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Consumers' willingness to pay for renewable energy: A meta-regression analysis

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ABSTRACT

Using renewable energy for domestic consumption has been identified as a key strategy by the Intergovernmental Panel on Climate Change to reduce greenhouse gas emissions. Critical to the success of this strategy is to know whether consumers are willing to pay to increase the proportion of electricity generated from renewable energy in their electricity portfolio. There are a number of studies in the literature that report a wide range of willingness to pay estimates. In this study, we used a meta-regression analysis to determine how much of the variation in willingness to pay reflects true differences across the population and how much is due to study design, such as survey design and administration, and model specification. The results showed that factors that influence willingness to pay, such as renewable energy type, consumers' socio-economic profile and consumers' energy consumption patterns, explain less variation in willingness to pay estimates than the characteristics of the study design itself. Because of this effect, we recommend that policy makers exercise caution when interpreting and using willingness to pay results from primary studies. Our meta-regression analysis further shows that consumers have significantly higher

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willingness to pay for electricity generated from solar, wind or generic renewable energy source (i.e. not a specific source) than hydro power or biomass.

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) has identified renewable energy (RE), such as wind farms and hydro power, as a key strategy to reduce greenhouse gas emissions (IPCC, 2014; Moomaw et al., 2011). Renewable energy sources can provide a number of intangible benefits, such as greater energy security, lower CO_2 emissions (relative to fossil fuels) and continual innovation (IPCC, 2014; Wei et al., 2010). But, negative perceptions about the benefits of RE sources, higher prices and distrust in accreditation processes, for example, make traditional product marketing for RE more difficult (Bloom and Novelli, 1981; Rothschild, 1979; Wiener and Doescher, 1991).

Numerous studies have investigated people's stated intentions to purchase electricity from renewable sources (e.g. Aravena et al., 2012; MacMillan et al., 2006). These studies employed stated preference surveys to elicit respondents' willingness to pay (WTP) for a future change in a non-market good or service. Stated preference techniques that are predominately applied to identify preferences for RE are: choice experiments – which elicits the value of the characteristics of a good – and contingent valuation – which values the good as a whole (Bateman et al. (2002). Estimates of WTP for RE vary widely between studies. For example: Batley et al. (2001) found that WTP varies with social status and income, while Ek (2005) found that age, income and environmental awareness are the main individual characteristics affecting WTP for RE. Borchers et al. (2007) showed that the type of RE significantly influences WTP and Roe et al. (2001) report that WTP for emissions reduction increases when those reductions are from increased reliance upon renewable fuels. However, these conclusions are based on results from individual studies, and may not be valid across studies. If WTP is a function of study design, errors will arise when transferring estimates from one site to another.

The variation in these empirical WTP estimates does not provide the policy maker with a constructive, general understanding of consumer behaviour towards RE. Before using WTP values for policy making or benefit transfer,[1] a number of questions need to be addressed: what is the likely range of individual values for a particular study site or energy source; which explanatory factors should be considered; are there gaps in the data that may skew the recommended values. A tool to address these questions that has gained considerable traction in the literature is meta-analysis. Meta-analysis is a method that systematically summarises, in a quantitative manner, evidence across empirical studies (Glass, 1976).

A quantitative type of meta-analysis, 'meta-regression analysis', has the intuitive appeal of combining, sometimes widely scattered, empirical evidence on a particular subject and in increasing the statistical power of hypothesis testing when a large number of independent studies that use different data sets and methods are combined. More importantly, by controlling for variations in characteristics across independent studies, meta-regression analysis can furnish more insight into what factors explain the variation of results from different studies. Ultimately, it can provide a more informed consensus about the actual size of the effect (or dependent variable) under study. As such, meta-regression analysis provides a greater explanatory power than listing individual results or a standard narrative literature review (Stanley, 2001).

Nelson and Kennedy's (2009) meta-regression analysis of environmental economics did not include any studies of WTP for RE in their sample of 140 studies. A working paper by Sundt and Rehdanz (2014) reports on a meta-regression analysis conducted WTP for RE. This paper progresses previous literature by completing a more comprehensive meta-regression analysis based on a substantially larger sample.

[1] The use of existing studies in project evaluation and policy analyses (Morrison et al., 2002). In benefit transfer, WTP estimates from one study site (the source of the data) are transferred to another site (the site of policy interest).