

# Effect of Economic and Technological Development Zones on Green Innovation: Learning by Importing Perspective

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## ABSTRACT

Green innovation is an effective way of solving the dilemma of the economy–environment trade-off. As an important innovation policy in China, national economic and technological development zones (NETDZs) play a significant role in promoting innovation, but empirical studies on their impact on innovation, especially green innovation, are scarce. In this study, the authors used highly disaggregated micro-level data such as patent data, industrial firm data, and customs data to examine the impact of NETDZs on green innovation. The results showed that: (1) NETDZs significantly promote green innovation, as measured by both patent quantity and patent quality; (2) the binding environmental indicators in China's five-year plan enhance the promotional effect of NETDZs on green innovation; (3) learning by importing, including through foreign direct investment and importing capital goods, is an important mechanism for the nexus between NETDZs and green innovation; and (4) compared with non-state-owned enterprises (non-SOEs), SOEs are relatively passive in terms of engaging in learning by importing.

## KEYWORDS

Capital Goods, Foreign Direct Investment, Green Innovation, Learning by Importing, National Economic and Technological Development Zones

## 1. INTRODUCTION

Whereas innovation is the engine of economic growth, green innovation not only promotes economic growth but also improves the environment, and thus solves the dilemma of the economy–environment trade-off (Wang et al., 2020; Jing et al., 2021; Shen et al., 2022a, 2022b; Deng et al., 2022). The adoption of green innovation has been proven to be the key to effective pollution reduction, both in theory and in practice (Song et al., 2021; Pan et al., 2021).

DOI: 10.4018/JGIM.315748

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The construction of China's National Economic and Technological Development Zones (NETDZs) is considered to be an important engine driving technological innovation in China. In 2018, the proportion of high-tech firms in NETDZs was about 12.77% of all high-tech firms in China, and the patent intensity (inventions per 10,000 workers) in NETDZs was 5.26, which was much higher than that for the entire country (Cheng et al., 2020).

The first NETDZ was established in 1984, and by 2017 there were 219 NETDZs in China. The National Conference on Economic and Technological Development Zones held in 1989 pointed out that the main aim of NETDZs was to attract foreign investment to develop high-tech industries. In 2018, NETDZs attracted about 20% of the country's foreign direct investment (FDI) (US \$51.300 billion) and received 20.27% of China's imports of high-tech products (US \$136.020 billion)<sup>1</sup>. Therefore, learning by importing is an important channel through which NETDZs promote innovation.

The aim of this study is to analyze the impact of NETDZs on green innovation and reveal the underlying mechanisms from the perspective of learning by importing. This study contributes to the literature in three ways. First, we analyze green innovation from the learning by importing perspective, including both imports of capital goods and FDI. There is a large body of literature analyzing, both theoretically and empirically, how either capital goods imports (Eaton & Kortum, 2001; Chu et al., 2021) or FDI (Hoang et al., 2021; Chen et al., 2021) affect technological innovation. However, studies on the impact of capital goods imports or FDI on green innovation are scarce, and few studies have compared the impact of capital goods imports with that of FDI on green innovation. Indeed, learning from FDI is mainly achieved through spillover effects, whereas learning from capital goods imports is mainly determined by the importing firms, despite the possibility of indirect spillover effects.

Second, we test the pollution haven hypothesis (Al-Mulali & Tang, 2013) from a green innovation perspective. Numerous studies have argued that developed countries have transferred a large number of highly polluting industries to developing countries, which has had a detrimental effect on the environment in those developing countries (Sapkota & Bastola, 2017; Demena & Afesorgbor, 2020). However, we found that through channels such as FDI and capital goods imports, developed countries are diffusing green technology to developing countries, which is beneficial to the environment in developing countries in the long run.

Third, most of the existing literature analyzes the important role of NETDZs in attracting FDI and promoting economic growth but ignores their role in promoting technological innovation (e.g., Wang, 2013; Zheng et al., 2016; Alder et al., 2016; Cizkiewicz et al., 2017; Ambroziak & Hartwell, 2018). One of the ultimate goals of NETDZs is to promote technological innovation. This study is one of the first to empirically analyze the impact of NETDZs on technological innovation, especially green innovation.

The rest of the paper is organized as follows. Section 2 presents the theoretical analysis and hypotheses. Section 3 describes the dataset and empirical model. Section 4 presents empirical results of the impact of NETDZ pilots on green innovation, and several robustness tests. Section 5 explores the mechanisms underlying the NETDZ–green innovation nexus from the perspective of learning by importing, and Section 6 further analyzes the role of learning by importing for different types of enterprise ownership. Section 7 presents the main conclusions and policy implications.

## 2. THEORETICAL ANALYSIS AND HYPOTHESES

In recent years, the Chinese government has paid increasing attention to the leading role of NETDZs in enhancing overall innovation capacity in an effort to promote high-tech industries, upgrade traditional industries with new technologies, and provide a vital service platform enabling China's high-tech enterprises to compete globally. Empirical studies have found that China's NETDZs have been an effective means of attracting foreign investment (World Bank, 2008; Du et al., 2013; Wang, 2013; Zheng et al., 2016) and importing capital goods.

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