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Driving forces behind the Chinese public's demand for improved environmental safety

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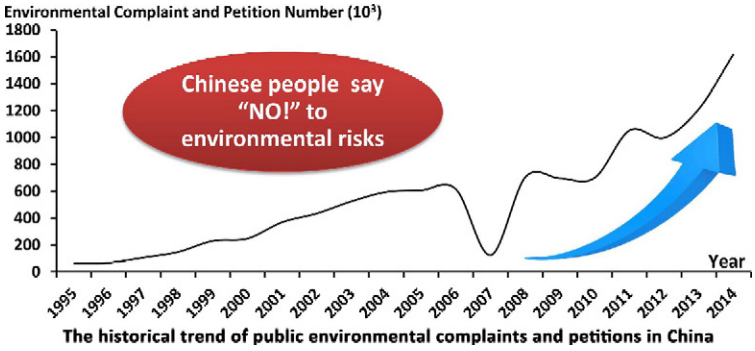
HIGHLIGHTS

- Driving forces of public demand for environmental safety in China were assessed.
- Population and educational level are positively associated with public demand.
- The EKC effect was found between income level and public demand.
- The gap between public demand and actual environmental safety level is increasing.
- Proactive environmental management system and risk communication system is needed.

GRAPHICAL ABSTRACT



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ABSTRACT

Over the past decades, the public demand for improved environmental safety keeps increasing in China. This study aims to assess the driving forces behind the increasing public demand for improved environmental safety using a provincial and multi-year (1995, 2000, 2005, 2010, and 2014) panel data and the Stochastic Impacts by Regression on Population, Affluence, and Technology (STIRPAT) model. The potential driving forces investigated included population size, income levels, degrees of urbanization, and educational levels. Results show that population size and educational level are positively ($P < 0.01$) associated with public demand for improved environmental safety. No significant impact on demand was found due to the degree of urbanization. For the impact due to income level, an inverted U-shaped curve effect with the turning point of ~140,000 CNY GDP per capita is indicated. Since per capita GDP of 2015 in China was approximately 50,000 CNY and far from the turning point, the public demand for improved environmental safety will continue rising in the near future. To meet the increasing public demand for improved environmental safety, proactive and risk prevention based environmental management systems coupled with effective environmental risk communication should be established.

1. Introduction

Nearly four decades of rapid industrialization and economic growth combined with a lack of effective environmental regulation and

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management, have resulted in serious environmental pollution and conditions which pose both chronic and acute risks to public health. The degradation of the environment has gradually attracted great attention from government and the whole of society, and the government has gradually begun to explore the establishment of effective environmental control and management systems.

Along with the continuous improvement of environmental management systems in China, the environmental safety levels (including environmental quality and risk levels) have begun to improve, especially over the recent decade. For example, China implemented a strict energy conservation and emissions reduction (ECER) policy during late 2006. Due to the ECER policy, energy usage intensity in 2010 was reduced by 19.06% compared to that in 2005 (Lo and Wang, 2013). Since then, emissions of SO_2, dust, and chemical oxygen demand (COD) have continued to decrease (Wang and Hao, 2012; Xue et al., 2014; Yuan et al., 2011). The ambient air SO_2 and PM_{10} concentrations have also decreased (Kan et al., 2012). Ma et al. (2016) found the co-benefit of the ECER policy that China's $PM_{2.5}$ concentrations decreased slightly after 2008. For another example, the frequency of environmental pollution incidents decreased from 2000 to 3000 cases per year in the early 1990s to around 700 per year after 2007 (Bi et al., 2015a). These achievements have been benefited from continuous improvements to China's environmental management system and emergency response capabilities (Bi et al., 2015a; Bi et al., 2015b; Ding et al., 2015).

Meanwhile, the public demand for improved environmental safety continues increasing rapidly. According to data from the *China Environment Yearbook*, the number of public environmental complaints and petitions expressed to local governments via letters, official hotlines, and the internet generally continued to rise year upon year from 1995 to 2014 (Fig. 1). The frequency of environmental protests and Not-In-My-Back-Yard (NIMBY) activism also increased year upon year from 2003 to 2014 (Rong and Xie, 2015). Why does the public demand for environmental safety keep increasing rapidly even over the last 10 years when there has been great improvement in environmental safety? Understanding the potential social-economic driving forces behind this phenomenon is of great significance for environmental management and eliminating the gap between the public environmental safety demand and the actual environmental safety levels.

Many studies have identified the social economic drivers (e.g., population, income, urbanization, etc.) of various anthropogenic environmental impacts (e.g., land use change, carbon emission, water footprint change, etc.) (Dietz and Rosa, 1997; Liddle, 2015; Xie et al., 2005; Zhao et al., 2014). And there have been a handful of researches on the public demand for better environment (Brasington and Hite, 2005; Fouquet, 2012; Hökby and Söderqvist, 2003; Kline, 2006). Brasington and Hite (2005) investigated the public demand for environmental quality in Ohio State of the United States and found that people with higher incomes, higher educational levels, and people with children demand more environmental quality. Besides, studies on the public perceptions of environmental risk and acceptable environmental risk levels related to specific environmental risks at the micro (individual) scale (Chung et al., 2008; Huang et al., 2010; Huang et al., 2013; Shi and He, 2012; Weiner et al., 2013) can also help us to understand the potential influence factors of the public demand for environmental safety. For example, Huang et al. (2013) studied the public perception of the environmental risks associated with algal bloom in four freshwater lakes and found lower algal bloom risk tolerance levels were associated with higher income, education, and urbanization levels. To our best knowledge, studies on the driving forces behind the public demand for improved environmental safety at the macro (e.g., national) and long-term scale have been lacking in China. Previous studies on the driving forces of environmental issues and public perceptions of environmental risks provide the theoretical basis for us to study the driving forces of the public demand for environmental safety at the macro scale in China.

In this paper, we aims to explore the potential driving forces behind the public demand for improved environmental safety at the national scale using a provincial panel dataset. The goal is to put forward corresponding policy recommendations for macro environmental management in China. The rest of the paper is organized as follows: Section 2 describes the sources and structure of the provincial panel data and the statistical model used in this study. Section 3 provides the summary statistics of the panel data and the model results. The potential driving forces are then discussed and policy recommendations are given in Section 4. Finally, we summarize the major findings and present conclusions in Section 5.

2. Data and methods

2.1. Data sources

Indicators such as the public willingness to pay (WTP) for better environmental safety, the number of environmental protests events, or the number of public environmental complaints and petitions (*CP*) expressed to local governments via letters, official hotlines, and the internet system, could be the proxy variables of public demand for improved environmental safety. In this study, we selected *CP* as the proxy of public demand for improved environmental safety because this indicator has a relatively complete official statistical data set. The *CP* data from 31 provinces for the years 1995, 2000, 2005, 2010, and 2014 were obtained from the *China Environment Yearbooks*. Taiwan, Hong Kong, and Macau were not included in this study due to issues of data availability.

Based on literature review, population, income level, degree of urbanization, and educational level were selected as the independent variables to test the potential driving forces behind the public demand for

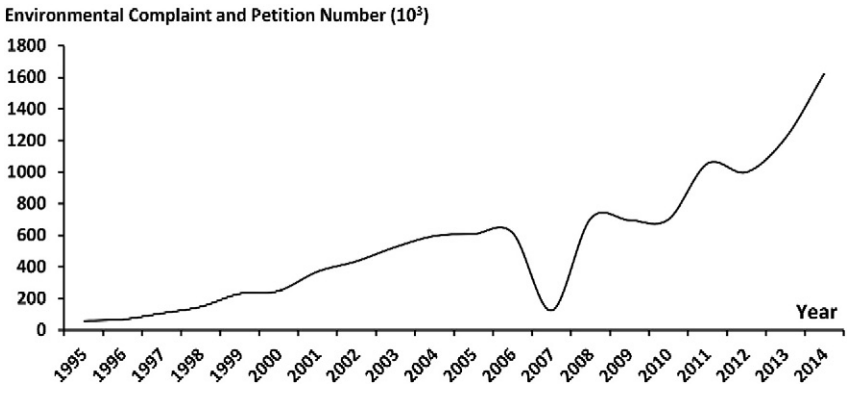

Fig. 1. The trend in the number of public environment related complaints and petitions throughout China.