Air Pollution and Settlement Intention in China

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Contributor: Jianing Liang , Xiao Yu , Yanzhe Zhang

Air pollution has a significant negative effect on migrants' settlement intention. The effect of air pollution on settlement intention is influenced by individual socioeconomic status; that education level, as an indicator of cognitive ability, affects migrants' motivation to migrate; and that personal income, as an indicator of economic ability, affects the feasibility of their migration. Motivation to migrate and the feasibility of moving determine together the divergence in settlement intention, and those with higher incomes and higher education levels are more likely to leave cities with serious air pollution. Third, the heterogeneous effects suggested that the negative effect of air pollution was greater for older, male, and married migrants. Air pollution has a variety of effects on the heterogeneous migrants, resulting in changes in the demographic structure of cities.

air pollution   air quality index   migrants   socioeconomic status

1. Introduction

Since the Opening of China in 1978 and the rapid economic development that followed, the problem of environmental pollution has gradually emerged. Most parts of China have experienced it, albeit to varying degrees. The 2013 tract 'Towards an Environmentally Sustainable Future Report' stated that "among the 500 largest cities in China, fewer than 1% follow the World Health Organization air quality requirements, and seven out of the most 10 polluted cities in the world are in China" [1]. Although air quality has improved since the revision of the Air Pollution Prevention and Control Action Plan in 2013, most cities still fail to meet air quality standards.

Air pollution causes serious damage to both the physical and mental health of residents, and leads to a significant increase in respiratory diseases and lung cancer [2]. The inhalation of PM2.5 particulates (particles with a diameter of 2.5 μm or less) induces inflammation of the respiratory system and oxidative stress response [3], and the presence of PM10 particulates (particles with a diameter of 10 μm or less) in the air have been shown to have a significant correlation with respiratory mortality [4]. Air pollution also increases the mortality rate of people with heart and lung diseases, which significantly hinders the expected trend of improved health and extended life expectancy among the population [5]. The health effects of air pollution, however, are not only physical: it is common for affected residents to experience a rise in anxiety and other unwanted psychological afflictions [6]. Long-term exposure to air pollution can also increase the incidence of persistent depression [7]. In the short term, residents can minimize the damage caused by air pollution by avoiding or reducing outdoor activities or by wearing a mask. Residents with a longer view, however, are gradually choosing to migrate to cities with better air quality, and as a result, air pollution has become an important factor in determining their settlement intentions.

As an important component of urban environmental quality and livability, the effect of air pollution on the labor force has also received much attention in recent years, and studies have found that air pollution reduces the labor supply [8][9]. Air pollution also leads to a decrease in labor productivity [10]. Air pollution is one of the important causes of population migration changes in China and causes of labor outflow. However, most existing studies have been analyzed using aggregated data at the provincial or municipal level to examine the impact of air pollution on labor mobility at the macro level. In fact, labor mobility and supply at the macro level are the results of individual decisions at the micro level, so it is important to look not only at the impact of air pollution on regional labor mobility and labor supply at the macro level, but also at the mechanism of air pollution's impact on individual labor migration decisions at the micro level. On the other hand, most of the existing studies are analyzed under the assumption of migrants homogeneity, ignoring the heterogeneity of migrants. The heterogeneity of migrants refers to the differences in individual characteristics of migrants, including gender, age, education level, and personal income. Differences in these characteristics directly affect not only their migration decisions and settlement intentions but also their value judgments about the macro factors that influence their decisions.

China has a unique *Hukou* system, which is the residential registration system. The *Hukou* system is key to understanding the migrant issue in China. There are differences between those with and without *Hukou* in terms of urban public services, housing segregation, and education for children [11][12]. In China, migrants without *Hukou* in their destination cities are called the floating population, and migrants who have been granted *Hukou* in their destination cities are called permanent migrants [13]. Migrants refer to those without *Hukou* in their destination cities, also called the floating population. The number of migrants in China is huge and growing yearly, from 14,449 million in 2000 to 22,143 million in 2010. The number of migrants in China reached 376 million in 2020, accounting for 26.6 percent of the country's total population according to the Seventh Census of 2020. The large-scale migrants provide the labor supply for the inflow cities and promote urban economic development. The population is the core resource of sustainable economic development in cities, and cities need to attract new migrants. Enticing migrants to stay is a key factor in the population competition between cities. A full understanding of factors that influences the settlement intention of migrants will help city governments to formulate policies that will attract migrants to settle, increase the local labor supply and promote local economic development. Second, as the originally-registered population of city age, new migrants are needed to balance the demographics. Attracting migrants to settle is of far-reaching significance to alleviate regional aging and improve the population structure. Last, in the COVID-19 era, the retention of migrants to alleviate the ensuing structural employment problems (which were amplified by the epidemic) has become a key determinant in achieving rapid economic recovery in cities.

2. Effect of Air Pollution on Migrants in China

Population migration has been extensively and thoroughly studied in the literature and has been explored from several theoretical perspectives, such as human capital theory [14], assimilation theory [15], and push-pull theory [16]. Unlike other countries, migration and settlement do not occur simultaneously in China, and population migration is neither one-step process, nor do they differ in important ways from the circular flows of other countries. Settlement

intention is a unique research topic in the Chinese context, and Chinese scholars have conducted in-depth studies on the factors that influence migrants' settlement intention. From an economic perspective, migrants tend to settle in a destination that meets their economic expectations [17]. Their settlement intention is significantly positively correlated with the ratio of income to expenditure, while high housing costs have a restraining effect [18]. In addition to economic factors, public services, and city amenities significantly enhance settlement intention [19][20][21]. From the perspective of individual characteristics of migrants, gender, marital status, age, and education level have a significant impact [22][23] Social integration, relative deprivation, and other psychological factors influence where migrants choose to live [24]. Social factors such as the length of time a migrant has lived in a city, the strength of their social relationships and networks also affect the intention to settle [25][26][27].

In recent years, the impact of air pollution on migration decisions and settlement intentions has gradually begun to emerge as air pollution intensifies and people aspire to a better life. Settlement intention can be understood as a re-decision to either settle down in the current city or continue to migrate. It is a measure of how satisfied migrants are with the result of their last migration after living in the destination for a period. Research into the impact of air pollution on settlement intention is based on the study of air pollution on the migration decision. Air pollution has a negative effect on labor, whereby workers will emigrate from a polluted area if they have the means and opportunity to do so[28]. Another study suggests that air pollution will reduce the stock of innovative technological professionals(TIP), and a 1% increase in PM2.5 in China's cities decreases the stock of TIP by 146 people [29]. There are also views that in China, population loss caused by environmental pollution is currently only seen in economically developed coastal areas and large inland cities [30]. However, because China's migrants come mostly from rural, low-income areas, it often ranks expected revenue higher than concerns about air pollution when deciding on a destination. This may mean that air pollution indirectly leads to more rural migrants moving to cities [31].

In fact, migrants with different individual characteristics may make different decisions when faced with the same situation due to differences in their individual characteristics. Massey proposed that to fully explain migration behavior, it is necessary to consider the combined effects of the macro social structure, the micro individual, and the family decision-making process [32]. Takatoshi and Thisse introduced heterogeneity into the new economic geography model. They found that the labor did not respond uniformly to the wage gap because it exhibited varied mobility behaviors and could be affected by individual characteristics, family and marital status, and personal preferences [33]. Additionally, migrants with a higher level of education usually have an elevated human capital, are less affected by the labor market, have more diverse employment options, can more easily get better jobs and high incomes in numerous different cities, and can better integrate into life at their destinations [34]. It has been proved that more highly skilled migrants with more advanced social levels tend to have higher requirements for livability [35]. As a result, the subjective feelings of migrants regarding air pollution vary significantly according to their economic and social status [36].

The cognitive ability of migrants to perceive the hazards of air pollution depends largely on their level of education, which is related to their motivation to migrate because of air pollution. The more advanced the individual's education, the more environmental knowledge they have, and the more considered their subjective opinion of air

pollution [37][38]. Studies on air pollution and labor productivity show that the impact of air pollution on highly educated workers is more obvious than that of those who are less educated [39]. The dis-utility of air pollution on highly educated migrants is, therefore, greater, and these migrants have an increased motivation to leave cities with serious air pollution. The deterioration of air quality significantly reduces the life satisfaction of individuals with high education levels.

High personal incomes ease the budgetary constraints of potential migrants and increase migration feasibility. Those with high incomes have a strong economic capacity and face fewer financial constraints when deciding whether to migrate. Because they are better able to bear migration costs, their risk is lower. This shows that when both high-income and low-income migrants are exposed to air pollution, the former can "buy fresh air", and migrate to cities with better air quality, while the latter is economically disadvantaged and unable to migrate [40]. Low-income migrants are more concerned with employment opportunities than the quality of their environment, i.e., the income utility is greater than the utility of clean air. The higher a migrant's income, the more seriously they will consider the effects of air pollution, and the more likely it will form part of their migration decision. The deterioration of air quality significantly reduced the life satisfaction of individuals in the high-income group. It was proved that they were usually willing to pay more to live somewhere with better air quality [41].

3. Summary

Air pollution has a significant negative effect on migrants' settlement intention. Air pollution is selective for migrants, and migrants with high income and high education levels are more likely to leave the cities with severe air pollution, while migrants with low education levels and income have less ability to leave their current city of residence, so they are more likely stay in highly polluted areas.

The negative effect of air pollution on migrants' settlement intention is small. This is because China's urbanization process is not yet fully completed. At China's current level of urbanization, job opportunity and wage still play an important role in people's migration decisions and settlement intentions. However, in recent years, the impact of air pollution on migration decisions and settlement intentions has gradually begun to emerge as the public's increased awareness of the environment and increased concern about air quality. Although the negative effect of air pollution on migrants is not particularly large at this stage, it cannot be ignored that in some cities with high air pollution there has been a loss of population. In particular, migrants with high education levels and high incomes are more likely to leave cities with serious air pollution[36] . As migrants' income and pursuit of high quality of life, the negative effect of air pollution on migrants' settlement intention will become greater. The negative effect of air pollution on the population has become a problem that cannot be ignored.

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