HAS THE EUROPEAN EMISSIONS TRADING SYSTEM INDUCED CARBON LEAKAGE IN EUROPEAN MANUFACTURING? A SECTOR-LEVEL ANALYSIS

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Overview

Facing the global problem of climate change, climate policy that regulates only one region, e.g. Europe, risks being ineffective: such unilateral policy may lead to a shift of emissions from regulated to unregulated parts of the world – a phenomenon known as carbon leakage – without solving the global climate problem. The main climate policy affecting the traded goods sectors in Europe is the EU Emissions Trading System (EU ETS). Under the EU ETS two types of emissions are regulated for manufacturing firms: Emissions from own power and heat production, as well as process emissions. Furthermore, firms may incur indirect costs due to higher prices for electricity they purchase. If carbon leakage were sizable, it would make EU policy efforts ineffective and moreover disadvantage European firms vis-à-vis their international competitors, potentially leading to job loss and economic downturn. This explains why the leakage question has become a key topic for research and policy makers.

This paper addresses the research question of whether the introduction of the EU ETS has caused carbon leakage. The question is highly controversial from both an academic and a policy perspective. Ex ante approaches predict leakage, while ex post analyses typically fail to confirm these predictions. Ex ante evaluations typically use equilibrium models, finding positive carbon leakage rates of up to a 25% (Felder and Rutherford, 1993). Leakage may be reduced by using protective measures such as border carbon adjustments or output-based allocation of allowances (Fischer and Fox, 2007; Monjon and Quirion, 2011; Meunier et al., 2014). Ex post studies typically find that the EU ETS had a limited impact on carbon leakage (Chan, 2013; Sartor, 2013). Using installation-level survey data of multinational firms Dechezlepretre et al. (2014) find no evidence of relocation within firms. Martin et al. (2014) conclude that current EU ETS rules on free allocation of allowances to industry over-compensates for leakage risk in many sectors. In contrast Aichele and Felbermayr (2015), considering the broader context of the Kyoto Protocol, find that being a party to the Kyoto Protocol has led to carbon leakage.

We contribute to the literature evaluating *ex post* whether carbon leakage has occurred in the European manufacturing sector due to the introduction of the EU ETS. We focus on the question of leakage through trade of manufactured goods, leaving out green paradox type general equilibrium effects of climate policy on energy prices (Jensen et al, 2015). Our definition of carbon leakage thus includes both relocation of production by European firms as well as imports from foreign firms. Following this definition, carbon leakage should be evaluated at the sector level. A firm-level analysis may only provide evidence on one aspect of leakage, namely relocation. However, even if no relocation of production by European firms is found, leakage may occur through an increase in market shares of competing firms that produce in regions with no climate policy. Data allowing to disentangle these two effects are typically not available.

Methods

We proceed based on the insight that for a given level of consumption, carbon leakage leads to a higher share of imports in total value added. Thus, a sector-level approach identifies whether European climate policy has led to carbon leakage. We examine the evolution of import intensity at the sector level before and after the introduction of the EU ETS. According to our identification strategy, if there is carbon leakage, then a greater carbon cost of embedded emissions (as a share of a sector's revenue) will, on average, lead to an increase of the import share in European trade. Note that the focus is not on the *level* of import intensity, often used as a proxy for vulnerability to carbon leakage, but on *changes* in import intensity at the sector level over time in response to the carbon cost imposed by the EU ETS. We argue that idiosyncratic determinants of a sector's import share (e.g. cost-pass through ability, exchange rates, transport costs, technological change) are uncorrelated with the sectors' ordering according to the effect of carbon-cost intensity on changes in import intensity. In our estimations we additionally control for sector-level fixed effects and trends to isolate the cross-sectoral effects from sector-specific events. We reject the hypothesis of no carbon leakage in case of a systematic link between the sector-level relative carbon cost and the change in the import share.

In our analysis we use sector-level European external trade and production data from Eurostat's Comext database at the sectoral PRODCOM level, which we map into four-digit NACE codes. Emission intensity is available at PRODCOM level from the benchmarking established by the Commission. This benchmark represents for each sector the average of the 10% most carbon-efficient firms. Price data for European carbon permits is readily available from trading platforms such as the ICE.

Results

Based on preliminary results we do not find indications for carbon leakage. In our data, the cost of embedded carbon varies between 0.1% and 50% of the final product price, so that there is sufficient "treatment" variation. However, across different measures – ranging from correlations, over rank-correlations to regressions with sector fixed-effects – we do not find any statistical link between the evolution of import-intensity and the relative carbon-cost induced by the EU ETS. This result is not compatible with the hypothesis of carbon leakage: even if only some sectors suffer carbon leakage whil some other sectors remain unaffected, the average correlation should be positive.

Conclusions

Based on our analysis we conclude that the EU ETS has not induced carbon leakage in the European manufacturing sector, even though it is predicted by theory and ex ante simulation analyses. This suggests that barriers against carbon leakage exist which are not accounted for in the more stylized ex ante models.

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