Impact of Chinese Air Pollution on Health and Potential Solutions

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Abstract. Economy development usually comes with pollution. Also, when economy develops, people require high living quality. So finding a way to reduce pollution as well as keeping the economy development becomes a main issue. In this article, the author will discuss the relationship between the air pollution and health, analyze the factors that cause air pollution, as well as give potential solutions to the air pollution problems.

Keywords. Air pollution, health impact, potential solutions.

1. Introduction
With growing number of reports on Chinese air pollution from various renowned news sources, the notorious air quality in China has finally attracted attentions from the world. With numerous studies linking air pollution and cardiovascular diseases, it is urgent to implement appropriate policies to restore air quality back to a healthy level in China. However, in order to do that, it is important for the public to understand how air pollution affects public health so that the people can be more aware of the severity of the condition and demand actions from the government, speeding up the policy making process. Also, it is equally important for the policy makers to understand the air pollution as well as how their past policies unintentionally acted as an accomplice in the worsening condition of air quality so that they will understand on what infrastructure to build and what policy changes to make to reduce emissions. This paper will utilize studies that have been conducted on Chinese air quality to dissect this long-lasting problem.

2. Impact of Air Pollution on Health
Before going deeply into the heart of what causes air pollution, it is worth learning about exactly how bad air quality affects people’s health. As breathing is the number one inevitable task in a human’s life, polluted air will affect citizens much more than other types of contamination for it is harder to be avoided. Naturally, it should be every nation’s priority to deal with air contamination. Air pollution refers to the presence of pollutants, usually involving numerous kinds of chemicals but, among them, particulate matters (PM), ozone (O₃), sulfur dioxide (SO₂), and nitrogen dioxide (NO₂) are the most common components. As air pollutants concentrations go up, studies have reported that a correlation is found between pollutants concentration and cardiovascular diseases. In Rajper’s study, the researchers disseminated questionnaires to 2100 randomly selected students from 13 major cities across China between October 2015 and March 2016. The questionnaires, containing questions about the effect of air...
pollution on an individual level, were then collected and analyzed. Containing 2048 subjects, majority of them have experienced the effects of air pollution. Among the subjects, 88.9% reported that they felt the impact of air pollution on their overall health including sneezing, dry throat, and eye irritations and 62.0% experienced respiratory problems. In addition, many of the students experienced low energy level as well as sleeping disturbance as a result of bad air quality (Rajper 4).

Still, this is rather expected for it is logical that air pollution will affect one’s respiratory system. What many have overlooked is the psychological effects of the smog. As shown in the table from Rajper’s study, many have felt depression, anxiety, or aggressiveness during days when all are covered inside a grey mist, revealing not just those with weak respiratory systems will be affected (Rajper 6). Also reported in this paper, the younger generations are more affected than the elderly, meaning potential increase for criminality. As psychological health has become a societal issue in China, air pollution is doing nothing but making the problem even more severe. Therefore, cleaning up the air for public health should be the top priority of Chinese government.

To properly design an appropriate solution to air pollution, the Chinese government needs to realize where the emissions come from. The Chinese government has provided either free or subsidized winter heating to the regions north of Huai River and Mountain Qin, often known as the dividing line of North and South. This is not an arbitrary line made up by the Chinese government but rather based on science for this line is both the line of average 0 degrees Celsius during winter as well as average yearly 800 millimeters of precipitation. It was the meteorological reason that drives the government to provide subsidized heating to regions north of the line. As much as the Huai River policy was created out of scientific reasons, however, it has resulted in tremendous effects on the environment and citizens’ health. What should not be misunderstood is that the Huai River Policy itself does not cause air pollution, the policy allows the northerners to utilize indoor heating more often, resulting in more coal burning which is where the heart of the problem lies. Both Chen’s and Ebenstein’s studies on this topic have found the correlation between degrees north/south of Huai river and increasing/decreasing TSP concentrations as a result of increasing coal burning. In Chen’s research, he has collected TSP concentration and mortality rate from 1981 and 2000. He then uses an econometric model to translate the data into useful information. These are the two figures (Figure 1 and 2) derived from the analysis.

Figure 1. TSP Concentration Comparing to Degree North of Huai River (Adapted from Chen)
Clearly shown by the figures, a correlation is established that an increase in TSP concentration, resulted from Huai River policy, means a decrease in life expectancy (Chen 12936-12941). In fact, according to data, the north has air that is 55 percent more concentrated than the south which translates into 5.5 years less of average life span, meaning that China has lost 2.5 billion life years (Chen 12936-12941), which could have contributed so much to Chinese economic work force. In the follow up the study by Ebenstein, an even more detailed data set is collected to show the disparity between northern and the southern air pollution. Clearly shown by the map (Figure 3), a massive difference in PM$_{10}$ is revealed between the north and the south.

![Life Expectancy Comparing to Degree North of Huai Rive](image1)

**Figure 2.** Life Expectancy Comparing to Degree North of Huai Rive (Adapted from Chen)

The authors then analyzed the data they acquired from Chinese Center for Disease Control and Prevention between 2004 and 2012 and came up with a table (Table 1) on the impact of PM on health. The analysis suggests that winter coal burning has made tremendous impact on the environment. (Ebenstein 10384-10389). According to analysis, for every 10 micrograms per cubic meter increase in airborne particulate matter, expected lifetime is reduced by 0.64 years. Comparing the current air

![PM10 Concentration in China](image2)

**Figure 3.** PM10 Concentration in China. Green, Yellow, and Red represents from low to high concentration. Black dots indicate DSP location. (Adapted from Ebenstein)
condition with those of US before the Clean Air Act, Chinese TSP concentration is 5 times more than the US’s (Almond 184-190). Facing such extreme environment, rapid response is vitally needed.

### Table 1. Comparing OLS and RD estimates of impact of PM concentration on Health

| Outcome                              | [1]          | [2]          | [3]          |
|--------------------------------------|--------------|--------------|--------------|
| Life expectancy at birth, y          | -0.27*** (0.09) | -0.86* (0.51) | -0.64*** (0.22) |
| Cardiorespiratory (per 100,000, log) | 0.02*** (0.01) | 0.11* (0.06)  | 0.08*** (0.03)  |

3. Potential Solutions

Many solutions have been proposed to save the Chinese air condition. Within all those proposals, however, there is a rather interesting one. As seen in the history of many developed countries like nations in the Western Europe, US, and Japan, a turning point in the environment condition is usually correlated with reaching a certain quota of GDP per capita. This is known as the environmental Kuznets curve or EKC. As China develops, researchers are expecting an EKC to be observed. However, common problems among the developing nations can be seen everywhere in China like wastefulness, reliance on environment-harmful coal, and inefficiency in utilizing resources. Chinese economy is rapidly expanding, yes, but it is based on the expense of the environment. However, as life quality continues to get better, increasing per capita income results in people pursuing higher living standards like clean air. Although the air quality is abysmal in China currently, some researchers, like Shostya for example, are optimistic about China’s future. As mentioned above, economic growth first lowers the environment but will meet a turning point when manufacture economy slowly transforms to service economy which much more environmental friendly. For the US, this turning point came at 8000 dollars in the 1990s. In China, the researchers collected data of PM, SO$_2$, and NO$_x$ from 31 regions of China from 2005 and 2014. PM is found to have a negative relationship with economic forces, implying that China has already reached the turning point for PM. However, increasing economic forces still correlates with the increasing SO$_2$ and NO$_x$ levels, indicating that China is still on its way to meet the turning point (Shostya 295-304). A caution worth mentioning is that while the turning point theory does hold true, the turning point does not come automatically. It still requires the more environmental policies from the government. For the US, it was the Clean Air Act, but for China, more needs to be done. In addition, EKC cannot apply to all contaminants, so no blind optimism should be held by anyone. In the meantime, winter heating process should be done more efficiently. The current heating solution relies on using coal to heat up water and transport water to households, leaving a huge room for energy loss. Meanwhile, the coal burning during this process is responsible for 87 percent of SO$_2$ and 76 percent of NO$_x$ emissions (Almond 184-190). Switching to cleaner fuel or building up better insulation for the heat transporting pipe can easily reduce considerable amount of emissions. The government can also subsidize home-based heating solution that puts the water heating process directly into the user’s home, which will greatly reduce the energy loss during heat transportation. As shown, much can be done to increase energy efficiency and decrease emissions.

4. Conclusion

This paper aims to provide the readers with information of health effects of air pollution and raise people’s awareness of this social issues. The upper class in China has already realized air being part of life quality and started spending resources to pursue clean air. The rest of the society needs to take actions to demand actions from the government so that better regulations can be made to reduce emissions. In the meantime, this paper can provide insights to policy makers on what can be done to
improve the environment. After all, the earth belongs to everyone meaning everyone generation before and after us.

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