Water and sanitation economics: reflections on application to developing economies

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February 28, 2017

Background

- Cost-benefit analysis is uncommon in the WASH (water, sanitation and hygiene)
- Benefits
- Commonly used methods
- Key challenges

Simple analytic model

- Stylized framework to evaluate water and sanitation technology (Pattanayak et al., 2005)
- Household maximize utility from leisure ($T1$), health (S) and composite consumption good (Z)
- S{water quality Q, the extent of coping activity a}
- water quality Q: public policy (G), e.g. sewage and piped water network and hygiene education, and averting behavior in the community (A), e.g. open defecation
- coping activity a: $T2$, M material and $K(r)$. Privacy, comfortable

$$L_{T_1, T_2, Z, M, K, a, \lambda, \mu} = MaxU[T_1, Z, S(a, QG, A), a; \theta] - \lambda[f(a, T_2, M, K)]$$
$$+ \mu[E + w(T - S - T_1 - T_2) - pM - rK - Z]$$

Benefits

- less sick days and save time to engage in the income-generating activities (not always)
- Aesthetic benefit, high quality life.
- lower mortality rate
- positive externality for community cleanliness
- social norm, social interaction (Brock & Burlauf, 2001), e.g. open defecation-free community

Approaches to benefit estimation

- Water demand function, derive unity maximization problem
- cost saving analysis: ignore non-health cost, data collection and identify
- travel cost model: expensive, all available water sources, Ukunda, Kenya(Whittington et al., 1990)

$$\text{Value of time} = (B_1/B_2) \qquad (30)$$
$$= (-0.053/-0.101)$$
$$= \text{US\$0.0052 per minute}$$
$$= \text{US\$0.31 per hour}$$

This result is almost 25% more than the market wage rate for unskilled labor in Ukunda in 1986 of US\$0.25 per hour. This estimate of the value

Approaches to benefit estimation

- hedonic property value model(revealed preference approach)
  market premium: connection to the piped water
  downward biased: subsidy; actual price not sales price; isolate the
  effect
- stated preference: contingent value or choice experiment method
  familiar with improved water, meta-analyses of SP (Abramson et al.,
  2011; Van et al., 2013), no significant difference across the regions
  negative signal

Challenges

- unperceived benefits, ex ante<ex post
- Monetizaition of benefits: $Death = CFR * Pop * Eff * Inc$
  $Mortalitybenefits = VSL * Death$, moral issue, multiple of annual income
- valuing nonresidential water use, mobile people, uninitiated business

WTP to water service by firm managers in Uganda

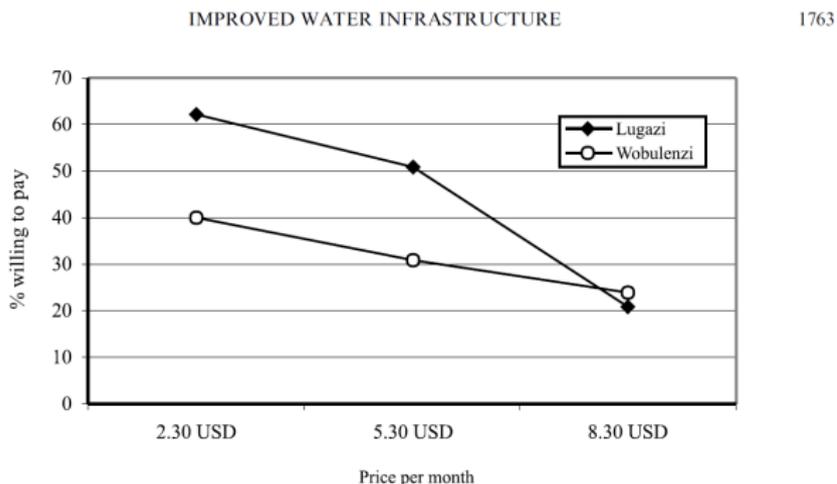Evidence from Uganda that firms' WTP is relative low (Davis et al., 2001)

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Figure 2. *Percentage of firms willing to pay indicated per-month increase in rent for private water connection.*

Other perspectives of benefits side

- dynamic model, virtuous cycle by WASH investment
- Humanitarian aid, lift more people out of poverty