Ecological Economics 136 (2017) 126–135

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

What are Households Willing to Pay for Improved Water Access? Results from a Meta-Analysis

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ARTICLE INFO

Article history:
Received 28 July 2016
Received in revised form 27 December 2016
Accepted 4 January 2017
Available online xxxx

JEL classification:
Q21
Q25
Q51
Q56

Keywords:
Meta-analysis
Water
Sanitation
Contingent valuation
Willingness to pay

ABSTRACT

Although several factors contribute to low rates of access to improved water and sanitation in the developing world, it is especially important to understand and measure household demand for these services. One valuable source of information regarding demand is the growing empirical literature that has applied stated preference methods to estimate households' willingness to pay (WTP). Because it is difficult to generalize and support planning based on this scattered literature, we conduct a meta-analysis to take stock of the worldwide sample of household WTP for improved drinking water services. Using 171 WTP estimates drawn from 60 studies, we first describe this sample and then examine the potential factors that explain variation in WTP estimates. Our results suggest that households are willing to pay between approximately $3 and $30 per month for improvements in water access. Specifically, in line with economic theory and intuition, WTP is sensitive to scope (the magnitude of improvement in drinking water services), as well as household income, and stated-preference elicitation method. We demonstrate how our results can be used to predict household-level WTP for selected improvements in drinking water access in regions with low coverage, and find that private benefits exceed the cost of provision.

1. Introduction

For decades, the international community has recognized the widespread problems associated with inadequate water and sanitation. Yet, nearly 700 million people lack access to improved water supplies and almost 2.5 billion people lack adequate sanitation even today (WHO/UNICEF, 2015). The burden of disease imposed by inadequate water supply and sanitation (WSS) largely falls on the developing countries of Asia, and central and southern Africa (Fig. 1), and these health impacts are likely to worsen with global warming and climate change (Confalonieri et al., 2007; Haines et al., 2006). The international community initially responded to this problem by pledging to reduce the percentage of people living without basic water and sanitation services by half as part of the Millennium Development Goals (MDGs) (United Nations, 2007). A commitment to ensure universal and equitable access to safe and affordable drinking water has been upheld in the recently-adopted Sustainable Development Goals (SDGs) (United Nations, 2014). However, appraisals show that very few WSS are resilient to climate change and that the threat of climate change itself may become a major driver for improving service quality and adapting to changing conditions (Howard et al., 2010).

Unfortunately, regions that struggle with a lack of access to improved water services also face a host of other socioeconomic challenges, such as low income, energy poverty, poor education, and high rates of respiratory illness due to poor air quality. Because there are so many margins for improvement, the opportunity costs of sector-specific interventions (such as WSS delivery) can be especially high. Without a meaningful understanding of the nature and scale of the benefits of WSS, policy-makers cannot determine the optimal level of support for this sector. The planning and delivery of water and sanitation interventions must rely on economic principles of demand (Gunatilake et al., 2007; Whittington and Pattanayak, 2015).

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http://dx.doi.org/10.1016/j.ecolecon.2017.01.023
0921-8009/

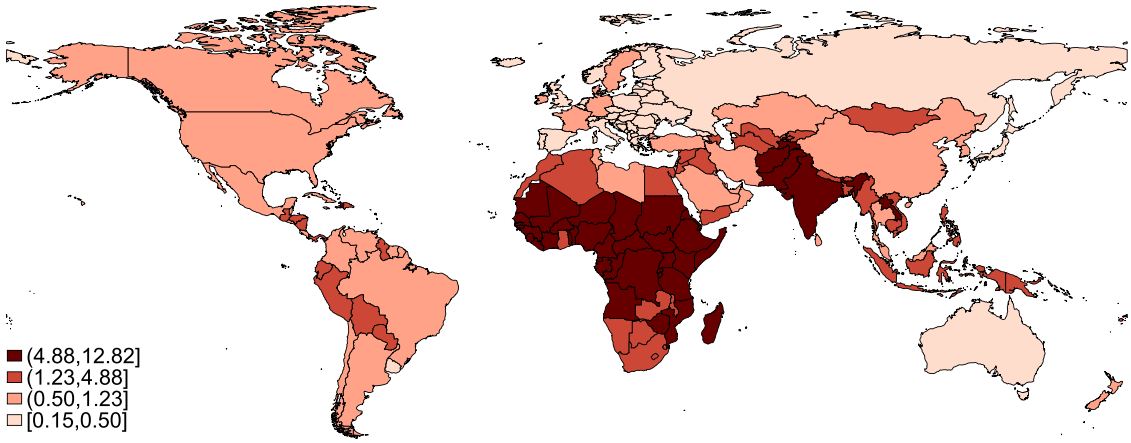

Fig. 1. Diarrheal disability-adjusted life years (DALYs) as percentage of all-cause DALYs for the year 2012. Data on DALYs obtained from the World Health Organization (2014).

Therefore, we review and synthesize the evidence base for household demand and willingness to pay (WTP). As the global agenda refocuses on achieving the SDGs and WSS remain front and center, our analysis of household demand is timely.

Although several socioeconomic, political, and demographic factors contribute to low rates of access to WSS in the developing world, it is important to understand and measure the economic benefits associated with improved access to drinking water. One valuable source of information regarding these benefits is the extensive empirical literature that has applied stated preference (SP) methods to estimate households' WTP for improved access (Gunatilake et al., 2007). Another potential source of WTP information is from revealed preference (RP) studies on averting and preventive behaviors. However, there are at least two concerns with relying on RP studies. First, as shown by Pattanayak et al. (2010), there are simply too few RP studies from developing countries to develop any broad understanding of global demand for WSS. In addition, where there is no historical data, RP methods may not inform policies for improved supply of safe, reliable, and sufficient water in low-coverage regions. By definition, new government policies and new products are beyond the range of historical experience, setting up the case for SP studies (Whitehead et al., 2008). Second, unlike SP studies, RP studies do not provide estimates of total WTP for improved WSS because they fail to capture potentially important subcomponents of value, such as avoided pain and suffering due to illness, and nonuse values. For the purposes of our study, concerns relating to biases in SP data can be directly examined by evaluating how study design features influence WTP estimates, e.g., by including variables measuring design features in multivariate regression analysis of multiple WTP estimates from multiple SP studies.

We use meta-analysis to first describe and then summarize results from 60 SP WTP studies conducted in different parts of the world. As prefaced, such a meta-analysis allows us to take stock of the literature on household demand for improved WSS. Meta-regression analysis allows us to accomplish two other goals (Smith and Pattanayak, 2002): (1) examine a range of potential factors that explain variation in WTP estimates, including testing basic theory; and (2) predict household-level WTP for selected improvements in drinking water access and services. In this capacity—and, specifically, by comparing our WTP estimates to current costs of supply in different parts of the world—we comment on the prospects for implementing water and sanitation policies in line with the SDGs.

This paper proceeds as follows: Section 2 offers a brief background of meta-analysis and its application to nonmarket valuation of water and sanitation services; Section 3 presents an overview of our study-screening procedure and dataset; Section 4 describes our meta-regression models; Section 5 presents results; Section 6 presents estimates of costs and benefits of enhancing access to water services; and Section 7 concludes.

2. Background

Meta-analysis represents a set of methods that are now widely used to synthesize and integrate results from collections of individual studies. Although it originally evolved and has primarily been applied in the fields of health sciences and medical research, it has become increasingly popular in social science applications. In economics, the most widespread application of the meta-analytic approach is meta-regression analysis, where a common summary statistic from a set of studies investigating an empirical relationship is regressed on study-specific characteristics (such as study design or sample size) (Nelson and Kennedy, 2009). Such an exercise sheds light on what drives heterogeneity across different study sites and contexts, and is motivated in large part by the need for relatively low-cost and transferable benefit estimates to support economic analyses of a wide range of public programs and policies (Bergstrom and Taylor, 2006). Prominent applications include evaluations of gender-based wage discrimination (Stanley and Jarrell, 1998), the relationship between institutions and economic performance (Efendic et al., 2011), and the impact of environmental regulation on firms (Horváthová, 2010). Unsurprisingly, meta-analysis of nonmarket valuation and WTP studies has been a particularly active area of research (Boyle et al., 2013; Brander et al., 2006; Smith and Pattanayak, 2002; Van Houtven, 2008).

Although the empirical literature measuring households' WTP for improvements in drinking water services and access is now extensive, going back over two decades and including studies from all over the world, to our knowledge there is no peer-reviewed, published meta-analysis of this literature.[2] As such, a critical need exists to take stock of and summarize results from a large and sometimes disparate group of studies to guide our understanding of the perceived benefits of access to improved water services.

[2] In an unpublished Ph.D. thesis, Ukoli-Onodipe (2003) analyzed results from 20 studies on WTP for improved water services (including both drinking water and sanitation improvements). Although the study provides a basis for synthesizing WTP estimates, it is limited by a relatively small sample size, and does not investigate the robustness of results using alternative regression model specifications as we do.