THE PRODUCTIVITY-ENERGY NEXUS IN NIGERIA: ASYMMETRIC IMPACTS OF EFFICIENCY AND FACTOR SUBSTITUTION

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ABSTRACT

This study investigates the dynamic relationship between energy efficiency, productivity, and factor substitution in Nigeria's manufacturing sector from 1981 to 2023. Using a post-positivist framework and secondary time-series data, we employ Stochastic Frontier Analysis (SFA) to estimate energy efficiency, a Nonlinear Autoregressive Distributed Lag (NARDL) model to assess its asymmetric impact on manufacturing output, and a Translog cost function to compute Morishima Elasticities of Substitution (MES). Results indicate an average energy efficiency score of 82.2%, highlighting significant potential for improvement. The NARDL estimates reveal that energy efficiency asymmetrically affects manufacturing output, with negative shocks exerting a disproportionately larger long-run impact than positive improvements. Furthermore, capital and energy are substitutes (MES > 0), while capital and labor are complements (MES < 0), suggesting that energy price policies could reshape the sector's input structure. The study concludes that energy efficiency is not merely an environmental or cost-saving concern but a strategic determinant of industrial productivity in Nigeria. Policy should therefore prioritize institutionalizing energy efficiency within the national industrial strategy, supported by incentives for technology adoption and skills development.

Keywords: Energy Efficiency, Total Factor Productivity, Input Substitution, Nigerian Manufacturing, Stochastic Frontier Analysis, NARDL, Morishima Elasticity.