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JASON HAROLD, JOHN CULLINAN AND SEÁN LYONS



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*Jason Harold (ESRI), John Cullinan (National University of Ireland, Galway), and Seán Lyons (ESRI)

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INTRODUCTION

Many government policies seek to increase household incomes, particularly the incomes of households suffering from poverty or deprivation. Other policies aim to reduce the amount of energy that households use, to help limit carbon emissions and thus meet climate policy goals. In general, boosting a household's income leads it to consume *more* energy, not less. In order for policymakers to manage the inter-relationships between income-enhancing and energy-saving policies, they need information on how different sorts of consumers change their energy use following an income gain.

One common approach is to estimate the average percentage increase in energy use that would be expected for a one percent increase in income, known as the "average income elasticity" of energy demand. For example, if the average income elasticity was 0.5, a 10% increase in an average household's income would be expected to yield about 5% more demand for energy. With this statistic policymakers could plug in any expected change in average incomes and calculate the implied change in energy demand.

However, the average effects of income changes on energy use may not be the best indicator of policy consequences. In particular, some policies focus on

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households far from average incomes. For example, the Fuel Allowance benefit boosts incomes of vulnerable households to help with the cost of heating their homes during the winter months. The sorts of households receiving Fuel Allowance might behave very differently from the average Irish household when receiving an increase in income. For example, while an average household may already heat its dwelling to a comfortable level, a vulnerable household may severely limit its use of heating due to its constrained resources. The average household would have less reason to use extra income to increase heating than the vulnerable household. To allow for such differences, our research examines how the income elasticity of household energy demand varies among households with widely differing levels of energy expenditure.

DATA AND METHODS

This research is based on expenditure data from the five most recent CSO Household Budget Surveys (HBSs) in Ireland, carried out in 1987, 1994/1995, 1999/2000, 2004/2005 and 2009/2010. The HBS is a household expenditure survey of a representative random sample of all private households in Ireland where expenditures under the subheading 'fuel and light' is the main variable of interest for this research. A statistical technique is applied to estimate income elasticities of energy demand that are allowed to vary depending upon a household's level of total energy expenditure. Thus one can see whether households that spend more or less in total on energy respond in a similar way to income increases as the average consumer does.

RESULTS

It turns out that there are large differences in the income elasticity of household energy demand between low and high energy consuming households, with the elasticity ranging from 0.79 to 0.16 depending on the group and the year examined. In other words, households with low energy expenditure (i.e. mostly with low incomes) boost their energy demand by 0.79% when their income rises by 1%. This is a much stronger demand response than we see for households with high energy expenditure.

This also implies that the average income elasticity is not representative of the full range of households. If households are arranged in increasing order by their energy demand, the bottom 10% has a 146% larger elasticity than the overall average while the top 10% have a 32% smaller elasticity.

POLICY IMPLICATIONS

Policymakers recognise household income as one of the main factors influencing the level of fuel poverty and energy affordability. Our research emphasises the central role of income supports in helping mitigate such problems. If income supports were not provided, many households on low incomes would use much less energy than they do now.

Policy analyses and forecasting models of residential energy demand should take the substantial variation in the income elasticity into account, particularly where the effects of policy on different groups of people are of interest. Our research implies that changes in income support measures, energy efficiency supports aimed at vulnerable households or indirect taxation of energy goods will likely produce different behavioural responses than average elasticities suggest.

Whitaker Square,
Sir John Rogerson's Quay,
Dublin 2
Telephone **+353 1 863 2000**
Email **admin@esri.ie**
Web **www.esri.ie**
Twitter **@ESRIDublin**