitive price to final consumers in the retail market. Both theoretical literature and empirical evidence have highlighted cases where forward markets helped effectively in reaching the goal of more efficient electricity prices. We analyse whether these conditions are present in the I-SEM design and the key issues that the detailed design should take into account.

The conditions which influence the role of forward contracting in enhancing competition are theoretically outlined in the contributions by Allaz and Vila (1993), Wolak (2000), Green (1999), Holmberg (2011) and de Frutos and Fabra (2012). All these papers find beneficial effects on competition in the spot market if players are *selling* electricity on the forward markets. Another condition required by the theoretical literature in order to obtain beneficial effects on competition and final prices is a sufficiently elastic demand curve in the forward market.

Starting from these assumptions, and from the seminal contribution by Allaz and Vila (1993), contributions by other authors underline how the length of contracts (Green and LeCoq, 2010), strategic behaviour in the forward market (Holmberg, 2011), and asymmetries between generators (de Frutos and Fabra, 2012) matter in determining the intensity of competition in the spot market, which under the conditions outlined above is always achieved. However, as Bushnell (2007) points out, *"the pro-competitive impact of forward contracting (..) depends upon the same factors that influence the competitiveness of the market absent a forward market"*.

Liski and Montero (2006) introduce dynamics in the game and find that firms can collude in the forward market as well as in the spot market. If selling forward will reduce the other players' profits, one producer could reduce the quantity sold in the forward market (or start *buying* forward) in order to sustain tacit collusion. The same result (i.e. buying instead of selling forward) can be achieved when firms compete *à la* Bertrand, as demonstrated by Mahenc and Salaniè (2004).

In summary, forward markets may promote competition in the spot markets under a number of assumptions. In the electricity market, generators need to be willing to sell their quantities forward, in a transparent and liquid market. Moreover the number of buyers should be sufficient to ensure that the market is liquid and the selling prices are competitive. Only under these conditions, with a good amount (if not all) of their production sold forward, will generators have less scope to exert market power in the spot market.

3.1 Forward markets and competition: international evidence

In the European and American markets, there are some examples of successful market designs, in which a high degree of competition are combined with the efficient use of interconnectors and long term hedging options. In this first group of successful markets, in which forward contracts enhance competition there are the EEX, the NordPool and some of the US markets (in particular, PJM and Ercot). The conditions which effect good performance in these markets include high levels of integration, very liquid forward markets and competition between suppliers in the retail markets. When these characteristics are not present, the regulator may intervene to promote forward sales (such as in the case of the Iberian market) or investigate the discrepancy between wholesale and retail prices, as in the UK case.

3.1.1 EEX, NordPool, PJM and ERCOT

The European Energy Exchange (EEX) market is the result of merging the Austrian, German and French electricity markets, which took place in 2006. This is an energy-only market with no capacity mechanism, although capacity markets and strategic reserves are under consideration in each of the countries in this market (ACER, 2013). In the EEX, generators in each country may self-schedule their production on the day ahead market. The quantity which is sold through such bilateral contracts will be bid in the power exchange.

There is a power exchange in each country, which is responsible for price calculation in each national market. The electricity price is determined in a single price, closed bid auction for every hour of the next day, seven days a week. Once the national price is set, the TSOs of the three countries notify the exchanges of the amount of transmission capacity available between the countries. The interconnectors are then scheduled to export power from low-price regions to high price regions until prices are harmonised or until the lines reach their congestion limits, whichever occurs first. Thus if there is no congestion on the lines there is a single price common to each country in the market.

Intraday and balancing markets are also available to ensure the adequate supply of electricity on the market. In order to promote transparency, spot market data are published on a regular basis. The forward markets associated with the spot market are very liquid and trade both physical and financial products. As in the other European forward markets, the trades take place with weekly, monthly, quarterly and yearly deliveries up to

6 years in the future.

Several works investigate the effect of the EEX market in enhancing competition. Conditions which according to economic theory are necesary in order to achieve good results on the spot market are present in the EEX market. Players are willing to sell forward in a liquid market, as documented in Wilkens and Wimschulte (2007). So, it is not surprising that notwithstanding the merging process between small companies which took place in the EEX market after 2007 (see Economics and Decisions (2007)), Graf and Wozabal (2013) did not find any evidence of collusive behaviour in the spot market.

The Elspot market is the daily spot market for the Nordic power market NordPool, which now includes Norway, Denmark, Sweden, Finland, Estonia, Latvia, Lithuania, Germany and part of the UK. More than 380 companies from 20 different countries trade in this market, which in 2014 had a total turnover of about 500TWh.[5]. There is no explicit capacity payment mechanism in Nordpool, but system operators hold strategic reserves in order to ensure sufficient capacity and system capability (Botterud and Doorman, 2008).

Market participants submit their energy bids and offers and the pricing algorithm determines the merit order curve for the suppliers and the demand curve for the buyers. The price is determined on an hourly basis at the interception with the two curves. The time horizon of the financial settlement is similar to the rest of Europe, as contracts can be on daily, weekly, monthly, quarterly and annual basis. The market-clearing price is then used as the reference price for the forward and futures contracts in the financial market (called Eltermin), including the OTC market. In this case, self-dispatching in the spot market is not associated with physical contracts in the forward market.

In the financial market, contracts can be related both to baseload and peakload products. Both products are are necessary in order to hedge both producers and buyers from spikes in prices, which are likely to occur in a market in which water reservoirs are essential contributions to the spot price. The presence of spikes associated with financial forward contracts attracts speculators and increases market liquidity, as suggested by Botterud et al. (2010).

NordPool has several characteristics that the theory examined before identifies as necessary to promote competition levels, such as high degree of liquidity and strong market participation. Moreover, in the spot market, competition is also promoted by the participation of renewables, which can be easily accommodated by flexible generators. As a

[5]Information on Nordpool can be found here: `http://www.nordpoolspot.com/`

result, as highlighted by Fridolfsson and Tangeras (2009), the literature agrees that there is no evidence of *"blatant and systematic exploitation of market power on the Nordic power exchange, NordPool"*.

In the US there are two markets which are well integrated and in which there is no obvious sign of strategic behaviour in the spot market: the PJM (Pennsylvania - New Jersey - Maryland) and the ERCOT (Electric Reliability Council of Texas) markets. PJM is one of the largest electricity markets in the USA. The spot market is regulated by a multiple-part bidding auction. This means that, in addition to the quantity-price pairs for energy, bids include extra costs, such as start-up and shut-down costs as well as technical constraints such as minimum-stable loads[6]. PJM also includes a capacity market whereby Load Serving Entities (LSEs) are obliged to purchase capacity obligations to meet their demand. These capacity obligations can then be traded on a capacity market.

The spot price in PJM is a locational price: if there is no congestion between pricing zones, the price will be fixed at the intersection between total demand and supply. Otherwise, there will be a different locational marginal price within each zone and congestion rent is collected by the transmission owner. As a result, PJM operates like a stock exchange, in which bids and offers from supply and demand are balanced in order to determine the electricity price. However, the high amount of interconnection between markets often causes prices to converge.

On the forward market, it is interesting to note that in their analysis, Longstaff and Wang (2004) found a significant forward premium applied by market operators in forward contracts, essentially due to the right skewness of the electricity prices driven by unexpected spikes in demand. Almost 10 years later, Haugom and Ullrich (2012) conclude that the market has matured and forward prices may be seen as unbiased predictors of the spot prices. Consistent with the theoretical contributions examined above, the good performance of the PJM market is due to the high levels of interconnection which lead to high liquidity on forward markets and the presence of renewables in the different markets, which may have reduced the magnitude of the price spikes and directly increased the competition in the spot market.

The ERCOT market serves one of the three synchronous electricity grids in the US. ERCOT is an energy-only market with no explicit capacity payment mechanism and serves over 20 million customers. In 2010 the actual generation totalled 411.7 million

[6] This practise is not dissimilar to that which exists in the SEM at present.

megawatt hours (MMWh)[7]. The spot market is an hourly market, regulated by a multi-unit, uniform-price auction. As Hortacsu and Puller (2008) noticed, most of the trades occur on a bilateral basis as the spot market accommodates just 2 – 5% of the total electricity traded every day.

As in the Irish market, the marginal plants are often gas generators, but seasonality in Texas is much stronger than in Ireland; as a result, electricity prices often show huge spikes during summer. Finally, ERCOT is a zonal market, so the market is singular only when there are no congestions between different zones, as in PJM. Forward markets in ERCOT are characterized by bilateral contracts, with different setting times, as noted by Coulon et al. (2013).

Hortacsu and Puller (2008) investigate whether market power has been exerted in the Texan electricity market in recent years. In their work, they do not find strong evidence of strategic behaviour exerted by the biggest generators in the market. However, they found that small generation companies bid quite aggressively. Again, this result can be explained by considering the high market liquidity on forward markets, which prevents strategic behaviour and the presence of vertically integrated utilities[8].

3.1.2 MIBEL and BETTA

As mentioned previously, in the Iberian and the UK electricity markets the presence of forward markets are not sufficient to guarantee competition in the spot and retail markets. Mainly these results are due to lack of interconnection (MIBEL) or scarce transparency in the forward market joint to the presence of vertically integrated power companies (UK).

MIBEL arose from the integration of the Spanish and the Portuguese electricity markets, which took place in 2004. The structure of MIBEL is based on the existence of a derivatives market (Portuguese pole) managed by OMIP[9] and a spot market (Spanish pole) managed by OMEL[10]. The spot market is characterized by the high presence of renewables. In 2014 almost 21% of demand was met by wind, with the remainder met by gas, nuclear and coal generation. In 2012, the electricity traded on the spot market was around 50,000GWh. MIBEL includes a capacity payment which is paid to all generators

[7] See `www.ercot.com`

[8] Vertically integrated utilities in 2010 supplied only 1/4 of the total electricity demand in 2010 (for more information see here: `http://www.ercot.com`).

[9] Information on OMIP may be found here: `http://www.omip.pt/OMIP/Perfil/tabid/63/language/en-GB/Default.aspx`

[10] OMEL is part of the Spanish electricity operator, `http://www.omel.es/en/home/information-company`

on the basis of participation in the day-ahead market.

One interesting aspect of the Iberian market is that generators bid in the spot market subject to a minimum income clause: they offer to generate at a certain price only if they receive a minimum income over k periods. If not, they do not generate at all. This measure, combined with capacity payments, ensures generators will recover the capital costs associated with their investments[11].

MIBEL operates as a net pool, where generators can agree bilateral trades (both physical and financial) with buyers for the delivery of electricity, but must inform the system operator who takes these trades into account when scheduling. As a consequence, the derivative market deals with several products such as futures, forward or energy indexes whose underlying asset may either be real or virtual. As regards settlement type, futures contracts can be settled financially or physically, while forward contracts have a physical nature and swap contracts have a financial nature. The trades are made daily (from Monday to Friday) and the products have several deliveries: annual, quarterly, monthly and weekly. As reported by MIBEL Regulatory Council (2009), up to 2009 only the trading of baseload products was allowed, while peak hours were auctioned separately.

The Iberian market has two large players (ENDESA and EDP), and the participation in trading both on the spot and the forward market is limited by the lack of sufficient levels of interconnection. As highlighted by the theoretical contributions discussed in Section (3), in particular as shown by Marques et al. (2008), the presence of forward contracts is not enough to discourage implicit collusion between generators. Marques et al. (2008) used the Wolak (2003) methodology to measure the elasticity of the residual demand in the Iberian market and observe that collusive strategies may have been developed in the pool market from 2000 to 2006. Also Fabra and Toro (2005) suggests that Spanish producers alternated periods of collusion with periods of price wars before 2005. Finally, Ciarreta and Espinosa (2012) highlight the importance of regulation in the Spanish market in order to mitigate the market power problem. The authors discuss the performance of the Spanish market before 2006, finding that the price cap imposed by the regulator to control market power in the system was largely ineffective.

From 2007 several other regulatory measures were undertaken in order to promote competition. The two larger generators were required to hold a series of auctions offering

[11] More details on minimum income condition may be found here: `http://www.iit.upcomillas.es/batlle/Publications/2012%20Revisiting%20Residual%20Demand%20models%20R2%20v1.6%20_%20Vazquez%20et%20al.pdf`

virtual power plant (VPP) capacity to other generators, i.e. to sell hourly call options with a predetermined strike price. Both baseload and peakload contracts are available, with a duration of 3, 6 and 12 months. Moreover, the regulator promoted the proportion of energy traded through bilateral contracts by auctions.

Finally, the UK wholesale market (BETTA) is an energy only market, designed to encourage bilateral trading. A new capacity payment mechanism has been launched under which capacity is purchased in competitive auctions(Newbery and Grubb, 2014). A bilateral market of the type which exists in BETTA involves generators and buyers (suppliers or large customers) entering into contracts for the sale of electricity. As a consequence, generators can also buy when they don't generate enough power of their own.

On the spot market, the system operator maintains the balancing market, in order to ensure that supply and demand can be continuously matched in real time. As part of the balancing mechanism, the system operator purchases offers and bids to match supply and demand, as the system must run within the required operational standards. However, the price emerging from the balancing market is independent of the price set in the bilateral market, and cannot be considered an appropriate reference for the market performance (see Deane et al. (2014)). Furthermore, forward markets in BETTA are not really transparent and many of the generators in BETTA are vertically integrated with supply companies. The lack of transparency associated with the presence of vertically integrated firms permit generators to keep the balancing price below the long run marginal cost in order to deter new entry in the market. [12]

As mentioned above (see Liski and Montero (2006) and Green (1999)), collusive behaviour can emerge despite the presence of forward contracts when there are incentives for generators to buy forward emerge in order to preserve collusion. As Deane et al. (2014) show, if the wholesale market is not profitable, costs are recovered by the integrated utilities in the retail sector. This view is shared by Giulietti et al. (2010), who underline that after the market liberalization the UK retail prices did not decrease as much as expected. The authors track the cause of high retail prices in the opacity of the bilateral trades often made by different branches of the same vertically integrated utility.

Forward contracts are one of the main components of BETTA; however, given that

[12]Some concerns on the poor performance of the GB system has been pointed out by Helm and can be found here: `https://assets.digital.cabinet-office.gov.uk/media/54d8c096ed915d5141000009/Dieter_Helm.pdf`.Other consideration on vertical integration and lack of liquidity in the forward market in BETTA can be found here: `https://assets.digital.cabinet-office.gov.uk/media/54e378c7e5274a4511000012/Retail_Barriers_to_Entry_and_Expansion.pdf`

they take the form of bilateral contracts with confidential prices, this market is quite untransparent. Since Wolfram (1999) showed that integrated firms in the UK were exerting market power, leading to a price which was higher than their marginal costs but lower than the pure oligopoly price, several works analyzed the UK market performance. BETTA remains an example today of the failure of a forward market to enhance competition in the spot market and to facilitate entry.

Summarising, both the theoretical literature and the analysis of the US and European experiences indicate that forward markets help in reducing market power only if some other conditions on the market structure are fulfilled. First, competition in the forward market must be underpinned, either by the presence of an adequate number of players in the market (as in PJM or EEX) or by the efficient use of interconnectors (as NordPool market demonstrates). Second, high levels of transparency in the retail market are necessary conditions in order to guarantee competitive retail prices for consumers. The sufficient condition is represented by the consumers willing to switch provider enough to put the necessary pressure on suppliers in offering the best tariffs. Finally, as suggested by Helm (2015), the Regulation Authority should protect consumers linking the basic offered tariff to the wholesale price. The consequences of the violation of this condition are shown by the UK experience.

These two conditions are necessary for competition to emerge endogenously from the market. Indeed, when these conditions are not fulfilled by the market, as in the case of MIBEL, the regulatory bodies should correct the market inefficiencies, in order to control market power. These necessary conditions are not present in the Irish market, and so the regulator should address the different problems linked to the lack of competition in the spot markets.

4 Competition and forward trading in I-SEM

The current design of the Irish electricity market (SEM) does indeed address all these problems, as it efficiently regulates the presence of market power in the spot market. Unfortunately, the lack of liquid and transparent forward markets may inhibit the transfer of competitive prices to the final consumers, and more data should be provided in order to check the level of competition in the retail markets. Thus there is an ongoing argument for continuing to regulate participation in the forward market and to monitor the retail prices.

The necessity of strong regulation in the Irish market is justified also by the lack of interconnection between SEM and other countries. SEM is interconnected with BETTA by two interconnectors, with a total capacity approximately equal to 900MW[13], which is low compared to a system peak demand of roughly 6000MW[14]. At the moment the use of interconnection is far from efficient (as shown by McInerney and Bunn (2013)), and furthermore the level of interconnection itself is not sufficient to reach price convergence between the two countries (see Malaguzzi Valeri (2009)). Indeed, Great Britain itself is not heavily interconnected with mainland Europe at present, with the of imports and exports comprising a low proportion of total demand compared with other EU markets (Fitzgerald and Malaguzzi Valeri, 2014).

The European Target Model for electricity markets aims to make the use of interconnectors more efficient. This will be helpful in order to achieve an efficient dispatch, which is also important for accommodating the large amount of renewable generation envisaged for SEM. At the same time, it would be useful to check whether a better use of interconnection with BETTA will promote competition in the forward markets and enhance competition in the spot market.

The efficient use of interconnectors will be beneficial to promote competition in the I-SEM, even if some considerations on the magnitude of the final effect should be taken into account. First, it should be noted that some companies in the UK are also owners of electricity companies in the Irish market, and this may reduce the benefits in terms of competition which can be gained through interconnection. Second, the Irish market will be interconnected with the UK market, but not directly with Europe. Given the amount of interconnection between BETTA and the other EU markets it is unlikely that the interconnection will open the Irish market to other EU players. So, the potential benefits and costs associated with higher interconnection levels may deserve further analysis.

Regarding generator dispatch, the EUPHEMIA algorithm will be adopted as the platform through which generators will submit bids to the market. Thus the current three-part bids, which ensure the least-cost dispatch taking discontinuous costs such as start-up costs, will not feature in I-SEM. The use of EUPHEMIA could bring some undesirable consequences both in the spot and in the forward market. On the spot market, it will be crucial to keep the bids as transparent as at present, in order to guarantee that the new spot

[13] Interconnection capacity is limited to 750MW until at least 2016 due to a fault on the Moyle interconnector.

[14] The maximum system demand recorded to date is 6878MW.

market will deliver competitive and efficient prices. In particular, given the the small size of the Irish system, start costs are a higher proportion of total costs than in other countries, and increased variable renewable generation causes these discontinuous costs as a proportion of total costs to increase (Shortt et al., 2013). The extra risk generators must bear for including their start costs in their bids, while negligible in other countries, will be passed on to the Irish consumers through a risk premium element to spot market bids. In order to deliver the most efficient wholesale prices, it's crucial that these costs will be carefully monitored.

The adoption of the EUPHEMIA algorithm may also lead to an increase of forward premia. Under the SEM market design, forward contracts usually take the form of contracts for differences (CfDs), used by suppliers to hedge their future position against high electricity prices. Double CfDs usually are signed in order to hedge both producers and suppliers. As the bidding code of practice obliges generators to transfer the fuel costs in the spot price, generators do not currently bear much (if any) dispatching risk, as their profits are guaranteed under all circumstances by the constraints payment made by the system operator[15]. The adoption of the new bidding algorithm will transfer some risks to the generators in terms of dispatching, as it could reject block orders that should be accepted by the market[16]. Moreover, it is not clear how the technical constraints will be addressed by the new price algorithm. The risk bared by producers in the spot market may be transferred to consumers via the forward market risk premium. One way to deal with the dispatching risks associated to the use of the EUPHEMIA algorithm is to include specific payments in the I-SEM design. If these specific payments and constraint payments are in place, there is no reason to expect higher forward premia due to downside scheduling risk.

However, forward premia may be applied in any event due to the nature of the market. If liquid and, thus, transparent forward markets are not in place and bilateral contracts with hidden prices are the only way in which suppliers buy electricity forward, the retail market in I-SEM may face the same challenges of BETTA. Competitive retail prices are achieved by providing the right signals to suppliers. Either forward markets or the regulatory authority should keep making the price at which suppliers contract at the beginning of each trading period explicit. If margins are high enough, new suppliers will enter in

[15]The current uplift mechanism can give rise to situations where a generator is not dispatched at a price at which it could have profitably generated. However generators are insulated from downside risk.

[16]See some examples of bidding rejected here: http://www.allislandproject.org/GetAttachment.aspx?id=479e7964-71e6-4c1d-a0f3-7765a168602c.

the market, until the price has reach the competitive level. Forward markets are important not only to keep the spot price at the competitive level, but also to deliver the most competitive retail prices. At the same time, the literature mentioned above highlights the importance of active demand in order to incentive suppliers to compete. As done in SEM, the Regulation Authority should monitor the information provided by suppliers, encourage consumers to switch the electricity provider but also guarantee a basic tariff to all the consumers that do not switch provider. [17]

Finally, increasing wind generation may pose some challenges to the new Irish forward market[18]. In the I-SEM wind will be balance responsible, thus it is possible that wind farmers will be willing to participate in the forward market to hedge their positions. At present, there is not sufficient forward market liquidity to warrant trading more frequently than twice a month. This infrequent timing may not suit wind generators that need to revise their forecasts often because wind is subject to an high degree of uncertainty. Thus, the regulator may monitor whether wind farmers are able to access the forward market, in order to find possible solutions. [19]

The lack of competition both in the generation and in the retail side of the market, the low level of interconnection and the presence of unmitigated risks in the spot market may prevent the new I-SEM from providing the correct incentive to producers and suppliers in delivering an efficient price. One possible solution is to keep regulating the quantity the main market operator sell forward and carefully monitor the prices, in order to ensure some forward sales at a reasonable price. Moreover some measures to contain the risks associated with the new algorithm in the spot market should be considered in order to keep the risk premia close to zero and achieve competitive forward prices, which are a necessary (although insufficient) condition for competitive retail prices.

[17] There is the risk that energy consumers who switch between suppliers may benefit at the expense of those who do not. The extent to which this may feature in Ireland is unknown, as to our knowledge there has been no research performed in Ireland on the welfare effects of switchers versus non-switchers between energy suppliers. More studies are necessary to determine and quantify this phenomenon. However, evidence on consumers not switching or getting not the lowest tariffs is provided by Wilson and Price (2010) who used survey data from the UK electricity market and found that 20-32% of consumers who switched supplier in order to obtain cheaper electricity actually ended up paying more, while less than 20% switched to the firm offering the highest saving. On the default tariff, some proposals have been made by Helm (2015).

[18] Directive 2009/28/EC of the European Commission states that the 20% of consumption should come from renewables sources by 2020. In order to meet this target, almost the 40% of the electricity will be generated by renewables.

[19] See the document on forward markets and liquidity released the 10th of February 2015 and available here: `http://www.allislandproject.org/en/wholesale_overview.aspx?article=50e36f89-7232-40a0-a371-15cbcbe19c93`.

5 Capacity payment mechanisms

The requirement for a capacity payment mechanism, which compensates units for fixed costs not recovered through the energy market, is a hotly-debated topic among regulators, system operators and policy makers worldwide. In the case of electricity, the main arguments for capacity payments are the 'missing money' problem whereby a marginal generator will never recover enough energy revenue to compensate them for the fixed costs, the lack of a robust demand side, rendering it impossible to determine the value consumers place on the additional reliability afforded them from increased capacity, and a free-rider problem, whereby the shared electrical network renders it impossible to separate consumers who sign contracts for capacity from consumer who don't (Stoft, 2002). The presence of forward contracting may mitigate these concerns, as a generator which has committed to sell power on the forward market thus has an incentive to be available in order to deliver the power required. Forward contracts also allow consumers to provide a price signal for reliability. Indeed, Galetovic et al. (2013) argue that the added volatility of spot prices in an energy-only market acts as an incentive for generators to participate in the forward market in the first place. However, as discussed above, it is by no means certain that liquid forward markets will emerge under I-SEM. The lack of such forward markets is therefore a further argument in favour of specific capacity markets.

In the Irish market, the regulatory bodies favour separate capacity payment mechanisms in general and articulated this position in their decision on the high-level design of the I-SEM (CER and NIAUR, 2014). Thus our focus here is not on the question of whether capacity payments are justified at all, but rather on the appropriate capacity payment mechanism for the I-SEM. The particular characteristics of the Irish market inform the discussion which follows.

5.1 Current SEM capacity payment mechanism

Full details of the current capacity payment mechanism are available from the All Island Project website (CER and NIAUR, 2006). For our purposes, we focus on the method for determining the size of the total capacity payment pot and the division of the pot between eligible generators.

As outlined in the introduction, the current capacity payment mechanism takes the form of a capacity pot, which is calculated on the basis of the capital costs and required quantity of generation. The capital costs are based on the cost of the 'Best New Entrant'

(BNE) in a given year, i.e. the cost of unit with the lowest cost per MW installed capacity. The quantity of capacity required is based on the expected annual peak demand as forecast by the transmission system operators. The characteristics of the generation capacity on the system, such as forced outage rates and scheduled outage durations (eg. for maintenance) are then used to determine the required installed capacity to meet total demand within predetermined reliability standards. Thus a higher level of installed capacity on the system means the system in total is more reliable and therefore leads to a lower capacity pot. Interconnection is ignored, in that neither the ability of generation in Great Britain to meet the demand in SEM, nor the possibility of peak demand in SEM occurring when the interconnectors are exporting, is considered. In contrast, the capacity requirement for BETTA was determined under assumptions of full export at peak demand, which has arguably led to over-procurement of capacity under the new British capacity payment mechanism (Newbery and Grubb, 2014).

Once the capacity pot for the year has been determined, this pot is then divided each month between the generators that were available for generation. 70% of the division is decided *ex ante* and 30% *ex post* in order to provide certainty for generators while still incentivising the provision of capacity during those periods when it is most required. The *ex post* element was justified by noting that the objectives of the capacity payment mechanism "include the requirement to provide a short-term signal in the event of capacity shortages". The *ex post* element therefore has the benefit of mitigating market power in the energy market. By providing generators with a capacity payment for each period that they were available to generate, their incentive to withhold capacity in an effort to bid up prices in the energy market is reduced, as they would have to cause prices to rise sufficiently in order to offset the loss of capacity payment. Thus the current capacity payment pot cannot be inflated through the exercise of market power, and the mechanism itself provides a disincentive to the exercise of market power in the spot market.

A major strength of the current capacity payment mechanism is the fact that the size of the pot is determined independently of generators' actions. The operational and investment decisions of generators not only affect but essentially determine the *allocation* of the total capacity payment pot between different generators, but have no effect on the *magnitude* of the pot. This protects consumers from potential exploitation of market power by generation companies.

The main arguments against a pot type of payment mechanism are that exit signals are dampened. Under a system in which contracts are awarded for the total required amount of generation capacity, a new entrant which bids successfully for a capacity contract would remove this contract from an incumbent, providing an exit signal. However under a system where the pot is set and divided among all players, new entry simply dilutes the capacity payments to all players, including the new entrant, rather than eliminating payments to one player.

Due to concerns over excess capacity on the system, partly as a consequence of the lack of exit signals[20] CER and NIAUR (2014), the regulatory authorities have chosen to replace the current capacity payment mechanism which exists in the SEM at present. Designing a new mechanism is a nontrivial exercise, not least because there is a trade-off between choosing a mechanism which best suits the current market structure with a mechanism which is future-proofed and minimises the possibility of yet another redesign in the near future (the current market design is less than ten years old). In the case of the SEM, specific features which the new mechanism should account for are the small isolated nature of the system, the high levels of renewable generation anticipated in the next decade (Department of Communications and Natural Resources, 2010) and the high level of concentration within the market.

5.2 Capacity payment designs

Various capacity payment mechanisms exist in different electricity markets. These mechanisms are often catagorised as ‘price-based’ or ‘quantity-based’ mechanisms (ACER, 2013). Botterud and Doorman (2008) provides a good overview of the various mechanisms currently employed in regulatory regimes worldwide. According to their catagorisation, the current SEM CPM is considered a ‘capacity payment’, similar to that which existed in the old electricity pool of England and Wales. Alternative mechanisms include capacity requirements and markets. Under such systems, Load Serving Entities (LSEs) are required to hold contracts for a sufficient level of capacity to ensure forcast demand can be met with a given level of probability. Capacity markets are also established to enable LSEs to trade capacity contracts in order to meet their capacity obligations. These methods of capacity markets currently exist in several electricity markets in the USA, including PJM and New York ISO. Recent initiatives have included using a demand curve for capacity rather than a fixed capacity requirement as this can reduce the variability of capacity

[20] The high level of installed renewable generation in response to government targets, along with the economic downturn, have also contributed to the over-capacity.

prices and payments (Hobbs et al., 2007; Cramton and Stoft, 2005, 2006).

Another type of CPM is a reliability option, which essentially takes the form of a one-way contract for differences. This is the capacity payment mechanism which the regulators have chosen under the I-SEM. A target for capacity is set and an allocation of reliability options equal to the capacity target is auctioned at a pre-announced strike price[21]. When market prices (the reference price) rise above the strike price, generators which hold a reliability option are required to repay the difference between the strike price and the reference price to the TSO. The mechanism is outlined in detail in Vázquez et al. (2002). The regulators have announced that in the I-SEM those who hold reliability options will also be required to back up their capacity requirement with physical capacity.

5.3 Comments and concerns on plans for the I-SEM

While reliability options have much to recommend them in general, it is not immediately apparent that they are suitable for the Irish market. One concern is the role of renewable generation, particularly wind, in this mechanism. Another concern is the structural issues in the SEM, in particular the position of the dominant firm, the legacy monopolist.

5.3.1 The role of wind generators

The ability of wind generators to participate in a reliability option mechanism is obviously much lower than a conventional generator as wind output is variable, semi-dispatchable (i.e. can only be dispatched down) and relatively unpredictable. Thus the ability of wind to generate at the strike price when required is dependant on factors outside the wind generator's control, namely the weather. For this reason if wind operators are to participate in the reliability options framework they will bid a higher price in order to compensate them for this extra risk.

Under reliability options, the target for capacity is usually set at an estimate of peak demand plus a reserve margin. Although the regulatory authorities have not specified as of yet, we assume the method of calculating the required capacity target will be similar if not identical to the method used at present to determine the capacity requirement for the current pot mechanism. In order to ensure system reliability, there should be sufficient thermal generation to meet this target as there is no guarantee that the peak demand in any given year will coincide with positive wind output. If, as proposed above,

[21] It is also possible to include a demand curve rather than a fixed capacity target, similar to the curve which exists in capacity markets in the USA.

wind generators price scheduling risk in to their bids for reliability options, it should be expected that wind generators will win few if any contracts for provision. However this raises issues as wind generation is afforded priority dispatch according to EU regulations (European Commission, 2009). Therefore the system operators cannot schedule units which hold a reliability option ahead of wind generators who do not, no matter what the reference price. The situation could therefore arise that high energy prices are paid to all generators who are scheduled, including wind generators, but the difference between the reference price and strike price is only recouped from the thermal generators, leaving the consumer exposed to the high prices which are paid to wind generators.

It should be noted at this point that international experience is not informative on this question as other markets which have implemented reliability options (e.g. ISO-NE) do not face the legal obligation of priority dispatch of renewable generators that applies in SEM. In the European context, where priority dispatch does hold, reliability options have not been implemented in any market as of yet.

An obvious way around this is to set the strike price at or above the variable cost of the most expensive thermal unit which holds a reliability option. Indeed, the original Vázquez et al. (2002) proposal suggests the strike price be set at 25% above the marginal cost of the most expensive generator that holds a reliability option. Thus if wind is generating at all, the merit order effect will displace the high cost units, ensuring the reference price remains below the strike price and the reliability option will never be exercised. However, one of the reasons put forward by the regulatory authorities for reliability options in the first place is the removal of the incentive for generators to increase the spot price beyond the reference price. This may prove cold comfort if the reference price is set at a high level.

One final issue to consider regarding the interaction of reliability options with wind is that at present, any revenues received from wind generators in the SEM through the capacity payment mechanism reduce the subsidy to which they are entitled (by means of the REFiT mechanism). Therefore in order to represent a net benefit for the final consumer, the total cost of the previous capacity payment mechanism must be compared with the total cost of the reliability options scheme in addition to any increase to the REFiT payment arising from the loss of capacity payments to wind generators. Indeed, the fact that renewable generators' capacity payments are netted off from their REFiT payments will act as a floor to any price wind generators are willing to bid in order to hold a reliability option.

5.3.2 Market power concerns

In addition to the concerns surrounding wind generation, the high level of concentration in the Irish market is a cause for concern in choosing to move to reliability options. The SEM has high supplier concentration, with one generation company owning 34% of the generation capacity and providing 44% of total generation in 2011 (see Walsh and Malaguzzi Valeri (2014) for more details). Since 2011 renewable generation and interconnection have increased, but there is still significant concentration in thermal generation capacity. While reliability options, once they are auctioned, act as a disincentive to exercise market power in the energy market, there are concerns around the potential exercise of market power in the auctioning of reliability options in the first instance. If the full quota of reliability options cannot be met without the participation of one particular firm, that firm has the incentive and the ability to bid a high price for holding these auctions, which will lead to the auction clearing at a high price. The regulatory authorities have committed to including appropriate market power mitigation measures in the auction, but the form of these measures has yet to be decided upon.

There is little discussion in the literature on market power or supplier concentration with reliability options[22]. In general the literature examining quantity-based CPMs in general, and reliability options in particular, specifically does not consider market power (see for example Hobbs et al. (2007); Vázquez et al. (2002)). Cramton and Stoft (2008) state that reliability options can address market power "provided that the rest of the market design is reasonable and the market does not have structural problems such as high supplier concentration", which does not hold in the SEM.

Khalfallah (2011) uses dynamic programming to examine various capacity payment mechanisms including reliability options, which are considered a market-based mechanism, and capacity payments, which are considered a non-market-based mechanism. It is found that market-based mechanisms bring about optimal capacity adequacy when the different catagories of generators (baseload, off-peak and peak) compete *à la* Cournot. However, a sensitivity analysis finds that oligopolistic and monopolistic situations lead to higher installed capacities and increased payments for end-users under market-based mechanisms

[22] Contributions in the non-peer reviewed literature describe market power mitigation measures which have been undertaken in other jurisdictions, e.g. `http://www.ferc.gov/CalendarFiles/20130826142258-Staff%20Paper.pdf`

only. This paper also shows that mixed-technology firms, such as those that exist in the SEM at present, corresponds to their oligopolistic situation..

Various market power mitigation measures are proposed in the literature. In outlining their reliability options design, Cramton and Stoft (2008) include a measure whereby all generators, whether they hold a reliability option or not, receive revenues from the spot market capped at the strike price. "In other words, such generators, in effect, provide the hedge without compensation". The regulatory authorities have not indicated that they will pursue this aspect of the mechanism design but since it amounts to no more than a (presumably very low) price cap it would be difficult to see how it could be implemented in the SEM.

Competition from new entrants could arguably mitigate the exercise of market power by the incumbent, and in order to enhance this effect new entrants can be awarded reliability contracts on a multi-year basis while incumbents are expected to bid for a new contract each year[23]. Contracts of up to twenty years for new entrants are recommended in the literature (Cramton and Ockenfels, 2012). However this is a high-risk strategy as in a market as concentrated as the SEM it may be that this eventuality would have to be tested before it proved a deterrent to high bids by incumbents. This locks the consumer into paying a high price for capacity to a new entrant for up to twenty years, rather than a slightly higher price to an incumbent for one year, and so could prove a very costly mechanism through which market power is mitigated[24]. While it may be tempting to respond to this possibility by reducing the number of years contracts are awarded to new entrants, they must remain sufficiently high to ensure new entrants pose a genuine threat to the exploitation of market power by the incumbents. Finally the high level of over-capacity could mitigate market power, but as a significant amount of this over-capacity is from wind generation, which as argued above is unlikely to be able to compete in the reliability options auction, it is over-capacity in thermal generation which is required to mitigate market power.

It is therefore the view of the authors that the only realistic way to ensure that market power in a reliability option auction is mitigated in the SEM is for the regulator to perform a pivotal supplier test each year, and to set the price that each unit owned by each pivotal

[23]Indeed, Cramton and Stoft (2008) recommend that incumbents be constrained to bid zero - which in the case of overcapacity, as exists in the SEM at present, would lead to a market-clearing price of zero.

[24]The SEM has past experience of inappropriate long-term contracts. Consumers in the Republic of Ireland have been locked into honouring contracts made with two CCGTs which were considered necessary for security of supply reasons in 2004. These concerns proved unfounded and this policy decision has cost consumers up to a hundred million euro a year ever since (CER, 2014).

supplier can bid. This measure should be undertaken in addition to any measures that are required to mitigate local market power. This will lead to at least 35% and potentially up to 50% of thermal generation facing regulated bids[25]. Such a regulatory regime would also lead to a risk of litigation. While there may be competition between generators in the competitive fringe, the supply curve for generation capacity will have been to a large extent determined by the regulatory bodies. Given that the same regulators will determine the demand for capacity (either by an absolute figure or by using a demand curve), the regulatory bodies will have a far larger role to play in setting both the quantity and price of capacity than any of the market players themselves. As reliability options will certainly be implemented in the I-SEM, it is likely that applying regulation to both prices and quantities is nonetheless in the best interests of consumers.

It may be that these issues surrounding reliability options can all be resolved satisfactorily prior to the launch of the I-SEM. In a best case scenario, the new capacity payment mechanism will result in a lower net cost to the consumer while providing an exit signal which heretofore was lacking in the SEM. However given the fact that two of the most prominent features of the SEM, namely high supplier concentration and high levels of variable renewable generation, do not exist in any other market which currently operates or is even considering reliability options, the regulatory authorities are at the very least exposing both consumers and producers to considerable uncertainty.

6 Conclusion

This paper examined the evolution of the Single Electricity Market (SEM) of the Island of Ireland in order to comply with the European Target Model for Electricity. In particular, this paper considered the challenges raised by the high supplier concentration which exists in the SEM. The theoretical conditions under which forward markets can promote competition were outlined and competition in other markets in Europe and the USA was examined. We found that the necessary conditions for forward markets to bring about a competitive outcome do not hold in the Irish SEM, and international experience has shown that the presence of forward trading alone is not sufficient to ensure the competitive outcome neither in the spot or in the retail markets. The adoption of the EUPHEMIA algorithm for scheduling the dispatch of generators in the SEM is likely to

[25] The exact quantity will depend on the methodology for determining local market power and whether and how wind generators participate in the auction. As mentioned above, as of 2011 one firm owned 34% of thermal capacity

add a new scheduling risk to generators, which may be controlled by specific payments. Furthermore, the lack of competition in the deregulated retail market allows vertically integrated firms to potentially exploit market power. The new capacity payment mechanism is also vulnerable to the exploitation of market power in the auction of the options.

To date, the SEM has mitigated the effects of these issues by implementing a Bidding Code of Practice whereby bids must reflect the marginal cost of generators. A similar system of clear and specific rules should be put in place in the new market. In order to ensure a competitive outcome for consumers, regulation will have to continue through directed forward contracts, as currently exist. Regulation should also extend to the price and quantity which the dominant firm bids for holding new reliability options. Furthermore there is a strong argument for monitoring the bids which are submitted to the day ahead and intraday markets and also suppliers' retail prices. While there may be some competition among the competitive fringe, this is unlikely to have much of an effect on market outcomes. Thus the authors believe the best way to implement the regulatory authorities' preferred market structure is by regulating several components of prices.

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