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AGRICULTURAL POLICIES AND MIGRATION IN A U.S.-MEXICO FREE TRADE AREA: A COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

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Abstract

A U.S.–Mexico agreement to form a free trade area (FTA) is analyzed using an 11-sector, three-country, computable general equilibrium (CGE) model that explicitly models farm programs and labor migration. The model also uses a flexible functional form for specifying sectoral import demand functions, which is an empirical improvement over earlier specifications using a constant elasticity of substitution (CES) function. The model identifies the trade-offs among bilateral trade growth, labor migration, and agricultural program expenditures under alternative FTA scenarios. Trade liberalization in agriculture greatly increases rural-urban migration within Mexico and migration from Mexico to the U.S. Migration is reduced if Mexico grows relative to the U.S. and also if Mexico retains farm support programs. However, the more support that is provided to the Mexican agricultural sector, the smaller is bilateral trade growth.

1. Introduction

In June 1990, Mexican President Salinas de Gortari and President Bush agreed to negotiate the establishment of a free trade area (FTA) between their two countries. An agreement between the U.S. and Mexico will complement the U.S.–Canada free trade agreement, which went into effect in January 1988, creating a North American free trade area (or NAFTA). The trade block will not, in fact, be a "free trade" area, in which all trade barriers among member countries are removed. Assuming that U.S.–Mexico negotiations follow the precedent set in the U.S.–Canada agreement, tariffs will fall to zero over intervals negotiated sector by sector, but liberalization of nontariff barriers will be selective. U.S.–Canadian agricultural trade, although substantially liberalized by the gradual elimination of tariffs, was liberalized less than other sectors. Domestic agricultural programs in both countries, and the nontariff barriers used to support them, remained essentially intact [Goodloe and Link (1991)].

Drawing on experience with the U.S.–Canada FTA, realistic analysis of a U.S.–Mexico FTA should consider alternative treatments of agricultural trade, including partial liberalization scenarios and scenarios for retention or restructuring of domestic agricultural programs. This article provides an analysis of the U.S.–Mexico free trade agreement using a three-country, 11-sector, computable general equilibrium (CGE) model. Our "FTA–CGE" model focuses on three modeling issues which are especially important in analyzing a U.S.–Mexico FTA. First is the explicit modeling of agricultural policies in the two countries in order to capture the linkages, particularly in Mexico, between bilateral agricultural trade barriers and social policy objectives. Mexican agricultural policies that are modeled include tariffs; import quotas for beans, corn,and other grains; input subsidies to producers and processors; and low income tortilla subsidies to consumers. The tariff equivalents of quotas are determined endogenously and are not treated as fixed *ad valorem* wedges. U.S. policies included in the model are deficiency payments and the Export Enhancement Program (EEP). Since government agricultural program expenditures on subsidies for farmers and processors are included in the model, one can analyze the fiscal impacts of changes in agricultural output and trade.

A second issue is labor migration, and the effect that liberalization of trade in agriculture in particular is likely to have in stimulating rural-urban migration in Mexico and migration from Mexico to the U.S. rural and urban labor markets. Migration issues are not explicitly part of the FTA negotiations. However, labor migration is sensitive to relative economic conditions in the two countries, and to the mix of trade and domestic policies in Mexican agriculture. The FTA–CGE model includes migration equations and the results indicate the importance of migration in different FTA scenarios.

The third modeling issue concerns the specification of import demand. The standard approach in trade-focused CGE models has been to adopt the Armington assumption of product differentiation coupled with use of a constant elasticity of substitution (CES) import aggregation function. The CES specification has been criticized because it constrains import demand equations to have an expenditure elasticity of one, and also implies that every country has market power in its export markets.[1] Brown (1987) shows that these assumptions have led earlier multi-country trade models to generate unrealistically large terms-of-trade effects under trade-liberalization scenarios. The FTA–CGE model employs the Almost Ideal Demand System (AIDS) to describe import demand, a flexible functional form

[1]The CES formulation has also been criticized on econometric grounds [Alston *et al.* (1990)].

which allows non-unitary expenditure elasticities and yields more realistic empirical results, while retaining the essential property of imperfect substitutability.

In sections 2 to 5, we present the core CGE model and describe how we model import demand, migration, and agricultural programs. In section 6, we present model simulations. Our analysis with the FTA–CGE model focuses on the trade-offs between bilateral export growth, migration, and farm program expenditures. Trade liberalization, in which both tariffs and quotas are removed, results in significant bilateral export growth but also large Mexican migration flows. We estimate how much Mexican growth is required to absorb the increased rural migration without increased migration to the U.S. We show that migration can be reduced by simultaneously lowering trade barriers and increasing agricultural program expenditures in Mexico to support rural employment. Our results indicate that it is feasible to design transition policies so that Mexico can adjust gradually to the structural changes induced by trade liberalization, and so reap the benefits over time from the creation of an FTA without a precipitous shock to the labor markets in both countries from a dramatic increase in migration.

2. Core Three–Country CGE Model

The FTA–CGE model is an 11-sector, three-country, computable general equilibrium model composed of two single-country CGE models linked through trade and migration flows, plus a set of export-demand and import-supply equations to represent the rest of the world. The model is an extension of earlier CGE modeling undertaken at the USDA, which began with the single-country, USDA/ERS CGE model, designed to provide a framework for analyzing the effects of changes in agricultural policies and exogenous shocks on U.S.

agriculture [Robinson, Kilkenny, and Hanson (1990)]. The USDA/CGE model was extended by Kilkenny and Robinson (1988, 1990), and Kilkenny (1991) to model U.S. agricultural programs explicitly. The specification of import demand with the AIDS function was incorporated into the USDA/ERS CGE model by Hanson, Robinson, and Tokarick (1989). The multi-country application of the USDA/CGE was initially developed by Hinojosa and Robinson (1991), who also used the AIDS import-demand function. The FTA–CGE model extends the Hinojosa and Robinson model with an explicit modeling of domestic farm programs in both the U.S. and Mexico.

Table 1 and Figure 1 present aggregate data on the two economies and their trade, which are used to generate the benchmark or base solution of the FTA–CGE model. Mexico is a much smaller and poorer economy than the U.S. The gap between Mexico and the U.S. is wider than that between Spain and Portugal and the European Community.[2] Mexico has a higher trade share than the U.S. and is very dependent on the U.S. market, which accounts for 75 percent of Mexican exports. Most U.S. trade, on the other hand, is with the rest of the world. While Mexico is a significant market for the U.S., it takes only about 3 percent of total U.S. exports. Mexico, typical of a developing country, has a much larger share of its labor force in agriculture: 13.1 percent compared to 1.4 percent.

Table 2 shows the sectoral structure of GDP, employment, and trade for the two countries, as well as existing trade barriers. The model's 11 sectors include four farm and one food processing sector. The corn sector refers to corn used for human consumption. In Mexico, this includes white corn, the small proportion of yellow corn used for food, and No.

[2]The gap remains large, even using purchasing power parity comparisons such as those provided by the United Nations/World Bank International Comparisons Project (ICP). See Kravis and Summers (1982) for the latest comparative figures that include Mexico and Summers and Heston (1991) for the latest update on the ICP methodology.

Table 1 — Comparative Aggregate Data, U.S. and Mexico

	Mexico	U.S.
GDP ($US billions, 1988)	176.7	4,847.4
Per Capita GNP ($US, 1988)	1,760	19,990
<u>Trade flows (percent of GDP)</u>		
Total exports	13.6	7.1
Exports to partner	10.1	0.2
Total imports	12.0	10.1
Imports from partner	6.3	0.4
<u>Employment structure (percent)</u>		
Rural labor	13.1	1.4
Urban unskilled labor	13.6	17.3
Urban skilled labor	38.8	48.6
White collar workers	34.6	32.7
Total	100.0	100.0
Population, ages 15-64 (millions)	49	162
Total population (millions)	84	246

Sources:
GDP, per capita GNP, and population data refer to 1988 and come from World Bank, World Development Report 1990. All other data come from U.S. and Mexican social accounting matrices developed by the Economic Research Service, U.S. Department of Agriculture (USDA/ERS).

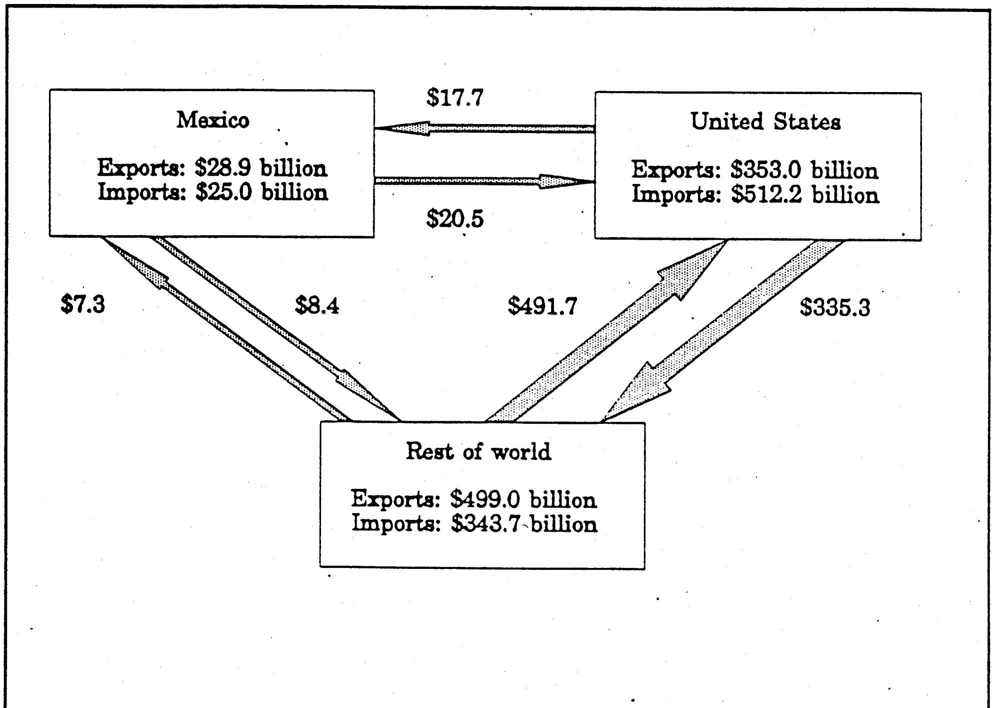

Figure 1: U.S.-Mexico Trade, Base Run

Table 2 — Sectoral Structure of U.S. and Mexican Economies, Base Solution

	Sectoral shares (percent) in:									
	GDP		Employment		Imports		Exports		Bilateral import barriers	
Commodity	U.S.	Mexico	U.S.	Mexico	U.S.	Mexico	U.S.	Mexico	U.S.	Mexico
Food corn	0.0%	0.6%	0.0%	6.3%	0.0%	1.2%	0.3%	0.0%	0.0%	55.0%
Program crops	0.5%	1.0%	0.4%	5.5%	0.0%	3.3%	3.3%	0.1%	0.0%	23.1%
Fruits/vegetables	0.2%	0.9%	0.4%	3.1%	0.4%	0.1%	0.4%	3.0%	13.2%	12.5%
Other agriculture	0.8%	4.6%	1.4%	8.9%	1.5%	1.3%	0.4%	3.8%	0.6%	8.9%
Food processing	1.7%	7.6%	1.5%	2.5%	2.3%	5.2%	2.9%	3.7%	7.0%	8.2%
Other light mfg.	4.5%	5.3%	5.1%	2.7%	16.2%	4.3%	7.0%	6.0%	4.7%	8.1%
Oil and refining	2.2%	2.5%	0.5%	0.5%	11.6%	5.0%	2.6%	10.2%	1.5%	8.8%
Intermediates	5.6%	7.9%	4.5%	3.2%	12.7%	16.7%	13.9%	12.3%	2.2%	8.0%
Consumer durables	1.8%	2.6%	1.7%	0.8%	28.4%	14.8%	10.0%	18.6%	1.8%	12.0%
Capital Goods	5.2%	3.5%	4.9%	2.2%	25.0%	26.4%	31.7%	12.0%	3.6%	12.7%
Services	77.4%	63.6%	79.6%	64.4%	1.8%	21.6%	27.5%	30.3%	0.1%	0.0%

Notes:
Bilateral import barriers are the combined rate of trade-weighted tariffs and tariff equivalents of quotas on trade between Mexico and the U.S. Percent composition columns sum to 100%, except for rounding error.

Sources:
U.S. and Mexican social accounting matrices, USDA/ERS. 1987 for U.S. and 1988 for Mexico.

2 yellow corn imports from the U.S., which are assumed to enter food use. In the U.S., the corn sector refers to No. 2 yellow corn, which exports to Mexico. The composition of the program crops sector corresponds to the other crops eligible for U.S. deficiency payments — feed corn, food grains, soybeans, and cotton. Other agriculture includes livestock, poultry, forestry and fishery, and other miscellaneous agriculture. The fruits and vegetables sector in Mexico includes beans, a major food crop.

There are six primary factors, including four labor types, capital, and agricultural land. The four labor types are rural, urban unskilled, urban skilled, and professional. The base year for Mexico is mostly 1988.[3] The U.S. uses a 1987 base year because of the severe contraction of agricultural output following the 1988 drought. Bilateral trade flows are from 1988. Because of the volatility in U.S. 1987-88 agricultural output, the model follows Adams and Higgs (1986) and Hertel (1990) in the use of a "synthetic" base year for the U.S., imposing 1988 U.S.–Mexican bilateral trade flows on a 1987 base U.S. economy. This approach has the advantage of achieving a more representative U.S. base year, with minimal adjustment to the data.[4] Tariffs and tariff equivalents of quotas are 1988 trade-weighted rates.

The core model follows the standard theoretical specification of trade-focused CGE models.[5] Each sector produces a composite commodity that can be transformed according

[3]The data base is documented in Burfisher, Hinojosa, Thierfelder, and Hanson (1991). Some of the Mexican agricultural support data refer to 1989. The Mexican agricultural programs have changed dramatically over the past few years, and it is important to use the latest data available.

[4]A comparison of 1987 and 1988 U.S.-Mexico trade shows that Mexican farm imports increased in 1988 as U.S. agricultural output fell. Use of a 1987/88 split year for the U.S. moderates the importance of Mexico in U.S. agricultural trade relative to 1988.

[5]See the appendix for a complete equation listing. Robinson (1989) and de Melo (1988) survey single-country, trade-focused, CGE models. The FTA-CGE model is implemented using the GAMS software, which is described in Brooke, Kendrick, and Meeraus (1988).

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 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 households, 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.

In factor markets, full employment for all labor categories is assumed. Aggregate supplies are set exogenously. The model can incorporate different assumptions about factor mobility. In the experiments reported here, we assume that agricultural land is immobile among crops, but that all other factors are mobile, including capital.[6] The results should be seen as reflecting adjustment in the long-run, with capital able to leave the agricultural sectors.

There are three key macro balances in each country model: the government deficit, aggregate investment and savings, and the balance of trade. Government savings is the difference between revenue and spending, with real spending fixed exogenously but revenue

[6]Note, however, that labor markets are segmented. Rural labor does not work in the industrial sectors, and urban labor does not work in agriculture. These labor markets are linked through separate migration equations.