Data Base and Statistical Packages

PROJECT REPORT

BA (Hons.) Business Economic- Sem IV
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Project Report

CONSEQUENCES OF OUTDOOR AIR POLLUTION

Submitted in partial fulfilment of the requirements for degree of
B.A. (Hons.) Business Economics
By

Ayush
(Roll no. 1939)

Harshita
(Roll no. 1971)

Aashish
(Roll no. 1943)

Radhika
(Roll no. 1973)

Supervisor

Mrs. Sukhwinder Kaur
Assistant Professor
(University of Delhi)

Mrs. Garima Babbar
Assistant Professor
(University of Delhi)

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Abstract

This research article focuses on the impact of the impact of air pollution, EPI on the premature death. The mortality rate has been though inclined in the world but one of the leading the reasons for premature death has been liver, kidney damage caused due the these two. According to the research papers of literature review we found that PM2.5 causes the maximum amount of damage in human health causing the premature death.
The Research study can further be used for Economic research of human development, Quality improvements, Health and life expectancy, the environment, Political Immunity, etc.

CONTENTS

INTRODUCTION

Air pollution is the cause of alarming number of premature deaths, as well as serious impacts on human health and environment particularly in big cities and highly populated areas. Economic growth and rising energy demand set to fuel a steady rise in emissions of air pollutants in the coming decades. By the middle of the century one person will die prematurely every 5 seconds from outdoor air pollution. The impacts of outdoor air pollution on health and the environment are linked to high concentrations of particulate matter (PM), ground level ozone (O_3) and other pollutants such as nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).

Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Some 8,42,000 people are estimated to die each year from diarrhea as a result of unsafe drinking-water, sanitation, and hand hygiene. Diarrhea is the most widely known disease linked to contaminated food and water but there are other hazards. Almost 240 million people are affected by schistosomiasis – an acute and chronic disease caused by parasitic worms contracted through exposure to infested water.

In this paper we will the talk about the impacts of air pollution ($PM_{2.5}$) and water contamination (EPI) on premature deaths.

Air pollution can be produced both outdoors and indoors. For the poorest families, indoor smog from coal- or dung-fired cooking stoves is typically the more serious problem. As economies develop and start to electrify, motorize, and urbanize, outdoor air pollution becomes the bigger issue. The health problems will be concentrated in densely populated areas with high PM concentrations, especially cities in China and India. In *per capita* terms, mortality is also set to reach high levels in Eastern Europe, the Caucasus region, and other parts of Asia, such as South Korea, where aging populations are highly vulnerable to air pollution.

The impact of air and water pollution is often discussed in dollar terms. By 2060, 3.75 billion working days per year could be lost due to the adverse health effects of dirty air. However, the dollar figures do not reflect the true costs of air and water pollution. Premature deaths from breathing in small particles and toxic gases, the pain and suffering from respiratory and cardiovascular diseases, and the adverse effects of contaminated water to health do not have a market price. Nor does the experience of constantly inhaling foul-smelling air, or forcing our children to wear a face mask just to play outside. These burdens weigh far more heavily on people than any price tag can represent.

Premature Deaths

The number of premature deaths due to air pollution have already been estimated to be high in recent years with elderly people and children being most affected. In the year 2017 premature deaths caused by air pollution were 3 million people globally and those caused by water pollution were a whopping 1.8 million people globally. Cumulatively, more than 300 million people will die prematurely in the next 45 years as a result of air and water pollution.

LITERATURE REVIEW

- An **OECD report** (2016) ***The Economic Consequences of Outdoor Air Pollution***, ***estimates*** that outdoor air pollution will cause 6-9 million premature deaths annually by 2060, compared to three million in 2010. That is equivalent to a person dying every 4-5 seconds. The global cost of premature deaths caused by outdoor air pollution would reach a staggering $18-25 trillion a year by 2060. Cumulatively, more than 200 million people will die prematurely in the next 45 years as a result of air pollution. There will also be more pollution-related illness. New cases of bronchitis in children aged 6-12 are forecast to soar to 36 million per year by 2060, from 12 million today. For adults, ten million new cases per year by 2060, up from 3.5 million today. Children are also being increasingly affected by asthma. All of this will translate into more pollution-related hospital admissions, projected to rise to 11 million in 2060, from 3.6 million in 2010. These health problems will be concentrated in densely populated areas with high PM concentrations, especially cities in China and India. In *per capita* terms, mortality is also set to reach high levels in Eastern Europe, the Caucasus region, and other parts of Asia, such as South Korea, where aging populations are highly vulnerable to air pollution. The market impacts of outdoor air pollution, which includes impacts on labor productivity, health expenditures and agricultural crop yields are projected to lead to global economic costs that gradually increases to 1% of global GDP by 2060.The potential economic consequences of both the market and nonmarket impacts of outdoor air pollution are very significant and underscore the need for strong policy action. There's no one size fits all recipe for reducing the impacts of air pollution. As both the sources of air pollutant are very unequally distributed across different regions, policies need to be tailored to specific local circumstances. Nevertheless, the implementation of policies, such as incentivizing the adoption of end of pipe technologies, implementing air quality standards and emission pricing, will certainly help avoid the worst impacts of outdoor air pollution.

- **Luke Curtis & William Rea (2006)** in their review article "**Adverse health effects of outdoor air pollutants and contaminated water"** analyzed the health effects of many types of outdoor air pollution and contaminated drinking water.
  In the last decade, much research has been published on the health effects of outdoor air pollution. It has been found that due to air pollution 800,000 premature deaths are accounted worldwide, it also causes large increase in medical expenses. The outdoor air contains many pollutants like Ozone, carbon dioxide, carbon monoxide, oxides of nitrogen etc. the outdoor air also affects the quality of indoor air to a large degree. Patients who have illness like asthma, allergies, COPD, heart patients etc. are subjected to poor outdoor and indoor quality. Air pollution has also been associated with higher rates of infection, cancer and mortality. Contaminated water and poor sanitation are linked to transmission of diseases such as cholera, diarrhea, dysentery, hepatitis A, typhoid, and polio. Many studies have reported a strong association between adverse health effects and levels of priority air pollutants (PM10/PM2.5, O3, NO2, SO2 and CO) which are well below standards set by US EPA, WHO and other agencies. In addition, the outdoor air often contains significant levels of many other pollutants such as metals (lead, mercury, cadmium, manganese and nickel), isocyanine, ethylene oxide, aldehydes (acrogenic, formaldehyde) and other volatile organic chemicals. The health effects (such as cancer or asthma) of occupational exposure to these chemicals are well known, however few studies have looked at the health effects of ambient air exposures to metals or volatile organics.

- **Health effects of Particulate matter (WHO)-** Report
  PM_{10} and $PM_{2.5}$ include inhalable particles that are small enough to penetrate the thoracic region of the respiratory system. The health effects of inhalable PM are well documented. They are due to exposure over both the short term (hours, days) and long term (months, years) and include:
  - ✓ respiratory and cardiovascular morbidity, such as aggravation of asthma, respiratory symptoms and an increase in hospital admissions;
  - ✓ mortality from cardiovascular and respiratory diseases and from lung cancer.

OBJECTIVES

Our objective is to construct a regression model to understand the effect of the following variables on premature death:

- ✓ Air Pollution
- ✓ Water Contamination

Apart from this we will also be deriving a relationship between the above mentioned variables.

We also hope to enhance our understanding of Environment and to gain practical knowledge about how air pollution will effect (is effecting) us.

Hypothesis

There are various factors that influence Premature Deaths. Following comprises the list of independent variables taken into account for the study:

- Air Pollution – Measured by PM2.5
- Water Contamination – Measured by EPI (Environment Performance Index)

Hypothesis formulated for the purpose of study are as follows:

Null Hypothesis (H_0): There is no impact of Air Pollution and Water Contamination on Premature Deaths.

Alternative Hypothesis (H_1): There is an impact of Air Pollution and Water Contamination on Premature Deaths.

Research Methodology

1. **RESEARCH DESIGN**

The research seeks to explain a causal relationship between air pollution and death mortality rate . In development of research regression model is designed from secondary data giving annual figures of the dependent and independent variables in the model. The data is developed and to prove the reliability of project and hence assist in explanation of relationship between the variables.
Statistical package for the social science (SPSS) statistics 17.0 and MS Excel have been used to access the relationship between air pollution and death mortality in India.

2. **MODEL SPECIFICATION**

It is based on the available literature and the theory. Such literature summarized in the review of literature helped us to identify independent, dependent variables and the relationship between them.

3. **DATA COLLECTION**

Secondary data has been collected for the research mainly found on the government data collection for mortality rate. Secondary data is useful for collection and testing regression model and conducting test theorem.

4. **DATA PRESENTATION AND ANALYSIS**

The main tool adopted is the linear regression to find the value of parameter.
The various tables analyzed are as follows:

- **Descriptive statistics:** To study mean, standard deviation and number of observations in the observed data.
- **Correlation:** To study the strength of relationship among the variables.
- **Model Summary:** Discuss the value of R square and adjusted R square.
- **ANOVA table:** For the analysis of variance and F test for overall significance.
- **Coefficients:** Determine the value of standardized and un-standardized coefficients.
- **Trend figure:** To show the dependency of the variables.

Table 1 : Data of Countries

Countries	PM2.5	EPI	Premature deaths(per million people)
Canada	11.89	72.18	8
Chile	18.84	83.95	3
Mexico	13.04	78.37	14
USA	11.79	71.19	93
EU Large 4	15.62	79.89	111
Other OECD EU	13.48	78.39	90
Other OECD	17.06	75.96	28
Aus & New Z.	15.37	74.12	2
Japan	16.76	74.69	60
Korea	26.25	72.84	17
China	54.15	14.39	905
Russia	14.29	63.79	119
Caspian Region	24.88	49.79	44
Brazil	14.23	60.7	36
Middle East	32.6	75.01	52
North Africa	23.27	72.6	52
ASEAN 9	18.2	49.88	102
Indonesia	12.14	46.92	57
India	43.4	33.75	613
South Africa	14.3	44.73	12

OUTPUT

Table 1

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	EPI, PM_2.5[b]	.	Enter

a. Dependent Variable: Premature_Deaths

b. All requested variables entered.

Table 2

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean		Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Std. Error	Statistic	Std. Error
PM_2.5	20	11.79	54.15	411.56	20.5780	2.50687	11.21107	1.988	.512	3.745	.992
EPI	20	14.39	83.95	1273.14	63.6570	4.06036	18.15849	-1.326	.512	1.373	.992
Premature Deaths	20	2.00	905.00	2418.00	120.9000	50.60351	226.30578	2.976	.512	8.519	.992
Valid N (listwise)	20										

Table 3

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.899[a]	.809	.786	104.64605	.809	35.929	2	17	.000	1.689

a. Predictors: (Constant), EPI, PM_2.5

b. Dependent Variable: Premature_Deaths

Table 4

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	786908.268	2	393454.134	35.929	.000[b]
	Residual	186163.532	17	10950.796		
	Total	973071.800	19			

a. Dependent Variable: Premature_Deaths

b. Predictors: (Constant), EPI, PM_2.5

Table 5

Coefficients

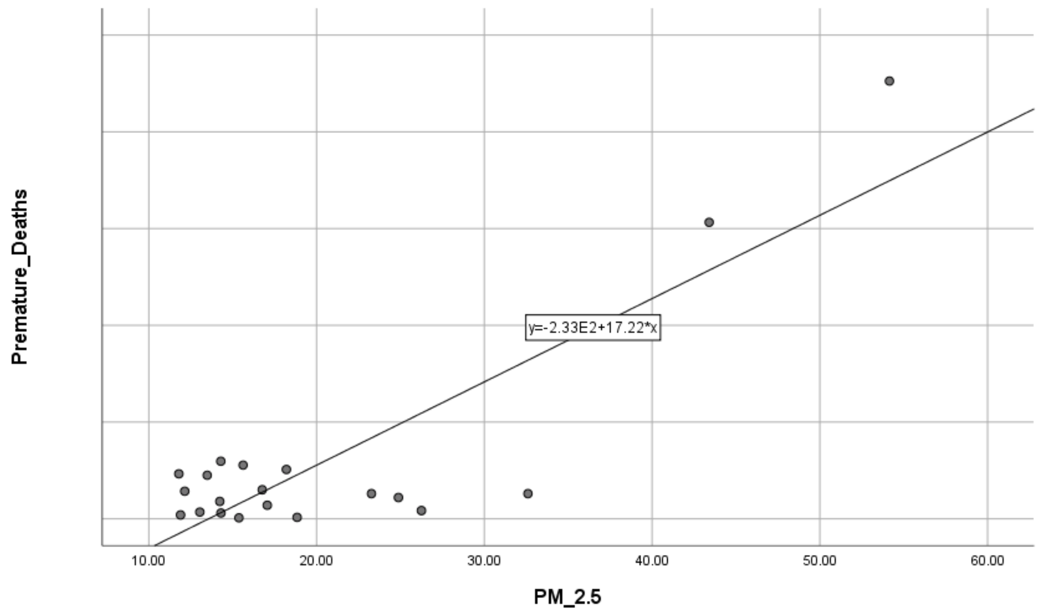
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics		
		B	Std. Error	Beta			Part	Tolerance	VIF
1	(Constant)	160.033	154.973		1.033	.316			
	PM_2.5	12.408	2.794	.615	4.441	.000	.471	.588	1.702
	EPI	-4.626	1.725	-.371	-2.682	.016	-.285	.588	1.702

Collinearity Diagnostics[a]

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	PM_2.5	EPI
1	1	2.747	1.000	.00	.01	.01
	2	.239	3.391	.00	.33	.06
	3	.014	13.943	.99	.65	.93

a. Dependent Variable: Premature_Deaths

Graphs



Effect of PM 2.5 on Premature Deaths

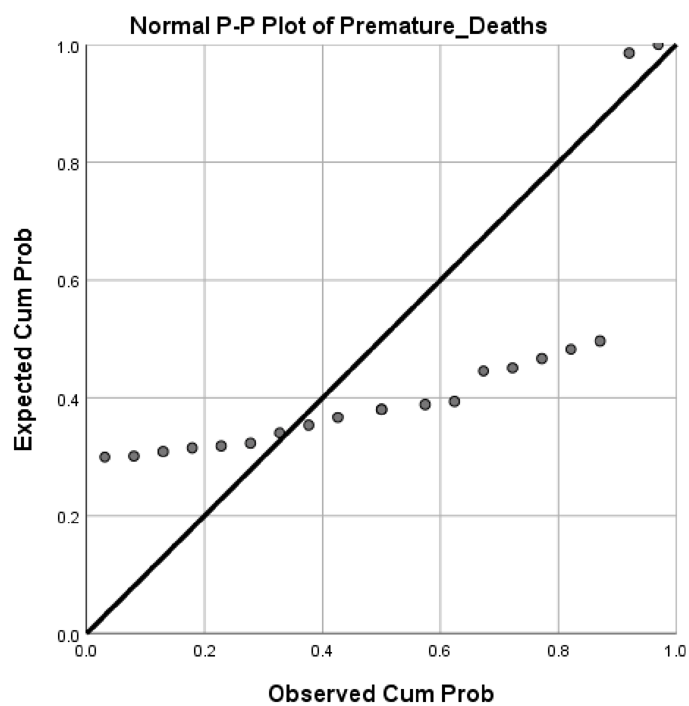


Fig 1: Normal P-P Plot

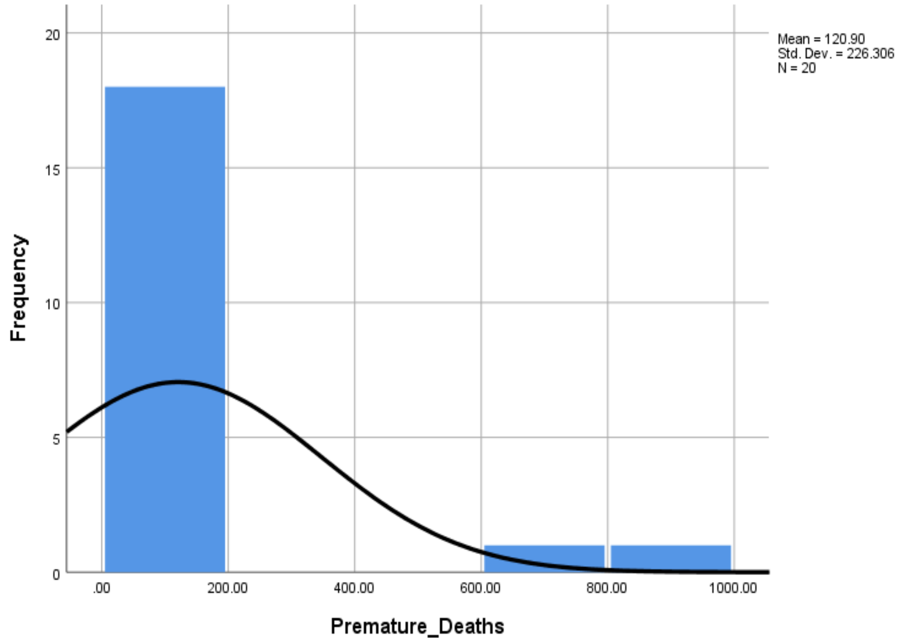


Fig 2 : Histogram Of Premature Deaths

Analysis and Interpretation

Analysis of Variance (ANOVA) is statistical method for making simultaneous comparisons between two or more means; a statistical method that yields values that can be tested to determine whether a significant relation exists between variables.

R measures the strength and the direction of a linear relationship between two variables.
An R of 0.899 implies a perfect positive fit, that is an increase in x value leads to an equal increase in Y values.

R_2 gives the proportion of the variance (fluctuation) of one variable that is predictable from the other variable. The coefficient of determination is the ratio of the explained variation to the total variation.
A R_2 of 0.809 implies that the entire variation can be explained by the regression model.

Adjusted R_2- it also takes into account the degrees of freedom (no of Xvariables).
An adjusted R_2 of 0.786 implies that 78.6% of the variation in the data is explained by the model.

Overall Significance

$H_{0:}$ $R^2 = 0$

Since **P value** is less than 5%, we reject the null hypothesis of overall significance.

Individual Testing

H_0: $B_1 = 0$
H_0: $B_2 = 0$

In this case, the **P value** for intercept and slope coefficient is extremely small and less than 5%, therefore, we reject the null hypothesis and the variables are individually statistically significant

CONCLUSION

In our project, we have analyzed the effect of $PM_{2.5}$ and EPI on premature deaths and loss of agricultural yield.

The conclusion which we could draw is that with emissions of air pollutants generally rising over time, the concentrations of $PM_{2.5}$ ozone are also projected to increase in most regions. Several other factors such as changing climatic conditions also influence the concentrations. In many places, concentrations of and $PM_{2.5}$ ozone are well already above the levels recommended by the WHO air quality guidelines. $PM_{2.5}$ concentrations are already high and rapidly increasing in South and East Asia, especially China and India. In large parts of North America, Europe and Africa $PM_{2.5}$ concentrations are also high but are projected to risen less quickly.

The number of premature deaths due to outdoor air pollution is projected to increase from 3 million people globally in 2010 to a global total of 6 to 9 million people in 2060.This large increase is not only due to higher concentrations of $PM_{2.5}$ and ozone, but also to an increasing and aging population and to urbanization, which leads to higher exposure. The number of premature deaths is unequally distributed across the world. The highest number of deaths takes place in non OECD economies and particularly in India and China. These regions also experience the highest increase in the number of premature deaths in 2060.

BIBLIOGRAPHY

- ✓ **N. Kunzil, R.Kaiser (2000)-** Public health impact of outdoor andtraffic related air pollution.
- ✓ **Luke Curtis & William Rea (2006)** -Adverse health effects of outdoorair pollutants**.**
- **OECD report (2016)** -The Economic Consequences of Outdoor AirPollution.
- ✓ **Simon Upton (2016)-** Air Pollution’s True Costs.
- ✓ **IEA (2016)-**World energy outlook special report on energy and airpollution.
- ✓ **C. Chuwah (2016)-**Global impacts of surface ozone changeson crop yields and land use.
- **http://data.worldbank.org/**
- **https://www.project-syndicate.org**
- **http://stats.oecd.org/glossary/**
- **http://www.who.int/gho/en/**