



Pollution and Human Well-being: What Do We Know?



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Abstract

Global warming, climate changes and environmental pollution are becoming the major global concerns. Rising environmental pollution threatens human's health and hamper economic development through dampening labor productivity and the pace of human capital development. Therefore, tackling the unparalleled environmental problems is important to decrease health costs and sustain growth. This paper reviews the literature on the effect of pollution on different dimensions of human well-being by synthesizing what literature highlights about the impact of pollution on health, the association between education and productivity as well as pollution, and finally the link between life satisfaction and pollution exposure.

Keywords: Pollution; Productivity; Education; Human capital; Life satisfaction

Introduction

Human development is affected by environment through two channels, i.e. health and level of income. The substantial negative impact of polluted air, soil and water on human health is a great concern, especially in fast growing economies. For an instance, the health diseases caused by air and water pollution is estimated to cost China the amount equalled 4.3 percent of its GDP [1]. The developed economies are not far behind this trend. The health cost of air pollution in Europe is USD\$1.6 trillion a year [2]. Polluted soil and water are also sources of human health problems such as cardiovascular and respiratory disorders, diarrhoea, malaria, dengue fever, and schistosomiasis. From economic point of view, pollution has negative association with macroeconomic variables such as labour supply and productivity.

All types of pollution are result of negative market externalities for which free market failed to efficiently allocate the resources. The cost of negative externalities has a direct relationship with economic activities. Therefore, it is expected that pollution of raises with economic growth if an economy failed to internalises the cost of negative externalities. Therefore, sustainable growth calls for reducing the environmental pollution which has become one of top priorities of most countries. Considering the high cost of internalizing the externalities to industry, optimal environmental policies require estimating the cost of pollution on human well-being. Focusing on the outcome of pollution may be of great help to understand the benefits of reducing pollution. This paper provides a short review of literature of the effect of pollution on health,

labour productivity, education and human capital as well as life satisfaction and happiness in sections 2,3,4, and 5, respectively.

Health

Health is the important dimension of human capital that can be affected by environment. Previous researches indicate the significant negative impact of air, water and soil pollution on human health. The World Health Organization reports that one out of eight deaths in 2012 occurred because of air pollution exposure [3]. Based on Environmental Protection Agency report, Deterioration of lung function, increasing cardiovascular illnesses, such as strokes and ischaemic heart disease, increased respiratory problems, and angina are some of the health problems resulting from the short-run exposure to the air pollution [4].

Long-run exposure to the air pollution increases asthma admissions by 5-14% among 1-18 years old children [5]. This effect was more significant among children belonged to families with lower socio-economic status [5]. It is also shown that the air pollution resulted from 1981-82 recession caused the death of 2500 infants [6]. This indicates the positive association between infant mortality and air pollution. It was also documented that the exposure acute fine particulate matter (PM2.5) was positively linked with elderly mortality rate [7]. Cardiopulmonary diseases, respiratory infections and lung cancer were found to be other consequences of air pollution [4]. While some of the health problems resulted from pollution can last for as long as ten years, the long-term effect of air pollution on men and women is more significant than children

whom appeared to recover faster and fully [8]. Pollution not only can be a threat to physical health of human being but also can cause severe mental and physiological well-being such as high anxiety and emotional instability [9,10]. There was negative association between PM2.5 and CO and standard test scores among Israeli high school students because of higher asthma problem and damaging neurological functioning, respectively [9]. It is also shown that PM2.5 increases the anxiety symptoms and depressive symptoms among American by 180-days moving average and 30-days moving average, respectively [10].

The positive effect of better air quantity on lower infant mortality rate has been found in several studies [6,11-14]. While better quality of air can be responsible for less respiratory disorders in infants and adults [15,16], its positive effect on mental health and cognition is also shown [17].

Labour Productivity

One of the important questions that have been addressed by researchers is the impact of pollution on the short-run as well as long-run labour. Health problem can be a transmission channel for the short-run negative effect of pollution on both labour supply [18-21] and productivity [22,23]. Pollution exposure in early life would cause lower labor participation as well as lower income at the age of 30 [21]. The short-run elasticity of work hour for Mexican with respect to SO₂ was estimated to be between -0.43 to -0.67 [19]. This is because the exposure can lead to lower physical strength and missing work days. The reduced working hours due to PM2.5 was shown to be more serious among working adults who had children or elderly to look after [18], indicating that working adults get absent from work to take care of exposed children or elderly to the pollution. It is also suggested that the exposure to air pollution reduces life expectancy by 5.5 years, which, in turn, forces firms to replace senior labours more often which results in lower productivity [24].

The adverse relationship between air pollution and short-run labour productivity in specific occupations has been demonstrated by several researches. These studies revealed that 10 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) increase in PM2.5 decreased the workers productivity of pear packing workers in California by \$0.41 per hour [23], Indian garment assembly industry by more than 0.3 percentage [25] and labours in tow textile sites in China by 0.5 to 3 percentage of mean daily output [26]. A decrease of 10 parts per billion (ppb) in ozone is associated with 5.5 percent worker productivity enhancement for California fruit pickers [27]. The number of daily calls handled by labour in call centre services in China decreased by 0.35 percent when the air pollution index (API) increased by 10 units [22].

Other researchers do not limit themselves into particular industry and try to answer the question how pollution affect labour supply and productivity as a whole. Comprehensive evidences of the negative impact of air pollution on Chinese manufacturing labor productivity in the short-run have been provided [28].

They also evident that better air quality substantially enhances manufacturing outputs resulting from higher labour productivity. In a natural experiment, it is shown that the long lasting (ten years) adverse effect of air pollution on labor supply in Indonesia [8].

Education and Human Capital

Recent empirical researches shed light on our understanding of the negative impacts of pollution on educational achievements and, thus, the formation of human capital. Students' success may decline because of oxygen deterioration, health problems (such as asthma attacks, fatigue, headaches, etc.) and high absents from school [29] induced by pollution.

The high school students in Texas whose mothers have been exposed to the ambient air pollution during birth performed poorly in the exit exam [30]. The similar result is reported for receiving among high school qualification students in London in 1952 [31]. Chilean fourth grade students' performance was significantly poor in mathematics and language among students whose mothers expose to carbon monoxide during pregnancy [32]. In addition, air pollution has been found to account for reduction in students' cognitive performances and their score in various tests [9,33-35].

Life Satisfaction and Happiness

How does the quality of environment affect the welfare of human being? There has been deviation from conventional approach (such as using Gross Domestic Product (GDP) or income as proxy for welfare) towards subjective well-being (such as life satisfaction and happiness) among researchers to address mentioned equation. Therefore, a broad range of researches investigate the relationship between pollution and life satisfaction, controlling for other socio-economic factors. The negative impact of pollution on life satisfaction has been strongly evident in both country level researches [14,36-41] and cross-sectional studies [42-46].

Conclusion

Environmental quality has deeply affected multi dimension of human well-being, including health, education, human capital formation and productivity. The significant air, water and soil pollution after industrial revolution has been rooting on human activities and it will not reverse unless policy makers implement appropriate environmental regulations. However, it is important to emphasize that implementing the regulation comes at its own costs (such as production costs), which may in return affect other aspects like education indirectly. These costs must be considered by policy makers when deciding how tight the environmental regulation has to be.

Academic and researchers have utilized variety of methods to evaluate the effect of pollution on human being. However, most of existing literature focuses mainly on the short-run effect. To make more efficient policies, understanding the long-lasting impact of pollution is extremely important. In addition, researchers say minimum about the transmission mechanism through which

pollution affect human well-being. This is important particularly because different channels require taking different policies.

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