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# GLOBAL CONTAINER SHIPPING AND $CO_2$ EMISSIONS: SHORT- AND LONG-TERM IMPLICATIONS FOR CLIMATE POLICY

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## Abstract

The maritime sector has a significant impact on climate change, and since over 50% of world seaborne trade by value is carried by container ships, the environmental footprint of container ships is particularly intensive. This study explicitly addresses the research gap on the causal and long-term relationship between global container handling and ship-generated $CO_2$ emissions, offering a novel empirical perspective applying Granger Causality (GC) and Engle-Granger (EG) cointegration while acknowledging methodological alternatives and data limitations. The findings reveal both short-term causality and long-term cointegration between container handling volumes and $CO_2$ emissions. Impulse Response Functions (IRF) reveal measurable but delayed effects of container handling shocks on $CO_2$ emissions, with impacts converging within six years. These results suggest that the effectiveness of regulations targeting $CO_2$ reduction in container handling becomes evident only after a certain time lag. Policy implications emphasize linking findings to IMO decarbonization strategies and cleaner technologies such as cold ironing. The study is contribution to sustainability frameworks and proposes directions for future research addressing regional differences, post-2020 dynamics, and comparative benchmarks.

*Key words:* $CO_2$ emissions, environmental management, container shipping, Granger causality, container handling

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