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# A step towards sustainable environment in China: The role of eco-innovation renewable energy and environmental taxes

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ABSTRACT

In the contemporary environment, developing countries are more focused on how economic factors can reasonably utilize technological advancement and carbon neutrality target as effective mechanisms in achieving sustainable production and consumption patterns. The effort to attain carbon neutrality target on natural environment in terms of lower carbon emission (CO2), haze pollution, and greenhouse gas (GHG) requires measures like the usage of non-renewable energy, ecological innovation, and environmental taxes. In doing so, this study considers the sustainability of China's natural environment in terms of CO2 emission, haze pollution through PM2.5, and greenhouse gas emission as well as factors like ecological innovation (ECO), environmental taxes (ERT), renewable energy, and globalization as the key determinants. The Quantile ARDL approach was used to examine both long- and short-run relationships between the explanatory and outcome variables. The results confirmed that there is a significant and negative impact of ECO, renewable energy, and ERT on CO2 emission in the region of China under different quantiles. Whereas, the globalization factor was observed as positively and significantly linked with CO2 emission but only for the higher quantiles. The long-run estimation further showed that ECO, renewable energy, and ERT can significantly help to decrease haze pollution in terms of PM2.5 in China. Furthermore, QARDL also confirms the negative and long-run estimation between the ECO, REN, and ERT, whereas globalization is causing more GHG in China, subsequently creating more environmental sustainability issues. Thus, it is concluded that effective innovation, renewable energy consumption, and environmental taxes reduce carbon emission while globalization increases the carbon emission in the country.

## 1. Introduction

Technological development is prominent to attain carbon neutrality (Chien et al., 2021a–c; Ji et al., 2021; Li et al., 2021a; Umar et al., 2021). However, such advancement has raised a question regarding the sustainability of production and consumption of non-durable goods (Baloch et al., 2021; Chien et al., 2021a–d). For this reason, it is important to consider the sustainable perspective of the Industrial Revolution 4.0 (IR4.0) particularly from the aspect of non-durable goods. Since 1978, significant growth has been observed in the economy of China as its Gross Domestic Product (GDP) is ranked second in the world (Bamisile et al., 2020; Zhang and Hao, 2020). However, such development has created serious environmental hazards, issues, and concerns such as higher carbon emission (CO2 emission) (Chien et al., 2021a,b; Li et al., 2021b), haze pollution like PM2.5, and greenhouse gas (GHG) (Bamisile et al., 2020; Malla & Brewin, 2020). This justifies the claim that such environmental concerns are attributed to the higher level of energy demand caused by significant economic growth and trade with the international community as China is believed as the 33rd most complex economy and the biggest exporter in the world (Bamisile et al., 2020).

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