

FUEL POVERTY IN THE USA, USING A MULTIDIMENSIONAL MEASUREMENT

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Overview

There are three different but related perspectives that make fuel poverty a distinct and serious problem: poverty and its reduction; health and well-being; climate change and the reduction of carbon emissions (Hills, 2011). The concepts of energy poverty and/or fuel poverty have become a popular focus of public policy concern and energy literature ever since the founding work of Boardman (1991) (Aristondo & Onaindia, 2018). Atsalis, Mirasgedis, Tourkoulis & Diakoulaki (2016), comment that fuel poverty in a developed country is a result of a combinations of three factors: low household income, low energy performance of buildings and high energy prices.

As Moore (2012) notes, “the definition of fuel poverty is important for policy formulation; for determining the scale and nature of the problem, targeting a strategy and monitoring progress” (Moore, 2012, p. 19). However, there is debate about which approach to use when attempting to quantify fuel poverty; expenditure approach or consensual approach, or is it best to use a multidimensional approach that incorporates multiple attributes of poverty and energy efficiency.

This paper is novel for several reasons, firstly, Thomson, Snell & Bouzarovski (2017) note much of the academic and policy frameworks addressing fuel poverty is historically centred around UK and Ireland, with a growing research field in other European states. However, there has only been two studies to date on fuel poverty in the USA. This study focuses on three regions in the USA; New England, East North Central & West North Central. These regions are the highest in terms of heating degree days and therefore most likely to be impacted by the adverse effects of fuel poverty. Secondly, were this paper differs from previous USA fuel poverty studies, is that we use multidimensional approach to measure the extant of fuel poverty which has been argued to give a truer reflection of the extant of fuel poverty. The objectives of this paper are as follows; firstly, to use a multidimensional measurement approach to highlight the extent and composition of fuel poverty, by presenting the statistics on fuel poverty in the three US regions. Lastly, to determine the probability of a household being fuel poor we use a logistic model to show what are the major socioeconomic and dwelling characteristics of households that affect the odds of being fuel poor using in the 2017 American Household Survey (AHS) dataset.

Methods

To overcome the short comings associated with the expenditure and consensual measurement approaches when measuring fuel poverty, this paper will employ a multidimensional poverty framework approach as demonstrated by Alkire & Foster (2011). A multidimensional poverty approach considers poverty as a shortfall from a threshold (cut-off) for each attribute. A household is only fuel poor under our multidimensional approach measurement if; if they spend 10% or more of their income on fuel costs, the 10% ratio for fuel poverty; the household unit was constructed before 1970; and the household is in the first three deciles of household income.

For the purpose of exploring the household factors that are likely to result in fuel poverty using our multidimensional approach, a logistic model is developed. Letting Y_i represent *Multidimensional Fuel Poverty*’ with a binary response. We define Y_i equal to 1 when a household is deemed fuel poor and 0 when it is not. The outcome depends on explanatory variables, the following model is estimated for each of the regions;

$$Y_i = \beta_0 + \sum \beta_i X_i + \varepsilon_i \quad (1)$$

where X_i is the vector of covariates and ε_i is the error term. The X_i variables in our model were selected on previous fuel poverty literature and include binary and categorical variables such as; Tenure, Education, Heating System, Type of House, Kids, Elderly, Solar, Cooking Fuel, Housing Unit Structure and Race.

Results

The table below shows some of the statistical information regarding the attributes that make up are multidimensional measurement. New England has the oldest housing stock with 61.3% of houses built pre 1970. Under the attribute 10% fuel poverty ratio we see that fuel poverty is at about 20% in the regions, while using the multidimensional measurement we see a dramatic decrease in those classified as fuel poor, over 10% in each region.

	Avg. Household Income (\$)	10% Fuel Poverty ratio	Energy Efficiency of Housing	Multidimensional Poverty Measurement
New England	125,866	26.2%	61.3%	12.1%
East North Central	77,850	23.6%	51.0%	12.5%
West North Central	78,458	19.9%	44.4%	8.7%

Furtherer analysis was conducted into the main determinants of those in fuel poverty to satisfy our second objective. A logistic model was used to analysis the impact of several socioeconomic factors and dwelling characteristics on the odds of being fuel poor on each region in our study. Some of the most common predictors of fuel poverty across all regions are those households the rent, that have children and that have elderly people living in the household. Those at particular risk of being fuel poor under the variable type of household type are household where the couple has separated. Households that use a form of electric heat system in their unit are less likely to be fuel poor than those that use a furnace for a heating system again across all regions. An interesting finding was that households living medium and large apartment buildings are less likely to be fuel poor across all regions compared to detached houses and could warrant further investigation.

Conclusions

The first objective of this paper was to use a multidimensional measurement to assess the extent of fuel poverty in three of the most at risk regions of the United States. The multidimensional measurement approach overcomes some of the issues surrounding the expenditure and consensual approaches to fuel poverty. As some these single dimensional index fail to fully comprehend the situation (Okushima 2017). In this study we follow the previous literature on multidimensional measurement approach and use the following three attributes to define fuel poverty; Energy, Income and Energy Efficiency of Housing. It was found that using the traditional 10% fuel poverty ratio measurement seems to overestimate the extant of the issue however that is not to say the issue is still serious. About one in ten households in the regions studied live in fuel poverty, unable to heat their homes to sufficient temperature. While the econometric analysis provided an overview of the extant of fuel poverty in three of the USA most at risk regions. The findings from our study can be use by policy makers to how best address the issue of fuel poverty. Future areas of research should examine, selecting different attributes of multidimensional fuel poverty measurement, for example, using a consensual measurement as an attribute.

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