

Consumption-based carbon policies from a top-down and a bottom-up perspective

Topic: Consumption-Based Carbon Policies and IO Modeling

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The approaches for calculating consumption-based carbon emissions can be divided into two broad categories: top-down approaches, in the form of multi-regional input-output (MRIO) models, and bottom-up approaches, in the form of life cycle assessment (LCA). Both have their virtues and drawbacks. Both approaches are very data intensive. Several MRIO databases have been developed and published over the past years. Now that these databases exist and have been refined and validated, they will be used to inform policy makers. LCA is usually only applied to very specific products and product groups, so there still exist many products that have not yet been subject to this kind of research. This paper uses both a top-down and bottom-up approach to calculate the effects of different policy measures on the development of consumption-based carbon emissions in the EU28.

This paper shows how the MRIO model GRAM can be applied to analyze the effect of these policies. The underlying MRIO database itself is a pure static accounting system. To analyze the effects of the policies, the accounting system needs to be linked with a dynamic macro-economic model that can be used for policy simulation. In this dynamic model, final demand, productions structure, energy use and related carbon emissions are determined endogenously and the interactions in the economy are represented in the model equations. The outcome of the policy simulation is reflected in changes in the different model variables. The impact on final demand, intermediate input structure, trade and emissions is then implemented in the static MRIO. This is then used to calculate the impact of the policies on consumption-based carbon accounts of the EU. The policy examples used are two sector specific policy options: the EU's CO₂ in Cars Regulations, and the Gas Flaring aspect of the Global Methane Initiative. The results from the top-down approach are then compared with those from the bottom-up LCA approach. Both, bottom-up and top-down approach use the same underlying assumptions regarding the impacts, but due to the very different nature of the methodologies, differences in the results are expected and need to be explained.