Deployment of new clean technologies in developing countries in a CGE framework: fostering investments in clean and renewable energy

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Abstract

Technological advancements are one of the major drivers of economic growth. Diffusion of new technologies provide the initial impulse for new and alternative production processes that will constitute additional engines for development. In addition, with adequate incentives these new technologies could grow in size and become an important sector within an economy. This is the case of clean and renewable energies which are growing fast not only in the developed world, but also on developing countries. Modeling these kind of processes have proven to be quite a challenge, in particular in a general equilibrium framework. Furthermore, given that computable general equilibrium (CGE) models use data from social accounting matrices (SAM) providing information for the calibration year, it is very difficult to introduce a new sector or technology in SAM where initially it was incipient. This paper describes a methodology to integrate new sectors in a recursive dynamic CGE by modifying the initial SAM and including a new type of investment which cumulates in time allowing the new sector to become mature and take part in the future economy development.

Keywords: CGE, Technical change, Adaptation

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1. Introduction

In all CGE models, the base year is of fundamental importance. Broadly speaking, we can think of it as a snapshot of the economic activity carried out in a particular year; this snapshot, or better said, the economic data behind it, is then used to solve the model and make projections or future scenarios. Thus, the future development of sectors that are not present (i.e. zero economic value) in the base year might be very challenging. To overcome such limitation, we introduced into the ICES model a new form of capital endowment representing a stock of investments in new clean or renewable technologies. These new technological capital can cumulate in time and could be exogenously shocked as well to simulate an additional effort to develop a new sector in the dynamic recursive CGE. The new primary factor is modeled as a "sluggish" endowment, it is not mobile across sectors and it is sector-specific. This allows us to target investments to selected sectors (e.g. solar or wind energy for example) and trigger the adoption of new technologies even in countries where such technologies do not exist yet. Thus, this new endowment is a sort of "auxiliary capital" used to foster the development of such sectors until the reach a mature stage. The investment is modeled as an exogenous variable which in each period increases the stock of the technological capital. This new capital endowment is then combined with the "traditional" output using a CES function. Therefore, the new final output at the top nest is made of the standard output (which, as in the original formulation combines all other primary factors with intermediate inputs) and the new form of capital. Through the CES function elasticity it could be also possible to calibrate investments in order to achieve a certain level of output of a particular sector. As a matter of fact, certain types of technologies require long term investments. Finally we run a policy exercise simulating a mitigation scenario with these additional clean energy technologies and compare them with a simulation where there are no such new technologies.

2. Methodology and model improvements

3. Policy experiment

4. Results

5. Conclusions

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Appendix