Reaping the carbon rent: abatement and overallocation profits in the European cement industry, insights from an LMDI decomposition

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Overview

Cement is the most used man-made material in the world, and also one of the most carbon-intensive products. Its manufacture can be divided into two main steps: clinker manufacture, and blending and grinding clinker with other material to produce cement. Calcination of limestone during clinker manufacturing emit carbon dioxide in two ways: process emissions (538 kgCO2 /ton of clinker) for two thirds and burning of fossil fuel for one third. In addition, indirect emissions (approximately 5%) comes from electricity consumption for raw material preparation, kiln functioning, and blending and grindin.

European cement emissions have been covered since 2005 by the European Union Emission Trading Scheme (EU ETS), presented as Europe's flagship policy to tackle climate change (Branger et al., 2013). While most of the economists favoured auctioning, the European Union opted for an almost fully free allocation for all sectors (industry and power sector) during phase I (2005-2007) and phase II (2008-2012); and maintained free allocations in phase III (2013-2020) fully for sectors "deemed to be exposed to carbon leakage" (including cement) and partly for the rest of manufacturing industry (European Commission, 2009).

In addition to generous allocation caps, the economic downturn after 2008 led to a decrease in industrial production, which generated an important surplus of allowances in the market and subsequent profits. Apart from financial outcomes, an important question remains: whether the EU ETS fulfilled its original purpose which is triggering a transition toward a low-carbon industry. Studies assessing abatement in the manufacturing industry come to mixed results (Ellerman and Buchner 2008, Neuhoff et al., 2014).

In this paper we propose to disentangle the questions of abatement and overallocation in the European cement industry.

Methods

We perform an LMDI (Log Mean Divisia Index) decomposition (Ang, 2004) of emissions due to cement production in Europe, allowing to disentangle seven channels of emissions change: activity, clinker trade, clinker share, alternative fuels, thermal and electric energy efficiency, and electricity decarbonisation. We conduct analyses from 1990 to 2011, at the European level (EU 27), and at the national level for six major producers: Germany, France, Spain, United Kingdom, Italy and Poland.

Three databases are crossed: the European Union Transaction Log (EUTL), which is the registry of the EU ETS, and provides allocations and verified emissions at the installation level; the Eurostat international trade data for clinker trade and the detailed and comprehensive Getting the Numbers Right (GNR) database from the Cement Sustainability Initiative (CSI).

A distinction can be made between the first two effects (activity and clinker trade) that generate non-technological abatement and the others that generate technological abatement. Making assumptions on counterfactual scenarios, we estimate the technological abatement induced by the EU ETS and decompose its main factors. Further, our emissions decomposition model allows us to disentangle in the allowances surplus (allocations minus emissions) what is due to technological performance and what is due to a change in activity or clinker outsourcing. We are then able to compute overallocation and "overallocation profits".

Results

The decomposition analysis reveals that most of emissions changes in the EU 27 can be attributed to the activity effect. After an increase in production in the 2000s which induced an increase of 43.6 Mtons of CO2 in 2007 compared to 1990 (+22.6%), the collapse of production was responsible for a decrease of 63.1 Mtons of CO2 from 2007 to 2009(-34.4%). The clinker trade effect has counterbalanced approximately one third of the high activity effect in phase I. In addition, there has been since the 1990s a slow trend of emissions reductions mostly due to the clinker share effect, but also to the fuel mix effect and the electricity emissions factor effect. They overall account for a decrease by 13.1% in emissions between 1990 and 2011. Finally, the energy efficiency effect was responsible for a decrease in emissions in the 1990s but an increase afterwards (overall it was responsible for a decrease of 2.8% of emissions between 1990 and 2011). The deterioration of energy efficiency was probably due to the mitigation options, combined to a lack of ambition of energy efficiency programs and to the fact that any plants now operate well below their optimal efficiency level.

Because of a small acceleration of clinker reduction and alternative fuel use after 2005, 21 Mtons of CO 2 (±12 Mtons) of emissions have been abated from 2005 to 2011, corresponding to a 2.0% (± 1.1%) decrease. However these effects could have been due to the rise of energy prices rather than the EU ETS. The UK and Germany (12% ± 3% and 5% ± 2% of emissions abatement) are the good students in Europe, while in France, Spain, Italy and Poland technological abatement was insignificant or even negative.

Furthermore, the cement industry has reaped 3.5 billion euros of overallocation profits during phases I and II, mainly because of the slowdown of production, while allowance caps were unchanged. The overallocation profits have been particularly high in countries with important production slowdown, such as Spain (820 M€). In addition, we estimate a low bound of offset credits savings at 342 M€.

Conclusions

The financial situation of European cement companies would have been far worse had the EU ETS not be implemented. During phase II, the scheme has been tantamount to a subsidy of 3.5 euros per ton of cement produced. Presented as a threat to competitiveness, the EU ETS has paradoxically boosted European cement industry competitiveness defined as ability to earn.

Since 2013 and the beginning of phase III, the allocation methodology has been more stringent. It is now based on the average of 10% best performing installations, corresponding to 780 kgCO2 /tClinker. However, though going in the right direction, this change raises two issues. First, a clinker-based benchmark does not give an incentive to reduce the clinker-to-cement ratio, which is the main lever of carbon emission reductions. Second, overallocation is still likely to happen as this benchmark is then multiplied for each installation by the historical activity level (HAL), which is generally based on pre-crisis level.

Therefore, considering that full auctioning and Border Carbon Adjustments are politically too hard to achieve,we advocate for:
(i) Output-based allocations, which have thedesirable benefit to by-pass the HAL determination, and potential overallocation profits or underallocation profit losses due to high uncertainty in future production levels.
(ii) Combined clinker and clinker-to-cement ratio benchmarking, which give an incentive to reduce the clinker-to-cement ratio without incentivizing clinker outsourcing.

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