

FROM RESIDENTIAL ENERGY DEMAND TO FUEL POVERTY: INCOME-INDUCED NON-LINEARITIES IN THE REACTIONS OF HOUSEHOLDS TO ENERGY PRICE FLUCTUATIONS

Dorothee CHARLIER^{1*} and Sondès KAHOULI^{2*†}

EXECUTIVE SUMMARY

The residential sector accounted for 25.40% of energy consumption in Europe in 2014. The energy demand of this sector is still growing steadily in line with society's increasing economic affluence. This trend is expected to continue in the near future. As a consequence, enhancing our understanding of the determinants of residential energy demand and characteristics of households is important for the field of economics as well as for policy analysis. Although the question of the determinants of energy demand in the residential sector has been abundantly analyzed, studies of the overlap between those determinants and the characteristics of households, particularly their fuel poverty profiles, are – to date – few and far between. In fact, on the one hand, there is ample literature on the determinants of residential energy demand which identifies variables explaining energy consumption by focusing mainly on the role of prices and income. On the other hand, the incipient literature on fuel poverty published over the last decade occupies an increasingly important space in the current energy landscape and focuses on the definition of fuel poverty, its measurement, and how to tackle it. Nevertheless, to develop public policies with the double objective of enhancing energy efficiency and fighting fuel poverty in the residential sector, there is a crucial need to understand to what extent households respond to these policies and if there are any heterogeneities in households' responses according to their fuel poverty profile. This goal can not be reached unless the issue of the determinants of residential energy demand and fuel poverty are jointly analyzed. This is the aim of this research.

In particular, we propose a panel threshold regression (PTR) model to empirically test the sensitivity of French households to energy price fluctuations – as measured by the elasticity of residential heating energy prices – and to analyze the overlap between their income and fuel poverty profiles. The PTR model allows to test for the non-linear effect of income on the reactions of households to fluctuations in energy prices. Thus, it can identify specific regimes differing by their level of estimated price elasticities. Each regime represents an elasticity-homogeneous group of households. The number of these regimes is determined based on an endogenously PTR-fixed income threshold. Thereafter, we analyze the composition of the regimes (*i.e.* groups) to locate the dominant proportion of fuel-poor households and analyse their monetary poverty characteristics.

As far as we know, a study of income-induced non-linearities in terms of the distinction between people's reactions – in particular, on how fuel-poor households react to price fluctuations compared with

1. IAE Savoie Mont-Blanc - IREGE. 4, Chemin de Bellevue. 74980 Annecy le Vieux, France. Tel: +33(0)4 50 09 24 46. E-mail address: dorothee.charlier@univ-smb.fr

2. Université de Bretagne Occidentale. IFREMER, CNRS, UMR 6308 AMURE, IUEM. 12 rue de Kergoat, CS 93837 - 29238 Brest Cedex 3. France. Tel: +33(0)2 98 01 73 81. Fax: +33(0)2 98 01 69 35. E-mail address: sondes.kahouli@univ-brest.fr.

*. Authors listed alphabetically.

†. Corresponding author.

non-fuel-poor households – has never been carried out before, although this issue is crucial for the implementation of policies that aim to eliminate fuel poverty and enhance energy efficiency in the residential sector. This fresh approach brings three new contributions to the field. Firstly, this study explores this distinction between fuel-poor and non-fuel-poor reactions to changes in energy prices. Secondly, we shed light through our empirical analysis on the issue of whether income poverty is different from fuel poverty or immediately translate into fuel poverty. In particular, we assume in our empirical analysis that the problem of generalized poverty, as measured by the income level, is a determinant of fuel poverty and we look if effectively fuel-poor households determined under each PTR regime (elasticity) are income poor. Thirdly, this is the first panel empirical analysis on the fuel poverty issue. As far as we know, all previous empirical analyses dealing with fuel poverty have been conducted using a cross-section analysis, usually due to a lack of empirical data.

Our results show that there is heterogeneity in households' reactions to energy price fluctuations. In particular, we identified two groups of households reacting differently and, by analyzing the composition of groups, demonstrated that fuel-poor households belong mostly to the group of households that have the highest energy price elasticity, *i.e.* the most sensitive households. Such high sensitivity, equivalent to the capacity of a household to handle problematic situations – such as an increase in prices – to satisfy its energy needs, is supported by high income level. We stress that, in our sample, the set of fuel-poor households that have higher elasticity do not necessarily correspond to low-income households, because only one-third of them are income-poor.

In terms of public policy, we suggest focusing on income heterogeneity by considering different groups of households separately when defining energy efficiency measures. We also suggest paying particular attention to targeting fuel-poor households by examining the overlap between fuel and income poverty.

KEYWORDS: Residential energy demand, Income non-linearities, Price elasticity, Fuel poverty, Panel threshold regression, France

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