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The potential for segmentation of the retail market for electricity in Ireland

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HIGHLIGHTS

- We calculate the gross margin associated with supplying electricity customers.
- Gross margin is highly linked to the level of electricity demand.
- Gross margin is highest for the richest households in our sample.
- Energy conservation measures have a negative impact on gross margin.
- Age, occupation and accommodation type are significant predictors of gross margin.

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ABSTRACT

We estimate the gross margin that is earned from the supply of electricity to households in Ireland. Using half hourly electricity demand data, the system marginal price (also called the wholesale price) and the retail price of electricity, we analyse how the gross margin varies across customers with different characteristics. The wholesale price varies throughout the day, thus, the time at which electricity is used affects the gross margin. The main factor in determining gross margin, however, is the level of demand.

The highest gross margins are earned from supplying customers that have the following characteristics: being aged between 46 and 55, having a household income of at least €75,000 per annum, being self-employed, having a third-level education, having a professional or managerial occupation, living in a household with seven or more people, living in a detached house, having at least five bedrooms or being a mortgage holder.

An OLS regression shows that gross margin is partly explained by the energy conservation measures which are present in a household; the number of household members; the number of bedrooms; age; occupation; and accommodation-type.

1. Introduction

Smart meters hold a lot of promise. Smart meters will enable demand side management for small electricity users through real time pricing and smart appliances. Smart meters will help with the integration into the electric power system of micro-generation and micro-storage, and of hybrid and all-electric vehicles. Smart meters will also yield unprecedented amounts of information about consumer behaviour. At present, the typical power company knows its clients' monthly electricity use. In the future, power companies could know electricity use per minute—if so desired.

In other markets, similar revolutions in data availability have led to market segmentation. This can be benign, as in the case of targeted promotions (e.g., supermarkets) or pricing (e.g., airlines) but in other cases regulators had to step in to prevent exclusion (e.g., health insurance). Because the wholesale price of electricity varies sharply over the diurnal cycle, high-frequency use data may turn out to be very valuable to power companies. Of course it is important that electricity providers identify the customers that generate the largest gross margins. In this way, suppliers can more efficiently target, satisfy and retain their most profitable customers. This is easily done through marketing targeted at particular groups or particular locations. At the same time, competition is far

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from perfect in the electricity market and regulation is tight. Older and lower educated people are less likely to switch electricity provider (European Commission, 2009), so that less profitable clients may stay with the incumbent while more profitable ones join the new entrant.[1] The new entrant would have a strong incentive to encourage that, say through selective advertising. However, electricity is seen as an essential good and there would be political pressure that the "vulnerable" (e.g., elderly, lower educated) would not pay "excessive" prices. In the current system, there is an implicit subsidy from the more profitable customers to the less profitable ones. In the future, this may become an explicit subsidy, or the regulator may take other action. Rural electricity customers are more expensive to connect, and while these customers do pay a higher fixed fee per month, utilities are not allowed to refuse to provide service to them. Similar restrictions may (have to) be imposed on otherwise unprofitable clients. Thus it is important to analyse whether the availability of time-of-use data, as provided by smart meters, may facilitate adverse selection in the retail market for electricity (Joskow and Tirole, 2006).

In this paper, we use data from the smart meter trial in Ireland to test whether profitability varies systematically between different types of households. Specifically, we estimate the gross margin earned from the supply of electricity. Using half hourly electricity demand data, the half-hourly system marginal price (SMP), some of the additional costs of supplying electricity, and the retail price of electricity, we analyse how the gross margin varies across customers, using their characteristics as revealed in a detailed user survey. We also run an OLS regression to establish which household characteristics are statistically significant in explaining gross margin. To the best of our knowledge, we are the first to do this for any country.

In Ireland electricity is bought and sold through the All-Island electricity market which commenced operations in November 2007. The Single Electricity Market (SEM) operates on the basis of a mandatory pool market. All electricity generated on or imported onto the island of Ireland must be sold to this pool. In addition, all wholesale electricity for consumption on or export from the island of Ireland must be purchased from the pool market. Suppliers purchasing energy from the pool pay the generators the SMP, capacity costs,[2] and system charges. The SMP is a single island-wide price for each half hour trading period. It is determined via market scheduling and pricing software for each half hour trading period.

There is a large literature in the marketing sphere that examines how businesses should identify and subsequently target their most profitable customers (see for example Kumar et al., 2010; Lee and Park, 2005) This is important in the Irish electricity market where increased competition in recent years has encouraged many customers to switch providers. In such a market, businesses should realise that retaining customers is significantly less expensive than attracting new ones (Jeffrey and Franco, 1996; Reichheld and Earl Sasser, 1990). By identifying the gross margin across different groups of customers, electricity suppliers can more efficiently target, satisfy and retain their most profitable customers, thus increasing profits. The methods employed in this paper can be easily adopted for studies of gross margin in other countries where high-frequency household electricity demand data are available.

The paper proceeds as follows: The data and methods used are described in the next section. The results are presented in Section 3. Section 4 concludes.

2. Data and methods

We calculate the gross margin for electricity supplied to 4232 households in every half hour period from the 14th of July to the 31st of December 2009. While we do not account for all the costs that electricity supply companies incur in bringing electricity to consumers, in our calculation we do account for some of the more significant costs; with a particular emphasis on those that vary by time of day. Furthermore, we assume the price that the electricity supply companies pay is the wholesale price, as determined by the SMP (system marginal price), and thus do not take account of instruments, such as contracts for differences, used to hedge against price fluctuations. The costs which we include in the calculation of gross margin are as follows:

The SMP (system marginal price), which is the wholesale price of electricity. The Single Electricity Market Operator (SEMO) provides data on SMPs for every half hour trading period of 2009 (SEMO, 2010).[3] The average SMP in 2009 was 3.5 cent/kW h.

Capacity charges: the capacity payments mechanism is a source of revenue for generators that supply generation capacity to the market. Capacity payments to generators are recouped from supply companies that pay capacity charges, which vary by half hour.[4] The average capacity charge in our data was €0.008/kW h.

Transmission and Distribution Use of Service Charges (TUoS and DUoS): TUoS charges consist of a network transfer charge (€0.002/kW h), a system services charge (€0.002/kW h), and a demand-side management charge (€0.0002/kW h); which apply in all half-hour periods. There is an additional component to the TUoS charge that applies only during day-time hours; that is the network capacity charge (€0.004/kW h). The DUoS charge is fixed during all hours of the day and was set at €0.030/kW h for the period up to end-September 2009, when it increased to €0.036c/kW h.[5]

Imperfection charges: these do not vary by half hour and were set at €0.0033/kW h up to end-September 2009, when they decreased to €0.0028/kW h.

Loss adjustment factor (LAF): we take account of the fact that not all electricity bought by the electricity supply company is brought to the consumer due to losses along the network. Losses vary by time of day and are higher when the network is more congested. We follow the CER methodology (CER, 2011a) and apply the following loss adjustment factors: Peak = 1.12, Day = 1.11, Night = 1.09.

Thus, the gross margin of electricity supply to a particular customer at a particular day equals:

$$G_i \sum_{h=1}^{48} (P - \mathrm{LAF}_h \times (W_h + \mathrm{DUoS} + \mathrm{TUoS}_h + CapCharge_h + ImperCharge)) \times D_{i,h}$$

where P is the retail price (in cent per kilowatt hour (kW h)), which is constant over time in Ireland; LAF_h is the loss adjustment factor, which has a time-of-day component; W_h is the wholesale price or SMP (in cent per kW h), which varies per half hour h; DUoS, as discussed above, does not vary by time of day, while TUoS_h has a time of day component; $CapCharge_h$ is the capacity charge, which varies by half-hour; *ImperCharge* is the imperfection charge which does not vary by time of day; $D_{i,h}$ is the demand for electricity (in kW h) of customer i at time h; and finally G_i is the gross margin (in € cents per day) of customer i. We find the total gross margin earned for each of these 4232 customers in the

[1] Indeed Giulietti et al. (2005) found that households in the UK that had prepayment meters installed and OAP-households were significantly less likely to be aware of the possibility of switching gas supplier.

[2] Capacity costs are payments to generators for making capacity available to the market, and vary by half-hour.

[3] Due to the absence of demand data from the Smart Metering trial prior to 14th July 2009, only SMP data after this date were needed for our analysis.

[4] For further details of the capacity payments mechanism see CER (2011b). Data on capacity payments are available from SEM-O, www.sem-o.com.

[5] Further information on TUoS charges are available from Eirgrid (2008), and further information on DUoS charges are available from ESB Networks (2009).