

An Introduction to Computable General Equilibrium Modeling

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Why do we emphasis on CGE modeling ?

- Theoretically consistent
- A clear policy orientation
- Capture both direct and indirect inter-sectoral, inter-regional, and inter-temporal effects induced by policy changes.

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Why do we emphasis on CGE modeling ?

- Able to provide more concrete welfare analysis that influence real policy making.
- Able to analyze the trade-off between efficiency and equity/distribution issues
- Able to analyze large, discrete, policy changes that are far away from the baseline.
- Very useful to build a bridge between economists and policy makers, and provide them with a base for dialogue.

What is CGE?

- Computable : Solved numerically
- General: Economy wide
- Equilibrium:
 - optimizing agents have found their best solutions subject to their budget constraints
 - quantities demanded = quantities supplied in factor and commodity markets
 - Macroeconomic balance

CGE Modeling System

Like all other models in economics



The importance of economic policy modeling and simulations

- Numerous historical examples show that any implementation of improper economic or social policy on a large scale would lead to economic disaster and social chaos, requiring years to readjustment at a very high cost.
- Unlike most physical scientists, who can test their ideas on controlled experiments in laboratories, economists have to rely primarily on natural experiments for their data.

The importance of economic policy modeling and simulations...

- The Rapid development of modern computer and IT provide the means for today's economists to examine their ideas by a computer-based simulation model before they put into practice. Simulation and economic modeling has become a major field in applied economics

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The history and development of CGE models

- One of the major advances in applied economics since the 1970s is converting the well-known Walrasian general-equilibrium structure from an abstract representation of an economy into realistic models of actual economies to conduct policy evaluations by specifying production and demand functions and incorporating data of the real world.

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Applications of the CGE methodology

- tax reforms
- trade liberalization
- economic integration
- change in world prices
- economic growth, dynamic model
- changes in public expenditure
- energy and environment policies

Components in CGE models

- A set of economic agents such as firms, households and government whose behavior is to be analyzed.
- Behavioral rules for these agents that reflect their assumed motivation such as profit maximization for firms and utility maximization for consumers.
- A set of signals observed by these agents on which they make their economic decisions, such as market prices or government rationing quotas.

Components in CGE models...

- Institutional structure of the model economy, which are the rules of the game by which various agents interact. For example, perfect competition implies that each agent is a price taker and prices are flexible.
- A set of explicit definitions of equilibrium conditions which are "system constraints" that must be satisfied for the whole economy but which are not taken into account by each individual agent in making his decisions.

Equilibrium in CGE models

- An equilibrium: can be defined as a set of signals such that the resulting decisions of all agents jointly satisfy the system constraints.
- The signals represent the equilibrating variables of the model. For example, in a perfectly competitive CGE model the assumption that excess demand equals zero in all markets is a system constraint that defines the nature of equilibrium.

Are CGE models only be applied to perfect competitive market economies?

Not necessarily...

the behavior assumptions, the institution structure, the signals, and the system constraints or macro closures all can be specified by various completely different economic theories and under a wide variety of institutional assumptions.

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Knowledge required for CGE analysis

- Basic Micro and Macroeconomics
- Knowledge of general equilibrium theory
- Knowledge of real world data. Be able to manipulate and convert it into a model admissible form
- Knowledge of computer programming. Be able to implement the model in computer
- Knowledge of policy issues and institutional structure

Steps in CGE modeling

1. define the issue to be studied
2. construct a consistent mathematical model
3. data collection – construct the benchmark that will be used for calibration
4. code the model
5. replicate the benchmark -- consistency
6. conduct policy experiments
7. analysis of results – compare the counterfactual solution with the benchmark

Programming to solve CGE models

- Single country models: GAMS, GEMPACK
- Global models: GTAP (GEMPACK)

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Data requirement and parameters

- The data requirements used to construct a CGE model are small when compared to the number of model parameters -- calibration.
- A SAM (i.e., a picture of the economy) is used to infer the value of model parameters.
- The SAM is combined with elasticities
 - own estimations, literature review, estimations for similar countries, guesstimates.