

What is the effect of weather on household electricity consumption? Empirical evidence from Ireland

EPRG Working Paper 2112

Cambridge Working Paper in Economics 2141

Jieyi Kang and David M Reiner

Over the past decades, econometric techniques have been used extensively to study residential demand at a macro level. In such analyses, meteorological variables were included to control for weather effects rather than being a focus of the studies. In micro studies, on the other hand, weather attributes were usually completely neglected. Instead, the focus was almost exclusively on household-level characteristics, such as socio-economic or building variables. Notably, panel data analysis for weather impacts on residential demand has been missing in the jigsaw. The scope of previous efforts was to discover how power demand was associated with either socio-economic background (e.g., family income, education level, social class) or building characteristics (floor area, heating type, number of bedrooms, etc.).

Our study therefore aims to fill the gap left by past studies. Unlike most studies using longitudinal datasets to study the effects of socio-economic factors on energy consumption, a high-resolution panel dataset (obtained from CER, the Irish electricity regulator) was used to examine the weather effects on household

consumers at different periods in time. In order to control for the endogenous and time-invariant variables at household level, such as socio-economic factors, building characteristics, and electric appliance ownership, we used Fixed-Effects models to control for, or partial out, the effects of these time-invariant variables.

We demonstrated that, in general, rain and sunshine duration have a greater potential to affect people's behaviour and daily routines, while temperature has robust but relatively small impacts. The findings have the potential to contribute towards not only greater appreciation of residential consumption behaviour but can inform the operational strategies of electric utilities. Firstly, our study provides a comprehensive picture of how weather conditions interact with household occupancy and lifestyle patterns in intra-day periods as well as workdays/weekends. Secondly, our approach offers the potential to gain greater understanding of consumer behaviour patterns without needing to employ relatively intrusive and costly approaches like surveys. Thus, utilities could, for example, use such an approach as a preliminary tool, based upon which they could then conduct more targeted surveys for certain value-added services.