***What determines the energy poverty?: the decisiveness of social and behavioural characteristics***

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## Overview

An increasing array of research endeavors is geared toward comprehending the scale and origins of energy poverty in developed nations. Income, energy prices, and energy efficiency have been argued to be the bedrock of energy poverty (Farrell & Fry, 2021; Lin & Okyere, 2021). However, less attention has been devoted to study the impact of social and behaviour characteristics, for which literature showed interest (Apergis et al., 2021). It is necessary for governments to have detailed information about characteristics of households which have more influential impact on the presence of energy poverty and make these households vulnerable. In addressing the energy poverty situation, policy responses in the form of subsidies have been implemented to reduce the high cost of energy use in recent times (Simshauser, 2021). However, recent evidence indicates that these responses have been ineffective as they worsen people's level of energy deprivation (Uddin et al., 2021). This is usually the case as suitable policy mixes are challenging to implement as they are typically misapplied (Awaworyi Churchill and Smyth, 2021). Thus, subsidies traditionally meant to be enjoyed by marginalized groups are often administered to their privileged counterparts.

In answering these questions, our study contributes to the literature in the following ways. First, we add to the literature on the determinants of energy poverty by considering social and behavioural characteristics. This is because previous studies on the determinants of energy poverty have mainly concentrated on income, energy prices, and efficiency (Farrell and Fry, 2021; Lin and Okyere, 2021). Second, we contribute to the literature on vulnerability by empirically testing whether the differences in energy poverty can be associated with particular vulnerable groups. These groups may be determined by age of household members, their education or income, housing conditions, as well as their behaviour regrading energy consumption. Drawing on principles from the poverty literature, this study further adds to the literature by analysing the efficacy of policies such as subsidies in moderating the effect of energy hardships that come with social and behavioural characteristics of household. The study again contributes to a small number of studies that use microlevel data to examine the impact of social and behavioural characteristics (Apergis et al., 2021).

## Methods

Energy poverty is without exception very present in developed countries such as Slovenia. Based on data from Statistical Office of the Republic of Slovenia (SORS), in 2022 3.5% of households in Slovenia faced challenges in maintaining adequate warmth within their residences. In addition, 6.3% of households encountered difficulties in managing their utility bill payments, while 17.8% contended with subpar housing conditions, including issues such as roof leaks, damp walls, foundation or floor problems, and window frame deterioration (SORS, 2023). These living conditions often intersect with the concept of energy poverty, which signifies the struggle to attain satisfactory levels of domestic energy services.

Thus, we employ the Slovenian household survey on consumption of energy fuels and other administrative databases to examine the influence of social and behavioural characteristics on energy poverty. We leverage this high-quality cross-sectional data to present initial findings regarding the characteristics of energy poverty within Slovenia. Initially, we investigate household-level attributes associated with energy poverty using a logit model where we regress the index of energy poverty on the wide range of household and building characteristics to determine which factors are more likely to make households more energy vulnerable. Recognizing the multi-faceted nature of energy poverty, we utilize diverse energy poverty indicators. This approach enables us to discern differences and commonalities in the factors underlying subjectively perceived and objectively measured energy poverty.

Energy poverty was assessed using three well-established indicators: the Two-Median indicator (2M), the Ten-Percent-Rule (10%), and the Low Income High Costs indicator (LIHC). According to these measures, the prevalence of energy poverty in our sample was 16.3% for the 2M indicator, 19.4% for the 10% rule, and 10.5% for the LIHC. These findings align closely with the results of previous studies conducted in Europe, as documented by Drescher & Janzen (2021), suggesting a consistent pattern of energy poverty across different regions.

## Results

The regression analyses conducted for each of these three indicators yielded broadly consistent results, indicating several key determinants of energy poverty. Notably, the age of the household head, their level of education, and whether they hold a white-collar job were inversely related to the likelihood of experiencing energy poverty, across all indicators. This suggests that higher socioeconomic status, as indicated by these factors, provides a buffer against the risks of energy poverty. Furthermore, family size was found to reduce the risk of energy poverty, indicating that larger households may benefit from economies of scale in energy usage. Conversely, the presence of children under the age of twelve was associated with an increased likelihood of energy poverty, possibly due to higher energy needs for heating, cooling, and powering electronic devices for educational or recreational purposes. Living in older buildings emerged as a significant risk factor for energy poverty, likely due to less efficient insulation and heating systems, which can lead to higher energy consumption and costs. In contrast, the size of the apartment did not significantly affect energy poverty risk, suggesting that the quality and efficiency of the living space are more critical factors than its size. Additionally, residents of single-family homes were more likely to experience energy poverty, which could be attributed to higher heating and cooling demands compared to multi-family dwellings.

External environmental factors, such as outside temperature, also influenced energy poverty, with lower temperatures increasing the risk, as expected. This underscores the importance of climatic conditions in shaping energy demand and poverty. Interestingly, the internal temperature of the dwelling did not significantly impact the likelihood of energy poverty, suggesting that residents may adapt their heating and cooling practices to mitigate costs, regardless of comfort levels. Finally, households that had undergone energy-efficient retrofits or installed heating pumps and/or solar collectors were less likely to be energy poor. This finding highlights the effectiveness of such interventions in reducing energy consumption and costs, thereby mitigating the risk of energy poverty. These results offer valuable insights into the multifaceted nature of energy poverty and underscore the importance of targeted policy interventions to address the various determinants of energy poverty, including socioeconomic factors, housing characteristics, and energy efficiency measures.

## Conclusions

Energy poverty has emerged as a significant concern within Slovenia, yet existing research has overlooked the demographic characteristics of those affected, a contrast to studies conducted in other countries. In this study, we scrutinized sociodemographic attributes traditionally associated with energy vulnerability in international contexts, drawing from the 2019 survey data compiled by the Statistical Office of the Republic of Slovenia, which explores household energy consumption and fuel use. Our investigation revealed a notable imbalance in the distribution of various sociodemographic traits across different regions of Slovenia. Energy poor (EP) households exhibited distinct characteristics linked to transportation, education, employment, household composition, and residential conditions. These characteristics encompassed subpar housing quality, lower educational attainment, an aging population, a higher proportion of females, a rural setting, absence of pensions, and reliance on expensive heating fuels. Furthermore, our logistic regression analyses reinforced the heightened likelihood of experiencing energy poverty among individuals possessing sociodemographic indicators of vulnerability. This trend held true for the entire study sample, as well as within rural-urban divides and across individual regions. These findings underscore the imperative need to tailor policies aimed at mitigating energy poverty to specifically address these vulnerable groups. Neglecting to do so risks exacerbating existing disparities in energy access and possibly creating new forms of energy injustice.

## References

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