Economic Policy Research Center

The Brief about CGE Modeling and the ways it can be employed for macroeconomic policy analysis for Georgia

Computable General Equilibrium (CGE) models provide a comprehensive macro-economic framework to describe market-oriented economies. With CGE models quantities and prices in various equilibrium can be computed and simulation analysis can be performed to infer what will happen if different policies, i.e. international trade regulation, sectoral policies, fiscal regulations or environmental policies are introduced. Quantities of consumption, output, imports, exports, savings, investments and other macro variables, in each commodity sector can be computed to analyze economic structure in detail.

Depending on availability of data, multi-sector models can be built to analyze sector-specific issues as well as economy-wide ones. With detailed sectoral disaggregation, the models tend to be large-scaled and for quantitatively measuring general equilibrium of an economy, computational techniques (GAMS non-linear programming software techniques in particular) should be utilized.

For the case of Georgia, CGE models have one strong advantage in data requirements. Usually, what is needed for econometric estimation is time series data for a long period. In contrast, CGE models require input-output (I/O) tables and basic national accounts for a single year. In the situation, when we don't have so long time series, CGE models can be a powerful tool in empirical analyses.

Nevertheless, as mentioned above, CGE modeling relies on Input/Output tables and Social Accounting Matrices, which require disaggregated data for the key sectors (the sectors we intend to analyze for Georgia). That is, we need disaggregation in factor inputs, intermediate inputs from other sectors in each sector; also how much of each sectoral output is used for final consumption, intermediate inputs for other sectors, exports, e.t.c. So, this kind of data requirement seems to be major difficulty for model-building in Georgia and we have to explore statistical support.

CGE models are utilized in estimating real side of an economy focusing on efficiency of resource allocation. That is, effects of distortion caused/removed by economic policies in terms of sectoral output, consumption, international trade, prices and terms-of-trade, utility e.t.c. can be quantified.

For illustrative purposes we can shortly list issues that can be analyzed with CGE models:
Macro-economy:
Effects of tax policies or public expenditure modifications in Georgia.
Income distributional aspects of taxation.
Possible scenario for introducing consumption taxes in Georgia.
International Trade:
Implementation of WTO agreements and effects of trade liberalization.
Environmental policy analysis for pollution controlling, impacts of taxation on tax revenues and sectoral outputs.

For giving the flavor of CGE modeling and how it's developed we sketch out the process of model building. First, economy structure is systemized and each agent behavior is mathematically formulated by simultaneous equations derived with Lagrange method and respective utility/profit maximizing behaviors. The system could include domestic production, domestic output transformation into domestic good and exports, Armington's aggregation of domestic good and imports into final domestic product, also government behavior, investment behavior, household behavior, Trade and BoP conditions and various equilibrium conditions. For example, simultaneous equations for Domestic Production would look like:

$$Y_j = b_j \prod_h F_{hj}^{\beta_{hj}}, \quad \forall j$$

$$X_{ij} = ax_{ij} Z_j, \quad \forall i, j$$

$$Y_j = ay_j Z_j, \quad \forall j$$

$$F_{hj} = \frac{\beta_{hj} p_j^y}{r_h} Y_j, \ \forall h, j$$

$$p_j^s = ay_j p_j^y + \sum_i ax_{ij} p_i^q, \ \forall j$$

Where Y is value added, X are int*ermediate inputs, Z is domestic output, b and β's are respectively scale and share parameters in Cobb – Douglas production function*
ax and ay are parameters in Leontieff int*ermediate function and p's are prices of value added and final products of* var*ious* sec*tors, indicated by suffices i and j.*

After the system of simultaneous equations for each agent behavior is formulated, we build Social Accounting Matrix from I/O table and perform process of calibrating share/scale/other parameters from existing economic data. And then GAMS program is built to solve the system and to quantitatively perform simulations in various policies.