Energy Economics 72 (2018) 135–144

Contents lists available at ScienceDirect

Energy Economics

journal homepage: www.elsevier.com/locate/eneeco

The elephant in the energy room: Establishing the nexus between housing poverty and fuel poverty

Andrew Burlinson [a], Monica Giulietti [a,*], Giuliana Battisti [b]

[a] School of Business and Economics, University of Loughborough, Loughborough, UK
[b] Warwick Business School, University of Warwick, Coventry, UK

ARTICLE INFO

Article history:
Received 24 August 2017
Received in revised form 24 January 2018
Accepted 29 March 2018
Available online 06 April 2018

JEL classifications:
Q4
I32
D1
C1

Keywords:
Fuel poverty
Housing poverty
Energy efficiency
Multinomial logit

ABSTRACT

This paper contributes to the literature on fuel poverty by bringing together the "housing-cost-induced-poverty" definition and the "low-income-high-cost" indicator. Relying on the housing-cost-induced-poverty definition, this paper identifies three "dimensions" of fuel poverty: 1) income-poverty-high-cost; 2) housing-cost-induced-poverty-high-cost; and, 3) fuel-cost-induced-poverty-high-cost. After breaking down the underlying structure of the low-income-high-cost framework, this paper proposes an alternative conceptual definition of fuel poverty and puts forward an empirical strategy which can help to identify the households most in need of financial and energy-related support. An application based on energy cost data in England allows us to identify several policy implications following from our proposed approach.

1. Introduction

Over three decades, fuel poverty has been recognised as a distinct form of poverty, arising primarily from the interactions between energy prices, energy efficiency and low income (Moore, 2012). Previous research suggests that fuel poverty can have debilitating effects (Liddell and Morris, 2010), limit the life chances of children (Harker, 2006) and lead to excess winter mortality (Healy, 2003; Marmot Team Review, 2011). Age UK (2012) estimated that the National Health Service (NHS) incurs a cost in the order of £1.3 billion per annum to provide services to elderly people suffering from conditions related to cold homes. It is estimated that around one tenth of English households are in fuel poverty (2.5 million in 2015/6), many of whom include vulnerable single parents, children and elderly people (BEIS, 2017). Although measures of fuel poverty vary across different European countries, estimates of the prevalence of fuel poverty for the EU27 range between <5% (e.g. Sweden and Finland) to over 40% (Bulgaria)[1] (Thomson et al., 2016). As several European countries are engaged in the fight against fuel poverty (e.g. France and Republic of Ireland), reliable and transparent indicators of fuel poverty are necessary to help policymakers address fuel poverty and the associated social issues.

While the measurement of fuel poverty has often relied on subjective approaches (Healy and Clinch, 2002; Waddams Price et al., 2012), objective measures, such as the Low-Income-High-Cost (LIHC) indicator (Hills, 2011, 2012), are favoured by the United Kingdom's government and are gaining traction in EU-based research (Legendre and Ricci, 2015; Bouzarovski and Tirado Herrero, 2017). However, the LIHC indicator is an opaque instrument, which draws upon vast amounts of household and property information to construct 1) the poverty threshold (i.e. 60% of the national median equivalised after housing costs income,[2] adjusted for required[3] energy costs) and 2) the energy

* Corresponding author.
E-mail addresses: A.C.Burlinson@lboro.ac.uk, (A. Burlinson), M.Giulietti@lboro.ac.uk, (M. Giulietti), Giuliana.Battisti@wbs.ac.uk. (G. Battisti).

[1] Households are defined as fuel poor if they answer negatively to the question: are you able to keep your home adequately warm? Subjective measures have helped gauge the prevalence of fuel poverty in the EU in the absence of national (and uniform) objective indicators (Healy and Clinch, 2002; Thomson and Snell, 2013).

[2] Definitions of income, housing and energy costs and the household are provided in the Appendix A, together with the equivalisation factors located in Tables A1 and A2 respectively

[3] Importantly, required energy costs are calculated on the basis of household needs (e.g. minimum internal temperatures, adequate lighting, ample hot water) rather than actual energy expenditure, in order to circumvent the problem of energy rationing (BEIS, 2017). Note also that the reduction in required energy costs needed to bring a household below the threshold (the "fuel-poverty-gap") can be used to estimate the aggregate or average depth of fuel poverty.

https://doi.org/10.1016/j.eneco.2018.03.036
0140-9883/

cost threshold (i.e. the national median of required equivalised energy costs).

A central pillar of the LIHC definition is the process of deducting housing costs from income to better reflect household disposable income (Hills, 2012). The public debate has been inflamed by the fact that households with below average incomes have seen a rise in housing expenditure of around £714 on average, compared to a fall of £217 for those with incomes above average, over the period since the financial crisis (2007/8 to 2015/6) (FT, 2017). Whereas, during the same period, the average fuel poverty gap in real terms has crept up from £324 to £353 (BEIS, 2017). This paper develops a framework that generates a clearer understanding of how the incidence of low income and high housing and energy costs affect the composition of fuel poverty.

In doing so, this paper attempts to move beyond the fall-back position that fuel poverty is best remedied by schemes primarily designed to improve energy efficiency, rather than by other means such as supporting income (Middlemiss, 2016). Utilising three key economic variables – income, housing costs, and energy costs – we put forward a conceptual and empirical framework that brings to the surface *three dimensions* of poverty underpinning the LIHC indicator: 1) income-poverty (IP); 2) housing-cost-induced-poverty (HIP); and, 3) fuel-cost-induced-poverty (FIP). In doing so, it becomes clear, *by construction*, that for households who find themselves below the poverty threshold – either due to low-income (i.e. IP) or to housing costs (i.e. HIP) (Kutty, 2005) – deducting the required amount of income to achieve acceptable levels of energy services pushes those households even further below the poverty threshold. Whereas, for the latter (FIP) group deducting the required energy costs from income (adjusted for housing costs) is the trigger that pushes the households below the poverty threshold, an issue that Legendre and Ricci (2015) (LAR hereafter) refer to as *fuel vulnerability*.

Our conceptual and empirical framework is distinct from the "after-fuel-cost-poverty" approach, which assumes that *all* households below the poverty threshold are in fuel poverty after deducting fuel costs (Hills, 2011; LAR, 2015). Similarly, LAR (2015) propose that households below the poverty threshold after deducting energy costs, but not before, are *fuel vulnerable* using the after-fuel-cost-poverty approach. Our proposed strategy departs from this approach by invoking the HIP definition and applying the energy cost threshold, which implies that all households within the LIHC group can be considered fuel vulnerable.

More specifically, within the LIHC group, income-poor and housing-cost-induced-poor households are vulnerable to relatively high energy costs albeit from a precarious position because they are already in poverty prior to deducting energy costs from their income (i.e., IP-HC and HIP-HC, respectively). Within the LIHC group, the fuel-cost-induced-poor group are vulnerable to relatively high energy costs albeit from a less precarious position because they are pushed into poverty exclusively after deducting energy costs (i.e. FIP-HC).

Applying a multinomial logit framework to data from the English Housing Survey, a nationally representative sample of households and housing stock, this paper reveals that the three dimensions of poverty contained within the LIHC are statistically differentiated. This finding has important policy implications, not only for the English definition of fuel poverty, but also for any (fuel) poverty measure which relies on the after-housing-cost (energy-cost) approach. By acknowledging the information underpinning the construction of the LIHC indicator, the present study not only adds to the existing literature in this area by proposing alternative definitions of fuel poverty (IP-HC, HIP-HC and FIP-HC), through the lens of "housing-cost-induced-poverty" and LIHC indicators; but also develops a broader set of policy measures aimed at specific dimensions of fuel poverty.

The rest of the paper is structured as follows: Section 2 outlines our conceptual and empirical framework that brings to the surface three *dimensions* of fuel poverty. Section 3 describes our data, methodology and results, before providing concluding remarks and policy insights in Section 4.

2. Conceptual framework

According to the LIHC indicator a household is defined as fuel poor, if they: 1) "have required fuel costs that are above the national median level"; and, 2) "were to spend that amount they would be left with a residual income below the official poverty line" (Hills, 2012: 9). As illustrated in Fig. 1, these thresholds create the quadrants of the LIHC framework.

The energy cost threshold equals the national median of equivalised required energy costs on the y-axis (Fig. 1, solid blue line). And, the poverty threshold, calculated at 60% of the national median after-housing-cost (AHC) equivalised income (the vertical dashed red line), increases with energy costs on the x-axis (Fig. 1, negatively sloped solid red line). The lower left-hand quadrant represents the LIHC group, as defined by Hill's indicator (Fig. 1, solid green, yellow and pink area). Our conceptual framework identifies three dimensions of poverty underpinning Hills' approach, before separating the dimensions using the energy cost threshold.

The first dimension, "income-poverty" (IP), represents households whose earnings fall below the poverty threshold *before and after* deducting housing costs[4] (Fig. 1, green area). This group's earnings are generally below what is necessary to achieve a minimum standard of living regardless of the cost of essential goods and services.

Professor John Hills (2011, 2012) argues that measuring fuel poverty after deducting housing costs better represents the income left at the command of the household. Removing housing costs helps control for regional variation in affordability and relative quality of housing (DWP, 2012). In contrast to Hills, the UK Department for Work and Pensions (2012) presents both sets of poverty figures to avoid over (under) representing homeowners and retired (single) households, i.e. before (after) removing housing costs; whereas since 2016 the relevant UK Government departments have stopped reporting fuel poverty before-housing-costs (BHC) statistics (DECC, 2016; BEIS, 2017). The methodology applied herein exploits, rather than being constrained by, this trade-off.

Clearly some households are more likely to fall below the poverty threshold after deducting housing costs (DWP, 2015):

> *"… in many cases, housing costs have the effect of pulling a subset of households just below the income threshold and into fuel poverty."*
> [(DECC, 2014)]

Taking this issue into account, the second dimension of poverty invokes Kutty's (2005) "housing-cost-induced-poverty" (HIP) approach, which defines households to be in HIP if they fall below the poverty threshold after deducting housing costs but not before. The HIP group is represented by the yellow area in Fig. 1. To our knowledge the links between housing-cost-poverty and fuel poverty are yet to be drawn.

The concept of being "pushed" (DECC, 2016) or "tipping" (Imbert et al., 2016) into poverty after deducting energy costs clearly echoes the notion of housing-cost-induced-poverty. For example, LAR

[4] It is worth highlighting that some households, who find themselves below the poverty threshold before housing costs (BHC) are deducted from income, can "escape" poverty after accounting for housing costs and upon recalculating the median AHC equivalised income. This can be the case for the households with relatively low (or zero) housing costs, such as small households (and homeowners).