The Value of Better Air Quality: Evidence from Beijing Housing Market

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Abstract

To better estimate the possible benefits of environmental protection policies, it is crucial to evaluate the value of better air quality. Given that air quality is a non-marketable amenity, we use house prices to infer the value people place on air quality. Our group studies the relationship between house prices and PM 2.5 (a measure of harmful particulate in the air) in Beijing, which is one of the worst affected areas by air pollution in China. We control for house characteristics, neighborhood characteristics, and time-fixed effects to isolate the impact of air pollution on housing prices.

1 Motivation

Air quality can be an issue that not only matters to residents in certain areas but also raised more concerns from the Chinese government in recent years. Due to too much emphasis on economic growth in China, air pollution has become a major environmental problem. Although China's State Council approved and issued the "Ambient Air Quality Standards" in 2012, it was not until 2013 when the U.S. Embassy announced the severe pollution in Beijing measured by PM 2.5 index that drew people's attention to air pollution. Since then, everyone in China has been familiar with PM 2.5., a particulate matter that stays in the atmosphere for a long time and contains many substances that are harmful to health. Recently policymakers in China have proposed a carbon neutral target and focused more on the environmental protection policy. To better evaluate such policies requires a complete analysis of the direct environmental benefit and the financial benefit to the homeowners. To measure people's willingness to pay for clean air, we use the PM 2.5 index as a proxy for air quality and investigate the relationship between air quality and housing prices in Beijing. Our research will shed light on the Chinese government and countries around the world to promote effective environmental protection policies.

2 Literature Review

Since there is no direct market for air transactions, researchers have studied the relationship between air pollution and property value to infer people's willingness to pay for better air quality. Anderson and Crocker [AJC71] quantified the residential value of the property given air quality at a theoretical level. They maximized utility function for both renter and owner and found the empirical result that air quality has a positive relationship with residential property value. Smith and Huang [SH95] reported the marginal willingness to pay (MWTP) for reducing particulate matter from the hedonic property value model. Their findings suggest that the estimated MWTP method can lead to severe mistakes due to substantial local conditions variations. Chay and Greenstone [CG05] adopted the hedonic approach and studied the effect of total suspended particulates (TSPs) on the median housing price of each American county. They found that a one microgram per cubic meter decrease in total suspended particulates will increase the median housing price by 0.2 to 0.4 percent. Other researchers have looked at local-level house prices. Tang and Niemeier [TN21] utilized a spatial lag model with an instrumental variable method to consider spatial autocorrelation and endogeneity effects between housing prices and air pollution in the Bay area. Surprisingly, their result indicates a positive relationship between air pollution and housing prices. Qin et al. [QWY19] also found a positive relationship by measuring

the immediate effect of air pollution on a house-buying decision. However, it takes time for buyers to decide, so measuring the relationship between the air pollution index on the transaction day does not represent people's decision process.

3 Research Design

Our research uses the methods of data visualization, classification, and OLS regression. We use two datasets for our empirical analysis. The PM 2.5 dataset includes hourly air pollutants data from 12 air quality monitoring sites obtained from the Beijing Municipal Environmental Monitoring Center from 2013 to 2017. The housing data containing house and district characteristics of all houses sold in Beijing from 2013 to 2017 is collected from Lianjia, one of the largest real estate brokerage firms. Different from previous literature, we classify the highest daily PM 2.5 index above 100 as unhealthy and investigate the relationship between housing prices and the number of unhealthy days in 60 days before the transaction because buyers usually take one or two months to make the final decision. Therefore, our model captures the air quality in people's decision-making process. We apply the hedonic model and control house and district characteristics in our regression. In Beijing, residents cannot choose schools across districts but can go to any schools in their districts, so school characteristics are also controlled. Then, we add a fixed year effect to capture unobserved variation across years. For example, when China implemented the two-child policy in 2015, the demand for houses with more bedrooms increased and drove up the market price. Lastly, we control seasonality in PM 2.5 and housing prices as PM 2.5 tends to increase in winter due to heating, and real estate brokers give significant discounts to sell more houses and receive a bonus before the Chinese New Year. After including all controlled variables, we can interpret our data and test for robustness. Our conclusion will be based on the result we get from OLS and hopefully will provide guidance and highlight the importance of environmental protection.

4 Outline

1. April 9th: Conduct Data Work
    - Classify unhealthy days using max daily PM 2.5, count the number of unhealthy days in 60 days and merge it to housing data by using latitude and longitude.
    - Data visualization and summary statistics
2. April 16th: Multiple Linear Regressions
    - Basic hedronic model: house characteristics, district characteristics (school)
    - Year and season fixed effect
    - Interactions
3. April 16th - 30th: Write-up

References

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