

Energy in the utility sector: two applications

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Introduction



The ESRI energy division objectives:

- Understanding the determinants of energy consumption in different sectors
 - Concern on emissions
 - Impact of different policies (EV, energy savings etc.)
 - Impact of carbon tax
- Measuring the impact of investment choices in the energy sector
 - Interconnectors
 - Generation
- Provide evidence for different policies

Introduction



European and international targets on emissions:

- **Supply side targets:**

- Emission reduction in generation sector (ETS)
- Emission reduction in consumption sectors (Carbon Tax)
- EV

- **Demand side targets:**

- House efficiency (insulation etc.)
- Shift in energy demand from peak to off peak hours
- Demand reduction

Supply Side



The current energy model

- 'Bottom-up' approach
 - Individual equations can be specified in more detail
- No assumed separability
 - Aggregation imposed, no residual component
- Update data on energy demand and electricity prices
- Focus on the transport sector

Estimation- electricity

ELECTRICITY	PRICE	INCOME	TREND
HOUSEHOLD	-0.0680	0.8380	x
INDUSTRY	-0.2750	0.5730	x
COMMERCIAL	-0.0260	0.2390	x
AGRICULTURE	-0.3750	0.7140	0.0140

- The price coefficient is always negative and significant
- The demand of electricity is quite price inelastic in all sectors (limited substitution in face of rising prices)
- The income coefficient in the household sector reflects the housing stock and not the income
- The use of electricity is going to rise in all the considered sector

Estimation – gas and oil

GAS	PRICE	INCOME
HOUSEHOLD	-0.3160	0.6930
INDUSTRY	-0.3700	x
COMMERCIAL	-0.2019	0.8609
AGRICULTURE	x	x

OIL	PRICE LFO	PRICE HFO	INCOME
HOUSEHOLD	-0.6996	x	x
INDUSTRY	-0.1700	-0.1910	x
COMMERCIAL	-0.6800	x	0.1633
AGRICULTURE	x	-0.2290	x

- the gas equation is more elastic than electricity
- the oil equation is generally more elastic than the gas curve.

A proportional increase of the final prices should lead to a stronger decrease in the oil than in the gas equation

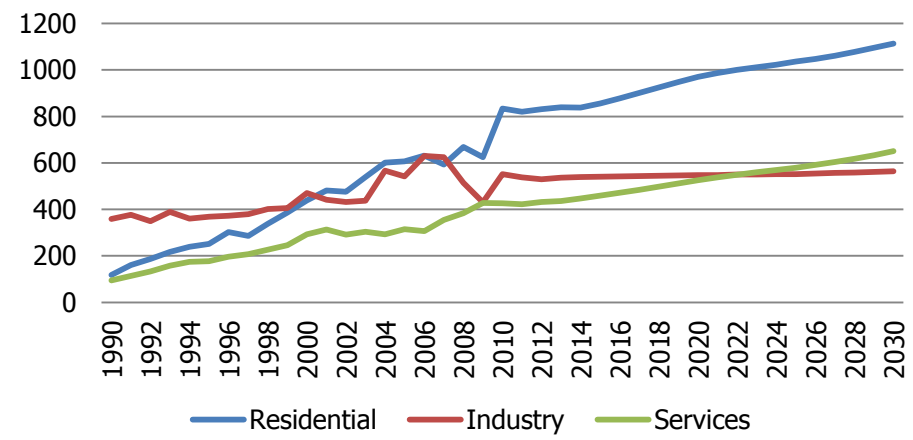
Transport sector

DIESEL			
	PRICE	TREND	CONSTANT
DIESEL CARS	-0.0492	0.0684	0.0684
	PRICE	STOCK	CONSTANT
FREIGHT	-0.2272	0.9500	-0.5586

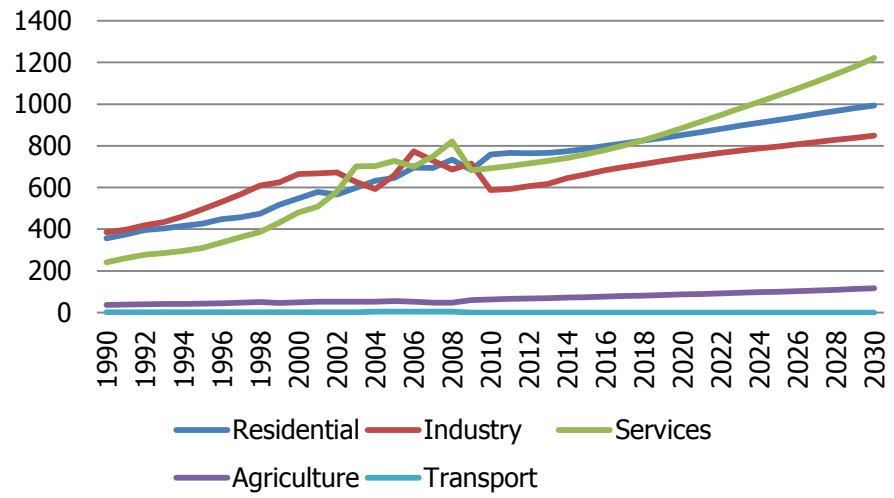
FUEL			
PETROL	TOURISM	INCOME	EFFSTOCK
PETROL CONSUMPTION	-0.2236	0.4825	0.0462

KEROSENE	PRICE	TOURIST	CONSTANT
AVIATION	-0.0406	0.7977	-3.4406

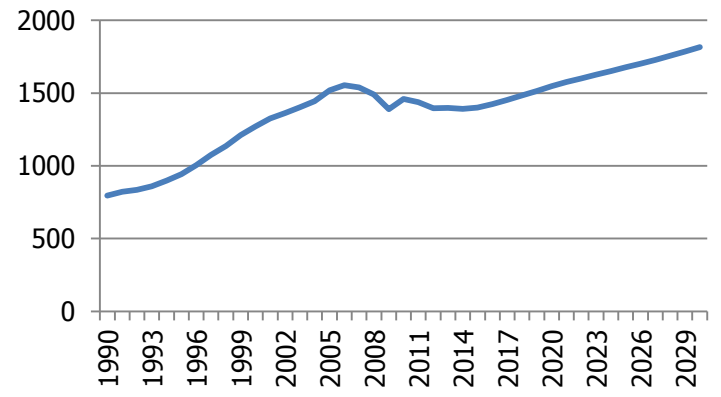
Gas



Electricity



Petrol Cars



Demand Side



Data gathered in Irish smart metering experiments



- Technical trials run by ESB Networks, Bord Gais and suppliers
- Consumer Behaviour Trial coordinated by Commission for Energy Regulation (CER) with assistance from SEAI, firms and consultants
- ESRI assisted CER in preparing cost-benefit analysis (CBA); work funded by Energy Policy Research Centre
- CBA also used cost and benefit parameters gathered from firms and consultants : trial microdata from ISSDA www.ucd.ie/issda

Summary statistics : electricity prices I

- **Control period:** 1st July – 31st Dec 2009. All charged same tariff of **16.24** €cent/KWh (VAT included) and received bi-monthly billing
- **Treatment period:** 1st Jan – 31st Dec 2010.
 - **Control group:** flat tariff (16 €cent/KWh, VAT incl.) and bi-monthly billing.
 - **Treatment group:**

1. 4 prices for 3 times of the day

	PEAK	DAY	NIGHT
A	22.70	15.89	13.62
B	29.51	15.32	12.49
C	36.32	14.76	11.35
D	43.13	14.19	10.22
W/E	33.09	14.46	11.35

2. 3 stimuli: bi-monthly billing, monthly billing and in home display (IHD) installed

Summary statistics : households involved

- Randomised controlled trial
- Sample size: **4,225 residential** meters each with 48 half-hourly meter reads per day over 536 days.
 - Test group: 3,296 meters.
 - Control group: 929 meters.
- **3,815** of these households also completed a pre-trial socio-economic survey.
- There was also a similar post-trial survey
- Separate trial for c.600 small to medium size firms (SMEs)

Methodology

- the only difference between groups in our sample is the **treatment**
- we estimate the difference $(\mu_{11} - \mu_{01})$ with **the random effects estimator** for panel data (0=control , 1= treatment)

$$q_{i,t} = \alpha_0 + \alpha_1 \text{Tariff}A_{11} + \alpha_2 \text{Tariff}B_{11} + \alpha_3 \text{Tariff}C_{11} + \alpha_4 \text{Tariff}D_{11} + \alpha_5 D_{bhol} + \sum_{i=1}^6 \alpha_6 Wkdays + \alpha_7 sun_t + \alpha_8 HDD_t + \alpha_9 T_t + \alpha_{10} T_g$$

1. the different tariff dummies reflect the price for the treated group in the treatment period
2. The dummy T_t controls for the treatment period, the dummy T_g for the treatment group
3. i represents the time of the day (peak, day, night) in which we estimate the model

Results on demand effects- tables

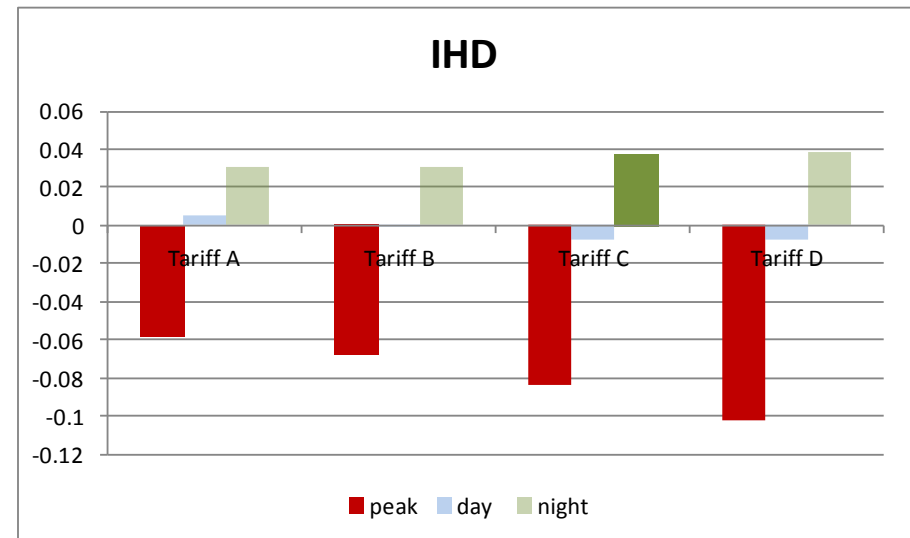
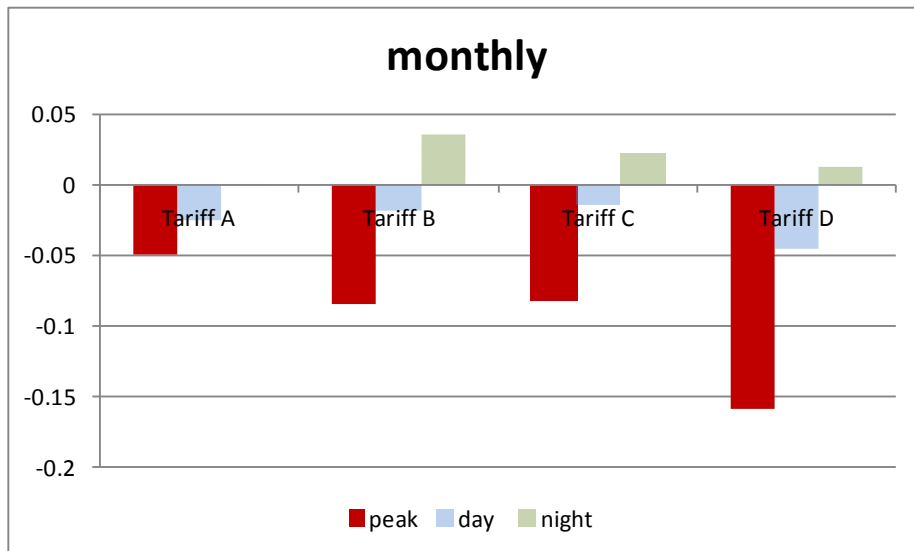
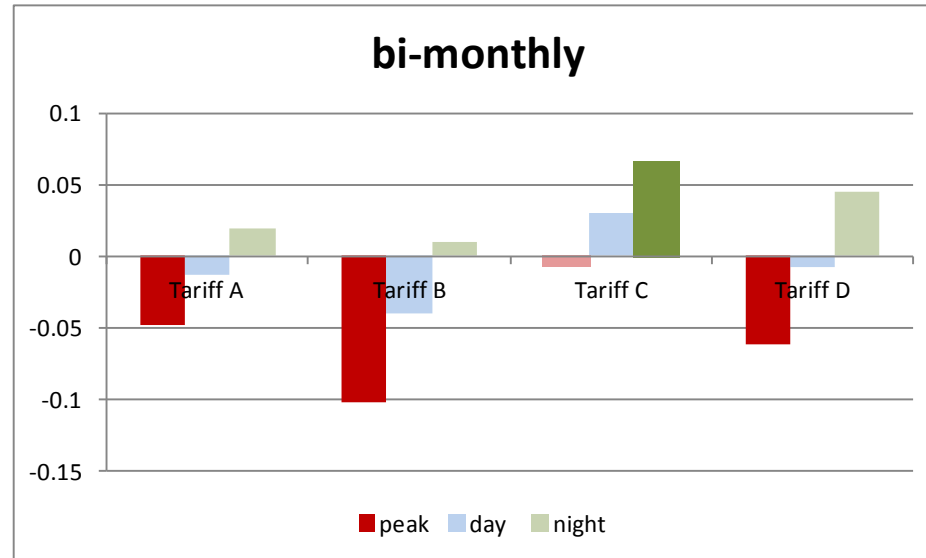
PEAK DEMAND			
	Bimonthly	Monthly	IHD
<i>Tariff A</i>	-0.0486** (0.0195)	-0.0508** (0.0209)	-0.0577*** (0.0205)
<i>Tariff B</i>	-0.103** (0.0408)	-0.0853*** (0.0243)	-0.0673** (0.0293)
<i>Tariff C</i>	-0.00783 (0.0204)	-0.0817*** (0.0239)	-0.0848*** (0.0201)
<i>Tariff D</i>	-0.0628** (0.028)	-0.160*** (0.0325)	-0.102*** (0.0377)



DAY DEMAND			
	Bimonthly	Monthly	IHD
<i>Tariff A</i>	-0.0132 (0.0165)	-0.0260 (0.0173)	0.00492 (0.0186)
<i>Tariff B</i>	-0.0415 (0.0357)	-0.0194 (0.023)	-0.00116 (0.0239)
<i>Tariff C</i>	0.0299* (0.0156)	-0.0154 (0.0207)	-0.00739 (0.0163)
<i>Tariff D</i>	-0.00851 (0.0226)	-0.0461* (0.0255)	-0.00717 (0.0253)

NIGHT DEMAND			
	Bimonthly	Monthly	IHD
<i>Tariff A</i>	0.0184 (0.0163)	-0.00190 (0.0175)	0.0310* (0.0177)
<i>Tariff B</i>	0.00969 (0.0317)	0.0356 (0.0266)	0.0303 (0.0294)
<i>Tariff C</i>	0.0659*** (0.0175)	0.0213 (0.0208)	0.0380** (0.0182)
<i>Tariff D</i>	0.0446 (0.0297)	0.0120 (0.0297)	0.0387 (0.0237)

Results on demand effects - graphs



Conclusions

- Easy to estimate the impact of the carbon tax on the fuel consumption in different sectors.
 - Possible to estimate the impact on the macro variables thanks to the joint work with the ESRI macro division
 - Deeper analysis on emissions/waste with specific models
- Other models in place to forecast the fuel prices and the impact of investment choices
- Econometric instruments to determine the impact of demand side policies

Thank you!!!

