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Urban Rail Transit Can Improve Air Quality

New Evidence from Chinese Cities

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In this research, we investigate whether urban rail transit expansion improves air quality. We also compare the magnitudes of the effects across cities and explain the variation. The results suggest that opening subways alleviated air pollution, especially during non-rush hours in the daytime. We find that the effects are smaller in the cities with higher income and more subway lines, while the effects are larger in the cities with higher population density. Furthermore, the effect of the first subway line opening is stronger, compared to expansion of an existing subway system.

It is well known that exposure to air pollution substantially harms public health and that automobile exhaust emits many harmful pollutants. China, as a rapidly emerging economy, is suffering from severe air pollution caused by both the rapid growth of highly polluting industries and the dramatic increase in vehicle ownership and usage in large cities. Motivated partly by these severe air quality problems, China has been investing heavily in expanding its subway systems. Dozens of cities in China have opened or expanded their rail transit systems in recent years. Although most of these transportation infrastructure investments—urban rail transit in particular—are motivated partly by a desire to improve air quality and public health, little is known of the effects of such investments on air pollution. This research aims to fill this important gap.

In this research, we take advantage of the fact that new subway lines opened at different times to identify the effect of opening subways on air quality. We pool together cities which opened new subway lines in recent years. We estimate the average effect of opening subways on air quality. We also investigate the differences in the effects across cities and look into the factors behind the differences.

We find that opening subways alleviated air pollution. The opening of subways reduced smaller particulate matter (PM_{2.5}) by 15%, larger particulate matter (PM₁₀) by 15.4%, nitrous oxides (NO₂) by 9.8%, carbon monoxide (CO) by 3.9%, and sulfur dioxide (SO₂) by 14% on average. In total, the opening of subways decreased the Air Quality Index (AQI) by 13.5%, where a lower AQI means better air quality. The opening of subway lines had no effect on ozone (O₃), which is not a major air-borne pollutant in automobile exhaust. These findings suggest that investment in public transportation alleviates air pollution by diverting automobile users to subways.

Furthermore, we explore the different effects across time and city. We find that subway opening alleviates more air pollution in the daytime, especially during non-rush hours. We also find that air quality improvements are smaller in the cities with higher income and lower population density. Also, the more existing subway stations, the weaker the effect of opening an additional subway line on air quality.

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Conclusion

By taking advantage of the different times that new subway lines opened, we find that opening subways reduced air pollutants that are caused by automobile use. The result verifies that investment in public transportation infrastructure has a positive influence on air quality, as the policy makers expected. We also find that the effect is smaller in the cities with higher income, more existing subway lines, and lower population density. The different effects provide more information to policy makers on the timing of building a subway in a city.

ABOUT THIS BRIEF

This brief is based on "The Effects of Urban Rail Transit on Air Quality: New Evidence from Multiple Chinese Cities." 2018. Environment for Development Discussion Paper 18-20. Gothenburg, Sweden and Beijing, PRC.

FURTHER READING

Chen, Y., and Whalley, A. 2012. Green Infrastructure: The Effects of Urban Rail Transit on Air Quality. *American Economic Journal: Economic Policy* 4(1): 58-97.

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