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The Workdays Lost of the Brick Kilns Emissions in Peshawar: A Policy Analysis

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Abstract
Air Pollution caused by Brick Kilns is a major environmental problem in terms of Human health. Pakistan's 3 biggest cities are ranked in Top ten most polluted Cities. Peshawar is ranked 3rd in the Top Ten most Polluted City in the world. We in our study, try to find out to what extent air pollution has been deteriorating human health and how it effect work days lost. We will establish our analysis by estimating the workdays lost related to the release of PM10 from brick kilns. For our analysis, we collected primary data of 60 households defining the socio economic conditions of the respondents. We have used Health dairy method to collect data regarding health information from the people. We then estimated one function which is Health cost function using Ordinary Least Square Technique (OLS). The Pm10 level to be set as low as 180 ug/m3. Our regression analysis estimated that pm10 released from the brick kilns have an adverse effect on people living close by to the brick kilns and it affects the work days lost
Keywords: cost of illness, workdays lost, Peshawar kilns' emissions, health production function, valuation.

1. Introduction

The adverse effects of air pollution on health are well known. People around the world living in urban centers or even remote areas have been subject to ill health due to air pollution. Diseases such as Asthma, blood pressure, bronchitis, cancer and other heart diseases have all been linked with high levels of air pollution. Despite the health issues, ambient air pollution also inflicts a heavy monetary loss on the individual in terms of increased health cost and loss of productivity. On the aggregate scale, it also has an adverse effect on public exchequer due to increased public sector spending. According to the World Health Organization recent report, Peshawar, Quetta and Lahore are among the top ten most polluted cities across the world.

There are many reasons for air pollution in Peshawar, However for this study we are interested in the use of rubber in the production of brick. The kiln industry is very old, dating back to the Indus Valley Civilization (2500-1500 BC). Such techniques were also used by the ancient civilizations of Egypt and Mesopotamia for building temples and tombs. Although the basic mechanism remains the same, the design, shape and weight of bricks have undergone drastic changes, while the production technology has remained stagnant.

In terms of brick production, Pakistan is the third largest producer of Bricks in the world. Bangladesh, India, China and Pakistan produce 75 percent of the global production of bricks. According to research it is the main cause of pollution in these regions. Pollution due to brick kilns account for 36 percent of total in Bangladesh.

Total numbers of brick kilns in and around Peshawar are 450. One working brick kiln produce around 7500 bricks per day. Coal, rubber and wood are used as fuel for the brick kilns. Every kiln needs to consume around 80 to 60 tons of coal, 12 to 17 tons of wood and 6 to 8 tons of rubber per month.

However according to section 17 of the environment protection act 1997, rubber has been banned as a fuel throughout Pakistan. The lack of accountability of the regulators and enforcers and inefficiency of the government has done very little to avoid the use of rubber as fuel and has resulted in reduced social welfare in terms of increased health costs.

Therefore in this paper, we present an economic analysis of public policy failure and its effect. We will show how air pollution has affected the workdays lost of the people in terms of their health and wellbeing and in particular the non-implementation of emission standards set for health benefit of people living in Peshawar, and how can we prevent it.

2. The State of Environmental regulations in the Province

Environmental Protection Agency KP is responsible for the regulation and implementation of the environmental laws in KP. These regulations are mentioned in the Environmental Protections act 1997. This act was passed on 6th December, 1997. It has certain rules and regulations about noise pollution, air pollution and water pollution. Section 14, section 13, and section 11 are all environment related. Section 17 includes the fine for the offenders.

Section 14, EPA act 1997.

"Where the federal and provincial is satisfied that the discharge or emission of any effluent water, air and

noise pollution or the disposal of waste or handling the hazardous substance or any other substance is likely to occur or occurring or has accrued in violation of this act."

Section 13, EPA act 1997:

"The Pakistan Environmental Protection Act, 1997 requires that no person may import hazardous substances of which chemical activity is toxic, explosive, flammable, corrosive, radioactive, causes directly or in combination with other matters, an adverse environmental effect."

Section11, EPA act, 1997:

"No person shall discharge and omit or allow the discharge or emission of any effluent or waste or air pollution or noise in amount, concentration or level which is in excess of the national environmental quality standard"

Section 17, EPA, 1997:

"The maximum penalties under section 17 are one million PKR and the additional 100,000 PKR[6] continue to be charged when the offence is continuing under section 11 and 13. This section does not specify a minimum penalty, so it is understood that magistrate enjoys discretion in sentencing." [1].

"The maximum penalty under section 17 is 100, 00, additional penalty is 1000 per day for continuing violation. This applies to offence related to the handling, under section 14, of the environmental protection act 1997."

However, the fine amount is just 5000 PKR for violations of the laws if convicted. According to Brick Kilns workers, the magistrate enjoys full autonomy in imposing fine for the violation but corruption and inefficiency of the Government prevents it from happening. Therefore this study is an effort to the value the cost of health for the residents of Peshawar and most importantly the target area where pollution related diseases are rampant.

3. Theoretical Framework

According to the objectives our study, we will give the Health Production which is the variant of the Household Production Function. We will eventually give the Work Days Lost Function which will represent how many days a person loses (in the last 15 days) due to diseases related to air pollution. For this we derive the utility function. Hearth (7), Naveen et all .(6), Usha (5) and Chowdary et al (2) have used the same theoretical formula.

The utility function is:

$U=U(X, L, H, Q)$…….. (1)

Where the utility function of x which is consumption of goods, I is the leisure time for the person, H represents the loss of a day (work days lost) due to air pollution while Q stands for air pollution. The individuals gain disutility from Q and H and they gain utility from L and X.

4. Description of the Study Site:

Peshawar derives its name from Sanskrit Language, 'Pushapura'. It means the city of flowers. Peshawar lies between 33° 44′ and 34° 15′ north latitude and 71° 22′ and 71° 42′ east longitude. According to 1998 census, the total population of Peshawar is 2.019 million. Peshawar has one of the biggest markets for Brick kilns (Ahmed et al 2012). A total of Four hundred and fifty brick kilns are operational in Peshawar as of January 2016. For the sake of our analysis, we have selected a region on the outskirts of Peshawar, called Baghbanan which has the highest number of Brick kilns in a radius of 1.5 KM. The proposed project will be located in Baghbanan, which is 35 kilometers South- East of Peshawar. Baghbanan is a brick kiln community of 29,340 persons living in 5,000 households; it includes 7,770 girls (<18), 9,025 boys (<18), 5,715 women and 6,820 men. The area has mixed population of host community, Afghan refugees and internally displaced people. They live in chronic rural poverty, with many households subsisting on an income of less than 1 US dollar per day. Children are born into bonded labor and start work on the brick kilns at an early age. Girls typically marry in their early teens and have multiple pregnancies with short birth spacing are usual. The adult literacy rate is low across the board but more so in case of girls where it is less than 3% thus leading to poor socio economic conditions and extreme poverty.

5. Sampling and Data Collection

The research is based on the primary data source. 1.5 kilometer radius of Baghbanan, located in district Peshawar has been selected as the study area, where 60 respondents were selected from around the brick kiln zones. It is limited to sixty sample size because of limited time and resources. A structured questionnaire was developed and filled from the 60 heads of the household, where four hundred and eighty six numbers of household members were taken.

Variables

Variables for the purpose of estimation of the health production function are as follows:

PM10: The pollution is measured as the microgramme (mcg) concentration per cubic meter of air of particulate matter smaller than 10 micrometers (PM10), about a seventh of the width of a human hair. Particulate matters (PM10 and PM2.5) are inhalable, and are among the most critical and harmful pollutants in almost all urban areas of the world and their impacts on human health and ecology are the largest. It is the main independent (explanatory) variable.

Age: It represents age of the individual members of the household.

Age^2: Square of age shows nonlinearity between age and illness.

Gen: It is the gender of the individual which is 0 for female and 1 for male.

EDU: this shows the education/literacy of the individuals and is equal to 0 for illiterate and 1 for literate. Literate individuals will be more conscious about the pollution than illiterate.

SH: Structure of the house shows 0 for muddy house and 1 for cemented house, where chances of illness in cemented houses are less than muddy house.

INC: This represents the monthly income of the individuals.

OCP: It shows the occupation of the individual, which is equal to 0 for unemployed and 1 for employed.

DIS: This variable represents the chronic diseases of the household.

WDL: The dependent variable is the work days lost (WDL), i.e. the number of workdays lost per person in the last fifteen days due to different diseases caused by pollution.

6. Econometric Specification

The following household health production function or WDL function has been estimated and regression model is used to estimate the equation, where WDL (work days lost) is the dependent variable.

$$H = \alpha_o+\beta_1 PM10+ \beta_2 Gen+\beta_3 Age+\beta_4 Age^2+\beta_5 EDU+\beta_6 SH+\beta_7 INC+\beta_8 OCP+\beta_9 DIS+v$$

7. Results and Discussion

Table-1 Descriptive Analysis:

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
WDL	60	0	12	2.02	2.325
PM10	60	175	430	306.75	128.505
Age	60	18	70	38.95	12.245
Age^2	60	324	4900	1664.55	1048.139
Gender	60	0	1	.88	.324
EDU	60	0	1	.40	.494
SH	60	0	1	.77	.427
INC	60	5000	100000	19450.00	14419.179
OCP	60	0	1	.83	.376
Death	60	0	1	.23	.427
Disease	60	0	1	.68	.469
Members	60	3	18	8.10	3.287
Valid N (listwise)	60				

Table-1 shows the descriptive analysis of the variables used in the study. The work day lost on average is two days in a month. The average particulate matter is 306mcg/m^3. 53 percent respondents are male while the remaining 47 percent are female. The maximum age of the respondent is 70 years and the minimum age is 18 years. 40 percent of the respondents are literate and 23 percent are living in muddy houses. The average income is PKR 19450. 83 percent of the respondents have jobs, while 68 percent households were found with different diseases, where four hundred and eighty six numbers of household members were taken.

Table-2: Regression Analysis

Model 1: OLS, using observations 1-60 Dependent variable: WDL					
	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	0.636643	2.84488	0.2238	0.8238	
PM10	0.00100883	0.0021608	0.4669	0.6426	
Age	−0.0700192	0.136276	−0.5138	0.6097	
Age^2	0.000465669	0.001567	0.2972	0.7676	
Gen	−0.556877	1.37511	−0.4050	0.6872	
EDU	−0.990178	0.598621	−1.6541	0.1044	
SH	−0.412018	0.640392	−0.6434	0.5229	
INC	2.91E-05	1.94E-05	1.498	0.1404	
OCP	1.93018	1.19188	1.6194	0.1116	
Dis	3.00384	0.594872	5.0496	<0.0001	***

Mean dependent var	2.016667	S.D. dependent var	2.325188
Sum squared resid	174.4886	S.E. of regression	1.868093
R-squared	0.452985	Adjusted R-squared	0.354523
F(9, 50)	4.600579	P-value(F)	0.000189
Log-likelihood	−117.1618	Akaike criterion	254.3235
Schwarz criterion	275.267	Hannan-Quinn	262.5156

Table-2 shows out of nine variables, five variables have significant impact on workdays lost (WDL). The coefficient of particulate matter (PM10) is 0.001, which shows positive impact on WDL; a unit increase in PM10 will increase the workdays lost. Gender has negative coefficients, which shows that males are more affected than females. Education and structure of the house also shows negative relation to WDL i.e. if the structure of the house is better (cemented) there will be little chances to get diseased and workdays lost will be reduced, similarly if more education will also reduce the WDL. Similarly more diseases will increase the workdays lost. The value of R-square is 45.39 percent, which explain the WDL with the given independent variables.

8. Conclusion

In Peshawar the concentration of Particulate Matter (PM2.5 and PM10) is increasing day by day due to rapid urbanization and industrialization. As compared to other pollutants, it is very harmful to public health and environment. The work presented in this research is carried out to find out the relation between the workdays lost and PM10 and other variables, where increased PM10 shows increased lost days of work. It becomes clear that brick kiln emissions are playing role in deteriorating the environment in respect of air pollution and human health problems. Government can play an important role in modernizing brick production. As in case of China and Vietnam both governments are involved in strongly promoting the use of tunnel kilns for brick firing. Thus pollution control (alternative) technology and resources and standard emission for brick kilns are suggested to be adopted along with the ban on rubber as fuel in brick kilns and construction of brick kilns away from residential areas to reduce the impact on environment and human.

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