

CGE Models for Regional Policy Research: Notes and Examples

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DRC Modeling Workshop

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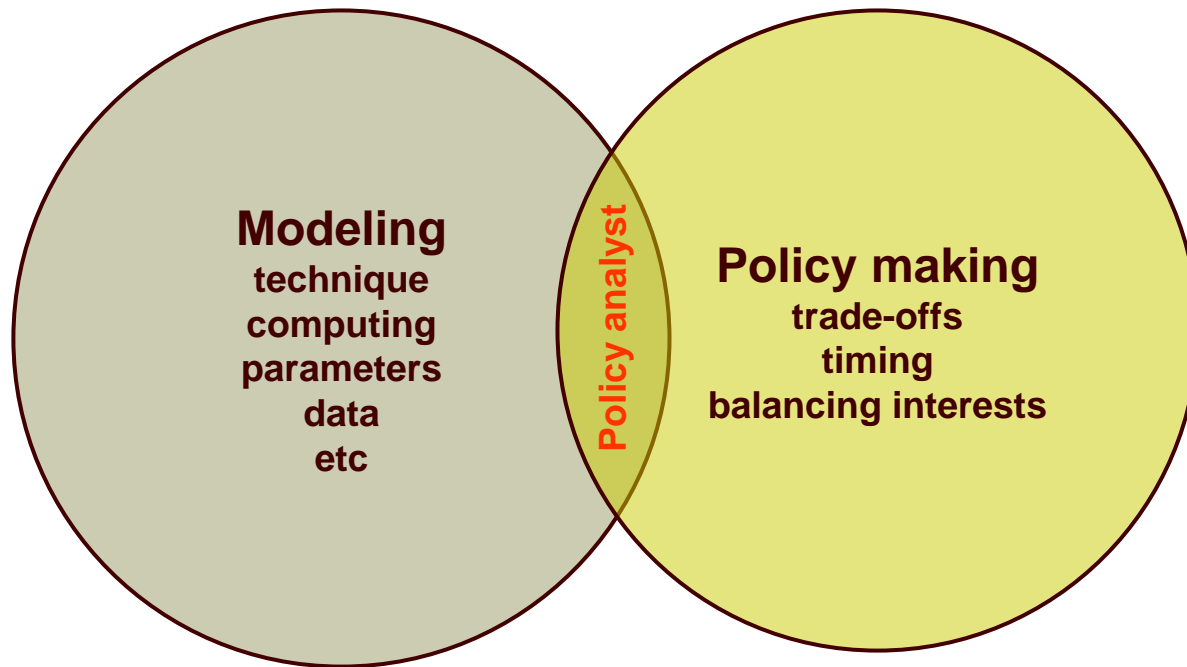
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Policy analyst's balancing act





The GE Modeling Offers

- Linkages and Indirect (and otherwise invisible) effects
- Effects of resource and other constraints
- Substitution patterns



The process of policy analysis

Preliminary steps

- Understand the problem and how it has been addressed in the past
- Understand the things that most concern the policy maker

The process of policy analysis

The modeling

- Think about the GE aspects of the problem
 - Why are we using a GE model for this issue?
- Get the modeling right
 - Make sure the problem is represented in the model
 - eg must have base tariffs if they are to be removed
- Understand and explore the results
 - What key parameters or data drive the results
 - How do changes in these change the results



The process of policy analysis

The communication

- Explain without any technical detail
- Cover policy makers concerns
- Repeat all the steps as necessary



Examples of CGE Applications



Some examples

- Agricultural Policy
- Trade policy
- Tax policy
- Environmental regulation and reform
- Poverty and Inequality

Agricultural Policy

- The issue
 - What does agriculture contribute to the economy and what does the (domestic and international) economy contribute to agriculture
 - What are the detailed effects of agriculture policy?
- Why a CGE model?
 - Agriculture remains a dominant sector in China, the most important source of income for the poor, and will experience many transitions in the next generation
- Key insights
 - Agriculture can be a main driver for growth and poverty alleviation, but the composition of this growth will be very complex
 - Big contrast with partial equilibrium analysis

Trade policy

- The issue
 - Effect of changes in tariffs and other forms of industry assistance
- Why a CGE model?
 - Trade policy is the classic GE problem
- Key insights
 - For dynamic exporters like China, it is a rich story about how the benefits and costs of protection were distributed

Tax policy

- The issue
 - Effect of replacing wholesale sales tax with goods and services value added tax
- Why a CGE model?
 - Very complicated initial structure of taxes
- Key insights
 - Overall gains very small and
 - very sensitive to some key assumptions



Environmental regulation

- The issue
 - Effects of regulations such as:
 - pollution
 - Resource (water, fisheries, forestry) policy
- Why a CGE model?
 - Still emerging in a live policy debate
 - Energy and water, for example, key inputs to all production processes
- Key insights
 - Environmental policies have many indirect effects

Poverty and Inequality

- The issue
 - What is the real composition of income and growth effects?
- Why a CGE model?
 - Institutional detail is essential
 - Relative incomes are determined by relative prices
 - Constraints play a major role in incidence and distribution
- Key insights
 - Who are the winners and how can they be enlisted to support policy?
 - Who are the losers and how can they be compensated?



DRC Modeling Strategy



Basic Tenets of Modeling Strategy

Policy makers need visibility. Economic models make a lasting contribution to this under three conditions:

1. They must incorporate advanced data and methods.
2. Their results must be transparent.
3. They must be locally implemented.

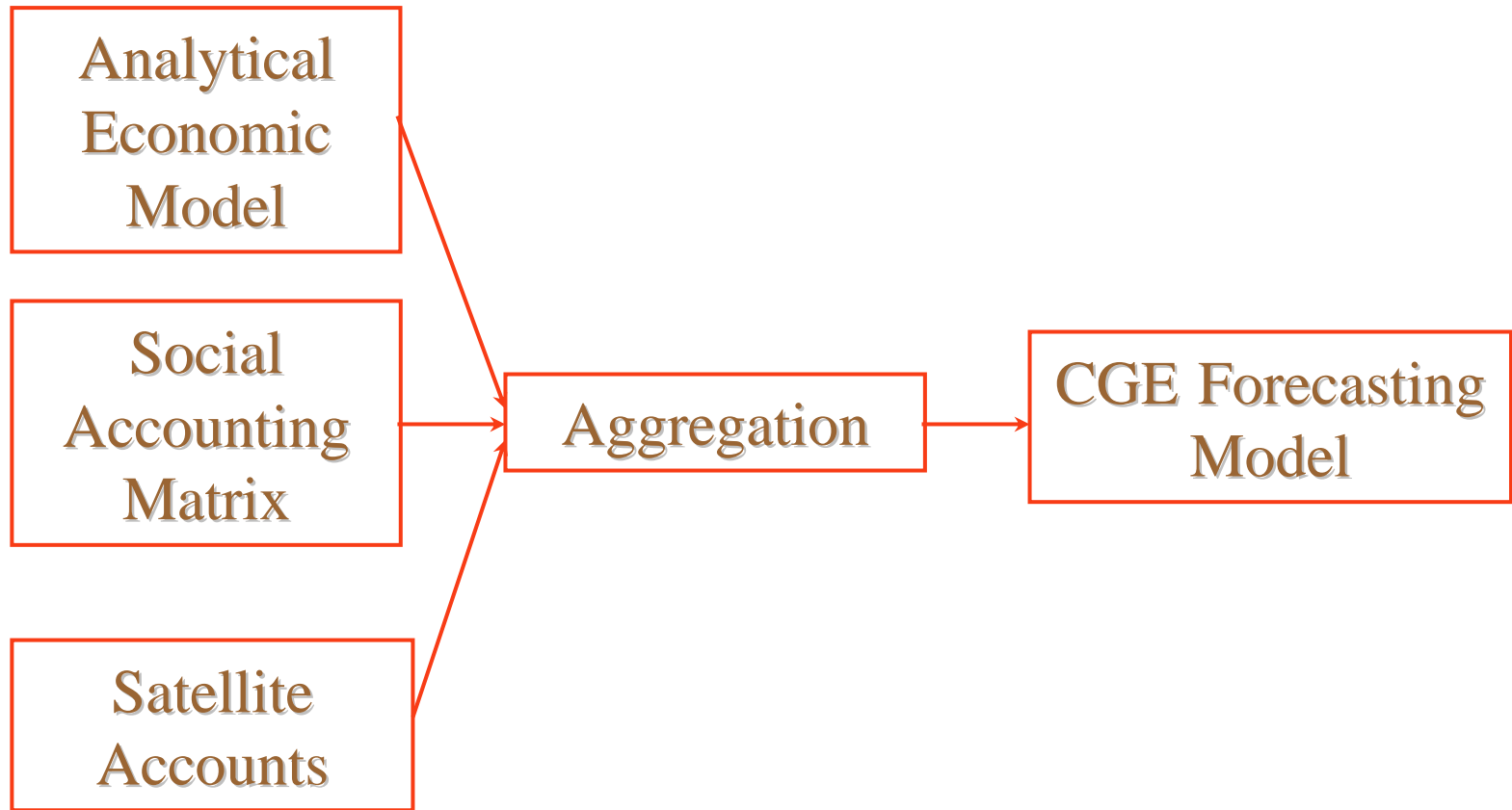
In order to achieve these three goals, we propose a three tier modeling facility.



Three Model Archetypes

1. **National research prototype model** – A state-of-the-art single country CGE model.
2. **Single region model** - for local implementation, a simplified single country CGE with a user-friendly interface.
3. **National multi-regional model** – A model based on the LINKAGE/GTAP multi-country framework, with flexible regional aggregation.

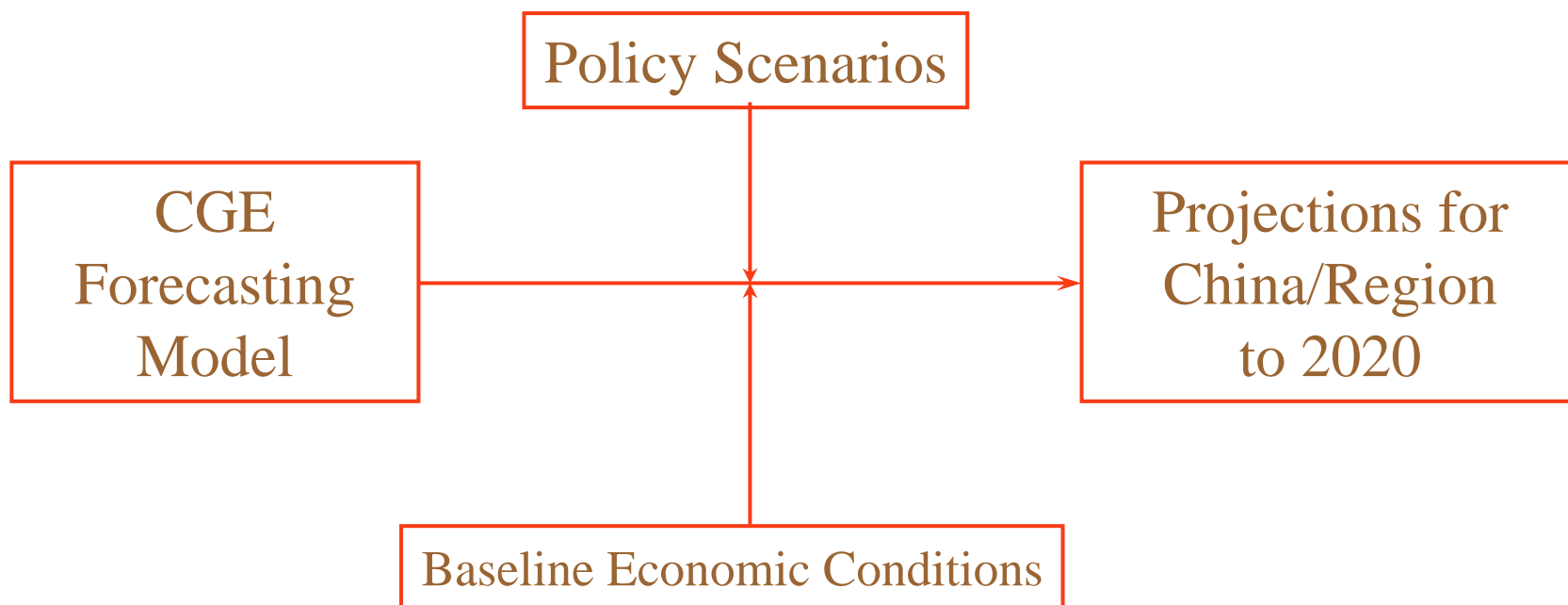
A Generic Modeling Facility



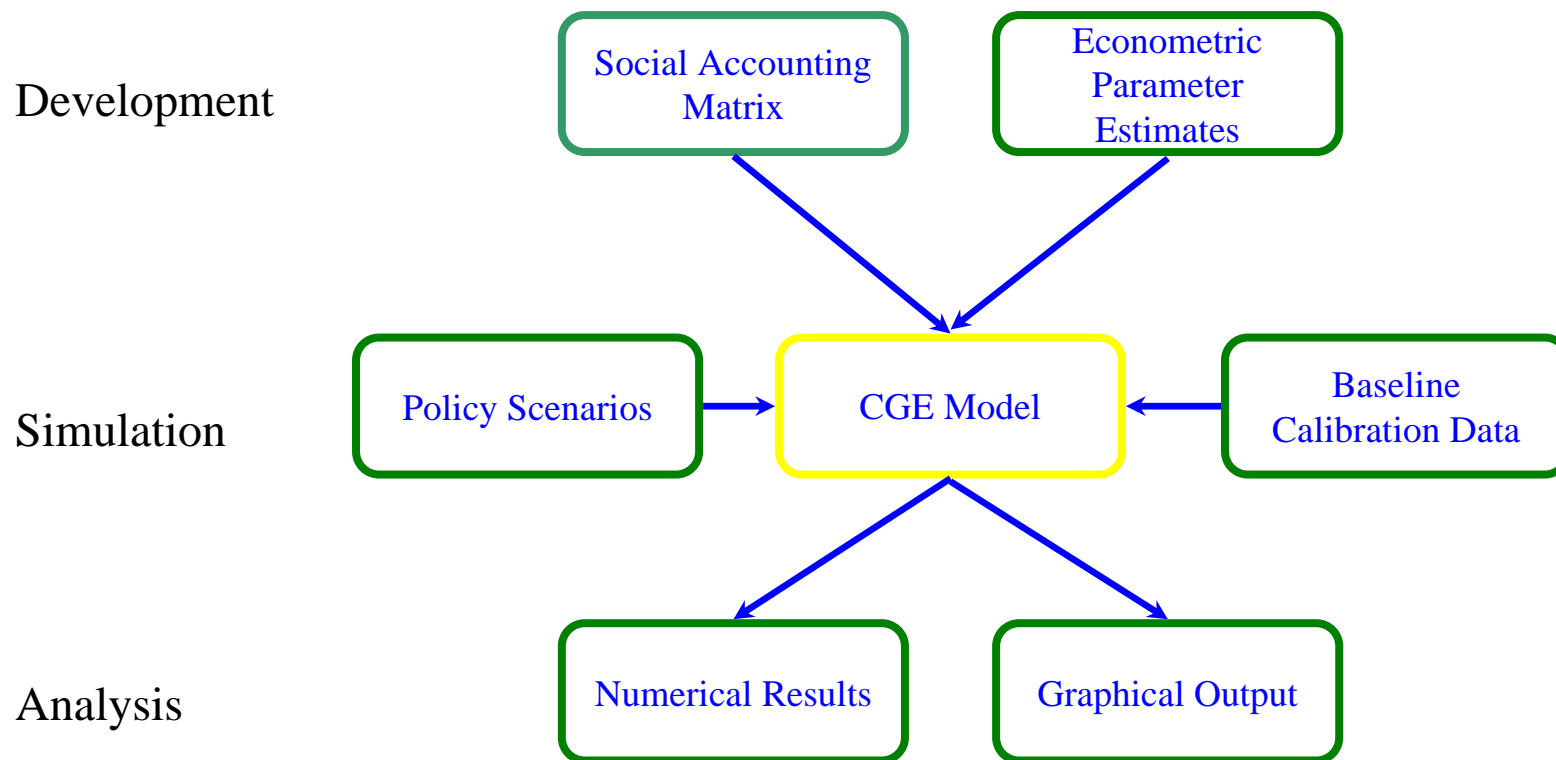
Analytical Economic Model

- Supply – Firm-level production technology with Leontief intermediate use.
- Demand-Domestic consumption functions by household and commodity type.
- Dynamic specification of factor growth and demographic transitions.
- Extensive accounting for transfer relationships between institutions (fiscal, capital flows, remittances, etc.).

Forward-looking Policy Analysis



Single Region Model: A Schematic View



Box Color Key to Software Implementation:

Green – Microsoft Excel

Yellow – GAMS



Multi-region Model Structure

based on the LINKAGE model by
Dominique van der Mensbrugghe



Model structure I—Overview

- Multi-sectoral and multi-regional
- Constant-returns-to-scale and perfect competition
- (Recursive) dynamic
- Single representative household per region
- Government and investment activities
- Linked bilateral trade flows.



Model structure II—Production

- Three production archetypes:
 - Crops (extensive vs. intensive)
 - Livestock (range-fed vs. ranch-fed)
 - Other (standard capital-labor substitution)
- Crop sectors include land, energy and agricultural chemicals as substitutable inputs
- Livestock includes land and feed as substitutable inputs
- Energy is a substitutable input in other sectors
- Fossil fuels also rely on sector-specific resource.

Model structure III—Factor markets

- Labor is perfectly mobile across sectors and there is a single market-clearing wage rate.
- ‘New’ capital is mobile across sectors, installed capital is partially mobile.
- All factor income accrues to single representative household
- Extended linear expenditure system for consumer demand

Model structure IV—Imports

- Aggregate demand is the sum of demand across industries, households, government and investment.
- Aggregate demand is composed of domestic and imported goods.
- Dual nested CES structure. Top nest allocates aggregate demand between domestic goods and an aggregate import bundle.
- Second nest allocates aggregate import demand across regions of origin.

Model structure V—Bilateral trade

- Output is modeled symmetrically with a dual nested CET structure. (Standard model assumes infinite transformation.)
- A single domestic price equilibrates demand and supply of the domestic good.
- Each trade node clears with a market-clearing price. The model therefore has $(N \times R) \cdot (R + 1)$ equilibrium goods prices.

Model structure VI—Trade wedges

- Each traded commodity has four prices—pre-FOB (export subsidy excluded), FOB, CIF, and post-CIF (tariff inclusive).
- FOB/CIF wedge modeled using international trade and transport services.
- Model also includes trade friction parameter (so-called iceberg parameter).

Model structure VII—Closure

- Taxes on intermediate inputs and final demand, factors of production, output, trade, and households.
- All taxes are exogenous save household direct taxes. The latter are endogenous to hit a given fiscal balance.
- Investment is savings (private, public and foreign) driven.
- Net foreign savings are exogenous.
- Model numéraire is OECD manufactured export price index.

Model structure VIII—Dynamics

- Labor force and population growth are exogenous.
- Capital stock is driven by past investments (and depreciation).
- Productivity is calibrated in baseline to achieve a GDP growth target.
- Productivity is typically exogenous (i.e. fixed) in policy scenarios, though some scenarios link sectoral productivity to export/output ratio.



Model structure IX—Variations

- Segmented labor markets (e.g. rural vs. urban) with or without migration.
- Minimum wage (with endogenous regime switch).
- Tariff rate quotas (TRQs).
- International capital mobility (driven by changes in relative rates of return).
- Increasing returns to scale with contestable markets



Proposed Project Timetables



Proposed Development Timetable

Each modeling exercise below includes SAM and other data development:

1. National research prototype
January, 2005
Essentially an update of the existing DRC model
2. Single region prototype
March, 2005
Initial version of the model and interface implemented with the national database.
3. Application to seven sample provinces
April, 2005
This will be done collaboratively, including joint work at UC Berkeley.



Proposed Dissemination Timetable

1. Regional dissemination workshops
May, 2005
2. National dissemination workshops
June, 2005
3. Documentation and Final Reporting