Extended Abstract

How has the relationship between wholesale electricity price and EU allowance price changed across EU ETS phases?

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Overview

The European Union Emissions Trading Scheme (EU ETS) is the world's first and largest emissions trading system, operating on a "cap and trade" basis. The system sets a "cap" on the total greenhouse gas emissions allowed, and the cap is gradually reduced over time to meet the EU's climate change mitigation goals. The EU ETS has been implemented in four phases, with each phase featuring distinct characteristics. Phase I (2005-2007) was the pilot phase, establishing European Union Allowances (EUA) to cover CO_2 emissions, allowing free trade of EUA across the EU, receiving almost all EUA for free for installations covered by the EU ETS, and with lack of EUA transfer between phases, which generated that the price fell to zero (since supply exceeded demand) at the end of this phase. Phases II (2008-2012) stood out for lower caps on allowances than in the pilot phase, transfer of EUA for the next phase, the entry of three new countries (Iceland, Liechtenstein and Norway), a free allocation of around 90% and the inclusion of nitrous oxide emissions in several countries. Phase III (2013-2020) suffered substantially changes such as a single EU-wide cap, auctioning as method for allocating EUA and more sectors and gases were considered. Finally, phase IV (2021- 2030) is characterized by a cap that will be adjusted gradually to reduce emissions by 62% in 2030 compared to 2005 levels.

A relevant aspect of the EU ETS is the impact of EUA on the cost of electricity. It is expected that changes in the cost of CO_2 allowances would be reflected in product prices, particularly in sectors like electricity generation, where CO_2 costs represent a substantial portion of production expenses. The literature reviewed shows that the pass-through rates of CO2 costs to electricity prices vary across different phases and countries (Sijm et al, 2006 and 2008; Smale et al., 2006; Keppler and Cruciani, 2010; Fabra and Reguant, 2014; Creti et al., 2012; Lo Prete and Norman, 2013; Boersen and Scholtens, 2014; Ahamada and Kirat, 2018; Pereira Freitas and Pereira da Silva, 2015; Hintermann, 2016; Cludius et al., 2020; Guo and Gissey, 2021; Bai and Okullo, 2023), with some studies indicating full pass-through in countries like the UK and lower pass-through in sectors exposed to international competition, like cement and steel.

The previous literature on analyzing the relationship between wholesale electricity prices and CO_2 allowance prices have focused on the initial phases. To the best of our knowledge, there is no study that analyzes such a relationship with updated data covering all phases to date.

The contribution of this paper is to extend the literature how CO_2 allowance prices affect wholesale electricity prices for main EU countries considering the first three phases of EU ETS and the unfinished phase IV, including a comparative analysis across phases.

Data and Methodology

The empirical sample used for the present study consists of daily wholesale electricity (last price) prices for the four main EU countries (France, Germany, Italy and Spain) and EUA spot and future prices, as well as Brent and natural gas prices. We have a common sample of 730, 1203, 1961 and 838 observations for Phase I, II, III and IV, respectively.

We first estimate the standard pass-through regression for each individual country and for each phase. Second, a time-varying parameter version of model is considered.

Main Results

This paper provides new evidence on the pass-through of EUA price and wholesale electricity prices for the main four EU countries considered. We observed the existence of cross-country heterogeneity of the pass-through rates and differences between phases, with the latter phases showing larger pass-through compared to the earlier phases.
These results could offer valuable insights into the evolving relationship between EUA prices and electricity market, helping policymakers refine future climate policies.

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