VALUATION OF PROPERTY DAMAGES FROM URBAN AIR POLLUTION

A case study of Colombo, Sri Lanka.

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Introduction

Consequences of poor air quality

- Directly affects human health
- Destructs agriculture and livestock forests, water bodies etc.
- Damages property, buildings, archaeological sites
- Lower visibility

Cost of air pollution

- Nearly 150,000 deaths from outdoor air pollution every year in South Asia (WHO).
  - Death from lung cancer, cardiovascular and respiratory diseases
  - Increased incidence of chronic bronchitis and acute respiratory illness, exacerbation of asthma and coronary disease, impairment of lung function
- Most significant health effects associated with fine particulate matter (PM)
  - Long-term exposure to an additional 10 $\mu g/m^3$ of $PM_{2.5}$ leads to a 4, 6, and 8% increase in the risk of all-cause, cardiopulmonary, and lung cancer mortality

Cost of air pollution

- Annual average PM10 levels in Colombo:
  - background (most representative of average resident exposure) - 50 ug/m3; hot spot – 84 ug/m3

- According to benefit transfer techniques estimated this level of PM10 exposure may cause each year:
  - 150 excess death and 1000 cases of chronic bronchitis
  - 3 million episodes of respiratory illness
  - Health damage equivalent to $US 30 million

Issue

- There is only a few studies done on property damage due to air pollution

- No study found in Sri Lanka

Objective

The main objective of the study is to:

Evaluate the cost of property damage due to urban air pollution in Colombo in Sri Lanka

Objectives

Other objectives:

- To measure the willingness to pay of the residents for the control of urban air pollution in Colombo to avoid property damage and improve air quality
- To determine the attitudes towards issues concerning air pollution control and hence air quality improvement.

Methodology

- Contingent valuation method was used to measure the property damage cost of air pollution.
- Both open ended questionnaires and payment card method were used to collect the information regarding the willingness to pay for the prevention of property damage cost due to urban air pollution.

Assumption

- Households maximize utility subject to an income constraint by choosing a bundle of market and non market goods.
- If one of the non market good is air quality then the willingness to pay (WTP) will be a function of the price of air quality, prices of other goods, income and household tastes.

$U(0, Y; A) \leq U(1, Y-W; A)$

U - Utility

0 - no additional measures to air pollution control

1 - additional air pollution control

Y - income

A - a vector of attributes that may affect the WTP for air pollution control

W- amount willing to pay

WTP Analysis

- To examine the frequency distribution of the responses to the valuation questions.
- To look at cross tabulations between WTP responses and such variables as socioeconomic characteristics of the respondent and attitudes toward the environment.
- To estimate a valuation function that relates the respondent's answer to the socioeconomic characteristics of the respondent and attitudes towards environment by using multivariate statistical techniques

Purpose of three types of analyses

- To see whether respondent's answers are consistent with theory and common sense (this increases one's confidence in the accuracy and reliability of the information)

- To establish statistical relationships or models that can be used in the aggregation of sample responses to the overall population under study, or for developing forecasts of benefits under alternative future scenarios.

Results and Analysis

Socio-economic analysis results

Description	Number	Mean	Std. Error	Std. Deviation
Family size	64	3.4	0.2	1.7
Age60<	6	1.3	0.2	0.5
Age <10	7	1.3	0.2	0.5
Education <OL	36	1.9	0.2	1.3
Education OL- AL	42	1.7	0.1	0.7
Degree <	27	1.5	0.1	0.5
Household Income - RS	55	30720.4	2841.7	21074.8
Employment/ Government	29	1.3	0.1	0.5
Employment / Private or Self	34	1.4	0.1	0.6

Annual property damage cost per household Rs.

Property damage per household per yr. Rs.	Frequency	Percentage
< 5000	42.0	64.6
5001 - 10000	8.0	12.3
10001 - 15000	3.0	4.6
15001 - 20000	3.0	4.6
20001 - 25000	3.0	4.6
25001 - 30000	1.0	1.5
30001 - 35000	1.0	1.5
35000 <	4.0	6.1

Annual health damage cost per household Rs.

Health damage cost per household per yr. Rs.	**Frequency**	**Percentage**
< 5000	17.0	39
5001 - 10000	15.0	36
10001 - 15000	7.0	16
20000 <	4	9

WTP to prevent property damage

WTP to prevent property damage per year per household – RS	Frequency	Percentage
0	15	23.08
10	2	3.08
15	3	4.62
20	1	1.54
25	5	7.69
50	11	16.92
75	1	1.54
100	8	12.31
200	1	1.54
250	6	9.23
300	2	3.08
500	3	4.62
700	1	1.54
1000	3	4.62
2000	1	1.54
20000	1	1.54

WTP for an air quality fund

WTP to a fund per year per household Rs.	Frequency	Percentage
0	14.0	21.5
25	4.0	6.2
50	4.0	6.2
100	13.0	20.0
500	12.0	18.5
800	1.0	1.5
1000	7.0	10.8
1500	2.0	3.1
2000	2.0	3.1
2500	1.0	1.5
3000	1.0	1.5
5000	1.0	1.5
10000	1.0	1.5
50000	1.0	1.5

Air pollution damage costs and WTP for air quality

	Value Per year per household in Rs.	Std. Deviation	Std. Error of Skew ness
Health damage cost per year	**11713.95**	**16857.05**	**0.361**
Property Damage per year	**11820.31**	**33978.39**	**0.299**
WTP for air quality Fund per year	**1451.563**	**6335.44**	**0.299**
WTP to reduce property damage	**486.4844**	**2500.17**	**0.299**

Summary results on attitude and knowledge

	Frequency	Percentage
Awareness on air quality	**49**	**75**
Knowledge on air quality	52	80
Affected by air pollution	41	63
WTP for a air quality fund	50	76

Conclusions

- Using CVM method air pollution damage cost can be estimated
- Residents have significant willingness to pay (WTP) to avoid property damage and improve air quality (76% agree to pay)
- The average property damage cost due air pollution in Colombo is US$ 118 per year per household
- Average WTP to avoid property damage is estimated to US$ 5 per year per household
- Average WTP to improve air quality in Colombo is estimated to US$ 14 per year per household

Remark

- We are sorry that we could not complete the regression analysis due to time constraints

THANK YOU