

What do we know about how households' energy demands respond to changing energy prices in UK Regions?

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Abstract

A large body of literature has explored the production side of the energy sector at a regional level, and more generally geographic variation in electricity production and employment. Meanwhile, little attention appears to have been paid to exploring whether regional differences exist on the consumer side. In this paper we begin by exploring the available aggregate data for each UK region to better understand whether there exists evidence of differences in household behaviour with respect to energy consumption and use. Given differences in the composition of households across UK regions, we then estimate a demand model which controls for observable characteristics of households to explore whether there is any evidence of regional differences between how households' electricity and gas demands respond to changes in energy prices and household income. This is done using the UK Living Cost and Food (LCF) survey and estimate a Quasi-Almost Ideal Demand System. Evidence on whether there are these regional differences is important given the wide variety of energy-economy-environment modelling that takes place at a regional level, particularly in the UK. More generally, evidence of regional variation in how households respond to changing energy prices has important implications for the use of price (through applying a tax on the use of energy) as an instrument of energy policy. In the UK, there are a number of dimensions of energy policy which, while intended to be spatially blind, have a distinct spatially differentiated impact. This makes understanding any regional differences important in understanding the impact of these policies.

Keywords: Household Energy Consumption, Energy Elasticity, Regional Variation, Microdata

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1 Introduction

Households are a main focus of both the UK Government's, and devolved administrations (in Scotland, Wales and Northern Ireland), policies to tackle what is referred to as the energy 'trilemma' of security of energy supply, low carbon energy, and affordable energy. It is not hard to see why, households made up 27% of the UK's total final consumption of energy products in 2014,¹ of which 87% was electricity or natural gas (hereafter, simply 'gas').² Yet, the spatial impacts of many of these policies is a subject that gets little attention; there is little recognition that there may be differences in how households consume energy and respond to changes in energy prices across the UK. Therefore, one of the early objectives of this paper is to explore the existing aggregate data to understand what, if any, differences emerge across UK regions in household engagement with the electricity and gas sector. While differences in these data may be driven by differences in the regional composition of households by, for instance, socioeconomic status it makes sense to start with these regularly updated and easily accessible regional trends.

A clear example of how regional differences become critically important to the impact of a policy can be seen with the feed-in tariff (FiT) programme. This was a programme designed to increase the supply of low carbon energy through providing a financial incentives for households to invest in renewable energy devices for their homes. This measure was paid for through a nationwide tax on each unit of household electricity consumption, having the effect of raising electricity prices. Given climatic variations and the design of the scheme (households need to meet the upfront capital costs), uptake under the FiT scheme is spatially rather uneven. One consequence of this policy design is that, in aggregate, richer households in the South are enjoying a generous subsidy to their electricity consumption, paid for by poorer households in the North. To understand the impact of this policy, requires understanding existing differences between how households in each region consume electricity, and then how they respond to changes in energy prices.

On a range of other policy measures, the prominence of price as a key enabling

¹https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/449134/ECUK_Chapter_3_-_Domestic_factsheet.pdf

²This was comprised of 62.7% gas and 24.5% electricity, while the other 13% comprised: 1.1% coal, 4.4% Bioenergy, 6.7% Petroleum, with <1% other solid fuels.

mechanism is clear. On the security of supply side, for instance, new measures have been introduced to support greater demand side management (through smart meters) and distributed generation, supported by FiTS. The whole impetus behind the installation of smart meters is to provide households with real-time information about energy prices so that they can switch from times of higher demand (and price) to lower demand (and price). In addition, in order to assist with security of supply concerns, there has been growing policy interest in energy efficiency, the so-called “fifth fuel”, and enabling households to better attain the use of this ‘fuel’.³ Improvements in energy efficiency, doing the same (or more) with less energy inputs, reduces the unit cost of energy. Intuitively, if the fuel efficiency of a car is improved the same distance can be covered using less fuel, reducing the cost per mile (or ‘price’ of each mile travelled).

The important role of ‘price’ in government policy affecting household energy choices is clear. Yet, up to date estimates on how households’ energy demands respond to changes in energy prices, and household income aren’t available in the literature. The main paper providing these estimates for the UK was Baker et al. (1989), which is now nearly twenty years old and is based on a dataset that is over twenty years old. This poses real problems for applied policy analysis. The lack of up-to-date estimates of households elasticities of demand for energy goods is particularly troublesome for the energy-economy-environment modelling that relies upon the existence and reliability of such estimates. Furthermore, in doing this kind of modelling at a regional level in the UK, there is no existing evidence base on which to argue whether the use of UK wide estimates in regional modelling is appropriate or not. More generally, there is a lack of evidence on whether there is much, if any, regional variation in households elasticities of demand for energy products.

This paper seeks to help provide this evidence. Specifically, we present estimates of Great Britain (GB)-wide and regional price and income elasticities of demand for electricity and gas. This is done using a variant of the almost ideal demand system (AIDS) of Deaton and Muellbauer (1980), using data from the

³A large literature has now demonstrated that the Jevons Paradox, where greater efficiency of resource use increases its demand, can have important impacts on the effectiveness of policies targeting energy efficiency improvements.

Living Cost and Food (LCF) Survey for 2007-2014. We then test whether these regional estimates are statistically significantly different from the GB-wide elasticity estimates. The remainder of this paper is organised as follows: Section 2 reviews the available aggregate data on household engagement with the electricity and gas market, Section 3 reviews the relevant literature covering both estimates of energy elasticities and their use in economy wide modelling, Section 4 introduces the model estimated here, Section 5 describes the data used in this analysis, Section 6 presents our results for GB as a whole and its regions, and Section 7 concludes.

Bibliography

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