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The Potential for Segmentation of the Retail Market for Electricity in Ireland

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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 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 7 or more people, living in a detached house, having at least 5 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, income, age, occupation and accommodation type.

Key words: Electricity demand, market segmentation, gross margin, Ireland.
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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. Joskow and Tirole (2006) outline how competitive screening and adverse selection by electricity suppliers can arise in a situation where electricity consumers have real time meters installed and non-uniform pricing is prohibited. The authors note similarities with issues arising in the insurance markets as discussed by Rothschild and Stiglitz (1976).

In this paper, we use data from the smart meter trial in Ireland to test whether profitability varies systematically between different types of households. Specificially, we estimate the gross margin earned from the supply of electricity. Using half hourly electricity demand data, the half hourly system marginal price (SMP) 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[1], 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.

[1] Capacity costs are payments to generators for making capacity available to the market.

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, Petersen and Leone, 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 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 4,232 households in every half hour period from the 14th of July to the 31st of December 2009. The gross margin of electricity supply to a particular customer at a particular day equals

$$G_i = \sum_{h=1}^{48} (P - W_h) D_{i,h}$$

where P is the retail price (in cent per kilowatt hour (kWh)), which is constant over time in Ireland; W_h is the wholesale price or SMP (in cent per kWh), which varies per half hour h; $D_{i,h}$ is the demand for electricity (in kWh) of customer i at time h; and G_i is the gross margin (in cents per day) of customer i. We find the total gross margin earned for each of these 4,232 customers in the second half of 2009 and we then compare the gross margin of households with different characteristics. By dividing gross margin by total demand over the period we can analyse the average margin earned for different types of households.

The Single Electricity Market Operator (SEMO) provides data on SMPs for every half hour trading period of 2009 (SEMO, 2010)[2]. The average SMP in 2009 was 3.5 cent/kWh. The retail price of electricity was 16.4 cent/kWh between January and April 2009. In May 2009 it decreased to 14.6 cent/kWh before falling to 14.1 cent/kWh in October 2009 (ESB Customer Supply, 2010). All households face the same retail prices. We use the standard 24 hour unit cost so that the retail price does not vary by time of day. We use data on half hourly household electricity demand in the second half of 2009 that was collected for the purpose of Smart Metering Customer Behaviour Trials (CER, 2011). The data provides demand data for the second half of 2009 (the benchmark period for the smart metering trials) and all of

[2] 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

2010 (the test period). The benchmark period ran from the 1st of July to the 31st of December 2009; however data from the first two weeks of July were subsequently omitted from the final dataset due to incomplete data collection in this period (CER, 2011). We chose to analyse electricity use in 2009 because during the test period participants were put on various time-of-use tariffs and other demand side management stimuli were also used. Average electricity demand in our sample was 2115 kWh. More detailed descriptive statistics can be found in Table 1.

[Table 1 about here]

The main factor driving gross margin is customer demand. Any changes in demand will result in changes in gross margin of the same proportion, ceteris paribus. Average electricity demand by time of day can be seen in Figure 1. The cost of supplying electricity varies with changes in aggregate demand in the residential sector. SMPs are highest between 18.30 and 19.00 on both midweek and weekend days. An increase in the SMP has a negative effect on gross margin but because such an increase is associated with a period of higher demand in most households, the net effect on gross margin is positive. The average SMP by time of day in 2009 is displayed in Figure 2.

Using the Smart Metering dataset we can analyse how the total gross margins and average margins vary across customers with different characteristics. The dataset provides information on household income and a range of socio-economic and household characteristics of respondents. The characteristics we include in this analysis are the respondents' employment status, social status, age and gender. We also consider the education level of the household's chief economic supporter (CES), the number of people in the household, the household's income level, the type of accommodation, the number of bedrooms and type of tenure. The number of respondents in each category can be seen in Table 2.

Having examined how gross margin varies across households with different characteristics, we run an OLS regression to establish which factors are most important in determining the gross margin. The model is specified as follows:

$$y_i = x'_i\beta + \epsilon_i$$

where y_i is the gross margin earned from the supply of electricity to household *i*. x_i is a vector of characteristics of household *i* and β is a vector of parameters. ϵ_i specifies the error term. The explanatory variables comprise a range of respondent and household characteristics which we think might affect the gross margin. The respondent characteristics include age, gender, social class and employment status. We also include the education level of the CES. Many of these socio- economic characteristics were found to be statistically significant in studies of household energy demand (Leahy and Lyons, 2010, Druckman and Jackson, 2008 and O'Doherty et al., 2008).

The household characteristics include the type of accommodation because different accommodation types have very different patterns of electricity demand (Leahy and Lyons, 2010, O'Doherty et al., 2008). We control for the number of bedrooms and the number of household members because these are positively associated with electricity demand (Leahy and Lyons, 2010). We also control for the number of household members that are at home during the day. As the SMP varies throughout the day, we expect that households that use electricity at the most expensive times will have lower gross margins. Another explanatory variable is the number of electrical appliances present in the accommodation. We also include the type of cooker present in the household. The year the accommodation was built proved significant in explaining household energy use and electricity demand in Ireland (Leahy and Lyons, 2010), thus we feel it may also play a role in explaining gross margin. The annual income earned by the household is also included as a control variable. Electricity demand increases with income so we expect income to be statistically significant in this model.

The dataset provides information on a number of energy saving features present in the household which we include as dummy variables in our model. We expect that the gross margin earned from the supply of electricity to households that are concerned with energy conservation will be lower than that of other households. The variables we include are attic insulation, external wall insulation, lagging jacket and concern for the environment.

3. Results

3.1. Descriptive statistics

Table 2 shows the total gross margin earned across households with different characteristics in 2009. Table 2 also shows the average margin i.e. gross margin divided by total electricity demand over the period.

[Table 2 about here]

During the period analysed, the average gross margin is highest for respondents in the 46-55 year old age group. A gross margin of €234 on average was earned from supplying each customer in this category in the second half of 2009. On the other hand, customers aged over 65 generated a margin of only €180 each over the same period. The average half hourly gross margin for the most elderly customers in our sample was 2.2 cent. In general, the relationship between gross margin and age is inverse-U-shaped. Gross margin increases with age until respondents reach the 46-55 year old category. Thereafter, gross margin decreases as respondents get older. This is consistent with the finding that electricity demand in Ireland decreases with age (Leahy and Lyons, 2010).

Because gross margin is so closely linked to demand, it is not surprising that gross margin is highest for the richest households in our sample. The highest gross margin is earned from supplying households that earn over €75,000 per annum. A margin of €247 can be earned from supplying each of these customers over the period analysed. This is €88 more than the margin earned from supplying the poorest households in our sample. We cannot say, however, that gross margin always increases with increases in income because those in the €50,000 - €75,000 category generate lower gross margins than respondents in the €30,000 - €50,000 category.

Considering employment status, the self employed, especially those with employees, generate the highest gross margin. This could be because these customers work from home and thus demand more electricity than their counterparts who work outside the home. The self-employed may also be using electricity at times when the cost of supplying electricity is relatively low, thus boosting the gross margin. Retired customers generate the smallest margin. In one sense, this is surprising because retired people are more likely to be at home during the day, when SMPs are relatively high, compared to their younger counterparts who are out working. However, given that gross margin is smallest for customers aged over 65, this result is to be expected. With regard to electricity demand, Leahy and Lyons (2010) found that households whose CES is over 65 use significantly less electricity than households whose CES is younger. Leahy and Lyons (2010) also found that households in which the CES is retired use less electricity compared to households whose CES is in any other employment category.

With regard to education levels, households whose CES is educated to third level generate higher gross margins than households whose CES has lower educational qualifications. Leahy and Lyons (2010) found that as education increases beyond second level, electricity demand increases but increases in third level qualifications result in decreases in electricity demand. This may be because the very well educated are more aware of the benefits of energy conservation. The Smart Metering Data does not specify different levels of post secondary education so we cannot tell if this inverse-U-shaped relationship exists for gross margin. The Smart Metering Data shows that education and income are positively correlated (0.37) and that the better educated and high income customers have a higher number of electrical appliances in their homes than their less well educated and poorer counterparts[3]. This helps explain the higher amounts of electricity demanded by these customers. Customers whose CES completed only primary education, generate the lowest gross margins. It is likely that these customers are also elderly ones because since 1972 it has been illegal to leave school before the age of 15 (See the *School Attendance Act 1926* S.I. No. 105/1972).[4] As stated previously, electricity demand decreases with age.

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3 Households whose CES is educated to primary level have on average 22.8 appliances. For households whose CES is educated to third level the figure is 25.8. The poorest households have 22 appliances on average whereas the richest have 26.8.

4 The *Education and Welfare Act 2000* states that it is illegal to leave school before reaching the age of 16 or before completing 3 years of post primary education.

The gross margin also varies slightly by the gender of respondents. During the period analysed the households of the male respondents generate €9 extra for electricity suppliers than their female counterparts; however, the standard deviation around the average is larger for males than it is for females. Customers in different social class categories also generate different gross margins. Customers who are employed in higher managerial, administrative or professional positions generate a margin of €243 whereas the figure is only €189 per year for customers who are either semi-skilled, unskilled, pensioners or unemployed. Those with a social status of higher managerial, administrative or professional are also the highest earners of all social status categories, so, this result is not surprising.

As expected, the gross margin increases as the number of people living in a household increases. The smallest margins are made on one person households, generating just 2.1c per half hour. Two person households are more prevalent than any other household size but they generate a margin of just 2.3c per half hour. Ten person households generate the highest gross margin but there is just one such household in our sample. Generally, households with seven or more people generate the highest margins.

Gross margins differ greatly across different types of accommodation. Customers living in apartments generate lower gross margins per half hour, and over the period of the analysis, compared to customers with any other characteristic considered in this study. Leahy and Lyons (2010) found that apartment dwellers demand lower amounts of electricity than those living in houses. This is probably because apartments are smaller and thus, easier to heat and they contain fewer electrical appliances due to space restrictions[5]. The biggest gross margins, in terms of accommodation types, can be earned on detached houses. Detached houses were also found to demand the most electricity by Leahy and Lyons (2010).

Gross margin also differs with tenure. Electricity suppliers earn a higher margin from the supply of electricity to those renting from local authorities than they do from those renting privately. The difference is only about 0.25 cent per half hour or €21 over the period, however. Customers who are mortgage holders generate the highest margin in this category.

As the number of bedrooms increases so too does the half hour gross margin earned by the electricity supplier. This is probably because homes with a large number of bedrooms probably have a larger total floor space. Thus, they may require more electricity for heating and lighting purposes and they may have more space for a large number of electrical appliances.

While gross margins do vary across households with different characteristics, results show that the average margin is stable. The average margin is approximately 10 cent/kWh for each category of households considered in this analysis. This indicates that the time at which electricity is used does not lead to differences in the average margin earned from supplying different households. It is clear that almost all of the variation in gross margin is explained by changes in the level of demand. Figures 3A, 3B and 3C show how the pattern of electricity

[5] Those living in apartments own 7 appliances whereas the average for the rest of the sample is 10.

demand varies with the age category of the respondent, the income level of the household and the employment status of the respondent. Although the level of demand is seen to vary across households, to our surprise, the pattern of demand is very similar. For this reason, the average margin is almost the same for all households.

3.2. Regression results

The results in Table 2 are univariate tabulations. This may be misleading: Income, age, and education are correlated. We therefore show the results of an OLS regression explaining gross margin in Table 3. We do not include household electricity demand as an explanatory variable because demand is used to compute the dependent variable. The variables that we do include in the model help explain approximately 43% of the variation in gross margin. Due to the large number of explanatory variables in the model, only the statistically significant results are discussed.

[Table 3 about here]

Results show that being aged between 26 and 35 is negatively associated with the gross margin. This is probably to do with different demand patterns exhibited by people of different age groups. Relatively younger respondents may not be at home as often or they may allocate time towards activities that do not require as much electricity as those activities pursued by their older counterparts. Interestingly, the coefficient for respondents aged over 65 is positive and significant. This contradicts the result displayed in Table 2 where we saw that the oldest respondents generate relatively low gross margins.[6] This may be because elderly people use little electricity in absolute terms but a lot relative to their income and household size.

Consistent with the result in Table 2 is the fact that the self-employed generate larger gross margins than their counterparts who are employees. As stated earlier, this may be due to increased electricity demand that may occur if one works from home, especially at times during the day when the SMP is relatively low. Only two of the social status variables are significant in the model: Being in the "Managerial, Administrative, Professional" category is positively associated with gross margin, which is consistent with the result in Table 2. Being a farmer is negatively associated with gross margin. This may be because farmers tend to spend more time outdoors and demand less electricity than those in other social classes. Or, it may be that rural households use power showers and electric cookers at peak hours.

[6] The regression results refer only to those respondents who provided income data and not to the full sample. 324 respondents who are over 65 provided income data. They must also be high users of electricity as they generate relatively high gross margins of €187 on average. There are 953 respondents aged over 65 in the full sample and their gross margin is slightly lower at €180 on average.

Only one category of annual household income is significant in the model.[7] Having a household income level of between €30,000 and €50,000 is positively associated with the gross margin of the household. The bottom and top income categories are not significant in the model. It may be that households in the middle income category are not as concerned about electricity bills as the poorest households in our sample but it may also be that the middle income respondents spent more time at home, thus demanding more electricity, than the richest respondents in our sample.

As expected, living in an apartment is negatively associated with gross margin. This is probably because apartments contain fewer rooms than other types of accommodation and, as a result, electricity demand is lower. Conversely, living in a detached home is positively associated with gross margin. Results also show that being a mortgage holder is positively associated with gross margin. Table 2 showed that the gross margin earned from supplying mortgage holders is higher than that earned from supplying respondents with different types of tenure.

Living in accommodation with only one bedroom is significantly and positively associated with gross margin. This result is surprising for two reasons. First, it contradicts the results displayed in Table 2 which indicate that living in accommodation with one bedroom is negatively correlated with gross margin. Upon closer examination we see that only 17 respondents who live in one bed-roomed accommodation provided income data and their gross margin is €139 on average. There are 46 respondents in total who live in one bed-roomed accommodation. The gross margin for all of the respondents in this category is lower at €128 on average. Second, this result is surprising because one bed-roomed accommodation is likely to have a smaller floor space than accommodation comprising of more bedrooms. Thus, one would expect it to have a lower electricity requirement. It must be that respondents living in one bed-roomed accommodation use electricity for heating and cooking as opposed to other fuels such as natural gas which may be used in larger homes. The coefficients for accommodation with 4 bedrooms and at least 5 bedrooms are positive and significant. The higher space heating and lighting requirements associated with having more bedrooms may explain this result.

Unsurprisingly, gross margin increases as the number of people living in the household increases. The number of electrical appliances present also proved statistically significant in explaining gross margin. The coefficient is positive indicating that as the number of appliances increases, so too does the gross margin.

Some of the energy conservation variables proved significant in the model. Having a lagging jacket, attic insulation or external wall insulation are all negatively associated with gross margin. This may be because those households that have invested in these measures probably have lower electricity demand than households that are not concerned with energy conservation. This is an important result as it indicates that energy-saving measures

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[7] The Smart Metering dataset specifies these income categories so it is not possible to include income as a continuous variable.

are clearly not in electricity supply companies' interests. This issue is discussed in Vine et al. (2003); the authors note that in competitive electricity markets it is in the interests of neither the wholesale nor the retail electricity supplier to encourage end-user energy conservation. In the case of the electricity suppliers, in order to maximise profits their objective will be to "maximize kWh sales" (Vine et al., 2009).

Having a gas cooker is negatively associated with gross margin; this is as expected as the presence of a gas cooker is likely to lead to lower electricity consumption. Other types of cooker were insignificant which is unsurprising as very few people in the dataset had a cooker which was neither electric nor gas[8]. The education level of the CES and the year the accommodation was built were not important in explaining gross margin.

4. Discussion and conclusion

In this paper we estimate the gross margin that is earned from the supply of electricity to 4,232 households in Ireland. Gross margin varies throughout the day with changes in customer demand and changes in the SMP. In a period of high demand gross margin increases even though the supply of electricity is more expensive at these times as indicated by higher SMPs.

We compare the degree to which gross margin varies across customers with different characteristics. We find that 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 7 or more people, living in a detached house, having at least 5 bedrooms or being a mortgage holder.

The average margin is 10 cent/kWh for each group of households considered in this analysis. Upon further investigation we find that the pattern of electricity used does not differ greatly between households with different characteristics. Almost all of the variation in gross margin is explained by the level of demand rather than the time at which electricity is used.

We run an OLS regression in order to establish which characteristics are important in explaining gross margin at the household level. Results show 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, and the age, social status and occupation of household members.

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.

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[8] Of the 1,946 people who provided income data only 47 had a oil fired cooker and only 33 had a solid fuel cooker

At the same time, competition is far 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. 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. At the moment, utilities are not allowed to charge higher prices, or refuse, rural clients, even though they can be expensive to connect. Similar restrictions may (have to) be imposed on otherwise unprofitable clients.

In sum, smart meters will not just allow demand side management and integration of active clients. Smart meters will also allow market segmentation, and may require regulation to prevent adverse selection.

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Table 1. Descriptive Statistics

	Mean	Std. Dev	Min	Max
SMP per half hour	0.046	0.054	0.017	0.562
Electricity demand per half hour	0.522	0.737	0.000	8.318
Total electricity demand	2114.769	1048.827	93.714	10623.630
Gross margin per half hour	0.026	0.013	0.001	0.130
Gross margin per household	211.920	105.137	9.242	1070.997

Table 2. Total Gross Margin in 2009

	Mean (€)	Std. Dev (€)	Min (€)	Max (€)	Gross Margin /Demand (€/kWh)	n
Age of respondent						
Aged 18-25	197	105	56	453	0.1005	16
Aged 26-35	204	98	20	689	0.1002	420
Aged 36-45	232	106	10	955	0.1001	905
Aged 46-55	234	111	11	1071	0.1002	1031
Aged 56-65	203	103	14	723	0.1002	883
Aged over 65	180	92	9	938	0.1003	953
Not specified	224	133	33	536	0.1001	24
Household income						
< €15,000	159	88	16	562	0.1003	185
€15,000 - €30,000	198	100	15	697	0.1003	292
€30,000 - €50,000	230	112	13	955	0.1002	463
€50,000 - €75,000	218	101	9	549	0.1002	634
> €75,000	247	109	19	689	0.1002	372
Employment Status						
Employee	222	102	10	787	0.1002	2001
Self-employed with employees	279	154	33	1071	0.1001	232
Self-employed without employees	237	109	11	697	0.1001	303
Unemployed seeking work	201	102	27	635	0.1000	200
Unemployed not seeking work	194	97	25	533	0.1000	170
Retired	181	88	9	840	0.1003	1285
Carer	231	98	44	477	0.1001	41
Education level of CES						
No formal education	192	91	37	398	0.1001	59
Primary education	178	96	16	840	0.1003	475
Junior Certificate	212	100	9	635	0.1002	712
Leaving Certificate	210	102	11	955	0.1002	1174
Third level	224	110	10	1071	0.1002	1580
Not specified	212	109	10	723	0.1001	232
Social Status						
AB: Managerial, administrative, professional	243	124	19	1071	0.1002	642
C1: Supervisory or clerical, junior managerial, administrative or professional	222	108	10	787	0.1002	1134
C2: Skilled manual workers	219	95	10	491	0.1002	706
DE: Semi and unskilled manual workers, casual workers, those in receipt of state benefits	189	93	13	840	0.1002	1593
F: Farmers	205	128	9	674	0.1001	113
Not specified	210	94	44	465	0.1003	44
Gender of respondent						
Male	216	107	9	955	0.1002	2127
Female	207	103	10	1071	0.1002	2105
Household Size						

	Mean	Std. Dev	Min	Max	Gross Margin /Demand	n
1 person household	173	89	42	549	0.1004	51
2 person household	190	86	9	938	0.1003	1340
3 person household	227	82	13	601	0.1002	740
4 person household	261	99	10	1071	0.1001	751
5 person household	304	106	14	787	0.1001	361
6 person household	319	106	14	694	0.1000	140
7 person household	327	92	177	689	0.1001	29
8 person household	328	89	210	468	0.1000	7
9 person household	338	98	269	408	0.1004	2
10 person household	439	.	439	439	0.1000	1
12 person household	286	256	105	467	0.1018	2
Not specified	125	72	10	955	0.1003	808
Accommodation Type						
Apartment	112	55	37	284	0.1002	72
Semi-detached	198	95	10	938	0.1002	1351
Detached	241	115	10	1071	0.1002	1121
Terraced	181	94	20	662	0.1002	613
Bungalow	223	104	9	955	0.1003	1068
Not specified	196	93	33	288	0.1004	7
Tenure						
Renting Privately	161	92	22	472	0.1003	71
Renting from local authority	182	89	27	453	0.1000	228
Owned outright	201	101	9	955	0.1002	2215
Mortgage holder	232	110	10	1071	0.1002	1706
Other tenure	197	94	67	373	0.1002	12
Number of bedrooms						
1 bedroom	128	110	27	697	0.1002	46
2 bedrooms	135	76	10	451	0.1002	358
3 bedrooms	187	88	9	840	0.1002	1884
4 bedrooms	240	98	13	955	0.1002	1470
At least 5 bedrooms	293	128	19	1071	0.1002	465
Not specified	245	108	33	400	0.1006	9

* Only 1946 respondents provided income data.

Table 3. OLS regression results: Gross margin

Variable	Coefficient	Std. Err.
Age of respondent		
Aged 18-25	23.247	31.548
Aged 26-35	-13.412	6.772**
Aged 36-45	-3.894	5.376
Aged 46-55 (ref)		
Aged 56-65	6.262	6.491
Aged over 65	21.799	9.535**
Household income		
< €15,000	9.968	8.413
€15,000 - €30,000	8.449	6.347
€30,000 - €50,000	8.339	5.034*
€50,000 - €75,000 (ref)		
> €75,000	3.669	5.608
Employment Status		
Employee (ref)		
Self-employed with employees	29.417	8.129***
Self-employed without employees	15.305	7.561**
Unemployed seeking work	-1.853	12.415
Unemployed not seeking work	12.685	14.846
Retired	1.733	8.818
Carer	35.131	25.618
Education level of CES		
No formal education	11.762	18.926
Primary education	-5.070	8.468
Junior Certificate	-4.734	6.201
Leaving Certificate	0.164	4.686
Third level (ref)		
Social Status		
AB: Managerial, administrative, professional	14.664	7.464**
C1: Supervisory or clerical, junior managerial, administrative or professional	5.298	6.622
C2: Skilled manual workers	6.677	7.119
DE: Semi and unskilled manual workers, casual workers, those in receipt of state benefits (ref)		
F: Farmers	-24.317	13.449*
Gender of respondent		
Male (ref)		
Female	1.835	3.941
Accommodation Type		
Apartment	-27.715	15.942*
Semi-detached (ref)		
Detached	12.146	5.245**
Terraced	-9.092	6.431
Not specified	11.326	5.342**
Tenure		
Renting Privately	-20.304	16.109
Renting from local authority	3.811	12.349
Owned outright (ref)		
Mortgage holder	8.270	4.694*
Other tenure	91.828	82.316
Number of bedrooms		

Variable	Coefficient	Std. Err.
1 bedroom	45.245	21.659**
2 bedrooms	-4.657	8.134
3 bedrooms (ref)		
4 bedrooms	13.253	4.695***
At least 5 bedrooms	40.812	7.057***
Type of Coker		
Electric Cooker (ref)		
Gas cooker	-8.703	4.503*
Oil fired cooker	1.552	12.353
Solid fuel cooker	-5.217	14.881
Number of electrical appliances	8.596	0.726***
Continuous Variables		
Year accommodation was built	-0.001	0.001
Number of household members	24.626	1.541***
Number of household members at home during the day	-0.669	0.509
Energy Conservation dummy variables		
External wall insulation	-9.960	4.205**
Attic insulation	-8.089	3.999**
Lagging jacket	-10.530	5.224**
Concerned about the environment	-5.145	7.451
Constant	-75.705	21.806***
Number of observations	1942	
Prob > F (47, 1894)	0.0000	
R-squared	0.4306	
Adj R-squared	0.4165	
Root MSE	81.36	

Figure 1. Average household electricity demand by time of day in 2009

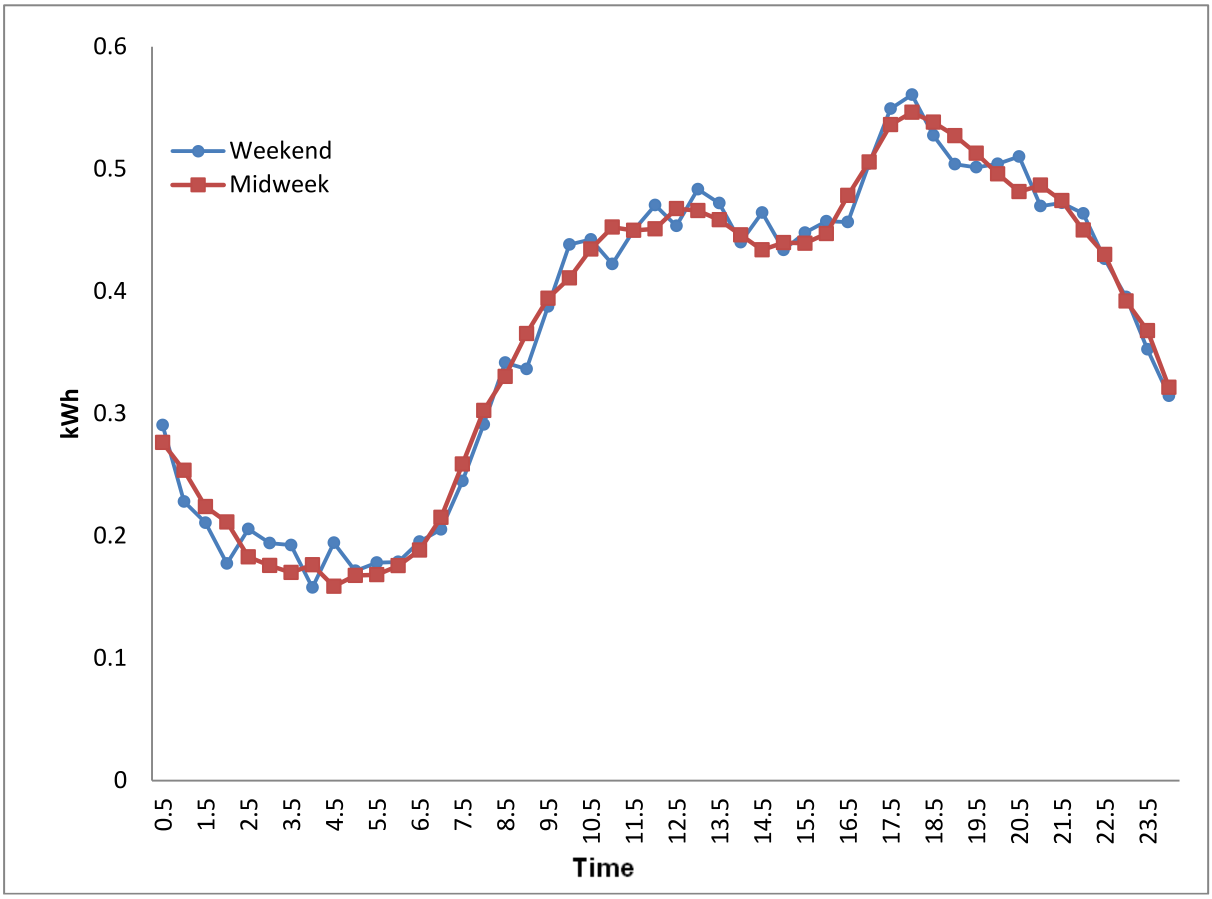


Figure 2. Average SMP by time of day in 2009

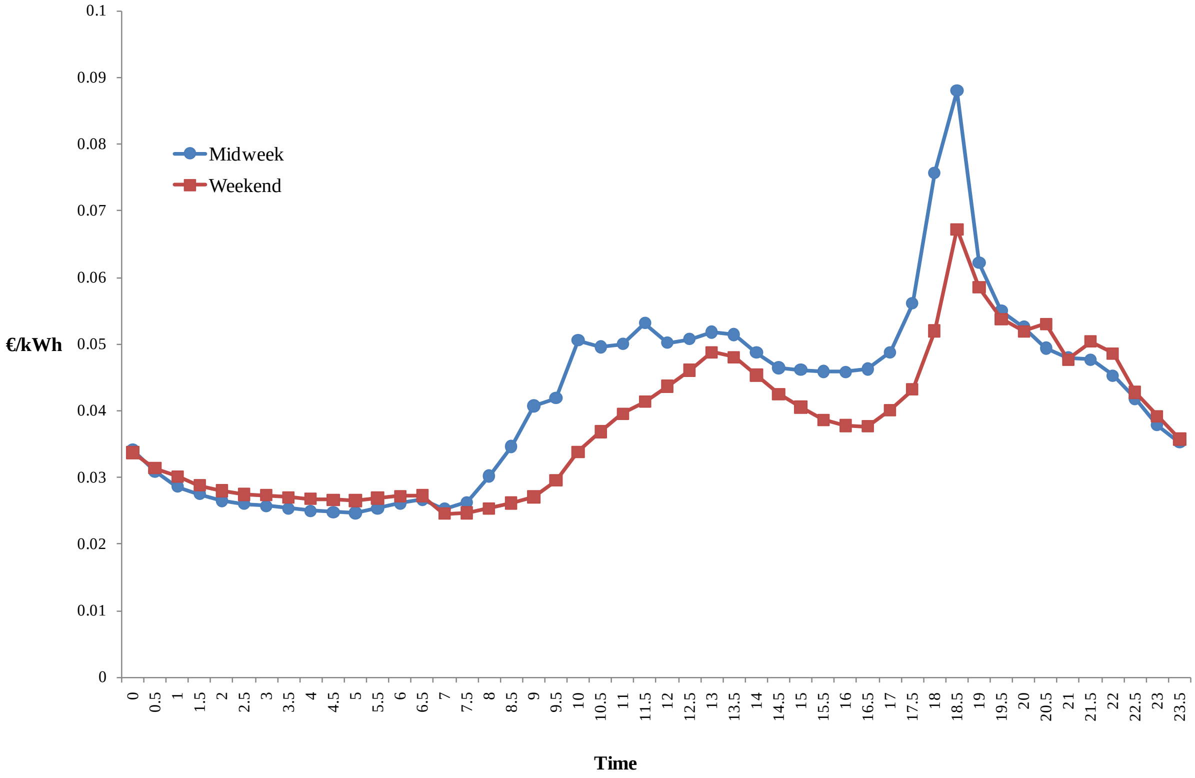


Figure 3A. Electricity profile by age group of respondent

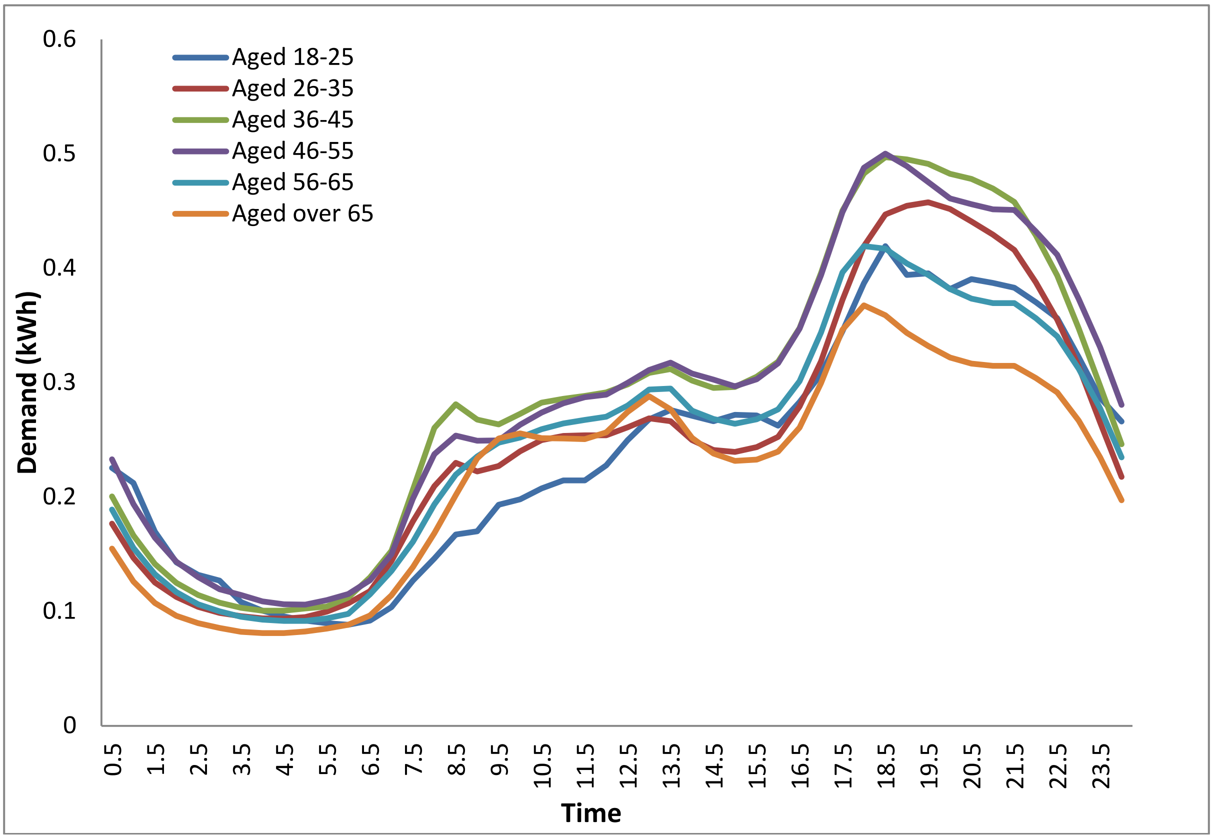


Figure 3B. Electricity profile by annual household income

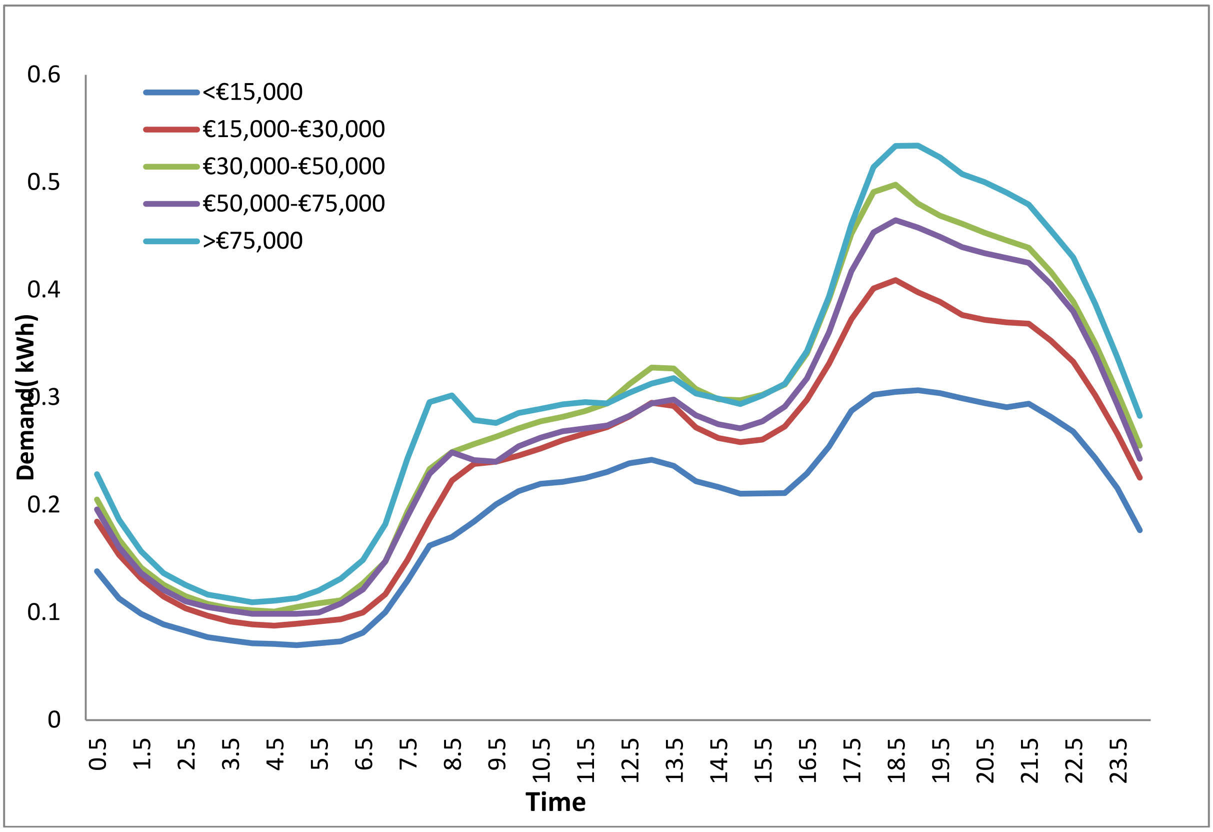
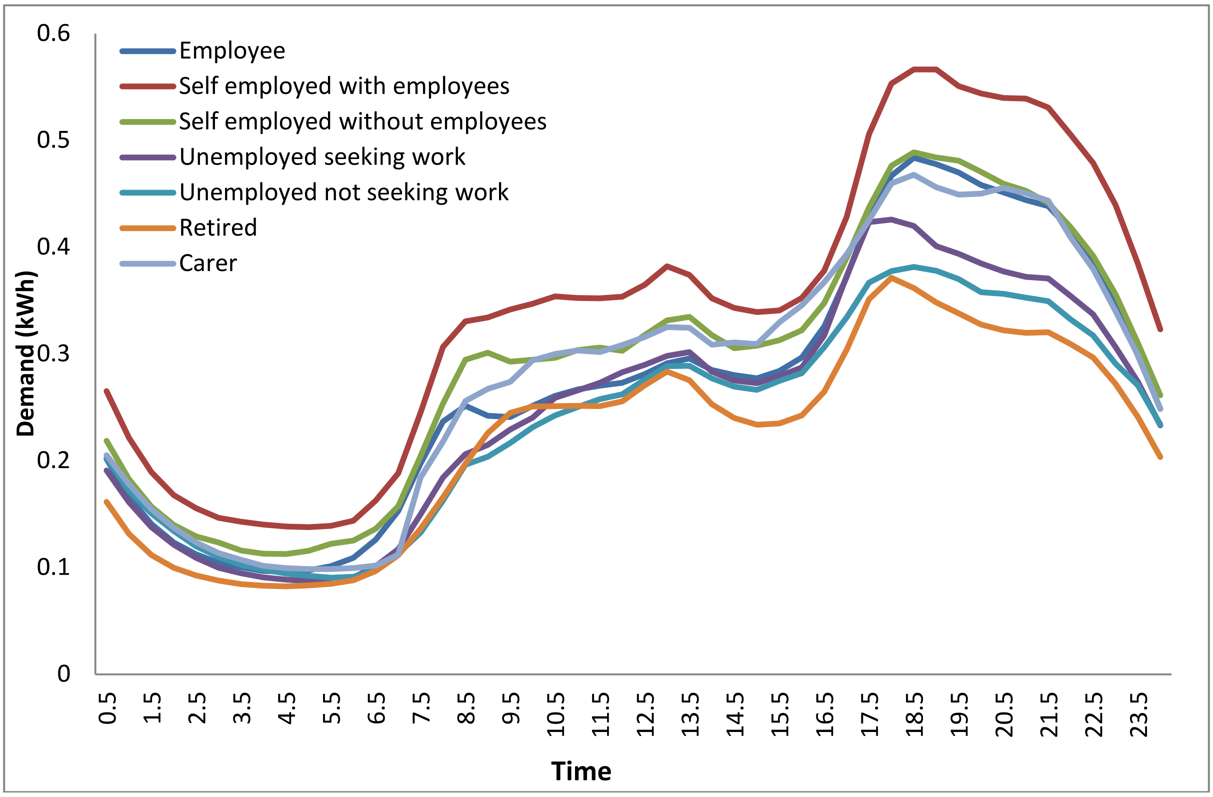


Figure 3C. Electricity profile by employment status of respondent



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