Climate policy design to preserve the competitiveness of the French industry with hybrid input-output tables

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While implementation of climate policy is at stake, there are always tensions between countries or agents. Beyond equity issues either at the regional or international scale, globalization drives concerns about unilateral actions. Indeed, issues of competitiveness for energy-intensive and trade-exposed (EITE) sectors and resulting carbon leakage often come up in the debate. To protect these industries and increase the environmental efficiency of a unilateral climate policy, compensation mechanisms or border tax adjustments (BTA) are often considered (BÃ¶hringer, Balistreri, and Rutherford 2012). Numerous studies examined the impact of such measures on competitiveness and leakage issues. If there is largely a consensus to say that BTA deals positively with those issues, the level of reduction remains uncertain. Partial equilibrium modelers generally rightly argue that computable general equilibrium (CGE) models embark poor details on EITE sectors, with a high level of aggregation. Some efforts tend to be made in CGE models to demonstrate the relevance of disaggregated EITE sectors; taking into account their heterogeneity changes significantly the impact of a climate policy at the sectoral level (Alexeeva-Talebi et al. 2012; Caron 2012). Nevertheless, the disaggregation is only in value. This paper proposes to embark physical information on energy, steel and cement sectors into the modeling framework. Then, we explore tax arrangements at the country scale of France that can help to reduce the negative aspects of the application of carbon tax through objectives comprising equity, competitiveness for EITE sectors and better environmental efficiency.
We use the IMACLIM-S France "hybrid" CGE model designed for comparative static exercises. It represents an open-French economy, distinguishing four categories of agents (households, businesses, government and "the rest-of-world"). The description of the production system distinguishes the energy sectors, as well as energy-intensive sectors, and a composite remainder of the economy.

The country scale allows proposing an innovative procedure for building hybrid Input-Output matrices including information about energy as well as cement and steel flows, prices and quantities coming from physical statistics, without alteration on this data. All this information is then introduced within a consistent social accounting framework. Standard macroeconomic models are exclusively built on monetary data drawn from national accounts and benchmark quantities are not described in physical units. The need for physical information, such as energy consumption, to carry out energy/economy/environment analysis has led to develop hybrid accounts. All hybridisation procedures follow two basic accounting principles: (i) both the physical and money descriptions must respect conservation principles (the balances of resources and uses, respectively in quantities and values), (ii) physical and money flows are linked by a system of price. However, the method of data hybridisation is not standardized and different procedures may be proposed. In developing hybrid methods for the IMACLIM modelling framework, we follow two main rules: (i) the total size of the economy is preserved, (ii) the data on energy quantities and prices faced by economic agents are reintroduced. The procedure involves three mains steps illustrated on the 2010 French economy, focusing on energy flows, but the same procedure is applied to cement and steel industries in order to isolate those sectors in the initial description.

The critical point of a carbon tax reform is to contain the spread of higher energy costs on production costs, which ultimately affect the purchasing power of households and affect the international competitiveness of firms when reform is unilateral. The combination of a carbon tax with structural policies to support growth (lower social contributions) does not reduce the unequal

effects of taxes. To reconcile equity, competitiveness and environmental issues, it seems essential to combine these policies with specific compensation mechanisms or complementary policies according to household income levels, and to the exposure of energy-intensive sectors to international trade. Thanks to the hybrid sectorial disaggregation described in the latest version of the model, we are now starting a set of experiments in which we consider various revenue-recycling schemes that better preserve altogether economic efficiency, equity and competitiveness. We are also testing an implementation of BTA for extra-Europe importations. Finally, we compare the impacts of those different strategies on various macroeconomic indicators, and through analysis of the corresponding distributive effects on EITE sectors. We can then observe how hybrid data on cement and steel sectors change the policy impacts.