THE SPILLOVER EFFECTS OF EU ETS: DRIVING LOW-CARBON INNOVATION THROUGH VALUE CHAINS

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Overview

In 2019, the European Union adopted the European Green Deal, committing to achieve carbon neutrality by 2050. Central to this objective is the European Union Emission Trading Scheme (EU ETS), a flagship policy for reducing greenhouse gas emissions. While emissions from the electricity generation sector have significantly declined since the EU ETS's inception in 2005, industrial emissions have remained relatively stagnant. Complementary measures, such as the Fit for 55 package, subsidies for renewable energy, bans on gasoline-powered vehicle production, and the introduction of a second ETS for building and transport sectors, have broadened the Union's climate policy framework. These developments prompt a key question: to what extent has the EU ETS catalyzed low-carbon innovation across Europe? Specifically, are unregulated sectors positioned near regulated sectors within value chains more likely to adopt low-carbon innovations? Furthermore, how do sectors at varying value chain positions respond to the incentives and pressures of the EU ETS?

This study investigates whether upstream (supplier) or downstream (customer) linkages to regulated entities influence low-carbon innovation among unregulated firms. A reworked version of the upstreamness measure developed by Antràs et al. is applied, focusing on sectoral relationships rather than solely consumer end points. By analyzing patent data and employing an empirical strategy combining Propensity Score Matching (PSM) and Difference-in-Differences (DiD), this research evaluates how regulatory spillovers from the EU ETS shape low-carbon innovation among non-EU ETS firms. Preliminary findings suggest that upstream firms with strong input-output linkages to regulated sectors exhibit heightened innovation activity, underscoring the EU ETS's role in fostering innovation through value chain interconnections. A temporal analysis confirms an increase in green patenting among unregulated firms following EU ETS implementation, particularly in sectors with high regulatory exposure.

Methods

This study employs a comprehensive patent analysis to assess the diffusion of low-carbon innovations. The empirical approach integrates PSM and DiD methodologies. A modified upstreamness measure is calculated to determine the relative position of non-EU ETS firms to EU ETS-regulated entities within value chains. Trade intensity between regulated and unregulated sectors is also measured. Using PSM, non-regulated firms are matched with comparable counterparts based on factors such as firm size, sector, and R&D intensity, ensuring a balanced sample for analysis.

Differences in value chain positioning (upstream vs. downstream relative to regulated firms), trade intensity (strong vs. weak input-output linkages), and temporal changes (pre- vs. post-EU ETS implementation) are analyzed to isolate the causal impacts of regulatory spillovers. Interactions between value chain positioning and trade intensity provide further insights into how

proximity to regulation and trade relationships influence firms' innovation activities. This robust analytical framework ensures that the estimated effects reflect genuine regulatory spillovers rather than unrelated trends or confounding factors.

Results

Preliminary results reveal that non-EU ETS firms positioned closer to regulated entities within value chains exhibit greater low-carbon innovation activity. Upstream firms, such as machinery and equipment suppliers, demonstrate particularly pronounced increases in green patenting, driven by incentives to address regulatory requirements faced by their customers. The amplification effect of trade intensity highlights that firms with strong input-output linkages to regulated sectors are more likely to innovate. Temporal analysis confirms a marked acceleration in green patenting among unregulated firms after the implementation of the EU ETS, particularly in high-exposure sectors. These findings emphasize the pivotal role of the EU ETS in driving innovation beyond directly regulated sectors through value chain spillovers.

Conclusions

This research underscores the EU ETS as a catalyst for low-carbon innovation, particularly for upstream firms and those with strong trade linkages to regulated sectors. The results highlight the importance of value chain proximity and trade intensity in shaping the innovation responses of non-regulated firms. Temporal analysis further illustrates a clear post-EU ETS surge in green patenting, particularly in sectors with significant regulatory exposure. These findings suggest that the EU ETS effectively stimulates innovation beyond its immediate scope, although the magnitude of this impact varies across sectors. Policymakers could enhance these spillover effects by implementing targeted measures to encourage broader decarbonization across value chains. Future research should explore sector-specific dynamics and evaluate the long-term sustainability of innovation driven by regulatory frameworks.

References

1. Antràs, P., Chor, D., Fally, T., & Hillberry, R. (2012). Measuring the Upstreamness of Production and Trade Flows. *American Economic Review, 102*(3), 412-416. https://doi.org/10.1257/aer.102.3.412

2. Abadie, A., & Imbens, G. W. (2016). Matching on the Estimated Propensity Score. *The Review of Economics and Statistics, 98*(1), 173-191. https://doi.org/10.1162/REST_a_00553