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Distributional aspects of energy policy: Domestic-scale PV uptake under FITs

Grant Allan and Stuart McIntyre

Department of Economics and Fraser of Allander Institute, University of Strathclyde

Introduction

A key aspect of the Scottish Government's aspirations is inclusive economic growth. That is, growth across the income distribution. The forthcoming Energy Strategy is therefore likely to consider the distributional impacts of energy policies.

This short briefing note summarises recent ClimateXChange research on the pattern of uptake of small-scale (domestic) photovoltaic devices under the UK-wide Feed in Tariff programme. The work was undertaken by the Fraser of Allander Institute at the University of Strathclyde.

Key Findings

- Installation of domestic scale PV devices is a financial, rather than an environmental consideration
- There is a clear early adopter advantage with respect to these renewable devices

Our models suggest that the rate of uptake of household renewable energy devices in one area is spatially dependent upon the uptake in neighbouring areas.

As a spatially- and income-blind levy on electricity consumption, and given that uptake is greatest in wealthier areas, policies like FiTs could exacerbate economic inequalities between wealthier and less wealthy areas.

Context of study

The feed-in tariff (FiT) was introduced in April 2010 for small-scale renewable electricity technologies in Great Britain. This promised the installing household a fixed price per unit of electricity – comprised from a "generation" tariff which was differentiated by technology, and an "export" tariff which was technology-blind. FITs have spurred significant development, particularly of Photovoltaic (PV) systems. During our sample period of the first 26 months of operation, over 1GW of domestic renewable electricity capacity and almost 300,000 installations were added. In all, 99.5% of these installations were PV, and 98.7% of capacity was in PV systems.

Payments to households under FITs are met from a tariff on electricity consumption, with a process of "levelisation" ensuring that the costs are distributed evenly across GB regions. This means that, for example, suppliers in areas distributing more FITs payments than the tariff on consumption received from households in that same area are compensated from other electricity suppliers.

It is important to understand the factors underpinning the deployment of domestic renewable energy devices. Financial incentives and economic opportunities may accelerate uptake. However this may exacerbate existing economic inequalities, as well as suggest implicit transfers from high to low income households. Additionally, there may be a spatial process to deployment, both as factors affecting uptake vary across space, and as spatial propagation between spaces affects the level and distribution of uptake. We used data on PV uptake under FITs as well as socio-economic, political and economic variables at local authority level on England. Scotland and Wales were excluded from this initial study as the economic and socio-economic variables used (described later in the

Methodology section) were not available at the same geographic levels. We investigated all of these factors in this study.

Results

We found that a higher uptake of domestic scale PV devices is associated with:

- a lower ratio of flats to houses in the area;
- lower population density;
- a higher proportion of the local population with formal qualifications; and
- a higher ratio of homes owned outright to those owned by a mortgage.

These are not surprising results.

Interestingly, we find that solar irradiance is not statistically significant predictor of uptake, although we do note that there is limited variation in solar irradiance across England.

We find no evidence for "environmental sentiment" – using our three measures described below – as affecting the uptake. This suggests that the primary motivation for households is financial.

Our model results indicate that the spatial term is statistically significant, suggesting that the rate of uptake of household renewable energy devices in one area is spatially dependent upon the uptake in neighbouring areas.

Perhaps of most interest is our finding that there is a clear early adopter advantage with respect to these renewable devices. Areas which installed more of these devices prior to the introduction of the Feed in Tariff policy, are areas where greater uptake was observed after the policy was introduced (the direct effect) but higher adoption was also observed in neighbouring areas as well (the indirect effect). This suggests that early adoption and existing experience are important determinants of subsequent adoption and the propagation of uptake across space.

Implications for policy

Our results support the view that installation of domestic scale PV devices is a financial, rather than an environmental consideration (none of our environmental sentiment variables are positively associated with uptake). Our measure of home ownership suggests that greater ownership means higher uptake.

Wealth is positively associated with uptake

Given the way the FITs policy was structured this makes sense. The requirement for households to meet the upfront costs of installation makes it more likely that households with access to sources of finance – such as personal financial assets or housing wealth – will be better placed to take advantage of the opportunity to install FITs devices. Future research could explore the impacts between FITs and other policies targeted at household groups in Scotland and identify the extent to which different household categories – including on spatial and distribution components – have been able to interact with these opportunities.

This implies regressive transfers up the income distribution

FITs policy is financed through a spatially- and income-blind levy on electricity consumption. Given that uptake is greatest in wealthier areas, this policy could exacerbate economic inequalities between wealthier and less wealthy areas. Future research could identify the implicit transfers between households at different points on the income distribution, and any differences between FITs and other policies aimed at stimulating renewable energy uptake at the domestic level in Scotland.

Methodology

We considered all domestic scale PV systems installed in England in the first 21 months of the FITs programme, i.e. April 2010 to June 2012. Over this period, 271,000 devices were installed at domestic level, 99.5% of which were photovoltaic systems, with an average installed capacity of 3.45kW. Such developments are not evenly dispersed across England however: the South West and South East of England regions have 24% and 16% of all installed capacity respectively, while London and the North East contribute, in turn, 2.5% and 3.5%. This spatial "clumping" suggests that the spatially-blind policy – i.e. the tariffs are the same for generation anywhere across the UK – has seen quite varied uptake across the UK.

We examined the extent to which uptake of domestic PV technologies was linked to a range of variables gathered at the local authority level[1].

We considered socio-economic variables first, such as: the local employment rate; the rate of unskilled labour; uptake of domestic scale renewable energy technologies prior to the introduction of FITs; and, population density.

Then we considered characteristics of the property stock in the area: the ratio of flats to houses; and, the ratio of homes owned outright to those secured by a mortgage[2]. Physical constraints on roof space as well as coordination issue between owners of shared building make installation of PV less likely on flats, while housing wealth might affect uptake.

Our third set of variables related to environmental sentiment. These are included as it could be expected households may show their environmental attitudes through installing a FITs accredited device on their property. We tested three alternative measures of local environmental attitudes: household recycling rates; the presence of a Green Party candidate in local elections; and, votes for a Green Party politician in the European elections.

Given the visibility of these installations, we would expect that there are spatial spillovers in the adoption rate of these technologies as greater uptake in one area increases awareness in neighbouring areas. In order to test for these kinds of effects we estimate a Spatial Durbin Model. Finding statistically significant spatial dependence, justifying the use of these methods, we were able to partition the effect of each variable on the uptake rate into direct and indirect effects. This provided additional information on the association between the characteristics of one area and adoption rates in that area (direct effects) and in neighbouring areas (indirect effects).

[1] We took the unit of measurement as local authority level, which is appropriate as this is the level at which local development planning policies are formulated.

[2] This is a proxy for the wealth of the area, with housing assets an important element of total household wealth.