

Governance, Environmental Vulnerability, and PM2.5 Concentrations: International Evidence

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Air pollution is a fundamental cause of climate change. Air pollution is mainly attributable to human activities that have a negative impact on the environment. As global population grows and industrialization, urbanization and modernization spreads across the globe, air quality has steadily deteriorated, especially in the developing world. Air pollution and climate change are often considered two sides of the same coin, adversely affecting many aspects of human life, particularly human health. Air pollution is the leading cause of respiratory diseases and has a pronounced effect on children's respiratory function.

However, since air pollution is mostly caused by human activity, it is preventable. In this study, we highlight the importance of governance and environmental vulnerability in pursuing cleaner air. The ability of a government to tackle environmental degradation could be hindered by the quality of public services, civil service, policy formulation, policy implementation and credibility of the government's commitment to a cleaner environment. Such institutional factors are captured in the Government Effectiveness index by the World Governance Indicators, which is the main indicator used in this study. We explicitly incorporate two key underlying factors, namely governance and environmental vulnerability, into the empirical analysis of air pollution for a global sample of countries.

More specifically, we examine the relationship between fine particulate matter (PM2.5) concentrations, and governance, environmental vulnerability, and other factors for a panel data of 128 countries from 2000 to 2014. Apart from data availability for a relatively large number of countries, we chose PM2.5 as the proxy for air pollution since the PM2.5 problem has recently attracted a lot of scientific and public attention. This is attributable to its harmful effects on visibility, human health, and global climate.

PM2.5 is widely recognized as a "major global killer" by the World Health Organization (WHO). Since PM2.5 is fine enough to lodge deep into human lung and blood tissue, populations exposed to PM2.5 are at risk of heart and lung diseases, ranging from stroke to lung cancer, which might cause death in severe cases. Furthermore, fine particulates such as PM2.5 are a main contributor to the incidence of pneumonia, which is a major cause of child mortality worldwide. PM2.5 is primarily the consequence of combustion, whether manmade like car emissions and coal burning, or natural like forest fires and volcanic activity. Despite its well-known health impact, PM2.5 is not monitored properly in many countries, especially in the developing world, due to lack of capacity, resources, and public demand.

For the full sample of countries, we find that better governance in terms of higher government effectiveness and higher educational attainment contribute to cleaner air. On the other hand, greater vulnerability causes air quality degradation. In theory, the effect of governance and environmental vulnerability on the environment is uncertain. However, the findings of this study indicate that better governance and reduced vulnerability (or higher educational attainment) benefit air

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quality. This suggests that promoting governance quality and educational programmes as well as tackling issues related to environmental vulnerability can contribute to cleaner air.

Our evidence on the environmental effects of governance and environmental vulnerability for different income groups of countries is more nuanced. The positive effect of environmental vulnerability on the level of PM_{2.5} concentrations holds across countries of different income levels. At the same time, a significantly negative effect of governance is found for high-income countries, but not for low- and middle-income countries, at the 5% significance level. The evidence thus suggests that developed countries have been more successful in tackling air pollution than developing countries.

On the other hand, developing countries are still struggling to find ways to grow rapidly without harming air quality. We also find that the coefficients of interaction terms between governance and vulnerability are negative while those between governance and education are positive. This implies that enhancing governance quality may reduce the negative effects of vulnerability on environmental performance. The results are robust to two different measures of governance quality.

The empirical findings underlie the central role of a strong institutional framework that facilitates policy formulation and implementation in addressing environment challenges. In countries with improved governance, firms tend to pursue more innovative activities that reduce environmental vulnerability. For instance, billions of dollars' worth of new cleaner technologies has dramatically reduced industrial pollutants and discharges in the US, leading to a fall in PM_{2.5} concentration levels by 30 percent between 2000 and 2018, according to a recent report by the U.S. Environmental Protection Agency.

This study points to a number of areas to improve governance quality and tackle environmental vulnerability in the developing world. Possible areas include enhanced public environmental awareness and educational programmes. Finally, the efforts of developing countries to grow rapidly without harming the environment would benefit greatly from the support of the international community. The support will improve their environmental institutional capacity and augment their environment-protecting resources.