

Tracing the Impacts of Food Assistance Programs on Agriculture and Consumers

A Computable General Equilibrium Model

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Introduction

In 1999, the U.S. Department of Agriculture spent approximately \$33 billion on domestic food and nutrition assistance programs, including the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), the Child Nutrition (School Lunch and Breakfast) programs, and the Food Stamp Program (fig. 1). These food assistance programs directly affect the health and well-being of recipient households. However, the impact of the programs does not stop there: food assistance programs have economic ramifications that extend beyond recipient households. Food assistance programs supplement household food budgets, triggering changes in household consumption expenditures and labor supply decisions. Likewise, because they are funded through taxes, food assistance programs affect nonrecipient household income, expenditures, and labor supply decisions. Eventually, changes in household expenditure patterns and labor supply decisions affect the general level and distribution of production and income throughout the economy. The level and distribution of economic activity in turn affects poverty levels and the need for food assistance programs.

The interaction between food assistance and the general economy depends on the economic interaction among households, industry, the government, and the rest of the world. This interaction involves a complex system of relationships and economic transactions. A Computable General Equilibrium (CGE) model describes this complex system. The Food Assistance CGE model developed at USDA's Economic Research Service (ERS) describes the U.S. economy, focusing on the relation-

ships between food assistance programs, households, and general economic activity. It provides a mechanism for examining the impact of food assistance programs on general economic activity, and vice versa.

In this report we describe the Food Assistance CGE model and discuss the contributions an economywide framework makes to the analysis of food assistance programs. We also report on two simulation experiments, both of which demonstrate the strength of the Food Assistance CGE model in analyzing the impact of food assistance programs on the general economy. The first simulation experiment traces the impact of a reduction in Food Stamp Program funding. The second experiment simulates the conversion of food stamp benefits from vouchers to cash.

What Is a CGE Model?

A single-country CGE model is a set of equations describing the economic interaction between households, producers, the government, and the rest of the world. The circular flow diagram (fig. 2) describes the core of a CGE model. It depicts the market transaction between the two primary sets of actors in the economy: households and firms. The core circular flow diagram illustrates that, as owners of factors, households supply labor and capital services to firms, while receiving payment from them in the form of wages and capital income. Households also purchase goods and services from firms, which, in return, receive payment.

The market transaction between households and firms is driven by the desire of households to maximize utility

and of firms to maximize profits. Households maximize utility, a measure of their well-being, through the purchase of an array of goods and services (given their budget constraints) and the enjoyment of leisure (given the constraint on the total amount of time available for work and leisure). Firms maximize profits from the sale of goods and services (given their production technology). The exact forms of these behavioral functions (utility and profit maximization) are taken from the economic literature and incorporated into the CGE model.

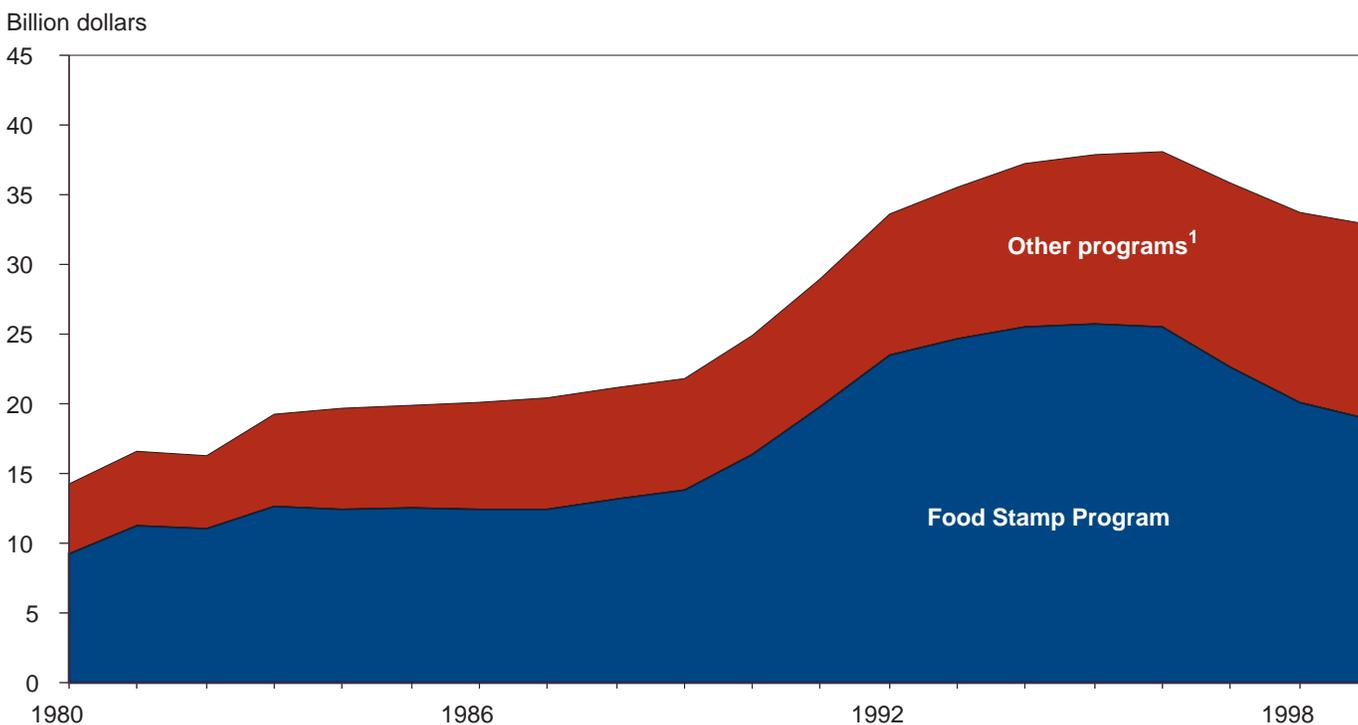
The core circular flow diagram also includes a description of the interaction among firms. It illustrates that firms purchase inputs for their production processes from other firms. Input-output tables describe these inter-firm transactions or linkages. Because of these linkages, a change in household consumption that directly affects production in one set of industries leads to an indirect change in production in another set of industries (that is, in those industries supplying inputs to the directly affected industries).

Figure 3 adds three new actors to the core circular flow diagram: government, rest of world (ROW), and a capital account. The government collects taxes, purchases goods and services from firms, and disburses transfers to

households and producers. The ROW supplies imports to the United States and purchases exports from the United States. The capital account describes the market for loanable funds. The demand for loanable funds (investment) is driven by the supply of loanable funds (savings). Total savings are from households, businesses, government surplus or deficit, and net capital inflows from the ROW. Business savings are from depreciation of capital stocks and retained earnings. Investment is divided between changes in inventory and the purchase of new capital stocks by industry and government (fixed investment). New capital stocks are produced through the purchase of capital goods and construction services.

A complete CGE model is a set of equations that describes the circular flow illustrated in figure 3. These equations describe the economic transactions of households, firms, government, the rest of the world, and capital accounts in the markets for factors of production, commodities, exports and imports, and loanable funds. The structural parameters for the equations come from a variety of sources. “Policy” parameters, such as tax rates and government assistance-program rules, are determined by government policy. “Share” parameters, such as household expenditure shares, savings rates, and

Figure 1
USDA outlays for food assistance programs, fiscal 1980-99



¹Include child nutrition programs, WIC, food donation programs, and administrative costs.

Source: ERS Website, <http://www.ers.usda.gov/briefing/foodnutritionassistance/gallery/outlays.htm>

Figure 2
The basic CGE model: The circular flow

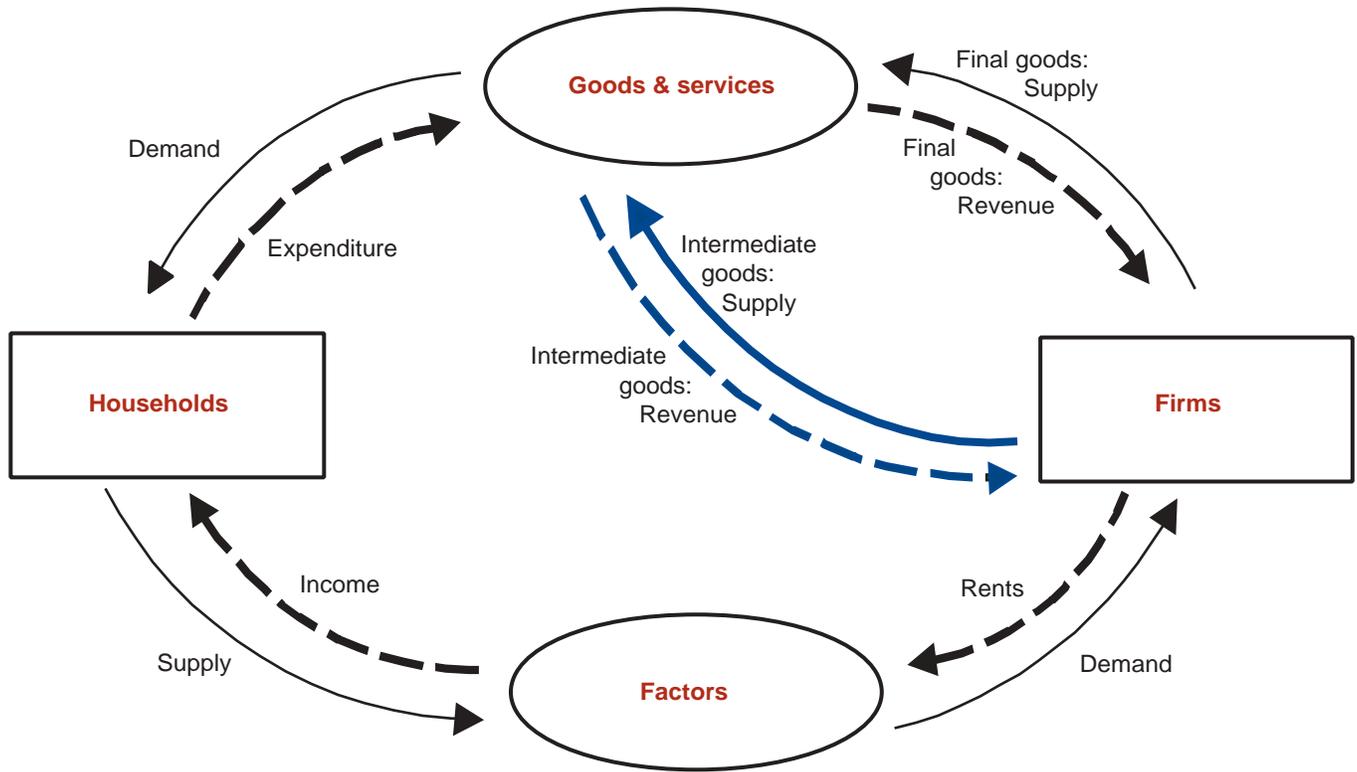
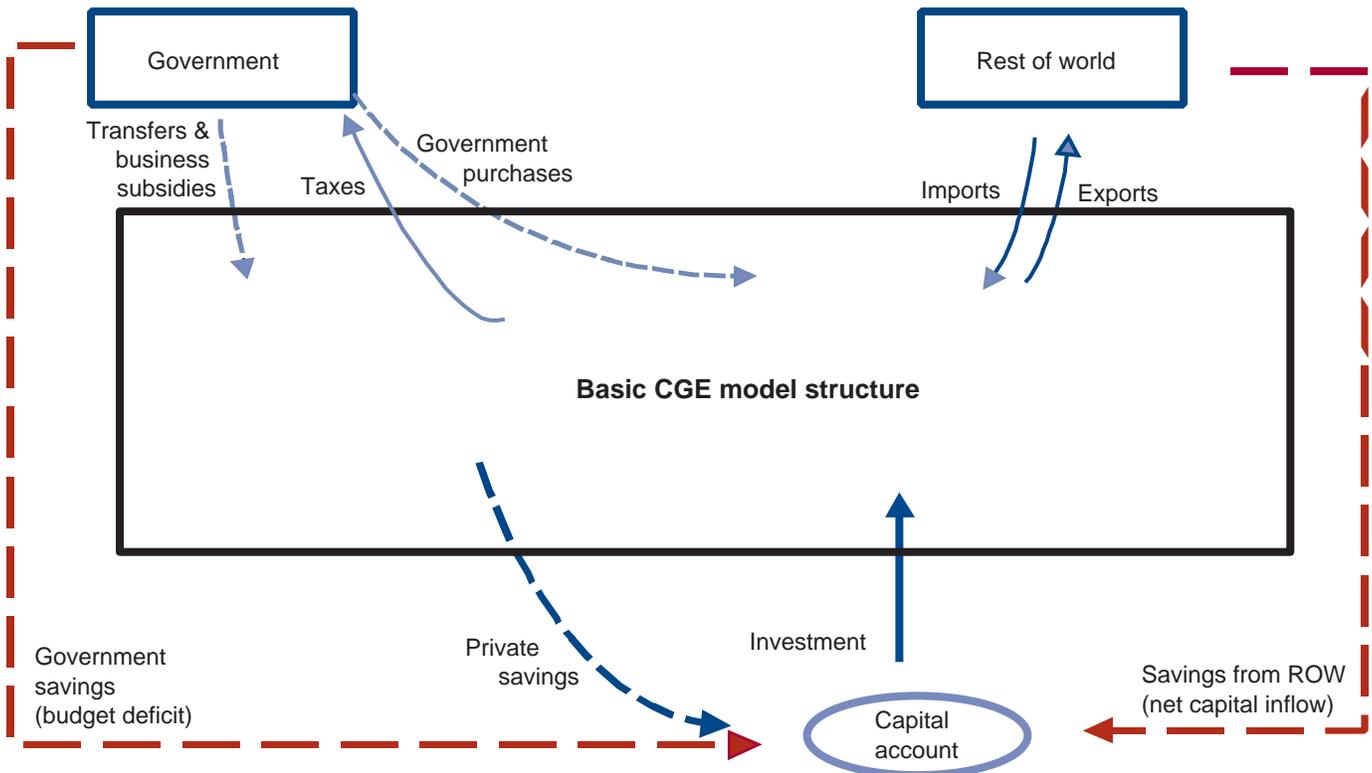


Figure 3
The full CGE model: Additional institutions



producer input shares, are derived from microsurvey data and data from national accounts. “Elasticity” parameters, such as those for labor supply, household consumption, and production, characterize the behavior of households and producers in response to changes in prices (wages) or income. Values for the elasticity parameters come from economic and social science research.

A complete CGE model also includes a number of closure rules. Closure rules place aggregate constraints on the economic activity simulated in the CGE model. They pertain to how the three major macroeconomic accounts (government, trade, and capital accounts) adjust to regain equilibrium in response to changes in economic activity. The accounting identity for the government account is

$$(1) \text{ Revenue} - \text{Expenditure} = \text{Surplus} \\ (\text{or Deficit if negative}).$$

For the trade account, which pertains to the relationship between the United States and the rest of the world, the identity is

$$(2) \text{ Imports} - \text{Exports} = \text{Net Value} \\ \text{of Capital Income from ROW.}$$

The identity for the capital account is

$$(3) \text{ Savings} = \text{Investment.}$$

The macroaccounting identities must hold true under all circumstances for any macroeconomic or economy-wide model (Robinson, 1989; Arora and Dua, 1993). Closure rules establish the mechanisms for keeping the three major macroaccounts in balance after a change in economic activity. These rules have an important effect on the way a policy change works through the economy. For example, if closure rules fix both real government expenditures and the government deficit, then a policy change that increases government revenue will necessarily result in lower taxes.

Once the CGE model is fully specified, it provides a mechanism for measuring the potential economywide effects of a hypothetical change in economic policy or other shocks to the economy. Simulating a policy change in a CGE model is a “what if” comparison of two equilibrium states of the economy. The CGE model calculates the changes to the initial equilibrium arising after an economic shock or policy change has been incorporated into the economy and a new equilibrium has been established (in equilibrium, prices equate demand and supply for all markets, including labor markets).

In the next section, we present the characteristics of the ERS Food Assistance CGE model and describe the strengths of this model for examining the interactions between food assistance programs and the general economy.

Building a CGE Model Focusing on Food Assistance: Characteristics and Innovations of the Food Assistance CGE Model

A CGE model can provide a framework for examining the impact of food assistance programs on the economy and the impact of economic change on the need for food assistance. Despite the contribution that a CGE model can make to this analysis, few CGE models have focused on food assistance or, for that matter, on any aspect of the welfare assistance system. One example of a CGE model that does examine welfare transfers was developed by Ballard and Goddeeris (1999) to examine Medicare and health care issues. Another example is the ERS CGE model used to examine the economywide impact of reduced Food Stamp Program funding (Smallwood et al., 1995a, 1995b, and Kuhn et al., 1996). This early ERS model was derived from a model developed by Robinson et al. (1990).

The Food Assistance CGE model was constructed using a modeling style similar to the one developed by Robinson et al.¹ The base model presents a snapshot view of the U.S. economy in 1996. We chose 1996 for the base for two reasons. First, we wanted to establish a pre-welfare-reform base model in order to be able to conduct simulation experiments examining the impact of welfare reform, and 1996 is the last year of official pre-welfare-reform data. Second, it is a lengthy procedure to establish the database for a CGE model. At the time this project began (1998), 1996 was the last year of complete data available.

The Food Assistance CGE model includes a number of specifications that make it particularly suitable for examining the interaction between food assistance programs and general economic activity. The specifications incorporated into the model are as follows:

- Households are categorized by demographic variables and income to better capture the impact of changes in food assistance programs and taxes.

¹For a technical appendix detailing the construction of the Food Assistance CGE model, contact Ken Hanson at khanson@ers.usda.gov.