

Mapping Carbon Cost Dynamics across Industrial Supply Networks

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Abstract

Carbon-pricing schemes shift production costs along supply chains, yet the point at which upstream carbon costs become either an incentive for green upgrading or a threat to downstream viability remains unclear. This study investigates how carbon-pricing shocks propagate non-linearly through manufacturing supply chains and whether a “comfort zone” exists in which downstream firms can absorb carbon costs without sacrificing profitability or green upgrading. Using a balanced panel of Chinese listed manufacturers from 2010 to 2023, we exploit the staggered ETS rollout as a quasi-natural experiment. A staggered-adoption difference-in-differences design first establishes the average causal effect of ETS entry on corporate profitability and green capital expenditure. We then build a firm-level Carbon-Cost Inflection Index (CCI), measuring the share of EBITDA absorbed by the carbonized electricity bill, and employ panel threshold regressions to locate a Carbon-Cost Comfort Zone (CCZ) within which cost pass-through remains tolerable. An input–output-based spatial Durbin model traces how CCI shocks diffuse across inter-industry links and tests whether supplier concentration or internal carbon pricing widens or narrows the CCZ. Findings will clarify when carbon prices incentivize green upgrading versus trigger financial stress, offering quantitative guidance for differentiated allowance allocation and supply-chain coordination.

Keywords: Carbon-Cost Threshold, Comfort Zone, Supply-Chain Spillover,
Inputoutputbased–Output–Based Spatial Durbin Model