



# The bittersweet fruits of industrialization in rural China: The cost of environment and the benefit from off-farm employment

Ying LIU <sup>a,\*</sup>, Jikun HUANG <sup>b,1</sup>, Precious ZIKHALI <sup>c</sup>

<sup>a</sup> School of Economics and Management, Beihang University, Beijing 100191, China

<sup>b</sup> Center for Chinese Agricultural Policy (CCAP), Institute of Geographical Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China

<sup>c</sup> Southern Africa Regional Office, International Water Management Institute, Private Bag X813, Silverton, Pretoria 0127, South Africa

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## ABSTRACT

While it is widely accepted that industrialization has brought both environmental pollution and economic growth in rural areas of China, very little is known about whether the negative effects of industrial pollution on rural residents have been proportionally offset by positive effects due to improvements in off-farm income. This paper improves our understanding of these tradeoffs by conducting an empirical analysis based on a set of nationwide panel data collected in 2008 and 2012 and covering five provinces, 101 villages, and 2020 households. Evidence is found to suggest that it is not always the case that rural households that are affected by pollution reap the off-farm employment benefits associated with industrialization. Specifically, although industrial pollution incidence is found to be positively related with the level of local off-farm employment, this relationship is statistically insignificant when migrant labor is included. It can be explained as areas that less economically benefited from industrialization tend to have more labors migrated out and the average annual wage income of one migrant labor is much higher than that of local off-farm labor.

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## 1. Introduction

The rapid industrialization in China has been accompanied by environmental, health, and social problems. The economy-wide policy reforms designed to promote growth and liberalization have had little regard for their environmental consequences (World Bank, 2007). Industrial pollution, especially air and water pollution, are a major source of morbidity and mortality in China (Zhang et al., 2010; Ebenstein, 2012). The government receives more than 700,000 in 2010 complaints related to environmental problems from the public through letters and calls (xin fang), which was 12 times more than that in 1995 (Ministry of Environmental Protection, MEP, 1995, 2010). The economic cost of environmental degradation to China was estimated to range from eight to 12% of its GDP between 2000 and 2006 (World Bank, 2007).

Compared to their urban counterparts, rural residents tend to be more adversely affected by the process of rural industrialization. Rural industrialization could be traced back to the antetype of township and village enterprises, which were promoted by the government in the late 1970s. The aim was to spur rural economic growth and ease problems of overcrowding and urban unemployment by creating employment opportunities for the surplus labor in agriculture. In general, rural residents, who accounted for nearly 50% of total population, have been found to suffer more environmental pollution from industry after controlling for other socioeconomic factors (Ma, 2010). This is partly due to differences in the stringency of environmental policies between rural and

\* Corresponding author. Tel.: +86 13552755872.

E-mail addresses: Liuying@buaa.edu.cn (Y. Liu), jkhuang.ccap@igsnr.ac.cn (J. Huang), prehgababela@gmail.com (P. Zikhali).

<sup>1</sup> Tel.: +86 10 64889440.

urban areas (Engardio, 2009; Su & Ma, 2006). Furthermore, enforcing environmental regulations tends to be harder in rural areas (Wang, Webber, Finlayson, & Barnett, 2008), mainly due to the low densities in rural industries and the insufficiency of environmental monitoring (Swanson, Kuhn, & Xu, 2001; Tilt, 2007; Wang, 2006).

Like a coin has two sides, industrialization has undoubtedly had an important and well-documented role in dramatic changes in rural labor market and rural economic growth. The proportion of net income from agriculture steadily shrinks to 1/3 of total income (China rural statistical yearbook, 2013), and off-farm income has become the most disequalizing component of rural household income (Fang & Rizzo, 2011; Khan, Griffin, Riskin, & Zhao, 1992; Wang, Smyth, & NG, 2009). First, rural industrialization succeeded in stimulating economic activity and raising income levels in rural areas (Rizwanul & Jin, 1994). Second, migrant income also contributed much to total off-farm income. A large number of rural residents have been moving from the countryside to the city, from underdeveloped economic areas to developed areas. In 2013, 19% rural labor engaged in off-farm employment in local town and 31% labor in rural areas migrated out of local town (National Bureau of Statistics of the People's Republic of China (NBSPRC), 2014).

However, the relationship between income growth and industrial pollution in rural China, the bitter and sweet fruits of industrialization, is a little complicated. Empirical studies often suggest that the relationship is not straight forward; specifically, pollution rises at early stages of economic development, and this trend is reversed in the later stages of development as growth becomes more environmentally friendly. That is to say the estimating results of the relationship depend upon the stage of economic growth.

Furthermore, in the context of China's migration phenomenon, the relationship between industrial pollution and level of total off-farm income, in which migrant income is included, is more confusing. Rural households enjoy economic benefits from industrialization both in local and urban areas, while rural environment is only associated with local industry. The impact of local industrialization on migrant employment might be confusing. On the one hand, areas that less economically benefited from industrialization tend to have more labors migrated to urban areas to seek higher income. While on the other hand, areas that suffering serious industrial pollution might also give rise to migration to less-polluted areas.

The primary objective of this paper is to examine whether the negative effects of industrial pollution on rural residents have been proportionally offset by positive effects due to improvements in off-farm income. While it is widely supposed that industrialization has brought both environmental pollution and economic growth in rural areas of China, very limited empirical research has been conducted to investigate whether the residents that are adversely affected by the environmental consequences of industrialization in rural China have been proportionally compensated by improvements in off-farm income. Possibly due to lack of data on rural industrial pollution, there has been no quantitative research on the relationship between industrial pollution and local off-farm employment in rural China. This paper fills this gap. It measures the prevalence of industrial pollution in a highly comprehensive way based on the households' perceptions on industrial pollution. A data set on 2020 households from five provinces in rural China is used to statistically and econometrically analyze the relationship between industrial pollution and off-farm incomes in rural China. The findings of the paper will have significant policy implications not only on balance between environmental conditions and economic development in rural China but also on ensuring sustainability of China's economic growth.

The rest of the paper is organized as follows: Literature review is offered in the next section, followed by a discussion of the data collected by the authors in 2008 and 2012. Sections 4 and 5 provide a statistical analysis on the intensity of industrial pollution and villagers' off-farm employment, respectively. This is followed by a brief outline of the econometric methodology used in the analysis, and Section 7 presents the results and discussions. Section 8 concludes the paper and offers policy recommendations.

## 2. Literature review

The relationship between industrial pollution and income has long been debated. The long-term relationship between pollution and income has been conceptually captured through the environmental Kuznets curve (EKC), which posits that pollution is an inverted-U shape function of income per capita. Intuitively, this means environmental degradation (pollution) rises as a country goes through early stages of economic development, and this trend is reversed in the later stages of development as growth becomes more environmentally friendly. In the case of China, different studies estimating an EKC often generate different results depending upon type of pollutant used and how it is measured (Diao, Zeng, Tam, & Tam, 2009; Du, Wei, & Cai, 2012; Henri, Cees, & Zhou, 2004; Jalil & Mahmud, 2009; Liu, Heilig, Chen, & Heino, 2007; Shen, 2006; Song, Zheng, & Tong, 2008; Yang, Yang, & Sheng, 2011). While interesting, measuring the prevalence of industrial pollution in a highly comprehensive way is a challenge. This partly explains the mixed results revealed in existing studies on the EKC in China, as in other countries.

In recent years, research on environmental inequality in China has been growing. The main difference between this kind of research and that on EKC is that the later focuses on the national level and examines the long-term relationship between pollution and income, whereas environmental inequality research typically focuses on the manner in which the quality (e.g., pollution) of the environment is distributed across different population groups and/or locations in the country. Research on environmental inequality sheds light on who bears the environmental burden.

The main research question associated with environmental inequality is whether the rich and poor bear the environmental burden disproportionately differently. Evidence on this is mixed. Ma (2010) suggests that people who benefited more, economically, from increased industrial production tend to suffer the most environmentally. On the contrary, some researchers argue that China's poor are disproportionately affected by environmental burdens (World Bank's, 2007; Tang et al., 2008). Brajer,

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