The Coalition of Finance Ministers for Climate Action

Computable general equilibrium model for the introduction of a carbon tax for the Moroccan economy

Morocco—Ministry of Economy and Finance

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Background and model characteristics

In response to a request from Morocco's Ministry of the Environment, the World Bank produced a report in 2019 assessing the impacts of introducing a carbon tax in Morocco. Given its modeling expertise, the Directorate of Studies and Financial Forecasts (DEPF) was called upon to adapt its computable general equilibrium (CGE) model to simulate the proposed scenarios, with technical assistance from the World Bank.

The study is part of Morocco's ambitious commitments to achieve its Nationally Determined Contribution (NDC). In 2019, Morocco unconditionally set out to reduce its greenhouse gas emissions by 17% by 2030, and by a further 25% achievable under certain conditions, i.e., subject to new sources of financing and international support, for a combined reduction of around 42% by 2030.

The DEPF's CGE model is a static neoclassical model, with Walrasian general equilibrium and perfect competition, which considers the optimizing microeconomic behavior of economic agents. In this model, markets are balanced by flexible prices. Economic agents are made up of a representative household, companies, the Government, and the rest of the world.

For the production of each industry, the two factors used are labor, assumed to be perfectly mobile between sectors, and capital, assumed to be specific to each sector. The main data required for the CGE model is contained in the 2015 social accounting matrix (SAM). This SAM, which uses a sectoral disaggregation of 15 industries and 21 goods and services, is an adaptation of the official one published by Morocco's Haut-Commisariat au Plan (HCP). Refined petroleum products have been broken down into gasoline, diesel, fuel oil, butane gas, and other refined petroleum products, using data available in the energy balance drawn up by Morocco's Ministry of Energy and Mines.

Carbon tax revenue recycling options and impact on GDP

The additional public revenues from the carbon tax can be recycled into the economy under five several alternative schemes. The first considers a flat-rate transfer of these revenues to households for the consumption of goods and services (excluding fossil fuels). The second uses them to increase public investment. The third uses these revenues to reduce household income tax. The fourth devotes them to reducing the corporate tax rate. The fifth dedicates them to subsidizing the main export industries.

The effect of the carbon tax on GDP depends on the revenue recycling scenario adopted. For example, the impact would be negative if carbon tax revenues were transferred to households or used to reduce income tax. On the other hand, carbon taxation would increase GDP if its revenues were used to increase public investment, reduce corporate taxes, or subsidize key export industries.[1]

Limits and perspectives

The CGE modeling approach has the merit of taking into account the sectoral aspect as well as the interactions between economic agents and markets (particularly factor markets). However, the assumption that all markets are in equilibrium, and the fact that the rigidity of certain prices is not taken into account, may affect the relevance of this approach. Another major drawback is that the model does not consider the pure financial sphere, in order to capture, for example, the integration of aspects of the carbon market. It should be pointed out that the accessibility and ease of use of data in this approach can be both an advantage and a disadvantage. Indeed, as an advantage, the flexibility of aggregation translated by the freedom to choose the number of sectors is advantageous for achieving the precision required by the problem studied. A disadvantage is the difficulty of obtaining complete data in the case of microsimulation (to overcome the hypothesis of the representative agent, particularly for households), enabling analysis of the distributive aspect of impacts (e.g., the impact on inequalities).

1Providing direct grants, rebates, and other forms of subsidization to encourage exports can improve the competitiveness of exporting firms, improving the trade balance.

In terms of prospects, the report recommends that DEPF's CGE model for energy be developed to disaggregate the household account in order to capture social effects in terms of poverty and inequality. The introduction of sequential dynamics into the model is also important. In addition, the model should take into account certain rigidities, notably in the labor market. Finally, assessing the impact of the energy transition requires a breakdown of electricity sector inputs. These perspectives require certain additional skills or techniques, enabling the development of "hybrid" models combining economics and physical environmental disciplines, on the one hand, and mastery of environmental accounting (according to United Nations statistical standards) on the other. In addition, it would be interesting to acquire the ability to integrate the financial sphere (especially at market level) into the Ministry of Economy and Finance's multi-sector analysis models such as the CGE model.