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 if 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.
The negative impact of air pollution on Chinese manufacturing supply and productivity as a whole. Comprehensive evidences of industry and try to answer the question how pollution affect labour China decreased by 0.35 percent when the air pollution index (API) productivity enhancement for California fruit pickers [27]. The to 3 percentage of mean daily output [26]. A decrease of 10 parts percentage [25] and labours in tow textile sites in China by 0.5 productivity of pear packing workers in California by $0.41 per per cubic meter (μg⁄m3) increase in PM2.5 decreased the workers by several researches. These studies revealed that 10 micrograms labour productivity in specific occupations has been demonstrated lower productivity [24].

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 how had children or elderly to look after [18], indicating that working adults get absent from work to take care of exposed children or elderlies 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 (μg/m3) 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 10units [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 whom their 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.

References


3. WHO (2014) 7 million premature deaths annually linked to air pollution.


