# Willingness to Pay for Reducing Indoor Air Pollution: Study of Rural Indian Households

Mriduchhanda Chattopadhyay[1]

**Abstract**

## 1. Introduction:

Indoor air pollution (IAP, hereafter) caused by the incomplete combustion of traditional cooking fuels along with inefficient cooking practices have remained a potentially large health threat (Duflo et al., 2008) especially in developing economies. Despite the efforts and expected positive returns from adopting modern cooking technologies/fuels, significantly large population in developing countries continue to rely on traditional cooking fuels to meet their household energy demand. To have a clear understanding of what motivates individuals' decision to adopt preventive behaviour from IAP, we need to understand their valuation of the health risks related to IAP. In this paper, we investigate how much the individuals are valuing the reduction in health risks related to IAP from adopting preventive measure using contingent valuation method (CVM, hereafter). In particular, we estimate the individuals' willingness to pay (WTP, hereafter) for a hypothetical preventive measure from IAP which stands as a quantitative measure of individuals' valuation of health risk reduction.

## 2. Econometric model and study design:

Since the individuals' true willingness to pay is unobservable, we can construct their WTP from an empirical analysis that includes the potential determinant of WTP (Gelo and Koch, 2015). To estimate the individuals' WTP, we exploit double-bounded dichotomous choice method (DBDC, hereafter) because of its statistical efficiency (Lang et al., 2010). In this method, the individual faces two take-it or leave-it bids, related to her WTP which she can accept or reject. We use this observable set of bid responses to obtain her WTP using the maximum likelihood estimation method.

For the analysis, we use a unique dataset of 557 respondents from rural India collected during December 2017- January 2018. Our respondents are the individuals responsible for cooking.

[1] Graduate School of Economics, Waseda University, 1-6-1 Nishiwaseda, Shinjuku-ku, Tokyo 169-8050, Japan
Telephone: +81-080-4193-2931; E-mail: mriduchhanda29@gmail.com

During the survey, the enumerators referred to the installation of appliances like exhaust fans that would reduce the exposure of IAP to give an example of a hypothetical preventive measure. It should be noted that the enumerators explained that the payments shall be a one-time one. To avoid initial bid bias, we randomly assign three different initial bids to the respondent. We designed the DBDC questionnaire such that the follow-up bid was doubled if the respondent has replied "yes" to the initial bid and it was reduced to half if she has replied no.

## 3. Results:

The average WTP of individuals in rural areas for adopting the preventive measure is INR 704.91 (~$10) which is approximately 9% of their average monthly income. The individuals are willing to pay this amount on average possibly because this is a one-time investment. The main factors that affect the individuals' WTP include income, household decision-making authority, age, occupation of the spouse and bid payments. Interestingly, individuals who had suffered from physical symptoms related to IAP are willing to pay more for the preventive measure. Finally, we find cooking practices of the individuals plays some role in determining the individuals' WTP.

**Table 1: Determinants of WTP**

|  | Accept initial bid | Accept follow-up bid |
|---|---|---|
| Initial Bid (log) | -0.889*** | |
|  | (0.074) | |
| Follow up Bid (log) | | -0.692*** |
|  | | (0.107) |
| Age of the respondent | -0.014** | -0.01* |
|  | (0.006) | (0.006) |
| Decision making authority | 0.486* | 0.442* |
|  | (0.268) | (0.241) |
| Spouse works in agricultural sector | 0.322* | 0.014 |
|  | (0.174) | (0.146) |
| Household expenditure | 0.045** | 0.021 |
|  | (0.022) | (0.019) |
| Use clean cooking fuels | 0.502*** | 0.27** |
|  | (0.146) | (0.135) |
| Sick with symptoms related to IAP | 0.511*** | 0.358** |
|  | (0.165) | (0.15) |
| Controls | Yes | Yes |
| Rho | 0.242** | |
|  | (0.123) | |

Robust standard error in the parentheses; *** $p<0.01$; ** $p<0.05$; * $p<0.1$

**Reference:**

1. Duflo, E., Greenstone, M., & Hanna, R. (2008). Indoor air pollution, health and economic well-being. *SAPI EN. S. Surveys and Perspectives Integrating Environment and Society*, (1.1).

2. Gelo, D., & Koch, S. F. (2015). Contingent valuation of community forestry programs in Ethiopia: Controlling for preference anomalies in double-bounded CVM. *Ecological Economics*, *114*, 79-89.

3. Lang, H. C. (2010). Willingness to pay for lung cancer treatment. *Value in health*, *13*(6), 743-749.