

The environmental consequences of domestic and foreign investment: Evidence from China



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ABSTRACT

Fixed asset investment (FAI) and foreign indirect investment (FDI) have important influences on economic development and environmental quality. Because environmental performance is related with economic development, FAI and FDI may affect environment indirectly through their impacts on economic growth. In this study, the direct and indirect effects of both FAI and FDI on China's environmental quality are distinguished and separately estimated for the first time with a carefully designed framework of a two-equation model. Because most economic activities and environmental pollutions occur in the urban areas, a panel data of 112 Chinese cities for the period 2002–2015 is utilized. Several spatial factors are also introduced to control for the potential spatial correlations in economic development and pollutant emissions. The estimation results indicate that there exist apparent differences in the environmental effects of FAI and FDI. The direct effects of FAI on SO₂ emissions are significant positive and dominate the negative indirect effects. By contrast, the direct, indirect and total effects of FDI on pollutant emissions are all negative. Therefore, overall speaking, well designed and targeted policies should be formulated to reduce the negative environmental impacts of FAI and to increase the positive influences of FDI on environment.

1. Introduction

Since the 1990s, economic globalization has greatly promoted the rapid growth of investment in China. Specifically, among various types of the investment in China, the most important two categories are domestic fixed asset investment (FAI) and foreign indirect investment (FDI). During the last a few decades, accompanied by the increase of investment is not only the rapid economic growth but also the deteriorating environmental quality, including rapid degradation of ecological environment, accelerating greenhouse gas (GHG) emissions and frequent natural hazards. In essence, it is an inevitable conflict between the limited ecological capacity that the environment has to self-clean and the surging demand for natural resources and pollution emissions. Due to the externality of environmental pollution and the difficulty in identifying the environmental property, the ‘market failure’

and the ‘government failure’ can hardly be avoided. Fig. 1 illustrates the trends of China's FAI, FDI and CO₂ emissions between 1995 and 2015. It could be seen clearly from Fig. 1 that the growing patterns of FAI, FDI and CO₂ emissions in China were quite similar during this time period. Given the fact that investment is one of the most important engines of China's economic growth (Chow, 1993), to investigate the relationship between investment and environmental quality is meaningful and has significant policy implications for relevant policy makers to efficiently control for environmental pollution as they conduct corresponding investment policies.

In recent years, there have been a growing body of literature investigating the impacts of FDI on the environment in the recent years (e.g., Lan et al., 2012; Wang and Chen, 2014; Hao and Liu, 2015; Shahbaz et al., 2015), although the studies on the environmental influences of FAI are still scarce so far. Some theories have been raised

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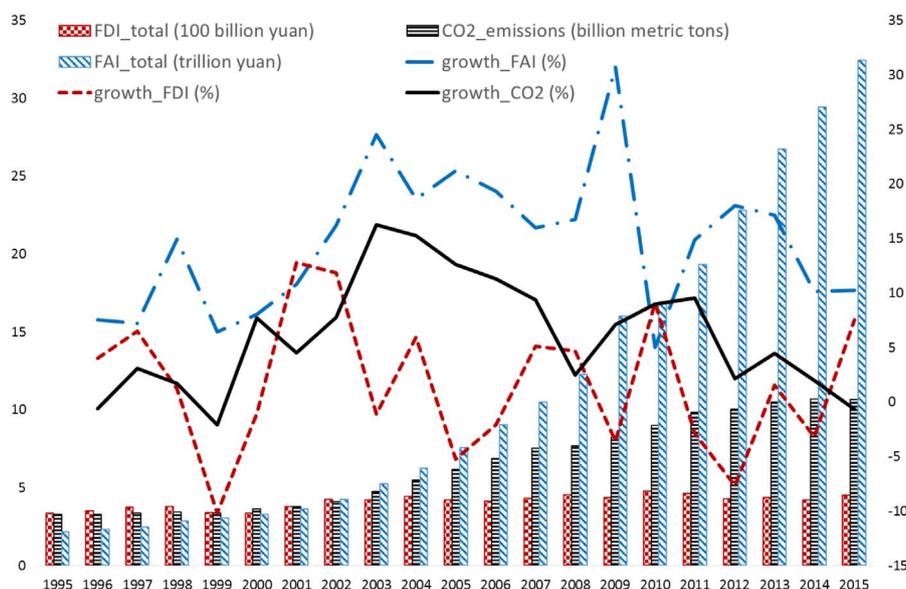


Fig. 1. The total amounts of FAI, FDI and CO₂ emissions (left scale) and their corresponding average annual growth rates (right scale), 1995–2015. Notes: FDI_{total}, FAI_{total}, CO₂emissions, growth_{FDI}, growth_{FAI}, growth_{CO₂} represent the total amounts of FDI, FAI, CO₂ emissions and their corresponding average annual growth rates, respectively. The total amounts of FAI and FDI are converted into real terms using constant 2000 prices. The original FDI data is in U.S. dollars and converted into Chinese yuan using average official exchange rate of the corresponding year. The data of FAI, FDI and average exchange rate are collected from *China Statistical Yearbooks* of various years. The CO₂ emissions data are taken from Joint Research Center (JRC)/PBL Netherlands Environmental Assessment Agency and could be downloaded at http://edgar.jrc.ec.europa.eu/news_docs/CO2_1970-2015_dataset_of_CO2_report_2016.xls.

to explain the association between FDI and environmental degradation, among which the pollution haven hypothesis (PHH) is very influential. PHH states that the polluting activities in developed countries have higher costs due to more stringent environmental regulations and higher labor and resource prices than in developing countries, therefore the firms and companies in developed countries have strong incentives to shift production to the countries with lower standards of environmental regulations to save production costs (Asghari, 2013). The governments of developing countries may loosen or even not enforce environmental regulations so as to attract foreign investment (Copeland and Taylor, 1994; Cole, 2004). However, on the other hand, FDI may also have positive effects on the environment, because FDI may facilitate the diffusion of relatively advanced technology through various investment programs. Some previous studies have already verified that technology progress and environmental innovation are the key driving forces of pollutant emissions reduction (Zhou et al., 2010; Zhang et al., 2017b). The environmental innovation and clean technology transfer through FDI would help improve the environmental quality in the host countries (Popp, 2011). Hence, the net influences of FDI on environment depend on the relative strengths of the two opposing forces. So far, the empirical studies on PHH still do not have consistent conclusions as some found evidence for the existence of PHH (e.g., Lau et al., 2014; Wang and Chen, 2014; Solarin et al., 2017) while some others claimed that PHH is not valid due to estimation results (e.g., Zheng et al., 2010; Tang and Tan, 2015; Zhu et al., 2016). As for FAI, in China's context, its impacts on environmental quality might probably be negative, because the majority of FAI in China is made on the infrastructure construction, which needs a great amount of energy- and pollution-intensive industrial products such as iron and steel and cement (Liu et al., 2013). As summarized by Copeland and Taylor, (1994, 1995), the pollution effects could be attributed to three major channels: scale, industrial composition and technology. Scale effect reflects the increased environmental pressures due to more economic growth; composition effect captures the difference between capital-intensive industry and labor intensive industry structure; technique effect reflects the higher labor efficiency and energy efficiency help improve the environment.

However, the extant studies only focus on the direct effects of FDI

and FAI on the environment, there may also be indirect effects through its influences on the economic development, because the Environmental Kuznets Curve (EKC) theory suggests the relationship between the environmental quality and economic development. EKC was originally introduced by Grossman and Krueger, (1991, 1995) as an empirical hypothesis, which claims that alongside economic development the environmental deterioration may be at first intensified and then reduced when the level of economic development is high enough. So far there has been a great amount of literature examining the existence of the EKC empirically, but no consistent conclusions have been drawn. Although many studies claimed to verify the existence of inverted-U shaped EKC (e.g., Culas, 2007; Song et al., 2008; Auffhammer and Carson, 2008; Bertinelli et al., 2008; Diao et al., 2009; Halkos and Paizanos, 2013; Hao and Liu, 2016), some researchers found evidence that EKC does not exist (e.g., Caviglia-Harris et al., 2009; Kearsley and Riddel, 2010; He and Richard, 2010). Despite the controversial empirical estimation results, the relationship between economic growth and the environmental quality may still exist. Previous studies have verified that both FDI and FAI play important roles in China's economic growth. For instance, Liu et al. (2002) and Yao (2006) found evidence for the strong and positive effect of FDI on China's economic growth, while Chow and Lin (2002) quantitatively evaluated the importance of FAI to China's economic development. As a result, FDI and FAI may also have indirect influences on environmental quality through their economic impacts: higher FDI or FAI could foster economic growth and increase GDP per capita, which may further affect environmental quality as EKC theory predicts.

Energy plays an important role in the relationship between domestic and foreign investment and the environment. As for China, there has been a growing body of literature that investigated and verified that many prominent problems, especially the deteriorating air quality represented by haze and smog that frequently shrouded most parts of northern and eastern China, were caused by the excessive growth in fossil energy consumption (e.g., Chen et al., 2006; Bloch et al., 2012; Hao and Liu, 2016). In recent years, especially since mid-1990s, to boost economic growth, the secondary industry has been rapidly developed in China (Bosworth and Collins, 2008; Wu, 2008). According to official statistics, the share of secondary industry to GDP

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