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Empirical Study on Green GDP Accounting of Various Provinces in China - PVAR Analysis Based on Provincial Panel Data

Wenbo XIAO[a],   Long WANG[a], Zhihao XU[a],   Qinying ZHU[a], Yi LIU[a] and Yi XIAO[a,*]
a College of Information and Intelligence, Hunan Agricultural University, China

Introduction

The study explores the shift from traditional GDP to green GDP in China, aiming to measure sustainable economic development by accounting for environmental impacts. China's rapid economic growth has led to significant environmental degradation, making green GDP a critical tool for addressing these challenges. The research analyzes data from 28 provinces between 1997 and 2020, excluding regions like Tibet and Xinjiang due to insufficient data. By utilizing a panel vector autoregressive (PVAR) model, the study examines the relationship between green GDP and various environmental and economic factors such as CO2 Clean Mechanism trading, solid waste recycling, and energy consumption.

Main Content

The paper develops a green GDP accounting system, measuring it by subtracting environmental and natural resource consumption from traditional GDP. The study constructs a PVAR model to investigate the dynamic interactions between green GDP and key environmental variables across three zones: energy-inefficient, medium-efficiency, and high-efficiency regions. The model uses data on CO2 Clean Mechanism trading, solid waste recycling, electricity and coal consumption, crude oil consumption, and natural gas consumption.

The analysis involves various empirical tests, including unit root and cointegration tests, to ensure the reliability of the data. The study also applies impulse response function analysis to explore how green GDP responds to changes in energy consumption across different regions.
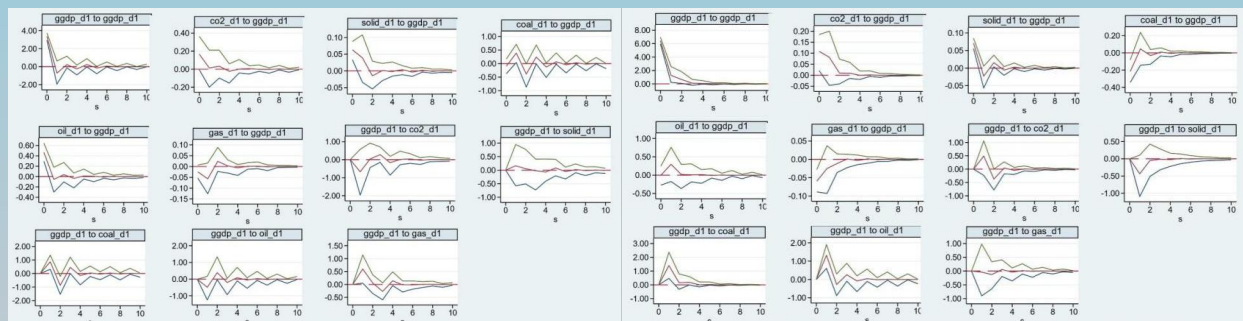
Figure 1. Impulse response plot for energy inefficient zone

Figure 2. Impulse response plot of energy medium efficiency zone
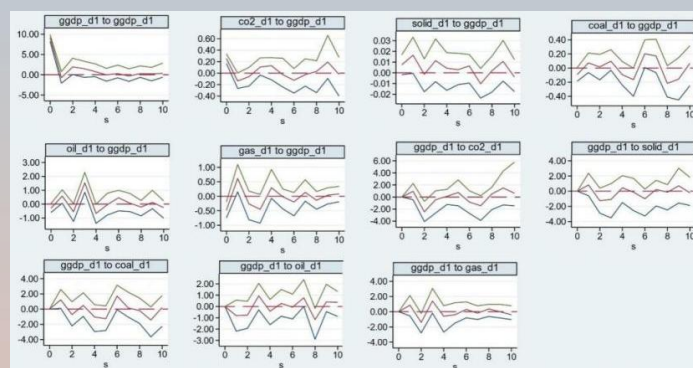

Figure 3. Impulse response plot for energy high efficiency zone

Results

The findings reveal that green GDP is influenced differently across the three zones. In energy-inefficient and medium-efficiency regions, both CO2 Clean Mechanism trading and solid waste recycling positively impact green GDP, while energy consumption shows unstable effects. In energy-efficient zones, green GDP growth is primarily driven by solid waste recycling, with energy consumption having mixed effects. The variance decomposition analysis further indicates that the influence of green GDP is largely dependent on its own development momentum, especially in energy-efficient zones.

The study concludes that achieving sustainable green GDP growth requires comprehensive policies, including enhanced CO2 trading mechanisms, increased solid waste recycling, and a reduction in reliance on traditional energy sources like coal and crude oil. The promotion of renewable energy alternatives and natural gas integration is also necessary for long-term sustainability.2