



Does public opinion affect air quality? Evidence based on the monthly data of 109 prefecture-level cities in China



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ABSTRACT

In recent years, serious smog and haze have shrouded vast areas of northern and eastern China, which has drawn broad attention at home and abroad. Although China is an authoritarian country with strict media control, public opinion may still affect air quality by putting pressure on the local and central governments to enhance environmental protections. In this paper, the impact of public opinion on air quality in China is for the first time quantitatively examined. Specifically, the monthly average levels of the Air Quality Index (AQI) and the concentrations of several main air pollutants, such as PM_{2.5}, PM₁₀ and SO₂, are utilized as indicators for air quality. Using a dataset consisting of 109 prefecture-level Chinese cities for the period between November 2013 and October 2016, the estimation results indicate that air pollution significantly affects public opinion on air quality, and the surge in public opinion on air pollution occurs more frequently in the winter. Public opinion seems to have a positive effect on the environment only in the short run: air quality tends to improve two months after the surge in negative public opinion. In general, public opinion about air pollution helps to improve air quality in China.

1. Introduction

In recent decades, China has achieved remarkable success in economic development through industrialization and urbanization. However, as a byproduct of industrialization and urbanization, air pollution has become increasingly severe in vast areas of China. On February 29, 2012, the Minister of Environmental Protection of the People's Republic of China released a new version of the “Ambient Air Quality Standards” and “Technical Regulation on Ambient Air Quality Index (on trial).” According to these documents, the newly established Air Quality Index (AQI), which monitors pollutants such as PM_{2.5} and ozone (O₃), should be updated and released on a regular basis (once per hour). Ever since these air quality reports were made public, high AQI levels (corresponding to serious air pollution) have generally drawn broad attention at home and abroad and have often become the target of media critiques. For instance, the severe smog that primarily hit the

Beijing-Tianjin-Hebei delta region resulted in high levels of AQI in December 2016, which drew the attention of both major and local media outlets in China, including sina.com, baidu.com, tencent.com, etc. Residents in many places raised questions about such poor air quality and high AQI levels. Both the media reports and the public's queries greatly pressured various levels of the Chinese government to control air pollution and improve air quality in the short-term through a series of temporary efforts, such as shutting down polluting factories, prohibiting construction, and restricting vehicles. In addition, China's local governments are generally inclined to utilize temporary measures to achieve the goal of improving air quality during important political and social events, such as the Asia-Pacific Economic Cooperation (APEC) meeting and the massive military parade to mark the 70th anniversary of the victory in the War of Resistance against Japanese Aggression and the World War II, which leads to the phenomena of “APEC Blue” and “Military Parade Blue”.¹ It is noteworthy that the

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¹ “APEC Blue” and “Military Parade Blue” respectively refer to the rare blue sky that appeared in Beijing when APEC China (the 22nd annual meeting of APEC leaders and some other influential international figures) was held in November 2014 and the mega-military parade commemorating the 70th anniversary of victory in the War of Resistance against Japanese Aggression and World War II in September 2015. The apparent improvement in air quality during these two important political events is the consequence of a series of temporary emission reduction regulations issued by the Chinese government. For more information, please refer to https://en.wikipedia.org/wiki/APEC_blue (Accessed 6 February 2018) and https://sinosphere.blogs.nytimes.com/2015/08/26/beijing-smog-gives-way-to-military-parade-blue-before-world-war-ii-event/?_r=0 (Accessed 6 February 2018).

policies formulated by the Chinese government have historically had important impacts on China's economic and environmental development (e.g., Montinola et al., 1995; Jin and Zou, 2005; Kanbur and Zhang, 2005; Li et al., 2018). In recent years the Chinese government has been exerting influence on environmental protection through direct regulatory policies and environmental law enforcement. Therefore, reliance on temporary environmental regulation has become one of the main features of the Chinese government's environmental protection strategy. Facing serious air pollution and smog issues, the Chinese government is currently under significant pressure from public opinion. Given that the media is generally believed to be under the tight control of the Communist Party of China (CPC) (Tong, 2010; Stockmann and Gallagher, 2011), these observations lead to a natural and interesting question: whether and to what extent public opinion affects environmental quality by putting more pressure on the government. In other words, does public opinion on smog affect air quality? If so, how does it affect air quality?

According to the Environmental Kuznets Curve (EKC) hypothesis that was developed by Grossman and Krueger (1991, 1995), as a developing economy edges into a middle-income economy, the public demands a cleaner and more comfortable living environment, which puts pressure on the government to take action to tighten environmental regulations and reduce pollution. Considering the fact that China has begun its economic transformation from extensive to intensive growth in recent years, its economy still has a relatively high level of dependency on high-polluting industries. Meanwhile, the public has been expressing more dissatisfaction about poor air quality, particularly the issue of smog (Shao et al., 2018). However, air pollution regulations, especially smog governance, may have economic costs, including a higher unemployment rate and a decelerating economic growth rate (Hao et al., 2018). Such regulations can affect economic growth, at least in the short run, and may even lead to social instability (Jorgenson and Wilcoxon, 1990; Jaffe et al., 1995; Greenstone, 2002). As such, the Chinese government must strike a balance between the public desire to improve air quality and the need to maintain economic development at a relatively rapid pace, which is generally recognized as legitimizing the ruling CPC. The rapid spread of public opinion about high AQI levels in recent years has put significant stress on local governments. In practice, without an effective long-term plan for smog reduction, China's local governments tend to restrict the short-term activities of pollution-intensive industries during the period when bad air quality and public concern are more likely to be reported and broadcast (Shi et al., 2016). Therefore, there are incentives for the Chinese government to implement at least short-run policies to regulate polluting industries and improve air quality in response to the pressure of public opinion.

However, the effect of public opinion on environmental governance and environmental quality has been largely neglected in previous studies. In China, it is traditionally believed that because the CPC has firm control of the press and media, the majority of negative public opinion cannot be reported and therefore has little to no influence on the behaviors of the government (Lee, 1994). Conversely, with the rapid development of Internet technology, it is increasingly difficult to have complete control over public opinion. Chinese citizens have broadened their horizons and become more critical. In addition, it has become technically more difficult to censor and remove all information on the Internet that is officially considered to be negative (Fu et al., 2013). Dahlgren (2005) believed that the Internet has dramatically changed traditional collective behavior and allowed it to break its temporal and spatial limitations so that the spread of public opinion through the Internet can occur in a short period. As early as the late 1990s, some researchers had already noticed the challenge of governance created by the Internet. For instance, Rash (1997) and Davids (1998) argued that Internet public opinion, which serves as an aggregated online reflection of the public's attitudes, views, and wills about public affairs, has brought profound changes to traditional politics. Moreover, Internet

public opinion has significantly shifted the relationships among individuals, societies, and countries. In recent years, a series of studies on China have also found that the development of the Internet has at least to some extent increased the ability of Chinese citizens to express their own opinions and even criticisms of the government (e.g., Lagerkvist, 2005; King et al., 2013). As for air pollution in China, not only does the Internet serve as a tool that visualizes AQI information, but it also provides a platform for expression that forms and spreads public opinion on air quality. Therefore, as the reflection of the public's views on air quality and smog issues, public opinion on air pollution—especially smog pollution—and the spread of Internet public opinion may affect the government's environmental policies and thereby air quality. However, because the government's regulatory policies may not be directly observable, it is infeasible to empirically examine the causal relationships of public opinion on smog, the government's regulatory policies, and air quality improvement. Thus, examining the effect of public opinion on air quality may provide insights into the government's attitudes and reactions to public opinion on smog.

To carefully examine whether public opinion on air quality, specifically smog, affects air quality by pressuring the government as argued above, we collected data to measure air quality and the intensity of public opinion on smog in each month and conducted empirical analyses. We focused on three aspects in answering the previous question: 1. examining the formation of public opinion with regard to the changes in local air quality; 2. examining “to what extent” and “at what pace” the formed public opinion affects air quality in the following periods in the full sample and among controlled comparative groups to study the Chinese government's short-run behaviors in environmental regulation; and 3. examining the influence of public opinion on the concentrations of main components of synthetic air pollutants to study the effectiveness of governmental regulations in controlling the concentrations of different pollutants, and offering suggestions to more efficiently control air quality. The main contribution of this study is twofold. First, this is the first study utilizing a city-level dataset to investigate the influence of public opinion on air quality in China. Second, considering the fact that there might be a time lag between the occurrence of public opinion and the change in environmental quality, reasonable and appropriate econometric techniques are employed to examine the possible causal relationship and time lag between public opinion and environmental quality change. The rest of the paper is organized as follows. In Section 2, the estimation methods and econometric tools used in this study are briefly introduced. In Section 3, the data utilized and its sources are interpreted. In Section 4, the empirical estimation results are reported, and the corresponding explanations are given. Finally, Section 5 contains the conclusion of the study and provides relevant policy implications.

2. Theoretical hypothesis

In recent years, the duration and coverage area of smog in China have consistently broken historical records. Public health and economic sustainability are both challenged by smog issues (Chen et al., 2017a, 2017b; Lu et al., 2017). As previously discussed, to achieve the short-run goal of air quality improvement, Chinese governments at all levels often utilize temporary strategies, whose continuity and sustainability remain questionable. It is reasonable and essential to review governmental regulations on air quality under the circumstance of severe and frequent smog and haze pollution occurring in many Chinese cities. According to the “2014 Report on the State of the Environment in China” released by the Ministry of Environmental Protection of the People's Republic of China, among the cities that enforced the new ambient air quality standards in 2014, 145 cities failed to meet the National Grade II ambient air quality standards, and the ratio of cities that succeeded in meeting such standards is less than 10%. Based on a report by the Asian Development Bank, less than 1% of large Chinese cities were able to meet the air quality standards suggested by the

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