

An Empirical Study on Green Technological Innovation and Economic Development in China's Ethnic Minority Autonomous Regions —Based on PVAR Model

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ABSTRACT

Over the years, the research on technological innovation and economic development has attracted the attention of many scholars at home and abroad. Technological innovation is widely considered to have an important influence on economic development. According to the new economic growth theory, technological innovation becomes the driving force and source of a country's economic growth not by increasing factor input, but by changing the production function. Therefore, technological progress is a quantitative manifestation of economic growth, and the embodiment of the quality of economic development. With the upgrading of technological innovation and environmental protections concepts in various countries, green technological innovation and sustainable economic development have been widely recognize. This means that enterprises' benefits brought by the implementation of green technological innovation are greater than the direct benefit. It makes the economic and ecological benefits of the enterprise consistent with each other and realizes the sustainable development of the economy and society. In view of the fact that the PVAR model can effectively control the unobservable individual heterogeneity, it can also take advantage of the panel model and extract individual effects and spatiotemporal effects at the same time. This paper studies the relationship between green technology innovation and regional economic development by establishing the PVAR model in China's ethnic minority autonomous regions, hoping to contribute to regional economic development.

Keywords: *Green technological innovation; economic development; PVAR model*

1. INTRODUCTION

Green technological innovation aims to achieve green development as the goal, focusing on guiding enterprises to green innovation of products, technologies, processes and services through innovation. With the popularization of the concept of global sustainable development, green technological innovation plays an important role in achieving high-quality economic development and environmental conservation. The interactive relationship between green technological innovation and economic development has attracted the attention of many scholars and has become a current research hotspot.

2. LITERATURE REVIEW

Green technological innovation is an important driving force to achieve high quality economic

development. For decades, with the development of theory and measurement technology, many scholars have put forward different perspectives on the relationship between green technological innovation and economic development. At present, relevant theories and empirical studies of foreign scholars are reviewed.

Many scholars have concluded theoretical and empirical studies, first affirming technological innovation's positive role in economic development. Gardner and Joutz used patent data to construct a measure of technological innovation and calculated output elasticity. The results show that patent stock directly promotes economic growth and indirectly contributes to it through financial capital stock, and the elasticity of technological innovation output is 0.9 [1]. Sener and Saridogan analyzed 2010-2011 year WEF-GCI data and found that host countries with technological innovation

as a global competitiveness-oriented strategy have sustainable competitiveness and long-term economic growth. Progress in scientific and technological innovation is a major driver of global competitiveness, economic growth, and national practices [2]. Using spatial data analysis methods, Torres-Preciado et al. find that technological innovation positively impacted Mexico's regional economic growth from 1995 to 2007. The cross-border dissemination of technological knowledge has had a positive impact, and countries' economic growth with strong innovative activities has also accelerated [3]. Adak research found a significant correlation between technology imports and the total number of patent applications, and technological progress and innovation have a significant impact on economic growth. Investment in new technologies has led to high productivity and high positive economic growth [4]. Using data from 1990 to 2013 for 32 OECD countries, Fernandes et al. found that sustainable technology transfer and sustainable innovation positively impact economic growth [5].

Many scholars have pointed out the green factors of technological innovation and economic development by studying the relationship between technological innovation, energy utilization, and economic development. Tang and Tan studied the relationship among power consumption, energy prices, technological innovation, and economic growth in Malaysia from 1970 to 2009. They found that technological innovation will lead to economic growth and electricity consumption in Malaysia. Green technological innovation can reduce fossil fuels, and the environmental quality and economic growth can be balanced [6]. Fei and Rasiah used annual data from 1974-2011 in Canada, Norway, Ecuador and South Africa to study the relationship between electricity consumption, energy prices, technological innovation and economic growth. They found a bilateral relationship between technological innovation and the economic development of each country. Therefore, they recommend that developing economies reduce the consumption of fossil fuels [7]. Sohag et al. used the distributed lag automatic decline test to examine energy use, trade economy and technological innovation data in Malaysia from 1985 to 2012. Studies show that technological innovation can reduce energy use and improve utilization efficiency. Technological innovation and diffusion support overall economic growth and determine the energy intensity of economic output [8]. Porfiriev believes that resource use and population response to global climate change have a restrictive effect on economic growth and that green technology is another important factor affecting economic growth and economic modernization [9]. Meirun uses a new type of guided automated decreasing distribution lag technology to study Singapore's time-series data from 1990 to 2018. This shows that there is a significant correlation between green technology innovation and economic growth, and

a long-term and short-term negative correlation between green technology innovation and carbon emissions. One must find a balance between economic development and environmental relaxation [10].

In China, research on green technology innovation and economic development has also aroused the attention and research of many scholars. Many scholars have researched environmental regulation, green technological innovation and economic development. Zhu believes that regardless of whether the closed-loop supply chain adopts a decentralized decision-making model or a centralized decision-making model, under the premise of strengthening environmental regulation, the green innovation motivation and green economic performance to technological innovation subjects will be improved. Appropriate environmental regulations can improve both green technology and economic performance [11]. Using data from 30 Chinese provinces and cities from 2006 to 2016, Sun found that market-oriented environmental regulations inhibit green technology innovation and economic development before the threshold and promote it after the threshold. Green technological innovation and market incentive environmental regulations have a significant positive effect on the green economy [12]. Fan and Sun believe that environmental regulation and green technological innovation are the two major drivers of the green economy. The environmental regulation policy with market incentives stimulates green technology innovation and promotes the development of the green economy. Giving play to the role of market incentives in promoting the transformation of the green economy can inject new impetus into high-quality economic development [13]. Wu et al. measured the high-quality economic development level of 30 provinces and cities in China from 2006 to 2017. They confirmed the positive intermediary role of green technology innovation between environmental regulation and economic development. At the same time, it is recommended to improve environmental regulations appropriately, increase policy support for green technology innovation, and attach importance to high-quality economic development [14].

Many scholars have turned their perspectives to the study of green technological innovation and the economic development of China and various regions in China. Ma evaluated the technological innovation capacity of China's 30 provincial-level regions from 2004 to 2012 and calculated the green GDP. There is a long-term equilibrium relationship between China's regional technological innovation capabilities and regional green economic growth, but this relationship has significant regional differences. Improving regional technological innovation ability is an effective way to promote the development of the green economy in China [15]. Wu, Gao and Yang used China's provincial panel data from 1998 to 2015 to study the impact of green

technology progress on China's. After analysis, they found a positive correlation between green technology progress and economic growth in eastern China and headquarters. Still, has no significant impact on the economic growth in the western region [16]. Ma and Cui believe that there is a correlation between green technological progress and economic growth. First, there is a positive correlation between green technological progress and economic growth. Second, the improvement of green technology progress can promote economic growth. Still, at the same time, the increase of pollutant emissions and environmental governance costs is not only conducive to the improvement of green technology progress in various provinces but also conducive to the realization of sustainable economic growth [17]. By calculating 30 local green technology innovation capacities and regional GDP, we believe that China's provincial green technology innovation capacity is constantly improving and gradually weakening from east to west. Green technological innovation has a significant positive effect on the economic growth of various regions in China, but the marginal utility it brings is diminishing [18]. Meng and Zhang believe that the innovation choice of technological progress mode is beneficial to improving green growth efficiency. In contrast, the choice of technology introduction is unfavourable to the improvement of green growth efficiency. China's existing natural resource endowment affects the efficiency of green economic growth through technological progress [19]. Gao used panel data from six provinces in central China from 1990 to 2019 to explore the dynamic equilibrium relationship between green technological innovation and economic growth. It is found that invention patent grant has lag effect and spill over effect on economic growth. The authorization of the utility model has the lag effect and crowding effect on economic growth. Therefore, the conduction of a green technology innovation platform and system is conducive to the high-quality economic development of the central region [20]. Du and Li used panel data from three provinces and one city in the Yangtze River Delta from 2008 to 2017 to establish a PVAR model. The empirical results show that from the entire Yangtze River Delta perspective, technological innovation significantly inhibits green development in the short term, and green development also significantly inhibits technological innovation. However, in the long run, technological innovation and green development reinforce each other [21]. Peng selected panel data off 31 provinces (municipalities and autonomous regions) in China from 2008 to 2017. Through a full-sample study, he found that both the realization of technological progress and the implementation of the green finance development concept can promote the better development of China's economy [22].

As can be seen from the above literature review, domestic and foreign scholars have carried out various

studies on the economic development of technological innovation and its green factors and obtained many results. However, most studies focus on related topics in different cities, provinces, or countries, and there are few studies on ethnic minority autonomous regions in China. There is still room for further research on this topic. The PVAR model is convenient to analyze the dynamic changes between two variables, improve the degree of freedom of data samples, and solve the problem of endogenous bias. The research object of this paper is the minority ethnic autonomous region of China. Therefore, this article takes China's ethnic minority autonomous regions as the research object, and studies the relationship between green technological innovation and regional economic growth by establishing the PVAR model, hoping to contribute to the green economic development of ethnic minority autonomous regions.

3. CONCLUSION

Based on literature data analysis, previous studies on the relationship between green technology innovation and economic growth show a certain relationship between the two to a large extent. Most of the literature believes that the impact of green technological innovation on economic growth is positive, while a few works of literature believe that green technology innovation is affected by regional differences and other factors, which have negative or invalid impacts on both sides. This paper studies the relationship between the two through the PVAR model and finds their relationship.

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