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Willingness to Pay for Improved Transport System: A Contingent Valuation Method for Lahore, Pakistan

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ABSTRACT

In this study the relationship between emissions from the transport sector and Pakistan's temperature has been tested empirically. The share of CO2 emissions from road transport in total emissions of CO2 is about 19 percent in Pakistan. Based on data of carbon dioxide from road transport sector, minimum and maximum emissions of carbon dioxide emissions from road transport sector and their damages in financial terms have been forecasted up till 2030. Predicted values of carbon dioxide emissions from road transport show that in year 2030 it will be in the range of 36 to 42 million metric tons. The total damages of carbon dioxide emissions from the road transport sector of Pakistan are estimated to rise between US$ 720 to 840 million by 2030. The study also uses the Contingent Valuation method to calculate the willingness to pay for a better traffic system in Lahore. The findings indicate that the people of Lahore are more conscious about their better transport system as they are ready to pay more for improved and better transport system. the lower bound of the willingness to pay has been calculated for some categories like education, participation, income and indoor/outdoor work. educated people and middle-income class people are willing to pay for improvement traffic system

KEYWORDS

Improved Transport System, Contingent Valuation Method, Transport, Emissions,

Introduction

Human activities, primarily the burning of fossil fuels, are very likely (with more than 90 percent probability) to be the main cause of climate change. According to the United States Geological Survey for Volcano Hazard Program, human activities emit more than 130 times of CO2 than volcanoes. (Gerlach 1991)[1] . Human activities emit 27 billion tons of CO2 every year. These human activities include fossil fuel combustion, cement production and gas flaring (Marland, et al. 2006).

While according to British Petroleum Statistical Review of World Energy (2015), the highest average primary energy consumption between 2004 and 2014 was seen in Asia which is around 38 percent in the said period. While in

[1] Volcanoes emit between 130-230 million tons of CO_2 per year (Gerlach 1991)

Europe and Eurasia average primary energy consumption is around 25 percent and around 24 percent in North America in the corresponding period. It can be concluded that the developing world has the higher primary energy consumption as compared to Europe and North America.

According to the Energy Information Administration (2001), in the US anthropogenic (human induced) GHG emissions from fossil fuel combustion have resulted 82 percent from the carbon dioxide[2] , 9 percent from methane and 5 percent from nitrous oxide. Since carbon dioxide (82 percent) is the main component of the anthropogenic emissions and it is also evident that once emitted in the atmosphere, it remains there for more than 100 years so damages will continue to exist for long period of time. Thus the main focus of this study is on carbon dioxide emissions.

If carbon dioxide is broken down into its main contributors, then the main culprit is the transport sector contributing almost 34 percent of all carbon dioxide (Envirolink, 2011). According to the U.S. Energy Information Administration (various issues) the increase in the petroleum consumption of Pakistan is 277 percent between 1980 and 2010. The average of Asia in the petroleum consumption is around 159 percent while in North America the average increase of petroleum consumption is around 17 percent in the corresponding period. The world average shows around 39 percent increase in use of petroleum products. Since the transport sector contributes greatly to carbon dioxide emissions, the focus of this study is to analyze the pattern of emissions, damages, and forecasting, in this rapidly expanding sector in Pakistan. The growth rate of transport sector in Pakistan is around 1300 percent between 1980 and 2009.

From the literature, it can be concluded, with 90 percent certainty, that anthropogenic emissions have caused the observed global warming after the industrial revolution. According to the IPCC the relationship between carbon dioxide emissions and temperature is positive (CDIAC 2007). According to IPCC the global average surface temperature has increased by approximately 0.65 °C over the last 50 years and between 1.0 to 1.7 °C since 1850. Moreover IPCC forecasts an increase in world average temperature by 2100 within the range of 1.4 – 5.8 °C (IPCC 2007). The National Research Council (NRC) report (2006) claims that rise in global average temperature has been higher during the last few decades as compared to any other period in the last 400 years. It is claimed that: "The risks of the worst impacts of climate change can be substantially reduced if greenhouse gas levels in the atmosphere can be stabilized between 450 and 550 ppm (parts per million) CO2equivalent (CO2e). The current level is

[2] Carbon dioxide is a colorless and odorless gas. It is heavier than the air and therefore can flow in low lying areas. According to the United States Geological Survey (volcano hazard program), if there is 5 percent CO_2 in the air, it will cause a perceptible increase in respiration, 6-10 percent causes shortness of breath, headaches, dizziness, sweating and general restlessness, 10-15 percent results in impaired coordination and abrupt muscle contractions, 20-30 percent results in loss of consciousness and convulsions, while over 30 percent can cause death (Hathaway et. al 1991)

400 ppm CO2e, and it is rising by 2ppm each year."(NASA, 2015). It is also forecasted that stabilizing at 550 PPM of CO2 (double of the pre-industrial revolution level) will lead to temperature increase of 2.0 – 4.5°C by 2050 (IPCC 2007). According to Stern (2007):

"If no action is taken to reduce emissions, the concentration of greenhouse gases in the atmosphere could double as compared to its pre-industrial level as early as by 2035. It means virtually committing us to a global average temperature rise of over 2°C. In the longer term, there would be more than 50 percent chance that the temperature rise would exceed 5°C.".

When we see the case of Pakistan then according to the World Development Indicators, in 1971, almost 19 million metric tons of carbon dioxide emissions was recorded in Pakistan and per capita carbon dioxide emissions were 0.3 metric tons, which increased to a total of 114 million metric tons and 0.8 metric tons per capita in 2003. This shows an increase of almost 500 percent in total emissions and 167 percent in terms of per capita emissions of carbon dioxide from 1971 to 2003. CO2 emissions have increased and the temperature has also increased in the corresponding periods from 0.2 to 1.0°C. There is a positive relationship between CO2 emissions and temperature in Pakistan

There is an acute shortage of environmental (temperature) data in developing countries, especially in Pakistan. Due to financial and time constraint, it is very difficult to conduct this study for the whole country. Thus, a survey was conducted to collect information. In order to obtain primary data we have chosen Lahore city to study Willingness To Pay (WTP) for better transport system. Main reason for choosing Lahore as the subject for this study is that Lahore city is the second largest city and second biggest commercial area of Pakistan and the capital of Punjab province.

Objectives of the Study

Following are the major objectives of the study:

To examine the relationship between expansion of transport sector and GHG emissions.

To study the linkage between GHG emissions and changes in temperature.

To calculate the willingness to pay for improved transport system.

Data Collection and Methodology

In this section data collection techniques and description of different data sets have been explained briefly. The study has been divided broadly into three main sections. In the first part the transport sector's contribution to Pakistan's share of GHG emissions has been computed; in second section the concentration of CO2 and consequently its effect on climate change has been estimated. In third section our objective is to find out the willingness to pay for improved and better transport system. For the first two sections, annual data is required, because as mentioned earlier, climate change is a long run phenomenon encompassing decades [Parry (2007)]. Therefore, initial analysis

is based on annual data. The third part of the study is based on the use of the contingent valuation method (CVM). For this purpose a household survey of Lahore city has been conducted. The primary objective of the paper is to calculate willingness to pay for an improved transport.

Survey Area[3] (Lahore City)[4]

Inadequate management of transport sector poses serious threats to the health of people and the environment of Lahore. Two air quality monitoring stations were installed in Lahore in April 2007. One is situated at Town Hall which is heavily crowded and has a busy traffic area while the other is installed at Township which is a commercial area. The data for air quality is being recorded since April 2007 in these two areas i.e. residential and commercial areas. The main source of environmental degradation in Lahore's transport system which includes two stroke rickshaws, old vehicles and a poor examination system of motor vehicles. The congestion of traffic in Lahore is another major cause which exacerbates the environmental condition.

Lahore experiences all four seasons. May and June are considered to be the hottest months while December and January are thought to be the coldest months. The temperature of Lahore city ranges from 1.2 °C to 46 °C. Lahore is divided into 9 towns and 150 union councils.

Survey Data

A questionnaire was developed with the consultations of the experts in this field. It took around three months in finalizing the questionnaire. A team of highly qualified and experienced people was formed to conduct the survey[3]. Data authentication is the primary responsibility of this study which is why a highly qualified and experienced data collection team was developed.

Due to financial and time constraints a target of 500 questionnaires were set. Out of 500 households only 322 responded returned the completed questionnaires. Getting only 322 completed questionnaires and non-response was checked with the survey team. They concluded that we have received a high number of questionnaires but we rejected some of them because they are incompletely filled. This may be due to the time constraints of the respondents or more importantly due to privacy and confidentiality concerns of the respondents especially when filling the portion of their income and expenditures. So we have selected only 322 questionnaire which are completed in all aspects. The number of questionnaires to be delivered in different parts of Lahore was decided according to the population of each of Lahore's towns. Each town has been given weights according to the town's population. There are nine towns in Lahore. The number of completed

3There were five members of the survey team who were highly qualified and had a minimum M. Sc level education in Economics/Environmental Economics. One member has an M. Sc Economics; two are doing M. Phil/MS in economics and environmental economics while two other members are PhD candidates in environmental economics.

questionnaires received from each town is reported in Table below.

Numbers of Completed Questioners from Each Town

Name of the town	Number of completed questionnaires	Name of the town	Number of completed questionnaires
AllamaIqbal	67	Aziz Bhatti	15
Data GanjBaksh	32	Gulberg	49
Nishtar	30	Ravi	28
Samanabad	34	Shalimar	18
Wahga	18	Cantt& DHA	31

Source: Survey conducted by Author

NOTE: Cantt& DHA are not included in any town and is separately mentioned in Lahore's map.

The average age of the respondent is 30 years. Minimum age of the respondent was 16 years while the maximum age was 76 years. Out of 322 respondents, the numbers of male respondents are 207 while 115 are female. Out of these respondents 148 are married, 169 are unmarried and 3 are divorced.

The educational level of the respondents has been reported in Table below.

Educational Levels of the Respondents

Educational Level	**Number of Respondents**	**Percentage Share**
Illiterate	15	4.66
Primary	6	1.86
Up to Metric	67	20.81
Up to Intermediate	37	11.49
Up to Graduation	76	23.60
Up to Masters	108	33.54
Above Masters	13	4.04
Total	322	100.00

Source: Survey conducted by Author

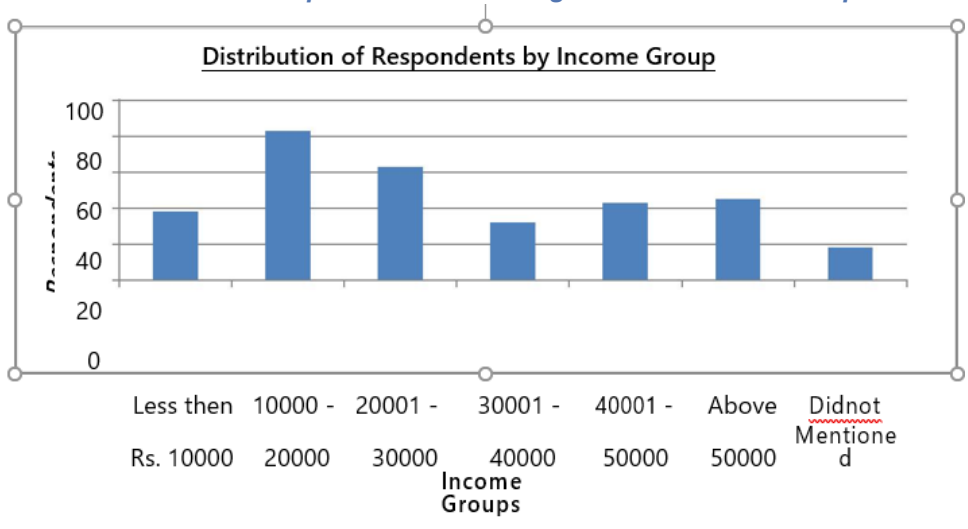
Out of our sample, 246 respondents have their own conveyance while 75 do not have personal conveyance (one respondent did not answer the

question). Out of our sample, 273 respondents (85 percent) are not satisfied with the current traffic system of Lahore, while only 49 (15 percent) are satisfied with this system.

The respondents were asked to rank the main problems and their solutions for the traffic system. Then the question related to improvement in the traffic system was asked. Out of the total respondents, 83 (26 percent) were **NOT WILLING TO PAY** for the improvement of traffic system of Lahore and 229 (71 percent) were **WILLING TO PAY** for the improvement of traffic system. Only 10 respondents did not answer this question. Out of 229, who were WILLING TO PAY, 156respondents showed the positive amount while the remaining said that they were willing to pay but could not specify the exact amount.

In the last section, respondents were asked about the monthly household income. The respondents were divided according to their household income and thus seven groups were created according to the income range.[4]The income groups of the respondents are shown in Figure below:

Division of Respondents According to Their Income Group



Source: Survey conducted by author

The majority of the respondent's household income is in group 2, Followed by group 3, group 6, group 5, group 1, group 4 and group 7.

Impact of CO_2Emissions on Temperature

In this section the impact of emissions of CO_2 on temperature has

[4]Group 1 (income less than Rs. 10000), Group 2(Income between Rs. 10000 – 20000), Group 3 (Income between Rs. 20001 – 30000), Group 4 (Income between 30001-40000), Group 5 (Income between 40001 – 50000), Group 6 (Above Rs. 50000), Group 7(Reluctant to mention the income)

been estimated using the Ordinary Least Square (OLS) method. Previous literature links the concentration of CO_2 to atmospheric temperature. There is no study (up to my knowledge) in Pakistan related to the relationship of emissions of CO_2 and concentration of CO_2. So initially the relationship of global emissions of CO_2 on global concentration of CO_2 in the atmosphere has been estimated and compared with other studies to verify these results. Then the same relationship with respect to Pakistan has been checked. Additionally, the relationship of the concentration of CO_2 on temperature has been estimated on global data and for Pakistan separately. Then the same relationship has been estimated for the emissions of CO_2 from transport sector of Pakistan. Finally using regression analysis and dynamic forecast, emissions of CO_2 from transport sector and their potential damages have been predicted up to the year 2030. For this purpose data on emissions of carbon dioxide from road transport and atmospheric temperature is needed. Due to the immense shortage of environmental data sets in developing countries the emissions of CO_2 from road transport were not available at city level. The other way to calculate the emissions of Lahore city is to look at the consumption of petrol/diesel in Lahore city. Unfortunately, both data sets are not available in any department's data base. So before looking at the impact of emissions of carbon dioxide on temperature, the emissions of carbon dioxide from transport sector excluding agricultural transport, railway and aviation have to be estimated. For this purpose yearly consumption of petrol/diesel has been used. This data set has been taken from Pakistan Energy Yearbook (McMicheal, et al. 2006). Motor Spirit, HOBC and HSD data has been taken which is currently being used in road transportation. In order to calculate the emissions from petrol (Motor Spirit & HOBC) and diesel (HSD), the formula, developed by the EPA, USA has been used. To calculate emissions of carbon dioxide, the carbon emissions are multiplied by the ratio of the molecular weight of carbon dioxide, which is 44, to the molecular weight of carbon, which is 12. i.e. 44/12. These calculations are based on each gallon of petrol consumed. The complete formulas for emissions calculation from a gallon of gasoline/diesel are as under:-

Carbon dioxide emissions from a gallon of gasoline = 2421(grams) x 0.99(44/12)

Carbon dioxide emissions from a gallon of diesel = 2778(grams) x 0.99(44/12)

For oil and oil products, the oxidation factor is 0.99(99 percent of carbon in fuel is oxidized, while 1 percent is not oxidized). This oxidation factor is used in calculating the emissions from oil products. Multiplying the above formulas with the total consumption of petrol and diesel gives us the total emissions for a year. The above emissions are in grams which are then converted into million metric tons.

This section has two main parts. In the first part we check how globally and specifically Pakistan's GHG emissions and concentration of CO_2 and change in temperature are related to each other. The second part consists of

estimated and predicted emissions and damages (1972-2030) to health from emissions of transport sector of Pakistan. For this purpose we need the annual data because as mentioned in the previous section that climate change is a long run phenomenon (M.L. Parry 2007) spreading over decades. Thus, the initial analyses are based on annual data.

Relationship of Emissions and Concentration of CO_2

Since concentration is related to atmospheric temperature; concentration can be calculated in Parts Per Million (PPM). Pakistan's contribution in terms of PPM is not available. Pakistan's contribution in terms of PPM can be calculated by first estimating the relationship of global PPM and emissions of CO_2 and by assuming that the same relationship can be applied to Pakistan. For this purpose global PPM data has been taken from the carbon dioxide Information Analysis Center (Keeling, et al. 2009). The global data for carbon dioxide emissions was taken from energy information administration (Griffin 2008). Carbon dioxide emissions are taken as Million Metric Tons (MMT). To check the relationship of PPM and MMT OLS method has been used. The regression results of PPM on MMT are as follows:

Regression Results of Emissions and Concentration

Variable(s)	Coefficient	Standard Error	T-Ratio[Prob]
C	321.3087	2.426878	132.39(0.0000)
MMT	0.000928	0.000137	6.7594(0.0000)
@TREND	1.284891	0.052040	24.690(0.0000)
R-Squared	0.998093		
DW-statistic	1.668214		

Dependent Variable: PPM

Where

PPM = Parts per million of carbon dioxide concentration in the atmosphere. MMT = Million metric tons of emissions of carbon dioxide

The results show that the coefficient of MMT is positive and statistically significant. It indicates that with an increase of one million metric tons of carbon dioxide emissions in the atmosphere the concentration of the carbon dioxide increases, on average, by 0.000928 parts per million in the atmosphere.

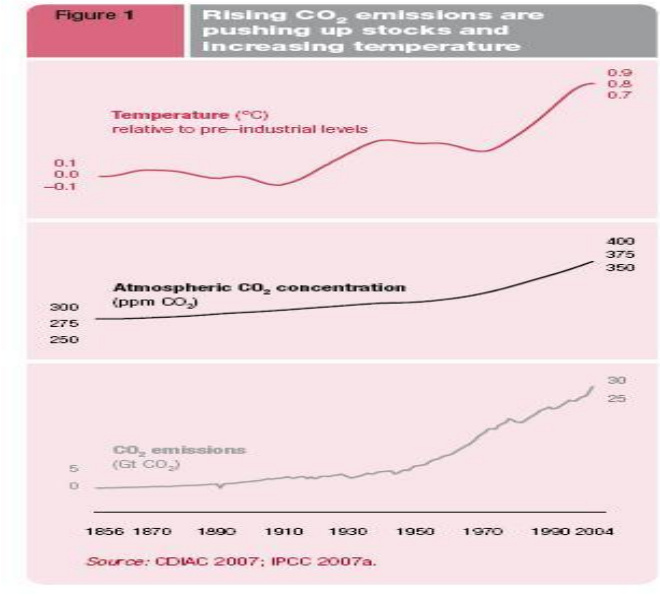
According to the Energy Information Administration (Griffin 2008) the total global emissions of carbon dioxide were 29195.4221 million metric tons in 2006 and the aggregate carbon dioxide emissions were 603,221.68 million metric tons from 1980 to 2006. The concentration of the carbon dioxide is 388 PPM as of 2009 (Keeling, et al 2009). According to the climate scientists the safest limit is 350 PPM of carbon dioxide which we have already crossed

(Hansen, et al. 2008).

Relationship of CO_2Emissions and Temperature

Next the relationship between global temperature and concentration of CO_2 (PPM) of the world has been checked. According to the IPCC the relationship of carbon dioxide and temperature is positive as shown in Figure below.

Relationships of Emissions of co_2, Concentration of co_2 and Temperature as Shown in IPCC 2007a.



The data for the global temperature is taken from the carbon dioxide

Variable(s)	Coefficient	Standard Error	T-Ratio[Prob]
C	10.44512	0.535840	19.49297(0.0000)
PPM	0.010764	0.001497	7.192418(0.0000)
R-Squared	0.683088		
DW-statistic	1.832950		

Information Analysis Center (Keeling, et al. 2009). The estimated relationship is reported in Table below.

Regression Results Emissions and Climate Change

Dependent Variable: TEMP

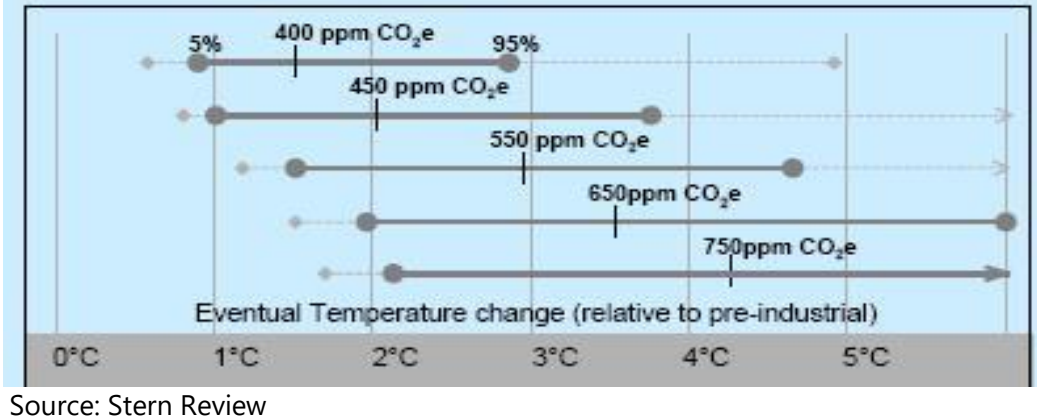
Where

Temp = Temperature of world (degree celsius)

PPM = Parts per million of carbon dioxide concentration

The estimated results, reported in Table above, show positive and statistically significant impact of changes in PPM on temperature. If there is an increase of one unit in carbon dioxide concentration i.e. one PPM of carbon dioxide then, on average, the global temperature rises by 0.011 Celsius or we can say that if there is an increase in the carbon dioxide of around 1078 million metric tons then the global temperature will be increased by 0.011C°. Alternatively, we can say that 98098 million metric tons of carbon dioxide emissions are associated with one degree Celsius increase of global temperature. To confirm our calculations we compared them with the findings of The Stern review on the economics of climate change. The review reports that almost 100 PPM are associated with one degree Celsius increase as shown in the figure below. (Stern 2007)

Relationship of Concentrations of Co_2 and Temperature.



Source: Stern Review

Comparison of PPM Calculation:

Author's Calculations	Stern Review
91 PPM = 1°C	100 PPM = 1°C

Comparison of estimates reported in Table above reveals that there are minor differences in the two estimates. This confirms that the author's calculations are comparable to estimates in other studies.

Next the above analysis has been repeated for the transport sector of Pakistan. First of all it has been ascertained whether transport is affecting the emissions of CO2? For this purpose a time series data of total vehicles of Pakistan have been taken from the transport sector and total emissions have been calculated for Pakistan. The results are reported in Table below.

Variable(s)		Coefficient	Standard Error	T-Ratio[Prob]
C		5.829455	2.163312	2.694690 [0.0127]
TVEH		3.03E-06	1.05E-06	2.883324 [0.0082]
MMTP(-1)		0.865584	0.064612	13.39661 [0.0000]
R-Squared	0.994993			
DW-statistic	2.940772			

Regression Results Emissions and Transport

Where
MMTP = Million metric tons of co2in Pakistan
TVEH = Total number of vehicles in Pakistan

The results, reported in Table above show positive and statistically significant impact of rise in number of vehicles on the emissions of carbon dioxide. It means if there is an increase of 3.3 lakh vehicles in Pakistan then, on average, carbon dioxide emission will increase by 1 million metric tons provided every vehicle consumes 1074 litters/vehicle using fuel.

After looking at the relationship of both series for the whole world , the emissions of CO2 and the PPM for Pakistan has been estimated. Assuming the same global relationship, the PPM for Pakistan has been calculated by multiplying the coefficient of MMT with the emissions of carbon dioxide of Pakistan. Pakistan has around 0.45 PPM of cumulative carbon dioxide concentration from 1980 to 2008 in the transport sector alone. The relationship of both the series in Pakistan is also the same as the global relationship.

After calculating the emissions and concentration, the relationship of carbon dioxide emissions with the concentration of carbon dioxide has been examined. The data for carbon dioxide emissions is taken from World Development Indicators (World Development Indicators). The results are shown in Table given below.

Regression Results of Emissions and Concentration

Variable(s)		**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
C		0.000724	0.001714	0.4222 [0.6770]
MMTPWDI		0.000862	2.23E-05	38.569 [0.0000]
R-Squared	0.985427			

DW-statistic	2.079649			

Where

PPMP = Parts per million of carbon dioxide concentration for Pakistan

MMTPWDI = Million metric tons of carbon dioxide for Pakistan (WDI)

The results show positive and statistically significant impact of emissions on the concentration of carbon dioxide. It means if there is an increase of one unit of emissions (one million metric ton) then, on average, concentration of carbon dioxide will increase by 0.000862 units (Parts per million) in the atmosphere.

Next the relationship between Pakistan's temperature and the concentration of carbon dioxide has been estimated. The data of temperature is taken from the Compendium on Environment (Compendium on Environment Statistics of Pakistan). A problem arose with respect to serial correlation in the estimation so the AR (1) process was included to remove the serial correlation. The results are reported in Table below.

Regression Results of Temperature and Concentration of Carbon Dioxide

Variable(s)		Coefficient	Standard Error	T-Ratio[Prob]
C		22.3979	0.0209	1071.632
PPMP		0.09174	0.0226	4.0514
AVGt-1		-0.358723	0.2374	-1.5110
R-Squared	0.7626			
DW-statistic	1.7705			

Where

Avg= Average temperature (degree celsius) in Pakistan

PPMP = Parts per million of Pakistan

The result show positive and statistically significant impact of concentration of carbon dioxide on the temperature. It means that if there is an increase of one unit in PPM in Pakistan then there will be, on average, an increase of 0.092 degree celsius in the temperature. Similarly, we can say that if there is an increase of around 11 PPM of carbon dioxide then there will be an increase in the temperature by 1 degree celsius.

Damages from emissions of petrol vehicles are estimated to be around 70 million US$ and around US$ 400 million from diesel in 2009. To see this huge difference between damages from petrol vehicles and diesel, we have examined the total number of petrol vehicles and diesel vehicles in Pakistan with their emissions separately. The total number of petrol vehicles in Pakistan were around 8 million and diesel vehicles are around 0.9 vehicles in corresponding period. While looking at the emissions of both categories, we saw that emissions from deisel vehicles are much more then the petrol vehicles. Emissions of deisel vehicles in the corresponding period was around 20 million while emissions from petrol vehicles were less the 5 million.

To see the reason that why the emissions of diesel have recorded a larger increase then the emissions of petrol when the diesel vehicles growth are much less then petrol vehicles. The consumption of petrol and diesel have been examined in the same period. Total consumption of deisel in the same period was around 2000 million gallons while consumption of petrol was around 500 million gallons in the same period.

Consequently, we have to be very careful in future about our transport sector. Either we have to control our energy consumption, decrease our growth of transport or we have to encourage/support green transport system.

Actual and Predicted Emissions of CO_2 from Transport Sector of Pakistan

Next the CO_2 emissions from transport sector of Pakistan have been predicted. The AR model for prediction has been used. The equation for prediction of the emissions is as follows:

Regression Results of Actual and Predicted Emissions

Dependent Variable: MMTPT

Variable(s)		**Coefficient**	**Standard Error**	**T-Ratio[Prob]**
C		1.360675	0.907176	1.499903 [0.1429]
T		0.650132	0.039049	16.64917 [0.0000]
AR(1)		0.624393	0.138552	4.506572 [0.0001]
R-Squared	0.983432			
DW-statistic	2.144517			

On the basis of the above regression and using the dynamic forecast, predicted values show that the maximum emissions for year 2030 will be around 42 million metric tons of the CO_2 from the transport sector of Pakistan and the minimum value for the same year will be around 36 million metric tons. Maximum emissions (predicted) have been calculated as follows:

MMTPTFMAX = MMTPTF + 1.96*MMTPTSE .....(1)

Where

MMTPTFMAX = Predicted maximum value of co_2 emissions (million metrictons)

MMTPTF = Predicted co_2 emissions (million metric tons)

MMTPTSE = Predicted standard error of co_2 emissions (million metrictones)

Likewise minimum emissions (predicted) have been calculated as follows:

MMTPTMIN = MMTPTF - 1.96*MMTPTSE .....(2)

Where

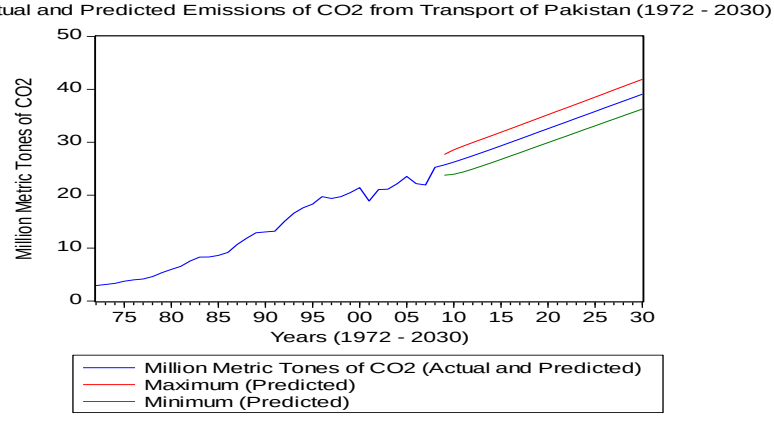
MMTPTMIN = Predicted minimum value of co_2 emissions (million metrictones)

MMTPTF = Predicted co_2 emissions (million metric tons)

MMTPTSE = Predicted standard error of co_2 emissions (million metrictones)

The standard errors have been added in predicted emissions to calculate the maximum emissions while subtracting standard errors to calculate the minimum emissions. Now there is a surety factor of around 95 percent that the range of emissions will be between these predictions. The range for, maximum predicted and minimum predicted emissions is shown in Figure below.

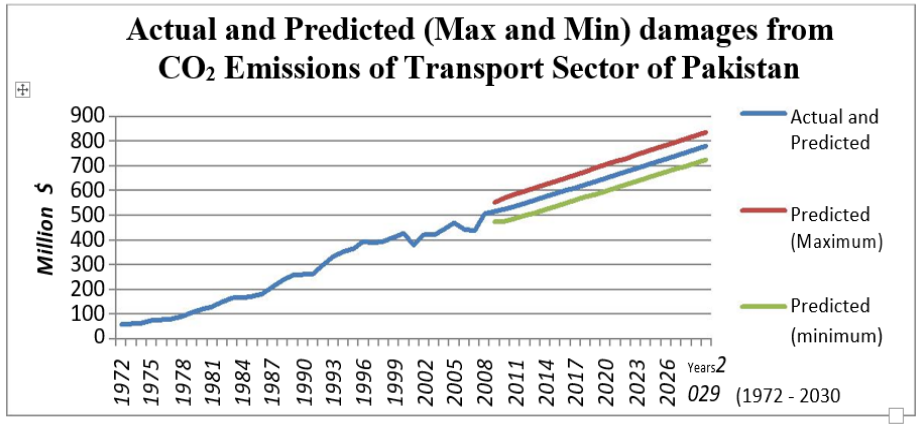
Actual and predicted emissions of $co_2$from transport sector in Pakistan (1972-2030)



Actual and Predicted Damages from CO_2Emissions of Transport Sector of Pakistan

On the basis of the predictions given above, total damages from transport sector of Pakistan have also been predicted for the corresponding period. Total damages (max and min) from CO_2 emissions from transport sector are shown in Figure below

Actual and Predicted Damages from Emissions of Co_2 from Transport Sector in Pakistan (1972-2030)



Source: Author's calculations

Total damages from one ton of carbon dioxide emissions are US$20 as estimated by the World Bank (1995 $). The total damages can be predicted from the transport sector of Pakistan by multiplying the total tonnes with 20 US$ (World Development Indicators 2007). It can be said safely that the range of damages perpetrated by Pakistan's transport sector will be between US$ 720 million to US$ 840 million in 2030.

Estimation of Willingness to Pay[5] for Transport Sectors– A Contingent Valuation Approach

In this section we have asked people how much they are willing to pay for the improvement of Lahore's traffic system and applied the contingent valuation method to estimate average WTP of respondents. The data, collected through a household survey, has already been discussed.

Since the variable 'willingness to pay' is continuous, it is better to use

5 Basically there are many methods to estimate the willingness to pay. For example. 1. The differences in wages that workers must be paid to take riskier jobs. 2. Examines behaviors where people weigh costs against risks (revealed preference) and this is indirect approach of obtaining the willingness to pay.(as mentioned by reviewer) 3. Contingent valuation surveys where respondents are directly asked how much they are willing to pay (stated preference) and this is direct approach of obtaining the willingness to pay.

I have applied the third approach and in literature many authors have applied the third approach like Anna Alberini et al(1997), Kumar (2001), Alan, et al. (2002), Anna (2004) etc have applied the third approach.

the OLS method. But before doing this it is better to check for the problem of heteroscedasticity. To check and confirm this White's heteroscedasticity test have been applied. The following regression has been estimated.

$$WTP\_AMOUNT = \beta_1 + \beta_2*AGE + \beta_3*EXP\_OF\_CONV + \beta_4*PHD + \beta_5*MASTER + \beta_6*GRAD + \beta_7*METRIC + \beta_8*MIDDLE + \beta_9*PRIMARY + \beta_{10}*HAV\_CONV + \beta_{11}*HHSIZE + \beta_{12}*INDOOROUTDOOR + \beta_{13}*MARITAL\_STATUS + \beta_{14}*PARTICIPATION + \beta_{15}*SEX + \beta_{16}*INC\_2 + \beta_{17}*INC\_3 + \beta_{18}*INC\_4 + \beta_{19}*INC\_5 + \beta_{20}*INC\_6 + \beta_{21}*POLLU\_RED4 + \beta_{22}*POLLU3 + \beta_{23}*POLLU4 + \beta_{24}*POLLU2 + \mu$$

Where

WTP_amount = Willingness to pay for improvement of Lahore's traffic system [in Rs.]
EXP_OF_CONV = Expenditure on conveyance (in Rs.)
PHD = Doctor of Philosophy
MASTER = Master's degree (16 years of education)
GRAD = Graduation (14 years of education)
METRIC = Metric (10 years of education)
MIDDLE = Middle (8 Years of education)
PRIMARY = Primary (5 Years of education)
HAV_CONV = Have own conveyance (if Yes = 1, otherwise = 0)
HHSIZE = Household size
INDOOROUTDOOR =Working area (indoor or outdoor) (if indoor = 1, otherwise = 0)
MARITAL_STATUS = if married = 1, otherwise = 0
PARTICIPATION = Willing to participate in betterment of traffic system (if yes = 1, otherwise = 0)
SEX = Sex (male = 1, female =0)
INC_2= Income group (Rs. 10001 – 20000 per month)
INC_3= Income group (Rs. 20001 – 30000 per month)
INC_4= Income group (Rs. 30001 – 40000 per month)
INC_5= Income group (Rs. 40001 – 50000 per month)
INC_6= Income group (Rs. 50001 and above per month)
POLLU_RED4 = Pollution reducing technology (if less important = 1, otherwise= 0)
POLLU3 = Major changes required for pollution problem (if required = 1,other wise 0)
POLLU4 = Complete overhauling is required for pollution problem (if required = 1, other wise 0)
POLLU2 = Minor changes required for pollution problem (if

required = 1,otherwise = 0)

By estimating the above regression, the residuals are obtained and then the auxiliary regression has been estimated, as suggested by White i.e. regressing the squared residuals on a constant, all explanatory variables, their squared and cross products. The heteroscedasticity problem was found in the test because the p value is less than 0.05. To remove the problem, instead of simple OLS method, White's heteroscedasticity-consistent variances and standard errors method has been applied. By applying this method the problem of the heteroscedasticity was also removed. White's heteroscedasticity-corrected standard errors are also known as robust standard errors. The following results show that the heteroscedasticity is removed. Because the P value is greater than 0.05.

White Heteroscedasticity Test:

F-statistic	0.671947	Probability	0.992322
Obs*R-squared	182.9017	Probability	0.926575

The estimated regression results are reported in Table below.

Estimated parameters of WTP for improvement of traffic system (CVM)

Dependent Variable: WTP_AMOUNT

Variable(s)	**Coefficient**	**Standard Error**	t-Statistic **[Prob]**
C	-9.573676	162.2945	-0.058 [0.953]
AGE	-5.567490	2.458666	-2.264 [0.024]
EXP_OF_CONV	0.020407	0.006266	3.256 [0.0013]
PHD	126.2479	172.2992	0.732725 [0.4643]
MASTER	151.7343	83.83159	1.809990 [0.0713]
GRAD	173.9455	85.57825	2.032590 [0.0430]
METRIC	95.50890	68.22596	1.399891 [0.1626]
MIDDLE	-8.409772	62.43609	-0.134694 [0.8929]
PRIMARY	132.9054	83.62173	1.589365 [0.1130]
HAV_CONV	85.51342	47.81120	1.788565 [0.0747]
HHSIZE	-9.899096	13.52955	-0.731665 [0.4650]
INDOOROUTDOOR	-113.9801	65.90832	-1.729374 [0.0848]
MARITAL_STATUS	-85.40914	57.91308	-1.474781 [0.1413]

PARTICIPATION	269.3020	42.71679	6.304359 [0.0000]
SEX	74.05455	61.61508	1.201890 [0.2304]
INC_2	-54.40893	69.10951	-0.787286 [0.4317]
INC_3	10.65278	79.52073	0.133962 [0.8935]
INC_4	236.7696	107.3949	2.204664 [0.0282]
INC_5	136.5305	110.8875	1.231252 [0.2192]
INC_6	-20.95879	97.27249	-0.215465 [0.8296]
POLLU_RED4	-140.4452	51.07261	-2.749912 [0.0063]
POLLU2	153.9866	119.6292	1.287199 [0.1990]
POLLU3	187.9689	91.43882	2.055679 [0.0407]
POLLU4	169.7297	97.93100	1.733156 [0.0841]
R-Squared 0.222579			
D-Watson 1.875371			

The results given above show that age is negatively related to the willingness to pay (WTP) this implies that the youngers have higher marginal utility for improved traffic system than older ones since the model shows that higher willingness to pay reflects higher marginal utility. The improvement in traffic system increases the welfare of the youngers more than the olders. The youngers are more willing to contribute to improvement of traffic system and thus the reduction in CO2. The increase in CO2 is one of the major causes of climate change. The negative sign of the age shows one additional year of age contributes on average Rs. 5.57/- less for the improvement of traffic system.

The expenditure on conveyance is positively related to willingness to pay. One additional rupee on conveyance contributes to around Rs. 0.02/- increase in willingness to pay for improvement of traffic system. This is because when people are stuck in the traffic their expenditure and cost of time increases. So to save these expenditures and time they are willing to pay more for improvement in the traffic system.

Education positively affects the willingness to pay for the improved traffic system. It means that educated people are more conscious about a good traffic system and clean environment. If a person is a graduate (14 years of Education), then he/she is willing to pay around Rs 174/- more than an illiterate person. Likewise if a person has a master's degree (16 years of education), then his/her willingness to pay is around Rs 152/- more as compare to an illiterate person. PhD, metric, middle and primary are insignificant in our sample survey.

Those people who have their own conveyances are willing to pay on average around Rs 86/- more than those who do not have conveyance. Because of traffic congestion system their expenditure on conveyance and time increases rapidly. Consequently, they are willing to pay more to save expenditure and time. The negative sign of the indoor/outdoor category shows that those people who are working indoor, are willing to pay on average Rs. 114/- less than the people who are working outdoors. This implies that the marginal utility from one additional unit of traffic improvement for persons working outdoor is higher than for persons working indoor. The reason may be that people working outdoor are more vulnerable to traffic pollution. Another reason may be that those who are working outdoor may want to work more on the site and minimize the time stuck in the traffic in order to increase their income by working more hours. Therefore they are willing to pay more for improvement in the traffic system. The variable participation is highly significant. Those people who are willing to participate in the improvement of traffic system are willing to pay, on average, Rs. 269/- more than those who do not want to participate. The individuals who are participating in improvement of traffic system derive higher marginal utility from one additional unit of traffic system improvement because their willingness to pay is higher than those who are not participating.

The income has been categorized into six different groups according to the income level instead of taking the income as continuous variable. By doing this we can pin point that which income group is willing to pay more amount for improvement in traffic and health sectors. Regarding the income, only category four is significant. It means that those people whose income lies between Rs. 30 – 40 thousands per month are willing to pay Rs. 237/- more than the people whose income is less than 10 thousands per month. All other income categories, lower and upper, are insignificant. It can be concluded that only the middle class is willing to pay for improvement in traffic system.

Regarding the mitigating activities, when asked about the problems and solutions of the traffic system of Lahore, only one problem is significant and that is the pollution. Pollution can be classified into two categories. Pollution3 shows the major changes (for example replacing the old vehicles with green technological vehicles, greening the cities etc.) are required and pollution4 shows that complete overhauling is required with reference to pollution. Those who view major changes positively are willing to pay Rs.188/- more than those who are not concerned about the problems posed by pollution. Those who support complete overhaul of the traffic system to control the pollution are willing to pay Rs. 170/- more than those who are not in favor of a complete overhaul. When asked about the solutions for the pollution. With respect to solutions for the problems created by pollution, people are in favor of the induction of various pollution reducing technologies. The negative sign shows that the people who consider technologies to be less important are willing to pay Rs. 140/- less than those

who give more importance to pollution reducing technologies.

By looking at the results given above, the lower bound of the willingness to pay has been calculated for the whole city of Lahore. The initial step in this process was the calculation of population of Lahore. The share of Lahore's population in Pakistan was around 3.8 percent.

Pakistan's total population is available for each year in the Economic Survey of Pakistan. Lahore's share in the population was calculated by using Lahore's population in 1998 as a correlative and assuming that the ratio was the same in 2009. Total population of Pakistan in 2009 was around 167 million. So by multiplying the share of Lahore population in 1998 with 167 million; the population of 2009, the population of Lahore has been calculated. By this method the total population of Lahore was around 6.4 million in 2009.

The same method has been applied to calculate the enrollment of colleges and universities in Lahore. The level of enrollment in Lahore was calculated by taking Lahore's share of population and the enrollment level of colleges and universities in Pakistan (Pakistan 2010). College level enrollment means that the students have definitely completed metric level education and university level enrollment means that the students have definitely completed graduation.

In order to calculate the total willingness to pay according to the level of education, the total numbers of metric people and graduates have been multiplied with their corresponding coefficient of education according to the regression given above. Total number of students who passed metric was 40812 and total number of graduates in Lahore was 31069 in 2009. Total willingness to pay according to the level of education is reported in the Table below. [6]

Total WTP for Education.

WTP for education	**Metric (10 years Completed)**	**Graduates (14 years Completed)**	**Net Effect of 4 Years of Education at Higher level.**
Willingness to pay (Lahore)	47 (Million Rs.)	64.87 (Million Rs.)	17.87 (Million Rs.)
Willingness to pay (Pakistan)	1237.25 (Million Rs.)	1677.7 (Million Rs.)	440.45 (Million Rs.)

[6]Due to non-availability of data of master level education completion, only up to graduation level willingness to pay has been calculated. If data of higher education completion had been available then the willingness to pay could also be calculated for higher education.

Source: Calculations based on survey conducted by author

Table below reports distribution of respondents based on the working conditions (Indoor/Outdoor).

Distribution of respondents according to working condition.

Indoor/Outdoor	Number of Respondents	Percent
Outdoor	97	30.12
Indoor	225	69.88
Total	322	100.00

Source: survey conducted by author

By looking at the above Table, the total population of Lahore who are working outdoor can be calculated. The total population of Lahore who is working outdoor is 1.93 million. From

the regression results it is clear that the people who are working outdoor are willing to pay Rs. 114/- more than those who are working indoor. Total willingness to pay for outdoor workers will be Rs. 220/- million per month more than those who are working indoor.

(Total population of Lahore) X (percent of people who Works Outdoor) X (WTP in Rs.)

(6.4 million) X (0.3012) X (Rs. 114/-) = Rs. 220/- million per month

Willingness to pay per year = 220 X 12 = Rs. 2640/- million

The Table below represents the number of people who view improvement of Lahore's traffic system positively and would like to participate in the process.

Distribution of Respondents Who Want to Participate or Not in Improvement of The Traffic System.

Participation	Number of Respondents	Percent
No	60	18.63
Yes	262	81.37
Total	322	100.00

Source: survey conducted by author

According to our sample, 81.37 percent population wants to participate in the improvement of traffic system. Our regression results show that these persons are willing to pay Rs 269/- more than those who are not

willing to participate. If this population percentage is multiplied with Lahore's total population and the resulting figure is multiplied with Rs.269; the resulting sum will be an approximation of how much more the people who want to participate are willing to pay than those who are not so eager about involvement. The equation for the people exhibiting willingness to pay with respect to Lahore is given as under

(Total Population of Lahore) X (percent of people who wants to participate) X (WTP in

Rs.)

(6.4 million) X (0.8137) X (Rs. 269/) = Rs. 1401/- million per month

Willingness to pay per year = 1401 X 12 = Rs. 16812/- million

With reference to the income groups, it is shown in our regression results that only category 4 is willing to pay for improvement of traffic system of Lahore. The willingness to pay for this group is Rs. 237/- more as compared to group one. Six income groups have been defined in Table below

Distribution of Respondents According to Income Groups.

Income Group	**Number of Respondents**	**Percent**
(Less than Rs. 10000)	39	12.11
(10001 – 20000)	87	27.02
(20001 – 30000)	70	21.74
(30001 – 40000)	33	10.25
(40001 – 50000)	48	14.91
(Greater than 50000)	45	13.98
Total	**322**	**100.00**

Source: survey conducted by author

(Total Population of Lahore) X (percent of people in group 4) X (WTP in Rs.)

(6.4 million) X (0.1025) X (Rs. 237/-) = Rs. 155.47/- million per month

Willingness to pay per year = 155.47 X 12 = Rs. 1865.64/ million

Conclusions and Policy Implications

The share of CO_2 emissions from road transport in total emissions of CO_2 is about 19 percent in Pakistan. Predicted values of carbon dioxide emissions from road transport show that in year 2030 it will be in the range of 36 to 42 million metric tons. The total damages of carbon dioxide emissions from the road transport sector of Pakistan are estimated to rise between US$ 720 to 840 million by 2030. From the point of view of policy making, it is

imperative to take cautious measures to prevent further damages.

The second conclusion of this study is that there is a strong relationship between emissions/concentration of CO_2 with the average temperature. If there are 12760 million metric tons of CO_2 emissions then it will be associated with 1°C increase in average temperature.

In the third part of the study, contingent valuation method has been applied to assess willingness to pay. In Lahore, people are willing to pay a huge amount for improvement in the traffic system. According to our analysis, people who work outdoors, people who want to participate in the betterment of the traffic system and expenditure on conveyance all contribute to a positive willingness to pay for betterment of the traffic system. Similarly, income group4 (Rs.30001-40000 per month), pollution reducing technologies, pollution problem solutions and people who have their own conveyance exhibit a positive willingness to pay for improvement of the traffic system. However, age has a negative relationship with the willingness to pay.

The fourth conclusion is that educated people and middle income class people are willing to pay for improvement traffic system. Education brings awareness to life. People want to live in a healthy and clean environment. Consequently, they are willing to pay for betterment of the traffic system. The middle income class is the only class who is willing to pay for better system.

Finally the lower bound of the willingness to pay has been calculated for some categories like education, participation, income and indoor/outdoor work.

Policy Implications:

As it has been concluded that the climate is changing i.e. emissions are increasing which result in an increase in temperature. The risks of serious impacts of this increase in temperature indicate that there is a dire need to quickly resolve the problem.

Environmental damages are not associated with private cost (household, firms etc.) therefore the role of public policy is necessary for the solution of the problem. Waiting for economic recovery rather than making a decision now will create more obstacles in future.

We must adopt some sort of double dividend policy (win-win situation) in shaping the tax system. It means that we must levy tax on those who are responsible for emissions and should give rebate to those who are using green technology. In this way we will get a double dividend i.e. reducing emissions or getting the revenue and giving incentives to those who are using green transport.

There must be some rebate or zero tax for importers of green transport.

We must add a tax to those items that are creating the problem of climate change. For example instead of levying tax on petrol we must tax those vehicles that are emitting a large amount of GHG and not using green technology or controlling devices for emissions. By levying the tax on

petroleum, we are taxing the whole country. We must not tax those who are not responsible for the problem.

We Must Reduce Subsidies on Those Items That Create the Emissions.

For implementation of this policy we need technology and finance (essential for mitigation and adaptation). For technology we should announce tax free imports and provide loans to the private sector and to those who are importing the green transport. Moreover we should start some sort of the project based on private-public partnership that is related to green technology and must give easy access to loans for importing green technology. For example public transport which is using the CNG.

For finance we should start carbon trading and tax those who are responsible for emissions. Moreover people of Lahore are willing to pay a huge amount for betterment of the traffic system. We should also avail this opportunity.

References

Alan Krupnick, Anna Alberini, Maureen Cropper, Nathalie Simon, Bernie O'Brien, Ron Goeree and Martin Heintzelman. "Age, Health and the Willingness to Pay for Mortality Risk Reductions: A Contingent Valuation Survey of Ontario Residents." The Journal of Risk and Uncertainty, 2002: 161-186.

Alberini, Anna, et al. "Valuing Health Effects of Air Pollution in Developing Countries: the Case of Taiwan." Journal of Environmental Economics and Management, 1997: 107-126.

Alberini, Anna, Maureen Cropper, Alan Krupnick, and Nathalie B. Simon. "Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?" Journal of Risk and Uncertainty, 2006: 231-245.

Anna Alberini, Maureen Cropper, Tsu-Tan Fu, Alan Krupnick, Jin-Jan Liu, Daigee Shaw and Winston Harington."Valuing health effects of air pollution in developing countries: the case of Taiwan."Journal of Environmental Economics and Management, 1997.

Anna, Alberini. Maureen Cropper, Alan Krupnick and Nathalie B. Simon. "Does the value of a statistical life vary with age and health status? Evidence from the US and Canada."

Journal of Environmental Economics and Management, 2004.

Aronow WS., and Ahn, C.. "Elderly nursing home patients with congestive heart failure after myocardial infarction lining in New York city have a higher prevalence of mortality in cold weather and warm weather months." Journal of Gerontol A. BiolSci Med Sci., 2004: 146-147.

Arriaga-Salinas, M. L. Cropper and A. S. "Inter-city Wage Differentials and the Value of Air Quality."Journal of Urban Economics, 1980: pp 236-254.

Anthony J. McMicheal, R. E.. "Climate change and human health: Present and future risks".

The Lancet; ProQuest Medical Library, 859, 2006

Basu R., S. J. "Relation between elevated ambient temperature and

mortality: a review of the epidemiologic evidence". 24(2),. Epidemiol Rev, 2002: 190-202

Braga, Alfesio L.F., Zanobetti, Antonella. And schwartz, Joel. "The Effect of Weather on Respiratory and Cardiovascular Deaths in 12 U.S. Cities."Environmental Health Perspective 110, July 2002: pp 859-863.

Chichilnisky, G. and Heal, G. "Global Environmental Risks." Journal of Economic Perspectives Vol. 7(4), 1993: pp 65-86.

Cline, William R. "The Economics of Global Warming."XVII Conference of the Indian Association for the Study of Population. Tamil Nadu, India: Institute of International Economics, Washington, D.C., 1992.

CNG Stations.2009. http://www.cngstations.com/vehicles-on-cng-ngv/.

Compendium on Environment Statistics of Pakistan. Islamabad: Federal Bureau of Statistics, Government of Pakistan, 2004.

Cropper, M. L., and Arriaga-Salines..A.S. "Inter City Wage differentials and the Value of Air Quality."Journal of Urban Economics, 1980: 236-254.

Cropper, Maureen L., Nathalie B. Simon, Anna Alberini, and P.K. Sharma."The Health Effects of Air Pollution in Delhi, India."Development Research Group, Policy Research Working Paper 1860. The World Bank, 1997.

Curriero FC, Heiner KS, Samet JM, Zeger SL, Strug L and Patz JA."Temperature and mortality in 11 cities of the eastern United States."American Journal of Epidemiol, 2002: 80:87.

Economic Survey of Pakistan. Islamabad: Finance Division, Government of Pakistan, Different Issues.

Environlink.org. envirolinkk.n.d. www.envirolink.org/orgs/edf/sitemap.html (accessed 2011).

GC, Keatinge WR and Donaldson."The Impact of global warming on health and mortality."

South Medical Journal, 2004: 1093-1099.

Griffin, Karen. U.S. Energy Information Administration. December 8, 2008. http://www.eia.doe.gov/pub/international/iealf/tableh1co2.xls.

Gupta, Usha. "Valuation of Urban Air Pollution: A Case Study of Kanpur City in India."

SANDEE working paper No. 17-06, 2006.

Haines, Andrew, McMichael, Anthony J., Epstein, Paul R. "Environment and Health: Global Climate Change and Health." CMAJ, 2000.

Hansen, et al. "Target atmospheric CO2: Where should humanity aim?" Open Atmospheric Science Journal, 2008: Vol. 2, pp 217 - 231.

Halsnæs, K.; et al. (2007)."Framing issues. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz et al. Eds.]".Cambridge University Press, Cambridge, UK, and New York, N.Y.

Houghton, J.T., Jenkins, G.J. and Ephraums, J.J. "Climate Change: the IPCC Scientific Assessment". Cambridge: Cambridge University Press for the IPCC, 1990.

Ian W. H. Parry, Margaret Walls, and Winston Harrington. "Automobile

Externalities and Policies." Discussion Paper: June 2006, Ref DP06-26 RESOURCES FORTHE FUTURE, USA. Www.rff.org, 2006.

Institute, World Resources. Climate Analysis Indicators Tool (CAIT). Vers.Version 8.0.12 25, 2010. http://cait.wri.org/cait.php?page=calctrend&mode=view&sort=gro-desc&pHints=shut&url=form&pOpts=shut&menu=emit&start=1980&end=2007&update =Update&sector=natl&co2=1.

IPCC. "IPCC Fourth Assessment Report." 2007.

Knutti, R. et al. "Constraints on radiative forcing and future climate change from observations and climate model ensembles." Nature 416: 2002: 719-723.

Lvousky, Kseniya. "Effective Pollution Charges: Lessons of Worldwide Experience." Environment Department, The World Bank, Number 50, 1996.

Maureen L. Cropper, Nathalie B. Simon, Anna Alberini and P.K. Sharma."The Health Effects of Air Pollution in Delhi, India."The World Bank, Policy Research Working Paper 1860, 1997.

McGeehin,M. A. "The potential impacts of climate variability and change on temperature-related morbidity and mortality in the United States". Environ Health Perspect 109(Suppl 2), 2001: 185-189.

Meehl, G. and C. Tebaldi. "More intense, more frequent and longer lasting heat waves in the 21st century." Science, 305, 2004: 994-997.

MM. Huynen, P. Martens ,D. Schram, MP. Weijenberg and AE. Kunst. "The Impact of Heat Waves and Cold Spells on Mortality Rates in the Dutch Population." Environ Health Perspect, 2001: 463-470.

Ojha, Vijay Prakash. "The Trade-Off Among Carbon Emissions, Economic Growth and Poverty Reduction in India." SANDEE working paper No. 12-05, 2005.

Pakistan Energy Yearbook. Islamabad: Ministry of Petroleum & Natural Resources, Various issues.

Pakistan, Govt of. Economic Survey of Pakistan. Islamabad: Finance Division, June 4th, 2010.

Park, SK., O'Neill MS, Vokonas PS, Sparrow D, Schwaartz J. "Effects of air pollution on heart rate variability: the VA normative aging study." Environmental Health Perspective, 2005: 304-309.

Pattenden, S., B. Nikiforov, and B.G. Armstrong."Mortality and temperature in Sofia and London."Journal of Epidemiol and Community Health 57, 2003: 628 - 633.

Robert D. Morris, N. E.. "Carbon Monoxide and Hospital Admissions for Congestive

Heart Failure: Evidence of an increased Effect at Low Temperatures", Environmental Health Perrspectives 106, 1998: 649-653.

Stern, Nicholas. The Economics of Climate Change. Cambridge University Press, 2007.

Stott, P.A. & Kettleborough, J.A. "Origins and estimates of uncertainty in predictions of twenty first century temperature rise." Nature 416, 2002: 723-

726.

Takeuchi, Akie, Maureen Cropper, and Antonio Bento."The Impact of Policies to Control Motor Vehicle Emissions in Mumbai, India."Journal of Regional Science, 2007: 27-46.

Ulph, A. and Ulph, D. "Global Warming, Irreversibility and learning."The Economic Journal (Blackwell Publishing for the Royal Economic Society) Vol 107, no. No. 442 (May 1997): pp 636-650.

UNFCC. Kyoto Protocol. 1997. http://unfccc.int/kyoto_protocol/items/2830.php (accessed 2011).

Whitman, S. G. “Mortality in Chicago attribute to the July 1995 heat wave”. American Journal of Public Health, 1997: 1515-1518.