

3rd International Workshop on Empirical Methods in Energy Economics (EMEE2010)

Surrey Energy Economics Centre (SEEC)

University of Surrey, UK

24th – 25th June 2010

NOTE:

The following Presentation represents *Work in Progress* for discussion at the EMEE2010 workshop. It therefore must not be referred to without the consent of the author(s).

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HOUSEHOLD ENERGY SPENDING & INCOME: THE CASE OF GREAT BRITAIN 1991-2007

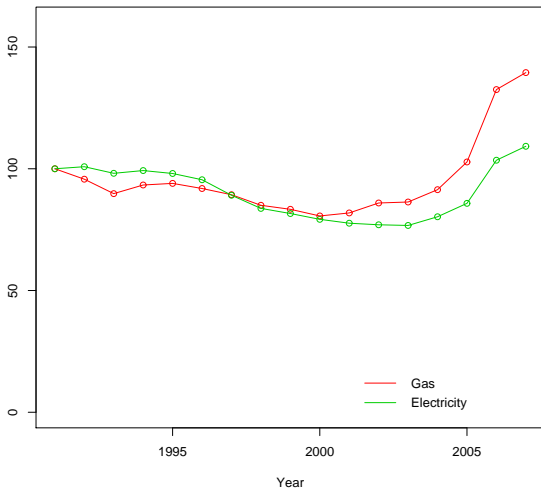
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3rd EMEE Workshop
Surrey, 24th of June 2010

Real Gas and Electricity Price Index, 1991–2007



- Electricity and gas prices have been fairly correlated.

Energy spending and different income levels:

Energy as a necessity:

- ▶ Share of energy spending over income declines as income rises
- ▶ Income elasticity of energy spending less than unity
- ▶ Shape of Engel expenditure curves?

Aim:

- ▶ Analyse the link between energy spending and income for different income groups.
- ▶ Describe Engel expenditure curves.
- ▶ Conduct an econometric analysis based on British data.

Questions

Literature

Data

Graphic Results

Methodology

Method

Regression Results

Summary

- ▶ What is the link between energy spending and income?
- ▶ What factors influence energy of households?
- ▶ How do responses differ for different income groups?
- ▶ At what income levels spending inflection points are observed?

Literature on energy spending and income

Journal articles

- ▶ Nesbakken, R.(1998), Price sensitivity of residential energy consumption in Norway, *Energy Economics*, 21/6. Differs between households with incomes $<$ or $>$ than mean income. Income elasticity hardly depends on income groups. Energy price elasticity of high-income households higher than of low-income households.
- ▶ Bradshaw, J., Mitchell, D., Morgan, J.(1987), Evaluating adequacy: the potential of budget standards. *Journal of Social Policy* 16(2), 165-181. Are scale rates of supplementary benefits adequate?
S-curve approach Based on Engel: As income increases, proportion of budget devoted to necessities decreases. Aim: Discern inflection points, where proportion of expenditure on given commodity 'turns over'

Official documents

- ▶ DTI (2007), Meeting the energy challenge - a white paper on energy. Target for household sector: Achieving cost-effective energy efficiency potential of homes.

Data

Panel Survey Data

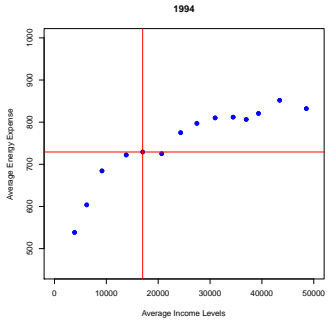
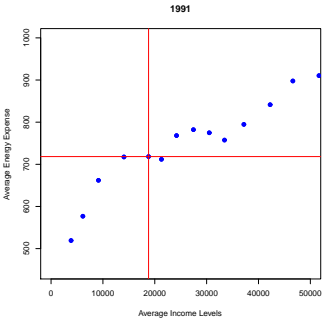
Main objective: Further understand social and economic change at individual and household level in Britain.

- ▶ Nationally representative survey of more than 5,000 households, starting in 1991
- ▶ Annual surveys of each adult (16+) member of such a household
- ▶ Today, 17 waves available (1991 - 2007)
- ▶ Major topics of data: Household organization, labour market, income and wealth, housing, etc.
- ▶ Annual data on yearly UK energy prices for gas and electricity, data from IEA.

Household Energy Spending & Income

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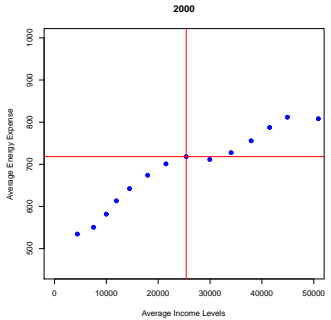
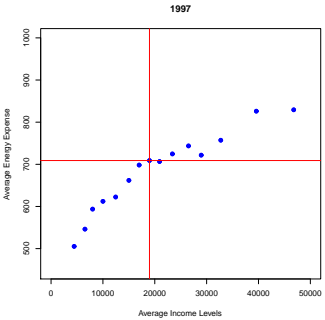
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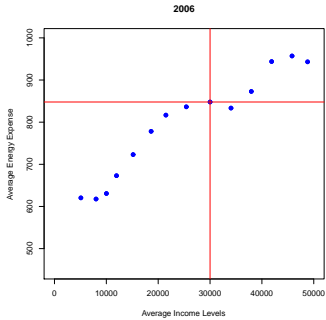
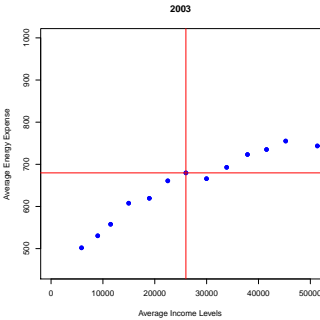


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Methodology

Short term electricity expenditure model

$$E_{it} = \beta_{Pe} Pe_t + \beta_{Pg} Pg_t + \beta_R Region_{it} + \beta_S SocEc_{it} + \beta_B Build_{it} + \nu_i + \epsilon_{it}$$

With

- ▶ E_{it} : Annual electricity expenditures
 - ▶ Pe_t : Electricity price (+)
 - ▶ Pg_t : Gas price (?)
 - ▶ $Region_{it}$: Regional characteristics (gas usage or not (+))
 - ▶ $SocEc_{it}$: Socio economic characteristics: Owner (?)
Annual hh-income (+), Number of children (+)
 - ▶ $Build_{it}$: Building characteristics:
detached/semidetached houses (+), end
terraced/terraced houses (+), flats (-)
 - ▶ $Trend_t$: Linear time trend (?)
 - ▶ ν_i : Household specific and time invariant fixed effect
- (+)/(-) indicate positive/negative influence on energy expenditures.

Method

Econometric specification

Functional form: log-linear

Dependent variable: log of a households's annual total electricity expenditures

- ▶ econometric specification: fixed effects model
- ▶ six specifications: regressions for all households and five different groups of households, according to income
- ▶ time period: 1991 to 2007

Regressions for different income groups

REGRESSION RESULTS

DEP. VARIABLE: LOG OF ANNUAL ELECTRICITY EXPENDITURES

Variables	Coefficients					
	ALL	<9*	9-20*	20-30*	30-45*	>45*
INCOME	0.062	0.046	0.050	0.076	0.152	0.098
ELECTR. PRICE	0.983	0.804	0.866	1.183	1.329	0.635
GAS PRICE	-0.218	-0.221	-0.151	-0.393	0.463	0.090
NO GAS	0.296	0.236	0.319	0.267	0.355	0.207
OWNED	0.069	0.036	0.036	0.072	0.064	0.059
CHILDREN	0.137	0.099	0.151	0.162	0.140	0.106
DET. HOUSE	0.122	0.013	0.114	-0.019	0.099	0.194
S.-DET. HOUSE	0.045	-0.026	0.080	-0.060	0.061	0.108
END-T. HOUSE	0.036	0.009	0.044	-0.038	0.016	0.089
TERR. HOUSE	0.013	-0.055	0.044	-0.072	-0.007	0.038
TREND	0.003	-0.006	-0.006	0.006	0.010	0.005
Constant	8.580	8.359	8.106	9.953	9.781	5.661
Observations	77,116	12,587	23,005	16,123	14,822	10579
Number of hh	13,573	4,371	7,294	6,154	5,197	3,234
R-squared	0.15	0.10	0.13	0.10	0.11	0.11
Values in RED stand for at least at 95% statistically significant results.						
* Annual household income in £1,000 per year						

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- ▶ Highest income elasticity of electricity spending at income between £30,000 to £45,000.
- ▶ Stronger reactions to price changes in lowest income groups.
- ▶ Electricity expenditures also depend on building types, tenure type and the number of children.
- ▶ Limits of work: Information on age of buildings missing, prices given only on UK-level \Rightarrow price elasticities only based on expenditures.

Backup

A brief aside on Fuel Poverty

Fuel poverty concept according to **UK National statistics**

Income	Income, net of Income Tax / National Insurance, including benefit payments: HB, IS etc.
Fuel Costs	Modelled as adequate level of warmth a household should achieve in line with def. of fuel poverty.
Fuel Poverty Ratio	= fuel costs (usage x price) ÷ income
Fuel Poverty Definition	> 0.1, household is counted as being fuel poor.
Main causes for FP	Energy efficiency of property, Cost of energy, Income

What is included in **our analysis**

Income	Annual household income (gross), including any benefit payments, investment income, etc.
Fuel Costs	Derived as the sum of annual expenditures on gas, electricity and oil.
Fuel Poverty	Instead of focussing on this aspect, we figure out differences between income groups.