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A MULTI-REGIONAL INPUT-OUTPUT FRAMEWORK TO EVALUATE EUROPEAN ENERGY POLICIES

Gerald FEICHTINGER[1]

Motivation

With the implementation of its comprehensive energy strategies 2020, 2030 and its Energy Roadmap 2050, the European Union began a profound transition process to establish competitive low-carbon economies in every EU member country in the longer-term basis. The overly ambitious climate change goals go hand in hand with several intensive expansion policies of low-carbon production technologies including renewable energy sources like wind, solar or biomass and low-emission production technologies like safe nuclear energy and modified fossil-fuelled technologies in the power sectors.

Methodology

The presented comparative-static model approach is capable of analysing the potential inter-regional effects caused by an extensive technology switch within the power production sectors of Austria, Germany and France by coupling a “top-down”-based, multi-regional, multi-sectoral input-output-model based on the World Input-Output Database (WIOD) with the “bottom-up”-based electricity sector model ATLANTIS. Moreover, besides the traditional Leontief demand cycle, the enlarged model approach implements two additional economic demand cycles to fully cover long-term effects: (i) a replacement-investment cycle in order to keep the capital stock operational and (ii) an income-induced consumption cycle to consider employment-induced consumption patterns. Since the electricity supply sector is of a very heterogeneous nature, a technology calibration approach provides a suitable method to split the energy supply aggregate into several sub-production technologies by considering significant input data of the electricity sector model ATLANTIS. A shared market based technology switch approach simulates the potential effects of a structural change in the electricity production technologies and highlights the emerging impacts of the integrated electricity sector model.

Results

The results show – keeping everything else constant – that an energy transition based on the EU reference scenario 2050 increases domestic demand while decreasing the import demand in Austria. The opposite can be observed in France while Germany faces a situation with both decreased domestic demand and import demand. The employment within the electricity sector decreases in all three regions. In the full model approach, only Austria and China face slightly positive output effects as well as the sector which produces electrical and optical equipment. In all other regions and sectors, slightly negative effects emerge in total. In terms of value added, Germany (due to its extensive energy transition) and the electricity sector itself face positive impacts, whereas China, along with the sector of electrical and optical production face only positive employment effects. Finally yet importantly, the primary energy delivering regions and the primary energy producing sectors face overall slightly negative effects.

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[1] Graz University of Technology, Institute of Electricity Economics and Energy Innovation, Inffeldgasse 18, 8010 Graz, gerald.feichtinger@gmx.at, www.iee.tugraz.at