Modeling Demand

Short Course on CGE Modeling, United Nations ESCAP

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- In CGE models, final demand is derived from the utility maximization problem of a representative household (or in some cases households).

- This is a very familiar problem, but working through it carefully will provide us with a number of insights into how CGE-type models are constructed in practice.

- In this session we will review the basic consumer problem, and work through an implementation the model in GAMS.

- Finally, we will explore consumer behavior using counter-factual simulation.

1. The utility maximization problem
2. Building the model in GAMS
   - Setting up the model
   - Calibration
   - Simulation and testing

- Consider a consumer that has preferences satisfying the axioms of consumer choice, and where their preferences can be summarized by the utility function $U = U(c_1, c_2)$, where c_i is consumption of the ith good.
- The usual properties apply to the utility function.
- The consumer choice problem can be viewed as choosing c_1 and c_2 such that the consumer maximizes $U = U(c_1, c_2)$ subject to the budget constraint $Y = p_1 c_1 + p_2 c_2$, where Y is money income.
- We assume an internal solution for simplicity.

The Solution

- At an optimal solution, the consumer will spend all income, and the marginal utility per dollar spent on each good must equal the marginal utility of income.
- Another way of interpreting the optimal choice is that the money value of the utility generated by the last unit of each good purchased must equal its price.
- Solving explicitly for the optimal consumption bundles yields the Marshallian demand functions.

Example - Cobb-Douglas Utility

A common (and simple) way of describing the preferences is with a Cobb-Douglas function:

$$U = \alpha c_1^{\beta} c_2^{1-\beta}$$

where:

- α is an arbitrary scale factor (why is it arbitrary?)
- $0 < \beta < 1$ is a share parameter, reflecting the consumption share of good 1.

Now let us consider exactly how the problem can be expressed in the GAMS language, using Cobb-Douglas utility.

Our first task is to create a set which will index the goods:

```
SET I Goods /1,2/;
```

The keyword is followed by an arbitrary name for the set, I, an optional description, then the elements of the set enclosed in forward slashes and separated by commas. The names used for set elements are also arbitrary. The command is completed with a semicolon.

Next, we need to define labels for all of the parameters and exogenous variables in the model. We are also going to define labels for the initial values of our endogenous variables:

```
PARAMETERS
ALPHA        Shift parameter in utility
BETA(I)      Share parameters in utility
Y            Income
P(I)         Prices
U0           Initial utility level
C0(I)        Initial consumption levels;
```