Impacts of the electric vehicle penetration in Spain: A dynamic EV-aware CGE model

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The European Green Deal aims to achieve the carbon neutrality in Europe for 2050. The transportation sector is an important contributor for this objective, where the efforts are focused on the electrification of the vehicle fleet. This electrification strategy involves an important conversion of the traditional automotive sector. The change in the powertrain from well-known combustion engines to electric motors and batteries brings new industries to the sector and a different distribution of imports and exports. The supply chain is highly affected due to the origin of raw materials and know-how of components of the electric powertrain. In this context, the aim of the present work is to analyse the impact of a massive penetration of electric vehicles with a dynamic approach up to the year 2050. To do it, a dynamic electric-vehicles (EV)-aware computable general equilibrium (CGE) model has been developed for the evaluation. This EV-aware CGE model is defined for the whole economy, establishing differences between Spain, rest of Europe and rest of the world. The case of Spain has been analysed isolated since this country is specifically sensitive to automotive industry change due the impact in its economy, given the fact that the automotive sector represents a significant percentage of the GDP. Moreover, most of the automotive sector in Spain is focused on manufacturing but there is no major technological centres so the risk can be more severe when analysing a change in the supply chain. The EV-aware CGE model designed reflects the behaviour and interactions of the economic agents (consumers, producers and public sector) so it is possible to measure direct and indirect effects of changes in behaviour of the agents and different economic policies. As a novelty, the dynamic EV-aware CGE model implements the selection of inputs for the production of electric vehicles, considering the necessary components of the production chain of the traditional automotive industry, and substitution by electric components, through elasticities of substitution. This extension works both on the production side and on the consumption side. The structures have been disaggregated in levels reaching the key sectors where the modifications are applied. The EXIOBASE database has been used as input data for the EV-aware CGE model for the year 2016, which presents a detailed number of sectors and environmental extensions, so it enables to take the appropriate activities under the production chain of interest. In particular for this work, the aggregation of sectors has been done according to the most relevant production chains and business for mobility. CGE models have been applied in the literature for the evaluation of this change in different regions of the world. However, there is not extensive work on the subject, and what is more, this work presents an extended horizon up to 2050 defining future scenarios and focused on regions where the traditional automotive sector has a significant weight in the overall economy. The scenarios simulated combine the change in demand by the main stakeholders, and also by fiscal policies that can be applied to promote the change. Additionally, we study the infrastructures required to address the development and accessibility of a network of public access for the supply of electric recharging points to enable the penetration of the most efficient and cleanest technologies in means of transport, as well as the development of measures to promote private access infrastructures for electric recharging in homes.