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An empirical analysis of the green paradox in China: From the perspective of fiscal decentralization

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ABSTRACT

While it is generally recognized that the introduction of environmental policy can effectively control carbon emissions, the green paradox hypothesis puts forth a new warning about the validity of this policy's implementation. This study uses panel data on 29 Chinese provinces from 1995 to 2012 to investigate the impact of fiscal decentralization on the functional mechanisms of environmental policy while controlling for the spatial correlations of carbon emission. The empirical results indicate that environmental policy alone can achieve the objective of reducing carbon emissions. However, the Chinese style fiscal decentralization makes the environmental policy significantly promote carbon emissions, leading to a green paradox. Moreover, we find that the impact of fiscal decentralization on environmental policy varies greatly among different geographical regions and the direct-controlled municipalities. In addition, our study confirms the spatial correlations in China's carbon emissions by using a spatial integration term. Finally, we recommend that emission reduction efforts should be incorporated into the local government's performance evaluation system to improve the institutional environment. Further, differentiated environmental policies and measures should be considered for different provinces to maximize the emission reduction potential.

1. Introduction

China's economy has made tremendous achievements since the reform and opening-up policy was implemented in 1978; the subsequent 30 years of rapid growth are known as the China miracle. However, the long-standing mechanism for extensive economic growth, characterized by high input, high energy consumption, high emissions and high pollution, has brought intense resource and environmental pressure on the sustained and healthy development of China's economy, and simultaneously, the massive consumption of energy resources has caused a large amount of greenhouse gas emissions (Wang and Zheng, 2012). In 2013, China's carbon dioxide emissions reached 10 billion tons, amounting to 28 per cent of total global emissions and exceeding the total combined carbon emissions of the United States and the European Union (Friedlingstein et al., 2014). Such huge carbon emissions put unprecedented pressure on China to reduce them. Furthermore, the traditional patterns of economic growth have difficulty in meeting the demands for sustainable development and construction of a harmonious society. Thus, controlling carbon

emissions and transitioning to a low-carbon economy is an inevitable choice for China in breaking through domestic resource and environmental constraints to achieve sustainable economic development.

On the other hand, as a responsible large country, the Chinese government attaches great significance to addressing climate change. For example, "actively respond to global climate change" has been regarded as an important part of promoting ecological civilization and building a beautiful China and thus incorporated into the national development plan (NRDC, 2015). In 2009, the Chinese government set specific greenhouse gas reduction goals for the first time, namely, that by 2020, China will lower carbon dioxide emissions per unit of GDP by 40–45% from the 2005 level. In the November 2014 U.S.–China Joint Announcement on Climate Change, China announced for the first time its target of peak carbon emissions by approximately 2030 and its intention to make its best effort to achieve this earlier. However, some studies (den Elzen et al., 2016; Yu et al., 2015) have shown that the mitigation policies currently employed in China are unlikely to be sufficient to meet the aforementioned targets. Therefore, faced with such ambitious targets and the ensuing enormous pressure on energy

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saving, stricter environmental regulations will become an inevitable choice.

However, there is a question as to whether environmental policy can achieve its purpose of reducing greenhouse gas emissions as decision-makers expect. German economist Sinn (2008) is skeptical about this question because he thinks that the environmental policy currently undertaken or advocated by policy makers and scholars focuses only on the demand side of fossil energy. In particular, as long as we try to reduce the demand of fossil fuels by a range of policies (e.g., tax or subsidy), the greenhouse gas emission reduction targets can be achieved through an anti-driving mechanism. In fact, the situation would change when considering the dynamic response of the supply side of fossil fuels to environmental policy. As fossil fuels are non-renewable resources, their price contains both production costs and scarcity rents. If the fossil resource owners who benefit from maximization expect a stricter implementation of environmental policy in the future, by considering their resource scarcity rent reductions and consequential loss of future benefits, they would increase the current exploitation and supply of fossil fuels. Eventually, carbon emissions would increase rather than decrease and global warming would accelerate. This is called the “green paradox,” which means that the imperfect design of the environmental policy may lead to unintended increase in emissions (Sinn, 2008).

The emergence of the green paradox raises concerns about whether current environmental policies can achieve the desired result and thus spawns substantial discussion about the effects of imperfect environmental policies on emission reduction. Generally, there are four possible reasons for the emergence of the green paradox. A literature review of the existing studies on the green paradox is given in Section 2. One important reason for the green paradox is the time lag between environmental policy announcement and its implementation, which enables economic agents to adjust their production and consumption behavior, resulting in increased carbon emissions. Given the actual conditions of China, it seems particularly important to explore the green paradox from the perspective of the policy's implementation lags. It is well known that environmental policy's implementation lags are very common in China, which we believe originate from the Chinese style fiscal decentralization. On the one hand, the core of Chinese style fiscal decentralization is that the central government gives local governments the autonomy in regional economic development and resource allocation and simultaneously holds the absolute right to speak on local officials' political promotion (Zhang, 2006). On the other hand, the central government is only the environmental policy-maker, whereas local governments are those who implement the policy. Therefore, this fiscal decentralization makes the central government's emission reduction demands conflict with the purpose of local officials to pursue economic development, leading to environmental policy's inevitable implementation lag or incomplete enforcement.

In particular, the Chinese style fiscal decentralization may have the following adverse effects on the environmental policy's implementation. First, in order to attract investments and promote economic prosperity, local governments with certain economic and financial autonomy have the ability to make an exception for high energy dissipation and high emissions enterprises by weakening the environmental policy. Second, under the dual restriction of emission reduction and political promotion, local officials often take extreme and short-sighted measures such as power rationing or suspend production to cope with the environmental policy. Above all, this series of adverse effects has raised concerns about whether environmental policies can actually achieve the desired emission reduction. In addition, existing studies (e.g., Zhang et al., 2011) show that China's fiscal decentralization is an important institutional source of increasing carbon emissions, making it difficult for current environmental policies to achieve emission reduction targets.

Therefore, based on China's reality, this study tries to examine the green paradox from the perspective of fiscal decentralization. In

particular, we want to explore the impact of fiscal decentralization on environmental policy, which aims to reduce carbon emissions. Simultaneously, carbon emission is a dynamic process and has specific regional characteristics attributable to the similarities between the resource endowment and the energy consumption structure among provinces (Yu et al., 2012). Thus, we add the first-order lag of carbon emissions and spatial correlation of carbon emissions to the econometric model. The purpose of this study is (1) to explore whether China's fiscal decentralization can make the environmental policy promote carbon emissions, leading to a green paradox; (2) to investigate the impacts of Chinese fiscal decentralization on environmental policy among different geographical regions and municipalities that are directly under the central government; and (3) to examine whether there is a spatial correlation in China's carbon emissions.

This rest of this paper is organized as follows. Section 2 presents previous studies on the green paradox. Section 3 describes the methods and dataset used in this study. Section 4 presents the results and discussion. Finally, Section 5 concludes this study and provides some policy implications.

2. Literature review

A growing number of studies have emerged on the green paradox as it has challenged the effectiveness of environmental policies that intend to reduce greenhouse gas emissions. Detailed analyses concerning the theoretical mechanisms of the green paradox have been performed by researchers outside China. Van der Werf and Di Maria (2012) give a comprehensive review of the existing works on the green paradox. Generally, there are four possible reasons for the emergence of the green paradox. (a) Unreasonable set of carbon taxes (Edenhofer and Kalkuhl, 2011; Hoel, 2010): A carbon tax that increases at a rate higher than the market rate of interest will accelerate the exploitation of fossil fuels in the near future, culminating in an increase in carbon emissions and exacerbating global warming. (b) Support policies for alternative energy (Gerlagh, 2010; Van der Ploeg and Withagen, 2012): The implementation of environmental policies aimed at supporting clean energy will make low-carbon energy become more widely available, leading non-renewable resource owners to front-load extraction, thus increasing the current emissions. (c) Time lags between policy announcements and actual implementation (Di Maria et al., 2012; Smulders et al., 2012): A time lag between the announcement of an environmental policy and its implementation allows agents such as exhaustible resource owners or households to change their behavior during the interim period, leading to an increase in near-term emissions. For example, Di Maria et al. (2012) investigates this paradoxical consequence from the energy supply side, while Smulders et al. (2012) pay attention to the energy demand side. (d) Unilateral climate policies (Ritter and Schopf, 2014; Sen, 2016): The abating countries that impose environmental policies (e.g., subsidize or tax) induce the non-abating countries to increase the use of fossil fuels, thus increasing emissions globally. This phenomenon is also known as carbon leakage. While we regard the three preceding reasons behind increase in emissions as constituting an “inter-temporal” version of the green paradox, carbon leakage can be understood as a “spatial” version of the green paradox (Van der Ploeg and Withagen, 2015).

Compared with the rapidly growing theoretical literature, empirical analyses of the green paradox are scant due to data availability. Moreover, existing studies on the green paradox have not come to the same conclusions. Di Maria et al. (2014) use the U.S. Acid Rain Program as an example in investigating the effects of policy implementation delays on sulfur dioxide emissions. They found that while high-sulfur coal price declined significantly in the interim period between the announcement of the Clean Air Act in 1990 and the actual implementation of the Acid Rain Program in 1995, there was no evidence that coal-fired power plant output and sulfur dioxide emission intensity increased. Grafton et al. (2014) apply U.S. energy data from

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