

A General Equilibrium Model for Energy Policy Evaluation using GTAP-E for Vietnam

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Abstract:

Overview

In the past several years, there has been seen growing concern on the scarcity of energy resources, the volatility of energy prices and the impact of energy sector on climate change. In this context, energy-environment models designed for analysis of energy systems have become more important. The issue related to environmental and energy policies have attracted a lot of studies both in term of technological and economy-wide impacts. There are two approaches to deal with the problem: bottom-up model and top-down model. Among top-down models, Computable General Equilibrium (CGE) models have assumed particular importance. One of the Computable General Equilibrium (CGE) models known as The Global Trade Analysis Project (GTAP) is a global project aiming at facilitating high quality quantitative analysis of the global economic issues. The main products of the GTAP are the global database (the GTAP Data Base) and the global economic model (the standard GTAP model) to conduct policy simulations with the GTAP Data Base.

The GTAP-E model is an extension of a standard GTAP model constructed by the Global Trade Analysis Project (GTAP) team. The model incorporated energy substitution both for inter-fuel and fuel-factor substitution into the Standard GTAP model. The new features allow the estimation of sectoral energy consumptions by fuel type - one important step to estimate carbon emission from fuel combustion.

In this paper, a new version of GTAP-E model based on the latest GTAP data (GTAP 7, with the base year of 2004) is introduced. Further, as a second step, a dynamic GTAP-E model is developed based on the theoretical structure of dynamic GTAP and the GTAP-E model for Vietnam for the period of 2004-2020.

Methods

The GTAP-E model for Vietnam utilizes the structure of the original paper of GTAP-E which is developed by Burniaux and Truong (2002) and then revised by Mc Dougall and A. Golub (2007). The determination of the number of sectors and regions to be aggregated is another step in the process of building a GTAP-E version. According to the GTAP-E approach, energy sectors should be presented, including coal, crude oil, gas (natural gas and gas distribution and transportation), petroleum and refined oil products, and electricity. Energy intensive sectors, non-intensive sectors or sectors which might emit relatively more CO₂ as described on the International Energy Agency (IEA) Energy Balances are also categorized. Specifically, 57 old sectors are mapped over to 17 new sectors. As for regional aggregation, Vietnam is disaggregated from the Data

Base. Other regions are similar to the mapped regions in the original GTAP-E model. In fact, 113 old regions are mapped to 9 new regions.

In the second step, a dynamic GTAP-E model is developed based on the theoretical structure of dynamic GTAP (Ianchovichina and Mc Dougall 2000) and the GTAP-E model for Vietnam. The data are taken from GTAP data base, the World Bank and the International Monetary Fund (IMF).

Expected results

The model is used to simulate the adoption of alternative carbon tax for Vietnam for the based year of 2004 and for the period of 2010-2020. The economy-level and detailed sector-specific effects are also examined considering energy intensive and non-intensive sectors. As a matter of fact, this is the first simulation of energy-environmental policy for Vietnam using the updated version of the GTAP-E.

Key words: *Computable General Equilibrium (CGE), GTAP, GTAP-E, Carbon Tax*

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