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Dual Pressures on Carbon: Tourism Development, Semiconductor Electricity Use, and Emissions in a Fossil-Dependent Economy

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Abstract: This study investigates the dynamic relationships among tourism development, economic growth, and the semiconductor sector's electricity intensity in shaping CO_2 emissions, using Taiwan as a case study. Addressing a gap in the literature, it integrates tourism's environmental impact with structural energy demand from high-tech manufacturing—an area often overlooked in prior research. Applying the Autoregressive Distributed Lag (ARDL) bounds testing approach to annual data from 2000 to 2023, the results reveal a significant long-run equilibrium among the variables. Tourism, GDP, and semiconductor electricity share all exert positive effects on CO_2 emissions in both the short and long run, with short-run elasticities notably larger. These findings highlight the immediate environmental pressures from service- and industry-based energy use in fossil-fuel-dependent economies. By linking sectoral energy intensity to macro-level emissions, this study provides policy-relevant insights for aligning tourism growth and industrial upgrading with net-zero targets—offering lessons for other energy-intensive, tourism-driven economies.

Keywords: Tourism Development, CO_2 Emissions, Economic Growth, Semiconductor Industry, Sustainable Development

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