Value of Better Air Quality: Evidence from Beijing Housing Market

To better estimate 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 PM2.5 (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 effect of air pollution on housing prices.

Air quality can be an issue that not only matters to residents in certain areas, but also raise more and more concern from the Chinese government in recent years. Due to rapid economic growth in China, air pollution has become a prominent 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 draws 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 policy makers in China have proposed a carbon neutral target and focus more on the environmental protection policy. To better evaluate such policies requires a more complete analysis on not only the direct environmental benefit, but also 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 not only on the Chinese government but countries around the world to promote effective environmental protection policies.

There is no market for air quality transactions, so researchers have studied the relationship between air pollution and property value to infer people’s willingness to pay for better air quality. For example, *Chay and Greenstone (2005)* adopted the hedonic approach and studied the effect of total suspended particulates (TSPs) on median housing price of each American county. They found that one microgram per cubic meter decrease in total suspended particulates will increase the median housing price of a county by 0.2 to 0.4 percent. With county level data, this estimate represents the willingness to pay for better air quality of the entire US population. However, it underestimates the variation of individual preference because the study does not control for taste heterogeneity within each county. Our study focuses on the housing market in Beijing. Our dataset on houses contains comprehensive data on house and neighborhood characteristics which captures variations in people’s preferences. The PM2.5 value comes from 12 test sites across the city which provides a more accurate air pollution value for each house. Other researchers have looked at local level house prices. *Tang and Niemeier (2021)* utilize 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 that there is a positive relationship between air pollution and housing prices. Qin *et al*. (2019) 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 make a final decision, so measuring the relationship between the air pollution index on the transaction day does not represent people’s decision process. Our group uses the number of unhealthy days

in 60 days before the transaction to characterize air quality. Therefore, our model captures the air quality when people are making their decisions.

This research uses the methods of data visualization, classification, OLS regression, and robust tests. 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 price 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. 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 district, 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 big 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.

References

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