Demand Response from CO_2 Prices in Energy-intensive Industries

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Overview

The heavy industrial sectors currently covered under the EU Emissions Trading Scheme (EU ETS) are expected to make a substantial contribution to meeting long-term emissions reduction targets in Europe. In the current debate industry reports that competitiveness of particular sectors is at threat given the repercussions from higher prices imposed by environmental regulation restricted to participants of the trading scheme. As response it is suggested to allocate allowances for free to these sectors, creating concerns about early action problems. We argue that muting the price signal would in addition undermine the substitution effect towards lower carbon products.

To understand the possible trade-offs policy makers are facing we investigate own-price elasticities, the marginal abatement cost curve and assumptions about cost pass through. High level of uncertainty are associated with individual estimations. We provide an overview on existing literature dealing with demand responsiveness for products from energy-intensive industries (cement, electricity, gasoline, newsprint, copper, aluminium, steel and iron ore) (and standard errors where available) and also covering the different estimations of marginal abatement costs.

Following, we will focus on the cement and steel sectors and present own estimation results showing the breadth of the associated standard error. Additionally, we estimate cross-price elasticities for cement and steel used in the construction sector of European economies to provide first insights into potential effects of material switching.

Finally we calculate the contribution demand responsiveness and efficiency improvements can make to emission reductions of the sectors and illustrate the uncertainties associated with the parameters.

Methods

First, to test the demand sensitivities to own price for cement and steel, we assume a very simple model for each industry where demand is a function of consumption *C*, own product prices *P* and *GDP* for 12 EU countries. We estimate a panel model regression using first differences, calculating a price index for energy used in cement and steel industries in order to employ standard instrumental variable techniques. We then test demand sensitivity to the price of both cement and steel to estimate cross-price elasticities.

Following, we closer examine the relationship between steel and cement using in 12 European countries[1] between 1990 and 2005 providing a sample of 192 observations. Construction is measured as value added inconstant prices (2000=100) taken from OECD Annual National Accounts, cement production from USGS and steel data is provided by IISI.[2] We normalize data to the reference year 2000 and use logged values to explain construction by cement, steel and an intercept in a very simplistic approach. Assuming optimal behaviour in revenue maximization own- and cross-price elasticity of demand is derived by $\varepsilon_{C,p_c} = -\frac{(1-\hat{\beta})}{(\hat{\alpha}-1+\hat{\beta})}$ *and* $\varepsilon_{C,p_s} = -\frac{\hat{\beta}}{(\hat{\alpha}-1+\hat{\beta})}$. Parameters $\hat{\alpha}$ and $\hat{\beta}$ are the estimated coefficients from a pooled panel fixed effects specification.

Results

For cement we estimate a demand elasticity of -1.2. Hence a 1% increase in price leads to a 1.2% decrease in consumption. For steel our estimation demand elasticity is -0.3. The uncertainty associated with individual estimations seems to be rather large. Elasticity of demand for cement in construction is –1.696, whilst the substitution elasticity is –0.03.

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[2] We assume 3% of steel production to be used in construction that is indicated by comparing input-output tables and indicated in several steel associations' publications.