UNIVERSITY OF CAMBRIDGE
Electricity Policy Research Group

Payment Matters? – An Exploratory Study into Pre-Payment Electricity Metering

EPRG Working Paper 1108

Cambridge Working Paper in Economics 1124

Philipp-Bastian Brutscher

With improvements in technology and falling operating costs pre-payment electricity metering is experiencing a revival all across Europe. A particularly impressive example is the case of Northern Ireland: To date more than 240,000 households in Northern Ireland (ca 30%) use pre-payment metering to pay for their electricity.

Despite the wide-spread uptake, little is known about the role of pre-payment for household energy consumption. This lack of research is surprising: Clearly, household energy consumption is high up on the policy agenda as reflected in a series of high-level policy reports including the NAO's *Programmes to Reduce Household Energy Consumption* and the Carbon Trust's report *Climate Change: a Business Revolution*. In addition, a large body of literature suggests that payment matters for consumer behaviour: People's consumption behaviour has been shown to depend on the payment method (Hirschman, 1979; Prelec and Simester, 1998); the time between payments (Gourville and Soman, 1998); the way payments are framed (Gourville, 1998); and the extent to which payments are "bundled (Morwitz et al, 1998; Chetty et al, 2010).

In this paper we make a first step towards better understanding the role of payment in the context of pre-payment electricity metering. Using data from the Northern Ireland Continuous Household Survey; from the main electricity provider in Northern Ireland (NIE Energy); and the Northern Ireland Neighbourhood Information Service, we focus on three questions:

E·S·R·C ECONOMIC & SOCIAL RESEARCH COUNCIL

- What is the effect of pre-payment on household energy consumption compared to post consumption payment?
- How do consumers use their pre-payment meters – e.g. what payment schedules do they choose? And
- What is the relationship between how consumers use their meters and their energy consumption – e.g. does purchasing smaller top-ups more often make people consume more energy?

The Effect of Pre-payment Metering

A naive way of assessing the effect of the keypad is by comparing the electricity use of households with a keypad meter and households without it. It becomes clear very quickly, however, that this is uninformative: since the two groups of households are very different from each other, any difference in electricity use is likely to reflect not only the effect of having/not having a keypad but also differences in income, housing, living arrangements etc. What we need to know to evaluate the effect of the keypad is what electricity consumption of households with a keypad meter would have been, had they not had a keypad meter. That is, what we need to know is the counterfactual. The evaluation problem arises, because we do not observe this counterfactual. All we observe is the electricity consumption of households with and without a keypad meter.

The recent evaluation literature has focused on matching estimators to overcome this problem. (See Dehejia and Wahba, 1999 and Heck-man et al, 1998). The basic idea of matching (applied to our context) is that the bias in evaluating the effect of the keypad meter on electricity consumption is reduced when the comparison of consumption is performed using households which are as similar as possible.

Using such a matching estimator, we find that having a keypad meter tends to increase (rather than decrease) electricity consumption. This is despite the fact that the keypad provides information feedback on electricity use and comes with higher transaction costs.

The Role of Top-up Behaviour

In the second part of the paper, we explore people's top-up behaviour – looking for a cue for why households tend to increase their electricity use under a pre-payment regime: What we find is rather puzzling: While a rational actor model suggests that households:

- top-up their meters with £230 every time they purchase top-up and
- adjust to increases in tariff by increasing the number of top-up trips and the average top-up amount

what we find is that households tend to purchase relatively small top-up amounts (£13 on average) – and tend to adjust to increases in tariffs almost exclusively by increasing the number of top-up trips.

We discuss a series of possible explanations for the discrepancy between the predications of our model and people's top-up behaviour – ranging from transaction costs to liquidity constraints, to fear of losing top-up to hyperbolic discount rates – but find that none of them fits the data.

The Relationship between Top-up Behaviour and Electricity Use

In the final part of the paper, we discuss the possibility that both the positive effect of using a keypad meter on electricity use and the puzzling top-up behaviour can be explained by the idea that people perceive costs differently depending on how aggregated they are.

The idea is that: If paying 10 times £10 feels more trivial than paying £100 once, people might end up using more (rather than less) electricity under a pre-payment scheme – which allows them to disaggregate their electricity spending in whatever way they want. Similarly, if paying 10 times £10 feels more trivial than paying £100 once, people (interested in minimising the negative hedonic impact of paying) can be expected to prefer relatively small top-ups to larger top-ups and to prefer adjusting to increases in tariff by increasing the number of top-up trips rather than the average top-up amount.

There is little systematic research on this idea – with the exception of Gourville's work on the 'pennies-a-day-strategy'. In a series of experiments, Gourville (1998, 2003) shows that framing a donation request of £100 as 'mere 27p a day' is effective: he finds that the percentage of subjects agreeing to donate is significantly higher when they are asked to give up 27 p a day compared to (the nominally equivalent) £100 a year. One testable implication of this hypothesis is that there should be a link between people's top-up behaviour and their electricity consumption: if smaller top-up amounts are perceived as more trivial, we should find that an (exogenous) increase in top-up amount should lead to (an increase in cost salience and hence) a decrease in electricity use.To assess the link between such an (exogenous) increase in top-up amount and electricity use, we analyse the effect of an increase in the minimum top-up amount. The change in minimum top-up took place on 15 May 2009. It applied only to top-ups purchased online or via a call centre and meant an increase in minimum top-up from £ 2 to £ 15.

What we find is that, in line with our hypothesis, an increase in the minimum top-up amount is associated with a decrease in electricity consumption.

Policy Implications

At least two policy relevant questions arise from our analysis:

- Should we discourage people from using pre-payment and encourage post-consumption payment, instead? Or
- To the extent that there is a preference for pre-payment metering, should we encourage pre-payment customers to top-up larger amounts every time they purchase top-up?

Taking this work forward, the three main tasks will be: i) to try to get better data on electricity consumption; ii) to model our main argument more rigorously and iii) to test, in a large-scale field experiment, how the relationship between top-up behaviour and electricity consumption varies across different parts of the population; for different changes in top-up amount; and over longer and shorter periods of time.

Contact pbb24@cam.ac.uk
Publication February 2011
Financial Support EPSRC Supergen Flexnet