Appendix 1-1

A CGE Model

The computable general equilibrium (CGE) model used in this chapter is composed of 16 countries or regions linked by trade. There are nine primary agriculture sectors and six processed food sectors; the other sectors in the economy are broadly defined as natural resources, manufacturing, and services.[1] The model data are from the Global Trade Analysis Project (GTAP) version 5, August 2002 update. The model base year is 1997, with results adjusted to 2002 dollars using the U.S. gross domestic product (GDP) deflator (U.S. OMB, 2003).

The model follows the standard neoclassical specification of trade-focused CGE models. Each sector produces a composite commodity that can be transformed according to a constant elasticity of transformation (CET) function into a commodity sold on the domestic market or into an export. Output is produced according to a constant elasticity of substitution (CES) production function in primary factors, and fixed input-output coefficients for intermediate inputs. The model simulates a market economy, with prices and quantities assumed to adjust to clear markets. All transactions in the circular flow of income are captured. Each country model traces the flow of income (starting with factor payments) from producers to household, government, and investors, and finally back to demand for goods in product markets.

Consumption, intermediate demand, government, and investment are the four components of domestic demand. Consumer demand is based on Cobb-Douglas utility functions, generating fixed expenditure shares. Households pay income taxes to the government and save a fixed proportion of their income. Intermediate demand is given by fixed input-output coefficients. Real government demand and real investment are fixed exogenously. Import demand is described by almost-ideal demand system (AIDS) import demand functions.

The model includes three primary factors and associated factor markets: labor, capital, and agricultural land. Land is disaggregated into two types-cereals and oilseeds, and all other land. Full employment for all categories is assumed, and aggregate factor supplies are fixed. In the experiments reported here, we assume that all factors are fully mobile. However, land markets are segmented. Land used in cereals and oilseeds cannot be substituted for land used to produce other crops.

There are three key macro balances in each country model: the government deficit, aggregate investment and savings, and the balance of trade. Government savings are the difference between revenue and spending, with real spending fixed exogenously, and revenue depending on a variety of tax instruments. The government deficit is therefore determined endogenously. Real investment is set exogenously and aggregate private savings are determined residually to achieve the nominal savings-investment balance. The balance of trade for each country (and hence foreign savings) is set exogenously and valued in world prices. Each model solves for the relative domestic prices and factor returns that clear the factor and product markets, and for an equilibrium real exchange rate which brings aggregate export supply and import demand into balance, given the exogenous aggregate trade balance of each country.

The model incorporates budgetary expenditure for 2001 domestic farm programs in the European Union, Japan, Canada and Mexico from the OECD Producer Support Estimate data-

[1] We use the standard global CGE model described in Lewis, Robinson, and Thierfelder (2003).

base for 2001 (OECD, 2002). Data for U.S. farm programs are the annual average of July 2002 projected expenditures under the Farm Security and Rural Investment Act. The model incorporates endogenous farm programs, where applicable, following Burfisher, et al. (2002). In the U.S., loan deficiency payments support floor prices for grains and oilseeds, with payments to farmers increasing when market prices decline below the loan rate. In the EU and Canada, export subsidies are used to clear excess domestic supplies resulting from the EU's fixed intervention prices for grain, oilseeds and livestock, and Canada's price management program for dairy.

Other farm payments are exogenous income transfers to households. These include direct payments and countercyclical payments in the United States, Canada (National Income Stabilization Accounts or NISA payments) and Mexico (PROCAMPO, the Farmers Direct Support Program). Households spend these transfers on consumption, savings and taxes according to the aggregate average propensities described in national accounts data.

The model also includes fixed, per unit ad valorem subsidies to inputs and output. Since the production technology in the model uses fixed input-output coefficients for intermediate inputs, a subsidy to intermediate goods operates like an output subsidy. Subsidies on capital inputs in agriculture lower the costs of capital and attract capital out of non-agricultural sectors.

The model uses data on tariffs and tariff equivalents from various sources. MFN agricultural tariffs for all countries are from the Agriculture Market Access Database (AMAD). AMAD provides tariffs on an ad-valorem basis, including the ad valorem equivalents of specific tariffs. Tariff rate quotas are modeled as ad valorem tariffs using the average of above and below quota tariff rates. AMAD tariffs are aggregated to the GTAP categories using import weights.

This chapter develops a preferential agricultural tariff database for U.S. GSP, ATPA and Caribbean Basin Economic Recovery Act (CBERA) programs, and for Canadian GPT and Caribbean preferences. Preferential tariff data for the U.S. and Canada are from their tariff schedules for 2000, aggregated to GTAP categories using simple averages. In MERCOSUR and Chilean bilateral trade pacts, agricultural tariffs in the model are assumed to be zero, although MERCOSUR, the Andean Community, and other preferential agreements in the Western Hemisphere allow some exceptions to their common external tariffs and zero internal tariffs (Stout and Ugaz-Pereda, 1998). This assumption may therefore lead to an underestimate of the FTAA's effects.

Following de Melo and Robinson (1992), the model incorporates links between the expansion of exports and imports of capital goods between developing and developed countries and technological spillovers that stimulate factor productivity growth in the developing country. Trade is assumed to have a role in stimulating productivity growth through channels that include technology differences among countries, knowledge spillovers, the transmission of ideas, and market expansion that leads to increasing returns to scale and/or Smithian economies of "fine specialization" (as opposed to Ricardian differences in factor proportions). A sectoral export externality links export growth in manufactures to an increase in total factor productivity (TFP) within the sector. An import externality links imports of manufactures with sectoral TFP. Finally, an increase in aggregate exports leads to economy-wide increases in the efficiency of capital inputs. Note, however, the conditions that must be in place for productivity growth to be accelerated are likely to include not only tariff reform, but also factors such as institutional reforms that facilitate investment and trade (Rodrick et al., 2002).

Appendix Table 1-1 A—Change in U.S. agricultural exports due to an FTAA ($U.S. billion)

	Canada	Mexico	C. America & Caribbean	Andean	Argentina	Brazil	Chile	Rest S. America	Total FTAA	Rest of world	World
Rice, raw	0	-2	102	12	0	0	0	0	112	-14	98
Wheat	0	2	22	45	0	0	0	1	70	-11	59
Other grains	-8	-27	56	60	12	1	3	0	98	-7	91
Horticulture	-7	1	34	22	3	10	1	0	65	-30	35
Oilseeds	1	-9	14	29	32	30	1	0	98	-21	77
Other crops	-3	0	66	32	13	21	1	0	129	-39	90
Livestock	-3	-2	19	4	4	3	1	0	26	-33	-7
Meat	-8	-1	77	25	2	4	0	2	102	-52	50
Oils and fats	0	-3	64	67	1	3	2	1	135	-10	125
Dairy prods.	203	-2	25	10	2	3	0	1	242	-10	232
Processed foods	-16	1	171	57	34	45	8	25	325	-110	215
Total agric.	159	-43	649	363	104	121	18	31	1401	-336	1,065

Source: Economic Research Service, USDA.

Appendix Table 1-1 B—Change in U.S. agricultural imports due to an FTAA ($U.S. million)

	Canada	Mexico	C. America & Caribbean	Andean	Argentina	Brazil	Chile	Rest S. America	Total FTAA	Rest of world	World
Rice, raw	0	0	0	0	0	0	0	0	0	8	8
Wheat	1	0	0	0	0	0	0	0	1	0	1
Other grains	34	0	0	0	1	0	3	0	38	4	43
Horticulture	0	5	14	1	1	10	22	0	54	1	55
Oilseeds	0	0	1	0	0	3	0	0	4	0	4
Other crops	1	3	15	5	1	24	2	0	53	2	55
Livestock	27	3	0	0	1	1	0	0	33	13	46
Meat	9	0	1	0	0	2	0	1	13	9	22
Oils and fats	3	0	0	0	0	1	0	0	4	4	9
Dairy prods.	0	0	1	0	4	0	0	1	7	7	13
Processed foods	10	3	279	164	47	91	75	10	679	39	718
Total agric.	86	15	311	171	56	133	102	12	886	88	974

Source: Economic Research Service, USDA.

Appendix Table 1-1 C—Average agricultural tariff rates of FTAA members on imports from Western Hemisphere, by country and commodity

	U.S.	Canada	Mexico	Central America	Andean	Argentina	Brazil	Chile	Rest. S. World
Rice	4.2	0.3	9.0	30.2	16.0	6.8	9.8	3.8	8.5
Wheat	0.9	41.9	15.4	0.6	6.8	2.0	2.3	5.1	0.7
Other grains	0.2	4.4	17.9	4.7	9.4	2.9	3.6	6.5	1.5
Fruits & vegetables	3.8	1.5	13.3	15.8	14.7	9.0	9.0	8.6	10.4
Oil seeds	14.4	0.0	1.5	2.9	6.3	3.7	4.4	7.8	1.2
Raw sugar	0.1	0.0	5.7	1.7	0.4	0.7	1.3	2.1	0.0
Other crops	17.3	2.0	7.6	8.3	8.8	7.7	6.9	8.1	7.0
Livestock	0.6	11.6	7.8	10.2	8.2	4.9	5.8	8.6	5.0
Meat manufacturing	3.6	41.6	40.3	16.7	16.5	9.7	10.5	8.7	11.7
Oils & fats	3.6	4.5	15.7	9.5	15.3	7.3	8.6	7.6	8.9
Dairy manufacturing	34.4	202.4	33.5	23.9	16.7	14.4	15.9	4.8	22.5
Processed sugar	43.6	2.7	1.4	12.5	10.5	9.6	12.0	8.5	10.7
Processed foods	8.2	21.0	16.1	15.2	16.5	13.9	14.9	9.1	15.2
Manufacturing	3.4	4.2	8.9	9.3	11.7	11.0	11.0	8.9	10.9
Average agric. tariff	10.4	25.7	14.2	11.7	11.3	7.1	8.1	6.8	7.9
Ratio ag. to mfg. tariff	3.1	6.2	1.6	1.3	1.0	0.6	0.7	0.8	0.7

Sources: AMAD, U.S. and Canadian 2000 harmonized tariff schedules. Tariff rates include bilateral preferential tariff rates.