THE NEW EMISSION TRADING SYSTEM ON DIFFUSE EMISSION IN THE EUROPEAN POLICY MIX

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Overview

The new European Union's Emissions Trading System for diffuse emissions (ETS2), scheduled for implementation in 2027 (EU, 2023), marks a significant extension of carbon pricing to transport and building sectors. This reform builds on the EU's existing policy mix, including ETS1 and the Effort Sharing Regulation (ESR), and will thus coexist whith them leading to the formation of two carbon prices. Examining literature estimates, carbon prices under EU ETS2 are projected to range between €175/t and €360/t by 2030 in the absence of complementary policies (Abrell et al. 2024, Rickels et al. 2023). Researchers argue that such high prices could have regressive impacts, disproportionately affecting lower-income households. Complementary policies, partly financed by the new Social Climate Fund, are proposed to mitigate these effects and lower carbon price levels (Günther et al. 2024). However, with less than two years until its implementation, no microeconomic study has yet addressed the questions of ETS2's efficiency and equity.

This study addresses these issues by exploring the short-term effects of the introduction of this regulation with two objectives. First, it examines the impact of ETS2 on consumers, focusing on utilities, emissions, and consumption. In particular, the analysis highlights the differentiated effects across income groups, allowing for an evaluation of complementary policies aimed at mitigating potential regressive impacts of ETS2. Furthermore, by studying the effects of ETS2 on consumption patterns, this research seeks to determine whether decarbonization is achieved through an overall reduction in consumption or through a shift from fossil fuels to electrification. Second, the study explores the interactions between carbon prices in the ETS1 and ETS2 markets. Specifically, the introduction of ETS2, which may lead to increased electricity consumption, could influence carbon prices in the ETS1 market in the short term. By integrating ETS2 into the existing European policy framework, this analysis aims to shed light on these dynamics, contributing to the design of efficient, equitable, and energy-focused climate policies.

Methods

The study builds upon the model of Eichner and Pethig (2019) and develops a microeconomic model to explore the effects of introducing carbon pricing for diffuse emissions. It incorporates three key production sectors: electricity, fossil fuels, and final goods, modeled using Cobb-Douglas functional forms to reflect technological constraints and input substitutability. Electricity production depends on a combination of fossil fuels and decarbonized sources, capturing the intermittency and limits of renewable energy. Fossil fuel production is treated as endogenous, allowing the model to account for supply-side responses to regulatory changes, a feature that differentiates this framework from previous studies. Final goods, treated as exogenous, are included to reflect the European economy's openness to global trade.

On the demand side, the model includes two representative households with differing income levels, enabling an analysis of income-based consumption disparities. Household utility is modeled with a Cobb-Douglas function that incorporates the consumption of final goods and energy services, the latter being derived from electricity and fossil fuel inputs. By defining energy services through a substitution function with fixed elasticity, the framework captures the technological and behavioral constraints households face in adjusting energy use. Budget constraints for households incorporate energy and goods prices, allowing for a comprehensive evaluation of how price changes under different policy regimes influence consumption patterns and welfare.

The model is structured to compare equilibrium outcomes under three scenarios: the Reference Case, the Benchmark Case, and the Subsidy Case. Equilibrium values are derived by solving for optimal quantities and prices based on profit and utility maximization. The Reference Case provides baseline outcomes without carbon pricing, the Benchmark Case incorporates ETS2 emission caps on fuel consumption, and the Subsidy Case adds targeted income-based subsidies to mitigate potential regressive effects. This approach enables the model to isolate the

impacts of each policy component, offering a robust methodological framework to evaluate how production technologies, consumer constraints, and regulatory mechanisms interact in a regulated economy.

Results

The study highlights the constraints households face in adapting to the new ETS2 system for diffuse emissions. In the short term, due to the inability to adjust energy consumption systems—such as switching from gas to electric heating in buildings or transitioning to alternative vehicle types in transport—households are unable to fully offset reductions in fossil fuel consumption with increased electricity use. Thus, emissions reductions are primarily achieved through a generalized decline in energy service consumption. As expected, due to the lack of investments capacities from low-income households, this reduction exacerbates regressive impacts, which are analyzed in detail in the study. While complementary policies could mitigate these distributional challenges, they also alter market equilibrium, driving up fossil fuel prices and the carbon price under ETS2. Furthermore, in the short term, the lack of changes in electricity consumption due to carbon pricing on diffuse emissions suggests no significant interaction between carbon prices in the ETS1 and ETS2 markets.

Conclusions

The introduction of ETS2 represents a pivotal step in the EU's climate policy, with significant short-term impacts on consumption, emissions, and equity. However, the current results focus on the short-term effects observed at the system's introduction. ETS2 is intended to operate over the medium and long term, allowing households and fuel suppliers to adapt their behaviors and investments. The short-term findings are therefore discussed in the context of investment behavior, which is often constrained for households by biases resembling resistance to change. Addressing these biases and facilitating decarbonization investments will be critical to unlocking the long-term potential of ETS2. This opens the door to future research that could deepen these insights through numerical simulations and empirical validations.

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