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## Whether WTP Is Affected By Some Other Factors? A Case Study On Durgapur

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*Industrialization process is the one of the vital key element of any developing country. It has two impacts. One is the benefit and the other is cost. While it is necessary for occupational transformation of the economy, in terms of employment and growth of the economy, but it has also substantial impact on environmental degradation, resource depletion and related social costs. In this research paper, the objective the study is to examine the how WTP is affected by the other factors in Durgapur.*

**Keywords:** *Industrialization, development, Environment and WTP.*

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### Introduction

Durgapur is an industrial metropolis in the state of West Bengal. I have visited different areas of Durgapur for the purpose of field survey of this PhD work. Whatever information I have collected in my primary data collection in Durgapur Industrial belt I have put the whole information in different tables and am trying to analyze the whole things in brief. Total number of households surveyed is 245 and total number of person surveyed is 952. Of them 68.9% are males. About 96.6% of the respondents are willing to pay as long as the air quality keeps on improving. According to place, according to different occupations

like businessman, shopkeeper and worker I have collected respondents' views and able get an analysis. For our analysis purpose total area of Durgapur has been divided into two regions, one is South-West of Durgapur and another is South-East of Durgapur. Angad Pur , D.C.L More and Maya Bazar are under the area of South-West of Durgapur and Gopalpur, Karangapara, Khatpukur, Rabindrapally , Sagarbhanga and Sukantapally are under the area of South-East of Durgapur. According to different places , according to occupations and according to regions respondents views regarding Willingness to Pay (WTP) for minor changes and major changes for the betterment of environment has been collected and analyzed. Due to industrialization there are two types of effects observed, one is positive effect another is negative effect. Positive effects are employment generation, profit of the factories etc. and negative effects are total medical expenditure of the family, WTP etc.

Out of the total respondent in my survey 68.9% is male and remaining 31.1% is female. 28.2% respondent has given a perception that pollution is unbearable, 70.6% has given their opinion that the pollution is tolerable and remaining 1.1% has told that pollution is moderate. 98.1% respondent is not ready in anyway to accept the pollution. A very large number of respondents, i.e. about 91.5%, have told that they are forced to keep their windows/doors closed on account of air pollution. A large number of those who says that they have to keep their doors/windows closed because of air pollution also say that either they have to keep them closed after 9 p.m. or throughout the day and night. The perception of respondents regarding the air pollution is based on their experience of living in a polluted area nearby the Industry. Though the pollution is very high and the respondent are not ready to accept it in anyway but a large number of respondent (88.0%) are not willing to move other places because majority of them (57.7%) have personal home, some (31.1%) are staying at quarter and few of them are staying in rented house.

## **Objective of the study:**

The objective the study is to examine the how WTP is affected by the other factors in Durgapur.

### **Review of Literature:**

Sharma-Rana (1986) opines that the economic development of every region is mainly determined by the degree of industrialization achieved. "Industrialization is the main hope of the most poor countries trying to

increase their level of income but still industrialization remains a mere hope reality.”

Dr. Kumari A. K (2006) highlights that development without damage to the natural resources is sustainable development and it is very much possible. Industrial development is necessary and it should be achieved through the balanced way. Protection of environment should not be seen as a sartorial interest but as an integrated component of economic and social development. Understanding sustainable development in the context of agriculture, industry, technology, economic development and water management is very important.

## **Methodology:**

The methods of revealed preferences rather than observed behaviors have to be used to derive the economic value. Several methods may be used; here I have used Willingness to Pay (WIP). Multiple Regressions has also been used.

### **Survey technique**

Self-administered techniques, such as mailing, are popular in survey studies. Their advantages over other methods such as interviews, by telephone or in person, are in terms of their cost-effectiveness, coverage of content, and sample sizes. I have used personal interview method.

### **Data Collection:**

There is a need for undertaking the primary survey, therefore, arose from the use of technique, Contingent Valuation Method (Stated Preference technique), in the valuation of environmental cost in an industrially developed township of Durgapur situated in the Burdwan district of West Bengal. To collect data I have used two techniques to measure cost of pollution: one is WTP and the other is WTA. Thus under equivalent measure the willingness to pay [WTP] is treated as an amount consumer is willing to pay for avoiding a less preferred situation. WTP under compensating measure is a willingness to pay for obtaining a more preferred situation.

I have done a field survey and Interviewed 245 households who are residing nearby the factories. I have collected important information regarding WTA and WTP. I also have got their valuable feedback regarding industrialization and pollution.

### **Research Design:**

Here I have assumed a model  $WTP = a y b_1$

i.e.  $\ln WTP = \ln a + b_1 \ln(y)$

$$\begin{aligned} \text{Therefore, } b_1 &= \partial (\ln WTP) / (\partial \ln y) \\ &= [(\partial WTP) / WTP] / [(\partial y / y)] \\ &= [y / WTP] * [\partial WTP / \partial y] \end{aligned}$$

We have selected only seven independent variables for the estimation of willingness to pay function. Here two multivariate regression equations have been used. One for minor changes (Development) in the environment and another for major changes (Development)/  $\ln WTP$  is our Dependant Variable and other seven variables are Independent Variables (Predictors).

Here we have used two Regression equations

$$\ln (WTP) = a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + e.$$

Where e is the error.

**Analysis:**

Whatever information I have collected in my primary data collection in Durgapur Industrial belt I have put the whole information in different tables and am trying to analyze the whole things in brief.

In my study I found that the maximum number of worker (85.7%) are residing at Rabindra Pally. In my whole survey I found 42.3% worker, 38.98% shopkeeper and 18.6% businessman.

There were a number of respondents who are not at all ready to accept the pollution by taking money. There are some protest zeros.

**Table-1:** Perception regarding Level of Pollution

Opinion	Proportion of People
Pollution Increasing	98.3%
Pollution same	1.7%
Pollution decreasing	Nil

**Table-2:** Distribution of respondents into occupational status by location

Source: Primary data

Location	Total Number of Respondents	Percentage of population in different Occupation		
		Businessman	Shopkeeper	Worker
Angadpur	158	32.1	25.0	42.9
D.C.L.More	85	0.0	71.4	28.6
Gopal pur	64	45.4	54.5	0.0

Karangapara	96	29.4	41.2	29.4
Khatpukur	75	20.0	0.0	80.0
Maya Bazar	181	11.4	52.3	36.3
Rabindra Pally	66	0.0	14.3	85.7
Sagarbhanga	102	7.1	28.6	64.3
Sukanta Pally	125	24.0	40.0	36.0
Total	952	18.6	38.9	42.3

According to my survey (from table 1) I have noticed that at Angadpur percentage of worker (42.9%) is higher than that of other professions. At D.C.L.More I found that percentage of shopkeeper (71.4%) is higher than that of other professions. In my study I found that the maximum number of worker (85.7 %) are residing at Rabindra Pally. In my whole survey I found 42.4 % worker, 39 % shopkeeper and 18.6 % businessman.

It is observed that 61.6% respondents have family size 4 to 5, 30.5% have family size 2 to 3 and 5.6% have family size 6 to 7. Among the visited locations, at Khatpukur (50.0 %) respondents have family size 2 to 3 . At Sagarbhanga (78.6 %). Respondents have family size 4 to 5.

**Table-3:** Socio- Economic characteristics of the respondents

Location	Total number of respondents	Size of Family		
		Mean	Median	S.D
Angadpur	158	4	4	1.44
D.C.L.More	85	4.07	4.5	1
Gopal pur	64	3.73	4	1.01
Karangapara	96	3.76	4	1.25
Khatpukur	75	3.5	3.5	1.18
Maya Bazar	181	4.11	5	1.02
Rabindra Pally	66	4.71	4	2.43
Sagarbhanga	102	5.21	4.5	2.61
Sukanta Pally	125	4.12	4	1.2
Total	952	4.14	4	0.62
	Grand Mean	4.14	Combine S.D =	0.64

**Table-4:** Distribution of respondents into Educational Qualification by location: Source: Primary data

Place	Percentage of population into different Educational Qualification Level			
	Less than X	X to XII	Graduate/ Diploma	PG
Angadpur	64.3	21.4	14.3	0.0
D.C.L.More	42.9	57.1	0.0	0.0
Gopal pur	27.3	72.7	0.0	0.0
Karangapara	58.8	35.3	5.9	0.0
Khatpukur	20.0	70.0	10.0	0.0
Maya Bazar	65.9	34.1	0.0	0.0
Rabindra Pally	42.8	57.1	0.0	0.0
Sagarbhanga	35.7	64.3	0.0	0.0
Sukanta Pally	44.0	52.0	4.0	0.0
Total	50.8	45.2	4.0	100

Table 4 shows that most of the respondents have the qualification less than X. It has also been observed that between X to XII a huge number of people are existing. No PG candidate is there. In total of my survey 50.9 % people have qualification Less than X , 45.2 % people have qualification between X to XII and 3.9% of people have qualification Graduate/Diploma .No PG qualified people is found. Also it is observed that at Angadpur 64.3 % , Karangapara 58.8 % and Maya Bazar 65.9 % of people have qualification less than X and for Other Places maximum number of people have qualification between X to XII. Avery few 4.0 % people are Graduate/Diploma holder.

**Table-5:** Distribution of respondents into Income groups by location Source: Primary data

Location	Nr of respondents	Percentage of population into different Income groups							
		1000-2000	2000-3000	3000-4000	4000-5000	5000-6000	6000-7000	7000-8000	8000 and above
Angadpur	158	14.3	28.6	39.3	17.9	0.0	0.0	0.0	0.0
D.C.L.More	85	21.4	57.1	21.4	0.0	0.0	0.0	0.0	0.0
Gopal pur	64	54.5	27.3	18.2	0.0	0.0	0.0	0.0	0.0

Karangapara	96	41.2	17.6	5.9	11.8	17.6	5.9	0.0	0.0
Khatpukur	75	20.0	0.0	0.0	20.0	30.0	20.0	10.0	0.0
Maya Bazar	181	20.5	45.5	29.5	4.5	0.0	0.0	0.0	0.0
Rabindra Pally	66	7.1	21.4	0.0	14.3	14.3	21.4	14.3	7.1
Sagarbhanga	102	14.3	21.4	14.3	14.3	14.3	14.3	0.0	7.1
Sukanta Pally	125	36.0	20.0	12.0	20.0	8.0	4.0	0.0	0.0
Total	952								

It is also observed from the survey that most of the respondents are in the Rs. 2000-3000 income group. It is found that at Angadpur maximum number of people is in the income group of Rs. 3000-4000. 11.3% people have per head income between Rs. 4000-5000, 6.8% people have per head income between Rs. 5000-6000. Only at Rabindra Pally and Sagarbhanga there are some people earning Rs. 8000 & above. It is also observed from survey that Per Head Income of maximum number of people lies between 2000 to 3000. And a very few people have the income more than 8000. People having age group 40- 50 are employed more than other age groups.

**Table-6** Distribution of respondents into Annual Income by different locations

Location	Total number of respondents	Annual Income (Rs.)	
		Average	S.D
Angadpur	158	3589.3	972.3
D.C.L.More	85	3000.0	679.4
Gopal pur	64	2636.4	809.0
Karangapara	96	3588.2	1847.6
Khatpukur	75	5350.0	2108.8
Maya Bazar	181	3090.9	772.1
Rabindra Pally	66	5785.7	2757.6
Sagarbhanga	102	4642.9	2824.5
Sukanta Pally	125	3460.0	1645.2
Total	952	3697.7	845.2
	Grand Mean	3697.7	

**Table-7.** Distribution of respondents into medical expenditure by location:

Source: Primary Data

Location	Percentage of population into different Medical Expenditure Groups					
	Number of Respondents	Below 500	500-1000	1000-1500	1500-2000	Above 2000
Angadpur	158	25.0	75.0	0.0	0.0	0.0
D.C.L.More	85	0.0	100.0	0.0	0.0	0.0
Gopal pur	64	18.2	81.8	0.0	0.0	0.0
Karangapara	96	29.4	70.6	0.0	0.0	0.0
Khatpukur	75	0.0	60.0	0.0	40.0	0.0
Maya Bazar	181	0.0	100.0	0.0	0.0	0.0
Rabindra Pally	66	14.3	42.9	14.3	28.6	0.0
Sagarbhanga	102	28.6	50.0	7.1	14.3	0.0
Sukanta Pally	125	32.0	68.0	0.0	0.0	0.0
Total	952	15.8	76.8	1.7	5.7	0.0

It is also observed from the survey that most of the respondents are spending Rs. 500-1000 per month for medical expenditure purpose. It is found that at Angadpur maximum number of people (75%) is spending Rs.500-1000 per month for medical expenditure purpose. Only at D.C.L.More 100% people are spending Rs. 500-1000 per month for medical expenditure purpose.. Out of my whole survey it is also found that 15.8 % people have monthly medical expenditure below Rs.500. Only about 2 % people have monthly medical expenditure between Rs.1000-1500 and about 6 % people are spending Rs. 1500-2000 per month for medical expenditure purpose.

It is also observed from the survey that most of the respondents are demanding Rs. 500-1000 as monthly compensation. It is found that at Gopalpur maximum number of people (100%) is demanding Rs.500-1000 as monthly for compensation. Only at Rabindrapally 64% people are demanding Rs. 1500-2000 as monthly compensation. Out of the whole survey it is also found that 53 % people want to take Rs.500-1000 as monthly compensation. Only about 23 % people are demanding Rs.1000-1500 as monthly compensation.

**Table-8:** Distribution of Willingness to pay Daily (For Minor Changes) in different locations Source: Primary Data

Location	Percentage of population for Willingness to pay Daily( For Minor Changes)				
	Number of Respondent	Rs.0	Rs. 1 to 3	Rs. 2 to 6	Rs. 6 and above



Angadpur	158	28.6	71.4	0.0	0.0
D.C.L.More	85	28.6	50.0	21.4	0.0
Gopal pur	64	72.7	27.3	0.0	0.0
Karangapara	96	41.2	58.8	0.0	0.0
Khatpukur	75	20.0	80.0	0.0	0.0
Maya Bazar	181	25.0	54.6	20.5	0.0
Rabindra Pally	66	42.9	57.1	0.0	0.0
Sagarbhanga	102	50.0	50.0	0.0	0.0
Sukanta Pally	125	48.0	52.0	0.0	0.0
Total	952	36.7	56.5	6.8	0.0

To control the pollution people are ready to pay to DMC/ADDA according to their best. Most of the people are willing to pay Rs.1 to 3 in daily basis for minor development in the environment. Only about 7 % people are ready to pay Rs. 2 to 6 in daily basis for the same. It is also observed that about 71 % of people of Angadpur are willing to pay Rs.1-3 per day and 80% of people of Khatpukur are willing to pay Rs.1-3 per day, for minor development in the environment. Throughout of my survey we see that 57 % of people are willing to pay Rs. 1-3 every day for minor development in the environments and 37 % people are not at all willing to pay money because they don't believe that the situation will be changed and the environment will be better.

**Table-9:** Distribution of Willingness to pay Yearly (For Minor Changes) by location Source: Primary Data

Location	Total Number of Respondent	Percentage of population for Willingness to pay Yearly( For Minor Changes)			
		Rs.100to 300	Rs. 300 to 500	Rs. 500 to 800	Rs. 800 and above
Angadpur	158	67.9	32.1	0.0	0.0
D.C.L.More	85	78.6	0.0	21.4	0.0
Gopal pur	64	100.0	0.0	0.0	0.0
Karangapara	96	94.1	5.9	0.0	0.0
Khatpukur	75	90.0	10.0	0.0	0.0
Maya Bazar	181	79.5	0.0	20.5	0.0
Rabindra Pally	66	85.7	14.3	0.0	0.0
Sagarbhanga	102	92.9	7.1	0.0	0.0
Sukanta Pally	125	88.0	12.0	0.0	0.0

Total	952	83.6	9.6	6.8	0.0
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To control the pollution people are ready to pay to DMC/ADDA according to their best. Most of the people are willing to pay Rs.100 to 300 in yearly basis for minor development in the environment. Only about 10 % people are ready to pay Rs. 500 to 800 in yearly basis for the same. It is also observed that almost all the people of Gopalpur are willing to pay Rs.100-300 in yearly basis for minor development in the environment and 94% people of Karangapara are willing to pay Rs.100-300 in yearly basis for minor development in the environment. Throughout of my survey we see that about 7 % of people are willing to pay Rs. 500-800 in yearly basis for minor development in the environment. From this table we can also conclude that every people are willing to contribute to control the pollution and ready to stretch their helping hand for the betterment of pollution in environment.

**Table-10:** Distribution of Willingness to pay Daily (For Major Changes) by location Source: Primary Data

Location	Total Number of Respondent	Percentage of population for Willingness to pay Daily( For Major Changes)			
		Rs.0	Rs. 1 to 3	Rs. 4 to 10	Rs. 10 and above
Angadpur	158	10.7	75.0	14.3	0.0
D.C.L.More	85	0.0	71.4	28.6	0.0
Gopal pur	64	72.7	27.3	0.0	0.0
Karangapara	96	35.3	58.8	5.9	0.0
Khatpukur	75	10.0	60.0	30.0	0.0
Maya Bazar	181	0.0	72.7	27.3	0.0
Rabindra Pally	66	0.0	78.6	21.4	0.0
Sagarbhanga	102	28.6	57.1	14.3	0.0
Sukanta Pally	125	24.0	64.0	12.0	0.0
Total	952	15.8	66.1	18.1	0.0

To control the pollution people are ready to pay to DMC/ADDA according to their best. Most of the people are willing to pay Rs.1 to Rs.3 in daily basis for also major development in the environment. Only about 18 % people are ready to pay Rs. 4 to Rs.10 in daily basis for the same. It is also observed that about 75 % of people of Angadpur are willing to pay Rs.1-3 per day for major development in the environment. Throughout of my survey it is observed that 16 % of people are not willing to pay every day for major development in the

environments because they don't believe that the situation will be changed and the environment will be better. And none of them are willing to pay more than Rs. 10 in daily basis for also major development in the environment.

**Table-11:** Distribution of Willingness to pay Yearly (For Major Changes) by location Source: Primary Data

Location	Total Number of Respondent	Percentage of population for Willingness to pay Yearly( For Major Changes)				
		Rs. 0	Rs.100-500	Rs.500-1000	Rs.1000-1500	Rs.above 1500
Angadpur	158	0.0	60.7	35.7	3.6	0.0
D.C.L.More	85	0.0	71.4	28.6	0.0	0.0
Gopal pur	64	0.0	81.8	18.2	0.0	0.0
Karangapara	96	0.0	82.4	17.6	0.0	0.0
Khatpukur	75	0.0	40.0	40.0	20.0	0.0
Maya Bazar	181	0.0	70.5	27.3	2.3	0.0
Rabindra Pally	66	7.1	50.0	21.4	21.4	0.0
Sagarbhanga	102	7.1	64.3	14.3	14.3	0.0
Sukanta Pally	125	4.0	76.0	16.0	4.0	0.0
Total	952	1.7	67.8	24.9	5.7	0.0

To control the pollution people are ready to pay to DMC/ADDA according to their best. Most of the people are willing to pay Rs.100 to Rs.500 in yearly basis for major development in the environment. Only about 6 % people are ready to pay Rs. 1000 to 1500 in yearly basis for the same. It is also observed that 83% the people of Karangapara are willing to pay Rs.100-300 in yearly basis for major development in the environment and 82 % people of Gopalpur are willing to pay Rs.100-300 in yearly basis for major development in the environment. Throughout of my survey we see that about 2 % of people are not willing to pay money in yearly basis for major development in the environment. From this table we can also conclude that almost every people (98% of people) are willing to contribute to control the pollution and ready to stretch their helping hand for the betterment of pollution on environment. The following graph shows the picture of willingness to pay of the people.

One interesting thing in the table is regarding WTA and WTP. There were a large number of respondents who are not at all ready to accept the pollution

by taking money due to increase of pollution. A large number of people are willing to pay money for reduction of pollution. From 732 respondents who answered the question and told that they (about 98.3%) are willing to pay as long as the air quality kept on improving.

**Table-12:** Distribution of respondents into Mean Willingness to Pay for Minor Changes by location

Location	Total number of respondents	WTP for minor changes	
		Monthly Average (Rs.)	Yearly Average (Rs.)
Angadpur	158	32.1	241.1
D.C.L.More	85	49.3	217.9
Gopal pur	64	10.9	140.9
Karangapara	96	22.9	170.6
Khatpukur	75	27.0	130.0
Maya Bazar	181	51.1	222.7
Rabindra Pally	66	21.4	135.7
Sagarbhanga	102	17.1	114.3
Sukanta Pally	125	21.6	168.0
Total	952	32.2	186.7
	Grand Mean	32.2	171.2

**Table-13:** Distribution of respondents into Mean Willingness to Pay for Major Changes by location

Location	Total number of respondents	WTP for major changes	
		Monthly Average (Rs.)	Yearly Average (Rs.)
Angadpur	158	68.6	516.1
D.C.L.More	85	96.4	510.7
Gopal pur	64	21.8	327.3
Karangapara	96	49.4	344.1
Khatpukur	75	84.0	725.0
Maya Bazar	181	81.8	520.5
Rabindra Pally	66	55.7	628.6
Sagarbhanga	102	45.0	503.6

Sukanta Pally	125	51.6	384.0
Total	952	64.9	489.6
	Grand Mean	61.6	495.5

We have collected information on the perception of people regarding pollution. There were number of questions through which this information was solicited from the respondents. The respondents were asked to state whether pollution in the area of their residence was unbearable; bearable or moderate; whether they had to keep the windows and doors of their houses closed, particularly at night, and the reasons thereof including pollution whether they had to incur higher maintenance cost, i.e. whether their house needed frequent coloring, replacement of pipes etc. and the reasons thereof, including air pollution.

Pearson Correlation Coefficient between Ln WTP and Ln income is 0.33 for minor changes (development) in the environment. Also Pearson Correlation Coefficient between Ln WTP and Ln Y is 0.47 for major changes (development) in the environment. Ln WTP is positively, though weakly, correlated with Income for perception of air pollution as unbearable; for which residents are forced to keep doors/windows closed.

**Table- 14**

Elasticity of WTP w.r.t income:	R Square	Beta	F	Ln WTP	
				Mean	S.D
For Minor Changes ( Monthly WTP)	0.22	1.99 (7.09)	50.32	4.63	0.87
For Minor Changes ( Yearly WTP)					
For Major Changes ( Monthly WTP)	0.26	1.86 (7.71)	59.45	3.44	1.63
For Major Changes ( Yearly WTP)					
For Major Changes ( Monthly WTP)	0.22	0.92 (7.08)	50.16	5.97	0.85
For Major Changes ( Yearly WTP)					

( ) value denotes t-value for 1 percent level of significance.

#### **Region wise Analysis:**

After analyzing the data collected through field survey the Elasticity of WTP with respect to income in different regions of Durgapur are given below:

**Table 15:** Region wise distribution of WTP for minor changes

Summary of Output:	S-W = South- West		S-E= South- East	Ln WTP	
Elasticity of WTP w.r.t income for Minor Changes (Monthly WTP) at	R Square	Beta	F	Mean	S.D
S-W of Durgapur	0.11	2.17 (3.26)	10.6	2.88	1.78
S-E of Durgapur	0.45	2.21 (8.49)	72.01	1.93	1.81
Elasticity of WTP w.r.t income for Minor Changes (Yearly WTP) at	R Square	Beta	F	Mean	S.D
S-W of Durgapur	0.16	1.07 (4.06)	16.46	5.14	0.72

The Beta value is 2.17 to measure the elasticity of WTP w.r.t income for Minor Changes at S-W of Durgapur where as The Beta value is 2.21 to measure the elasticity of WTP w.r.t income for Minor Changes at S-E of Durgapur. Therefore S-W of Durgapur is more polluted than that of S-E of Durgapur and there is a significant difference in F value.

**Table 16:** Region wise distribution of WTP for major changes

				Ln WTP	
Elasticity of WTP w.r.t income for Major Changes (Monthly WTP) at	R Square	Beta	F	Mean	S.D
S-W of Durgapur	0.2	1.76 (4.56)	20.84	3.92	1.08
S-E of Durgapur	0.38	2.15 (7.57)	54.31	2.98	1.91
Elasticity of WTP w.r.t income for Major Changes (Yearly WTP) at	R Square	Beta	F	Mean	S.D
S-W of Durgapur	0.1	0.58 (2.87)	8.24	6.1	0.53
S-E of Durgapur	0.32	1.09 (6.39)	40.84	5.84	1.05

From the above tables we can also see that the residents of Durgapur South-West suffered from air pollution to a greater extent as compared to those residing in the South-East of Durgapur. The residents of Durgapur South-West had shown a higher WTP as compared to the residents of South-East of Durgapur. Of course the number of observations for South-West of Durgapur is comparatively small.

South-West of Durgapur is expected to be not much polluted and The income elasticity of WTP is thus expected to be much lower for South-West of Durgapur as compared to South-East of Durgapur.

Regarding there WTP they are asked the amount they were WTP for a 50% reduction in air pollution. Majority of the respondents who were WTP positive sums of money were willing to pay as long as the work of reducing air pollution continued. The figures for WTA were for compensation on account of worsening of the air pollution scenario. But, the figures for WTP were for improving the air pollution situation.

There were seven Accessibility variables for which data were collected. These variables were [1] Status; [2] Educational Qualification, [3] Annual Income; [4] Family size [5] Yearly Medical Expenditure [6] Yearly WTA [7] WTP(yearly) For Minor Changes [8] WTP(yearly) For Major Changes, in the group of socio-economic variables. Most of these variables were correlated. We first of all prepare a correlation matrix for these variables.

### **Correlation Analysis:**

Now we want see the correlation among different factors under study in the following matrix.

**Table-16** Measure of Correlation among different factors

Variables	Business man	Shop keeper	Worker	Family Size	Less than X	X to XII	Graduate/ Diploma	PG	Annual Income (Rs.)	Yearly Medical expenditure	WTP(yearly) for minor changes	WTP(yearly) for major changes
Business man	1.00											
Shop keeper	0.33	1.00										
Worker	0.14	0.40	1.00									
Family Size	0.46	0.85	0.77	1.00								
Less than X	0.55	0.86	0.71	0.97	1.00							
X to XII	0.09	0.76	0.48	0.73	0.58	1.00						
Graduate / Diploma	0.73	-0.13	0.23	0.17	0.28	-0.38	1.00					
PG	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00				
Annual Income (Rs.)	0.41	0.65	0.93	0.94	0.90	0.61	0.28	0.00	1.00			
Yearly Medical Expenditure(Rs.)	0.18	0.75	0.87	0.92	0.88	0.70	0.00	0.00	0.93	1.00		
WTP(yearly) For minor changes	0.57	0.86	0.67	0.95	0.99	0.58	0.32	0.00	0.87	0.86	1.00	
WTP(yearly) for major changes	0.37	0.78	0.84	0.95	0.94	0.63	0.22	0.00	0.94	0.96	0.95	1



From the table-16 we can easily get an idea about correlation between different factors under study. Majority of variables are statistically significant variable that are positively correlated with each other income and four educational dummies were significantly correlated with each other. Similarly, family size and WTP were correlated with each other as well as with different levels of education. They are not significantly correlated with annual income of the respondents and WTP. There are high significant and positive correlation between Educational qualification and WTP. There are also high significant and positive correlation between Annual Income and WTP. From the above correlation matrix we can also conclude that there is also high positive correlation between medical expenditure and worker of the industries. Also workers are paying more medical expenses than that of other peoples in general. Similarly workers are ready to pay more money for cleaning the environment. That is WTP for workers are higher than that of others.

### **Regression:**

We have selected only seven independent variables for the estimation of willingness to pay function. Here two multivariate regression equations have been used. One for minor changes (Development) in the environment and another for major changes (Development)/ Ln WTP is our Dependant Variable and other seven variables are Independent Variables (Predictors). The results of our exercise are discussed below one by one

Now we want to see the first Regression equation is

$$\ln(\text{WTP for Minor changes}) = a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + e$$

Where  $x_1$ = Non Worker,  $x_2$ =worker,  $x_3$ = family size,  $x_4$ =qualification less than X,  $x_5$ = Madhyamik & Onwards,  $x_6$ = Annual Income,  $x_7$ =Medical Expenditure, It is observed that the R Square value is 0.99. After doing ANOVA we get the F value 9.60 the beta values are:  $b_1=0.41$ ,  $b_2=0.23$ ,  $b_3=-1.56$ ,  $b_4=0.92$ ,  $b_5=1.28$ ,  $b_6=1.27$ ,  $b_7=0.63$ .

Therefore the final Regression Equation is  $\ln(\text{WTP for Minor$

changes) =  $4.87 + 0.41 \ln x_1 + 0.23 \ln x_2 + 1.56 \ln x_3 + 0.92 \ln x_4 + 0.62 \ln x_5 + 0.31 \ln x_6 + 0.73 \ln x_7 + e$ .

It is observed that R Square value and F value are also high.

The second Regression equation is

$\ln(\text{WTP for Major changes}) = a + b_1 \ln x_1 + b_2 \ln x_2 + b_3 \ln x_3 + b_4 \ln x_4 + b_5 \ln x_5 + b_6 \ln x_6 + b_7 \ln x_7 + e$ .  $\ln \text{WTP}$  is our Dependant Variable and other seven variables are Independent Variables (Predictors).

Where  $x_1$ = Non Worker,  $x_2$ =worker,  $x_3$ = family size,  $x_4$ =qualification less than X,  $x_5$ = Madhyamik & Onwards,  $x_6$ = Annual Income,  $x_7$ =Medical Expenditure,

It is observed that the R Square value is 0.98. After doing ANOVA we get the F value 9.56 It is also observed that the beta values are:  $b_1=0.45$ ,  $b_2=0.27$ ,  $b_3= -0.73$ ,  $b_4=0.76$ ,  $b_5= -0.19$ ,  $b_6= -0.29$ ,  $b_7=1.10$ .

Final Regression Equation is  $\ln(\text{WTP for Major changes}) = -5.02 + 0.45 \ln x_1 + 0.27 \ln x_2 - 0.73 \ln x_3 - 0.16 \ln x_4 - 0.19 \ln x_5 + 0.30 \ln x_6 + 1.11 \ln x_7 + e$ .

## Conclusions:

It is also observed that here R Square value and F value are also high.

From correlation coefficient we can say that all those selected variables are highly correlated with  $\ln(\text{WTP for Major changes})$ . We found that most of the regression coefficients are statistically insignificant. Although, they have influence on WTP for cleaning the environment. From the value of regression coefficient we see that educational qualification has a great influence on WTP. Also we see that Income has less influence on WTP. For clean environment everyone is willing to pay.

The Beta value is 2.17 to measure the elasticity of WTP w.r.t income for Minor Changes at S-W of Durgapur where as The Beta value is 2.21 to measure the elasticity of WTP w.r.t income for Minor Changes at S-E of Durgapur. Therefore S-W of Durgapur is more polluted than that of S-E of Durgapur and there is a significant difference in F value.

The Beta value is 1.76 to measure the elasticity of WTP w.r.t income for

Minor Changes at S-W of Durgapur where as The Beta value is 2.15 to measure the elasticity of WTP w.r.t income for Minor Changes at S-E of Durgapur. Therefore S-W of Durgapur is more polluted than that of S-E of Durgapur and there is a significant difference in F value.

From correlation coefficient we can say that all those selected variables are highly correlated with Ln (WTP for Minor changes). We found that most of the regression coefficients are statistically insignificant. Although they have influence on WTP for cleaning the environment. From the value of regression coefficient we see that educational qualification has a great influence on WTP. Also we see that Income has less influence on WTP. It is also observed that for clean environment everyone is willing to Pay.

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