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Social acceptance towards the air pollution in China: Evidence from public's willingness to pay for smog mitigation

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HIGHLIGHTS

- Evaluating the social acceptance towards the air pollution in China.
- Up to 14% of respondents hold the protest responses.
- WTP for the smog mitigation accounts for about 1% of income.
- Household energy expenditure is closely related with public's WTP.
- The grading governance and policy transparency are recommended.

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ABSTRACT

Air pollution is one of the most predominant challenges in China. In order to ensure the smog governance projects could be promoted smoothly and the public shoulder the environmental responsibilities consciously, it is necessary for the policymakers to take public attitude into consideration, and understand the public willingness to pay (WTP) for smog mitigation. This paper adopts a CV method framework to assess the value of WTP and analyze the determinants. Given the consideration of the possible presence of the selectivity bias caused by protest responses, the bivariate sample selection model is constructed for estimation. Results show that up to 14% of respondents hold the protest responses, and neglecting the selection bias caused by protest responses would lead to downward biased estimates. The mean value of WTP for the smog mitigation is 1590.36 RMB per year, accounting for about 1% of annual income. Moreover, the NIMBY (not in my backyard) attitude among public is found to be significantly correlated with their WTP, and the other determinants such as household annual income, energy expenditure and economic loss caused by smog could also substantially affect the value of WTP. We further recommend grading governance and policy transparency to address the smog crisis.

1. Introduction

1.1. Background

Due to the serious impacts on human health and economic development, the severe smog crisis in China has drawn global attention. Air quality in nearly one half of the monitored cities in China has deteriorated because of the choking smog. Hundreds of millions of residents have been affected by the heavy smog (Zheng et al., 2014). According to the WHO (World Health Organization), smog mainly consists of nitrates, sulfate, sodium chloride, carbon, mineral dust, ammonia and water. The main contributing factor of smog is energy consumption, especially coal combustion, since coal accounts for about 68% of China's total primary energy consumption (China Statistical Yearbook, 2013).

Air pollution has been a persistent concern all over the world. It seems to be an unavoidable environmental problem during the process of urbanization and industrialization worldwide (Zhang et al., 2014). Smog can cause serious damages to both economy and human health. For example, due to the dense smog caused by heavy coal combustion, thousands of London citizens lost their lives in 1952; during the 1940 s and 1950 s, photochemical smog shrouded Los Angeles, resulting in thousands of premature deaths and traffic accidents. In 2005, the economic costs of suspended particulates and ozone in China were estimated to be US$112

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billion (Matus, et al., 2012), which was about 5% of the country's GDP. Since air pollution can affect many aspects of a society, such as human health, agriculture and industry, the accurate economic loss will be much higher. When smog envelops China, flights in some severely affected areas have to be canceled, and vehicles along the highways are backed up for a few tens of kilometers. Some primary schools have to be suspended in order to ensure students' health, when the cities suffer the extremely severe smog.

Air pollution in China is so severe that it has already threatened the vision of the "Chinese dream" laid out by China's new administration. The cruel reality pushes China to take effective measures to prevent the threatening smog. The central government proves to be able to control the air pollution, for example, Beijing and its neighboring cities imposed tight limits on private car use, ordered factories and construction sites to close to mitigate air pollution during the Asia-Pacific Economic Cooperation (APEC) meeting in 2014. These measures are effective in a short term but they are costly. The State Council has already demonstrated firm resolution to mitigate air pollution by releasing a series of legal documents such as the "Action Plan for Air Pollution Prevention and Control", in which, the government are committed to reduce the PM10 intensity by over 10% in five years, and reduction targets of PM2.5 intensity for the Beijing–Tianjin–Hebei (BTH) region, Yangtze River Delta and Pearl River Delta are 25%, 20% and 15% respectively (Sun et al., 2016). To accomplish such a tough work, on one hand, the enormous cost of smog mitigation must be accepted by residents who will bear the cost ultimately (Yang et al., 2014). On the other hand, according to Wei et al. (2007), smog mitigation policy should probably influence more than a quarter of the total energy consumption which is influenced by citizens' economic activities and lifestyles every year. The smog control is a nation-wide project, and everyone in the society should take unshrinkable responsibility. Facing the current smog crises, the central government explicitly claims "breathing together, sharing the fate", and called upon citizens to recognize their own environmental responsibilities. Therefore, if the sense of environmental responsibilities can be brought into public's life and work, the smooth implementation of smog governance can be largely accomplished by individual-level actions.

In order to ensure the smog governance projects could be promoted smoothly and the public shoulder the responsibilities consciously, it is necessary for the policymakers to take public attitude into consideration, especially whether or not the public are willing to share the cost of smog reduction. Public attitude can reflect the general public acceptance of the governance policies. Meanwhile, public attitude may indicate uncertainties to the policies. Therefore, better understanding of public preferences and securing public support are critical in making sustainable energy policies. However, public preferences for energy reform are likely to be complex. For example, clean energy may contribute to improving air quality and providing superior efficiency in energy utilization, but it also indicates huge capital investment. To set up clean energy generation systems should be an effective way to eliminate the smog from the source, while it will substantially increase the living cost of residents. Meanwhile, the cost concern could possibly lead to a severe NIMBY (not in my backyard) attitude (Sun et al., 2014) among public, in turn, the NIMBY attitude could lower the public acceptance level of smog governance. The huge cost has triggered public concerns, and appeared to hinder the implementation of governance policies. Based on above insights, it is important for policymakers to understand the public acceptance level of the recent policies of smog governance.

Since the contingent valuation (CV) method has been widely used to evaluate the economic value of non-market products (Mitchell and Carson, 1989), this paper adopts the CV method aimed at assessing public acceptance of the improvement of air quality to explore the above issues. In a CV survey, respondents are asked to elicit their willingness to pay (WTP) for the smog mitigation in a hypothetical market. The hypothetical market contributes to a better understanding of the CV survey. Willingness to pay (WTP) can reflect public's actual readiness to pay for smog mitigation (Adaman et al., 2011). This paper attempts to find out the public acceptance to the projects of smog mitigation using a national-wide survey data, and to provide some useful information that could be applied in future decision making. Meanwhile, since a part of respondents might seemingly show a zero WTP on smog mitigation, for reasons that differ from a genuine indifference to the smog governance. However, it can be interpreted as a "protest response" against the unfairness or inefficiency of the public administration. Usually, observations with protest votes are considered as true zero values (Sun and Zhu, 2014), or simply removed from the dataset (Mitchell and Carson, 1989), and only truncated sample with positive responses is considered in the WTP estimating analysis (Whitehead et al., 1993). These approaches will not have any effects for the validity of the estimates, only if there is no sample selection bias, which means the group of protesters is not significantly different from the remainder of the sample. Otherwise, the estimates of WTP will get an upward or downward bias, depending on the sign of the sample selection bias (Calia and Strazzera, 2001). In this paper, a bivariate sample selection model is taken into account to examine and correct the possible bias due to protest responses of smog mitigation, and we give an evidence of the sample selection bias in contrast with the estimates from the truncated sample of non-protest responses.

Research data of this paper come from a nationwide face-to-face CV survey of China's Public Perception of Air Quality[1] (CPPAQ) in July 2014. The CV survey was conducted in plain Chinese language since all the respondents are Chinese citizens, and the bid amount was measured in Chinese official currency (RMB[2]) for a better understanding of respondents.

There are at least three distinctive reasons for us to study the social acceptance towards the air pollution in China. First, since the central government recently claimed that the smog mitigation needs everyone in the society to take the responsibility and share the cost together, the current public's WTP for smog reducing should be paid more attention. Using a national wide surveys dataset, the assessment of the WTP value offers a good opportunity to understand the revealed preference of citizens to the government's decision. Second, it is inevitable that lots of respondents are not willing to pay for sharing the smog mitigation responsibility, but some of their reasons should not be treated as a genuine indifference to the smog governance. The sample selection model is taken into account to deal with the protest responses. Particularly, we focus on analyzing the effect that protest responses may produce on the validity of the estimates for WTP. Third, the determinants of WTP and protest responses are uncovered in the estimation process. To contribute to the growing literature of this area (Cai and Zheng, 2007; Yang and Xu, 2004;

[1] The survey of CPPAQ was conducted by China Center for Energy Economics Research at Xiamen University once to twice a year from 2013. The form of face-to-face interview was adopted because some questions were relatively professional which required oral explanations. In addition, the face-to-face interview could ensure enough communication with interviewees lasting more than 15 minutes, and convey information of the guidelines suggested by the NOAA Panel (Arrow et al., 1993). The respondents sampled for the CPPAQ were randomly drawn from 30 provinces in most parts of China, and a random sampling procedure (Barnett, 2002) was used to guarantee the representativeness of the sample. In particular, the preliminary surveys and pilot studies were conducted in order to identify issues related to questionnaire design, protest responses, statement expressions, payment vehicle, and bid amounts (Cooper, 1993). The dataset employed in this study came from the CPPAQ survey in July 2014.

[2] RMB: currency of China, 1 RMB = 0.1615 USD in 2014.