AN ESTIMATION OF ECONOMIC COST OF POLLUTION CAUSED BY RICE MILLS

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ABSTRACT

Rice mills emit smoke, dust and wastewater into the surroundings. As a result the residents living in the surroundings may experience health related problems. Sixty percent (60%) of the residents are complaining respiratory related diseases and other nuisance caused by these mills. this leads to a conflict situation between the rice mill owners and the local comities. visual observation have shown the accumulation of dust particles, polluted water logging, and the paddy husk scattered at the vicinity of the mills.

A study by rolla and pingali (1993) states that the health cost due to exposure to pollution can be valued through treatment costs. a single bidding game method of direct questioning was adopted by Abeyagunawardana (1999) to estimate the willingness to accept (WTA) compensation in return to permit the polluters to continue in operations. For this study 1000 households were selected from 1/2 to 1 Km radius from the mills by using RSWOR method. Hundred houses consisted of 441 residents. Questionnaire study was done after explain the nature of the study. The results show the estimated willingness to accept compensation is about Rs 4080 per person pre year. The probability of exposure to the pollutants from the rice mills was 0.58 in the ½ - 1 Km radius from the rice mills.

Linear probability model was used to estimate the relationship between other explanatory variables in determining the effects.

INTRODUCTION

Rice mills are exceptional industries, because rice mills are not managed scientifically. Most of the rice mills were located in the midst of the densely populated areas. The rice mill activities cause severe environmental pollution. They polluted land, water, and air. This lead to a conflict situation between the rice mill owners and the local community who are affected by pollutants produced as by products of the rice milling industries. Rice mills do have benefit to the community as well as harmful effects. The study area was Kalmunai, one of the major rice producing area in the Amparai District, and having many rice mills compared to the other areas in the eastern province, located on the Amparai – Batticaloa high way.

During the milling process, about 68% of rice can be recovered from the rough rice (unhusked rice). From this process, about 32% goes are residual (waste). These waste are enter into the water bodies land and atmosphere. This in turn causes damages to human and ecosystem. As a result of this waste disposal, the socially undesirable level of environmental pollution causes severe damages to the society. Disposal of waste from the rice mills and managing them is a growing problem in and around the rice mills area. Environmental and health impacts such as surface and ground water pollution, air pollution and sanitary health impacts are the most prominent.

the rampant practice of disposing waste open dumping is common practice of the rice mill owners without any environmental safeguards, these dumps can pollute surface and ground water. These dumping sites have been turning into source of contamination due to the incubation and proferation of flies, mosquitoes, and rodents; these in turn are disease transmitters. It is difficult to implement a proper environmental management without mill owners paying for it. In Sri Lanka,

no study has focused on rice mill pollution and its impact on human health, thus objective of this study was to evaluate the cost of medical expenses incurred by the residents living ½ - 1 km radius to the rice mill for the treatment of diseases, developed as a result of uncontrolled pollution. And to determine the residents' willingness to accept (WTA) compensation for the damages caused by the rice mills.

MATERIALS AND METHODS

Theory

Contingent valuation method used to estimate the people's willingness to accept (WTA) compensation (single bidding game method, Abeyagunawardana et. al 1999). Health cost due to exposure to pollution can be valued through treatment cost (rola and pingali, 1993).

Data

Hundred (100) houses were randomly selected (using random table). 441 residents were interviewed. Questionnaire survey conducted after explaining the nature of the study. Type of data collected based on income level. Demographic characters, educational levels, medical expenses, willingness to accepted with respiratory disease, and type of respiratory disease prevails in the study area.

A contingent valuation study carriedout was used as the base for present study. After selecting the households, the respondents were asked whether they were willing to accept compensation from the rice mill owners for continuous operation in the existing locations.

Method of analysis

Sexs, respiratory diseases relationship, income, demographic characteristics of the study area, giving the educational levels of the people in the study area, cost of medical expenses for treatment of respiratory diseases to the people in the study area, income level and peoples willingness to accept compensation from the rice mill owners were analyzed by using tabular statistical method.

Regression analysis (Exposure model)

Linear probability model of the following from was fitted and estimated by maximum likelihood method. Statistical packages used SAS, and SAS ETS.

(Robert S.Pindyck et.al)

$Y=f(X1, X2, X3, X4, X5, X6)$

Y=Dummy variable for the exposure to the pollution

   Y=1 if subjected to exposure, Y=0 if not

X1=Monthly income Rs/household

X2=Monthly household medical expenses

X3=WTA compensation if paid/ Household

X4=Dummy variable for sex. Where

   X4=1 male, X4=0 female

X5=Dummy variable for educational level

   X5=1 primary education, X5=0 otherwise

X6=Dummy variable for presence (YES), X6=0 Otherwise (NO)

RESULTS AND DISCUSSIONS

Legend: M: male, FM: female, P: primary education, S: secondary education, T: tertiary education, N: no schooling.

Out of 441 respondents about 158 persons in the age group of 16 -30 gained some level of education. There were 13 personnel obtained tertiary education among the age group. More persons in the age group between 16 and 45 obtained primary and secondary education

Table1. Sex and Respiratory Disease Relationship

Sex	Number	Asthma	Bronchitis	Free
Male	213	23	19	147
Female	228	118	78	30
Total	441	147	97	177
%	100	32	22	40

Source: Survey data

Survey data reveals that out of 213 male 23 of them suffering from Asthma, 19 suffering from Bronchitis and 24 suffering from T.B. Out of 228 female 118 were suffering from Asthma, 78 suffering from Bronchitis, the females were highly susceptible to Asthma and Bronchitis in the study area(table2).

Table2. Income levels and diseases

Income	No.of House	Asthma	Bronchitis	T.B
0 -1000	09	26	22	09
1001-2000	08	47	25	08
2001-3000	49	36	29	05
3001-4000	19	20	15	03
4001-5000	09	07	04	01
5001-6001	06	05	02	----
6001-7001	100	141	97	26

Source: Survey data

Table3 shows that the lower income earning groups were highly affected by diseases than the higher income earning groups. Due to lower income, there was no much attention paid to take preventive measures. (What sort of measures that the high income families have taken?)

Table 3: Cost of Medical Expenditures

Details	Asthma	Bronchitis	T.B	Total
No of persons affected	141	97	26	264
Medical Expenditures/person/month	350	230	245	825
Medical expenditure /person/year	4,200	2760	2940	9990
Number of persons affected in the entire Population of 2560.	818	563	150	1531
Annual medical expenditure for the entire population	3,435,600	1,553,880	441,000	5,430,450

Source: Survey Data

Table4, shows that the medical expenditures incured for the entire population due to pollution caused by rice mills operation. Out of the entire population of 2560,818 were sufferings from Asthma, 563 of them suffering from Bronchitis, 150 of them suffering from T.B. The medical expenditures incured by a person for the treatment of Asthma was Rs.350 per month, Rs.230 for the treatment cost for the Bronchitis per month, and Rs.245 per month for T.B.

The medical expenditure per person per year is Rs.4200 for the treatment of Asthma, Rs.2700 per person per year for Bronchitis, and Rs.2940 per person per year for the treatment of T.B. The annual medical expenditures for the population for the treatment of Asthma is Rs.3,435,600, for the treatment of Bronchitis is 1,553,880 and for the treatment of T.B is Rs.441,000. Annual total medical expenditure for the population is Rs.5,430,480.

Table 4. Willingness to Accept and Income Level

Income level	2000>	2001-4000	4001<
Minimum	120	130	210
Maximum	375	400	470
Mean	247.50	265.00	340.00

Source: Survey data

The table 5, shows that the willingness to accept compensation from the rice mill owners depend on the income level. When the income level is higher the willingness to accept compensation also higher. Lower income earning groups like to accept lower compensation. Here we accept the mean of the higher income group of Rs.340 per month. The annual amount is Rs.4080 per person. Therefore the total compensation on willingness to accept from the rice mill owners is more than this real earning.

Table 5: regression analysis exposure model

Variable	Parameter estimate	Standard deviation
Intercept	0.584840	0.305411
Sex	-0.120870	0.122197
Education	-0.002601	0.159211
Income	-0.000195*	0.000089
Disease	0.298251**	0.147812
Medical expenses	-0.004287	0.003280

$F = 3.212$ $N = 414$ $R^2 = 0.3896$ Adj$= 0.2429$

*, **: Referes to significant level at $P < 0.1$ and $P < 0.5$ respectively. Results of the regression are reported in table 6. This intercept 0.58, illustrates the probability of the household in the study area being exposed to pollution caused by rice mills. As expected. Standard socio – economic variables such as respondent's sex, education and income levels did not ply much on determining the willingness to accept compensation.

CONCLUSION

This study estimated the willingness to accept from the rice mill owners, to continued operation is Rs 1,044,800 per year. For these results the higher mean value of willingness to accept are taken by close ended question. Health cost due to exposure to pollution was estimated through the expenses incurred for the treatment is Rs 5,430,480 per year. And the probability of exposure to the pollutants is 0.58 from ½ to 1 km radius. Majority of respondents were not aware of the fact that the adverse health hazard was caused to them due to uncontrolled emission of dust and polluted water.

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