Welfare Effects of Agricultural Trading Blocs: The Simulation of a North American Customs Union

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Agricultural trade liberalization among the three North American Free Trade Agreement (NAFTA) signatories is modeled using a political preference function. The model distinguishes among Canada, Mexico, the United States, and a politically passive rest of the world. Through the use of intracountry compensation, the analysis shows that, from an agricultural perspective, economic integration is in the best interest of the group as a whole, although not in the best interest of individual countries. More specifically, of the agricultural production sectors, Canadian dairy, Mexican corn, and U.S. beef producers suffer the greatest losses from the formation of a North American customs union.

Key words: agricultural trade, customs union, NAFTA

Introduction

The period leading up to the passage of the North American Free Trade Agreement (NAFTA) was filled with controversy as to NAFTA's impact on the three signatory countries. Opinions on this subject ranged from Ross Perot's criticism that the agreement would result in a "giant sucking sound" as U.S. jobs move south, to views that NAFTA would serve as a catalyst for economic prosperity in North America (Racz). Regardless of the outcome of this debate, the impact on domestic prices of removing trade barriers among Canada, Mexico, and the United States will have welfare consequences throughout the economies of the three countries.

Given the levels of agricultural protection prior to NAFTA, it is clear that the agreement will influence agricultural trade in North America (Barichello et al.; Grennes et al.). In particular, projections indicated that North American trade liberalization would expand U.S. agricultural exports, with grains, oilseeds, and meats accounting for the majority of the increase (Claffey and Harwood; *AgExporter* staff). The initial results of NAFTA's implementation show that agricultural trade rose significantly during the first year, while the second year was affected by the peso devaluation and resulting economic slump (Goodloe).

Various approaches have been taken in examining the effects of NAFTA on the agricultural sector. For example, researchers have analyzed NAFTA's impact on specific commodities such as sugar (Devadoss, Kropf, and Wahl), fruits and vegetables (Goddard), and red meat (Veeman). These analyses provide specific commodity-related

information, but do not account for many agricultural cross-effects resulting from the agreement. In contrast, broader examinations of NAFTA have been conducted using a computable general equilibrium model (Robinson, Burfisher, and Thierfelder). Models of this type often use a level of aggregation that does not indicate specific agricultural commodity effects. To obtain information relevant to policy makers, analyses must be conducted that account for cross-effects and offer some specificity as to the gains and losses to producers, consumers, and the government as a result of the agreement.

With NAFTA, gains and losses will occur in various segments of the agricultural sectors in all three countries. The primary objective of this research is to quantify the welfare effects of a North American agricultural free trade agreement through the simulation of a North American customs union. To accomplish this objective, a political preference function (PPF) composed of specific agricultural production sectors, a consumption sector, and a government budget sector is used to simulate economic integration among the NAFTA countries.

Theoretical Framework

This analysis uses a multicommodity model of agriculture. N commodities are produced, consumed, and traded by K main countries and the rest of the world. Vectors of supply, demand, and excess demand represent the levels of aggregate production, consumption, and trade for each country. The supply sector in country k produces a combination of the N commodities in order to maximize profits given prices, technology, and endowments. Aggregate production of the N commodities is represented by the vector of supply functions, $\mathbf{S}_k(\mathbf{P}_{Sk}; \mathbf{X}_{Sk})$, where $\mathbf{P}_{Sk}$ is the vector of prices observed by the supply sector, and $\mathbf{X}_{Sk}$ is a vector of exogenous variables such as technology, input prices, and endowments for the supply sector of country k. Aggregate consumption of the N commodities is represented by the vector of demand functions $\mathbf{Q}_k(\mathbf{P}_{Qk}; \mathbf{X}_{Qk})$, where $\mathbf{P}_{Qk}$ is the vector of prices observed by the final demand sector, and $\mathbf{X}_{Qk}$ is a vector of exogenous variables for country k. The aggregate level of trade in the N commodities for country k is represented by the vector of excess demand functions $\mathbf{M}_k(M_{k1}, M_{k2}, \ldots, M_{kN})$, where $M_{ki}(\mathbf{P}_{Sk}, \mathbf{P}_{Qk}; \mathbf{X}_{Sk}, \mathbf{X}_{Qk})$ represents excess demand in country k for commodity i; $M_{ki} > 0$ indicates net imports, and $M_{ki} < 0$ indicates net exports of commodity i for $i = 1, 2, \ldots, N$.

Governments influence domestic markets through the use of price (π) or supply/demand shift (σ) instruments. Price instruments, denoted as A_{Ski}^{π} for producers and A_{Qki}^{π} for consumers in country k of commodity i, affect the prices observed by the supply and final demand sectors. With the world price of commodity i represented as P_{Wi}, the domestic price functions for country k are

(1) $$P_{Zki} = P_{Zki}(A_{Zki}^{\pi}, P_{Wi}), \quad \text{for } i = 1, 2, \ldots, N, \text{ and for } \mathbf{Z} = \mathbf{S}, \mathbf{Q}.$$

Supply/demand shift instruments, shown as A_{Ski}^{σ} and A_{Qki}^{σ}, respectively, for producers and consumers of commodity i in country k, are implicit elements of vectors $\mathbf{X}_{Sk}$ and $\mathbf{X}_{Qk}$ that shift supply and demand functions by modifying nonprice elements of the producers' or consumers' decision process. In order to make these instruments explicit, the vectors $\mathbf{X}_{Sk}$ and $\mathbf{X}_{Qk}$ are defined as follows:

(2) $$\mathbf{X}_{Sk} = \mathbf{X}_{Sk}(\mathbf{A}_{Sk}^{\sigma}; \mathbf{X}_{Sk}^{O}), \text{ and } \mathbf{X}_{Qk} = \mathbf{X}_{Qk}(\mathbf{A}_{Qk}^{\sigma}; \mathbf{X}_{Qk}^{O}),$$

where $\mathbf{X}_{Sk}^{O}$ and $\mathbf{X}_{Qk}^{O}$ signify vectors of nonpolicy exogenous variables, $\mathbf{A}_{Sk}^{\sigma}$ represents the vector $(A_{Sk1}^{\sigma}, A_{Sk2}^{\sigma}, \ldots, A_{SkN}^{\sigma})$, and $\mathbf{A}_{Qk}^{\sigma}$ represents the vector $(A_{Qk1}^{\sigma}, A_{Qk2}^{\sigma}, \ldots, A_{QkN}^{\sigma})$.

Through the substitution of the domestic price functions (1) and the functions of explicit variables (2), the aggregate supply, demand, and excess demand are expressed as functions of world price, policy instruments, and exogenous variables in the following terms:

(3) $$\mathbf{S}_{k}[\mathbf{P}_{Sk}(\mathbf{A}_{Sk}^{\pi}, \mathbf{P}_{W}), \mathbf{A}_{Sk}^{\sigma}; \mathbf{X}_{Sk}^{O}],$$

(4) $$\mathbf{Q}_{k}[\mathbf{P}_{Qk}(\mathbf{A}_{Qk}^{\pi}, \mathbf{P}_{W}), \mathbf{A}_{Qk}^{\sigma}; \mathbf{X}_{Qk}^{O}],$$

and

(5) $$\mathbf{M}_{k}[\mathbf{P}_{Sk}(\mathbf{A}_{Sk}^{\pi}, \mathbf{P}_{W}), \mathbf{P}_{Qk}(\mathbf{A}_{Qk}^{\pi}, \mathbf{P}_{W}), \mathbf{A}_{Sk}^{\sigma}, \mathbf{A}_{Qk}^{\sigma}; \mathbf{X}_{Sk}^{O}, \mathbf{X}_{Qk}^{O}],$$

where $\mathbf{A}_{Sk}^{\pi}$ represents the vector $(A_{Sk1}^{\pi}, A_{Sk2}^{\pi}, \ldots, A_{SkN}^{\pi})$, $\mathbf{A}_{Qk}^{\pi}$ represents the vector $(A_{Qk1}^{\pi}, A_{Qk2}^{\pi}, \ldots, A_{QkN}^{\pi})$, and $\mathbf{P}_{Zk}(\mathbf{A}_{Zk}^{\pi}, \mathbf{P}_{W}) = [\mathbf{P}_{Z1}(\mathbf{A}_{Zk}^{\pi}, \mathbf{P}_{W}), \mathbf{P}_{Z2}(\mathbf{A}_{Zk}^{\pi}, \mathbf{P}_{W}), \ldots, \mathbf{P}_{ZN}(\mathbf{A}_{Zk}^{\pi}, \mathbf{P}_{W})]$ for $\mathbf{Z} = \mathbf{S}, \mathbf{Q}$.

Let the main countries be denoted as countries $1, 2, \ldots, K$, and the rest of the world as country $k + 1$. The vector of excess demand functions for the rest of the world is shown as $\mathbf{M}_{k+1}(\mathbf{P}_{W}; \mathbf{X}_{k+1})$, where $\mathbf{X}_{k+1}$ is the vector of exogenous variables for the rest of the world. Through the adjustment of world prices, world markets are assumed to clear, i.e., world markets are competitive. Therefore,

(6) $$\sum_{k} \mathbf{M}_{k}[\mathbf{P}_{Sk}(\mathbf{A}_{Sk}^{\pi}, \mathbf{P}_{W}), \mathbf{P}_{Qk}(\mathbf{A}_{Qk}^{\pi}, \mathbf{P}_{W}), \mathbf{A}_{Sk}^{\sigma}, \mathbf{A}_{Qk}^{\sigma}; \mathbf{X}_{Sk}^{O}, \mathbf{X}_{Qk}^{O}]$$
$$+ \mathbf{M}_{k+1}(\mathbf{P}_{W}; \mathbf{X}_{k+1}) = \mathbf{0},$$

where the right-hand side of the equation is an $N \times 1$ vector of zeros. Letting the vector of country k's actions $(\mathbf{A}_{Sk}^{\pi}, \mathbf{A}_{Qk}^{\pi}, \mathbf{A}_{Sk}^{\sigma}, \mathbf{A}_{Qk}^{\sigma})$ be represented by $\mathbf{A}_{k}$, world prices are expressed as functions of actions in equation (7):

(7) $$\mathbf{P}_{W} = \mathbf{P}_{W}[(\mathbf{A}_{1}; \mathbf{X}_{S1}^{O}, \mathbf{X}_{Q1}^{O}), (\mathbf{A}_{2}; \mathbf{X}_{S2}^{O}, \mathbf{X}_{Q2}^{O}), \ldots, (\mathbf{A}_{K}; \mathbf{X}_{SK}^{O}, \mathbf{X}_{QK}^{O}), \mathbf{X}_{k+1}].$$

Within the agricultural policy formulation process, the welfare effects of various actions are taken into account by governments. Policy makers behave as though they are using a weighting system to compare the gains and losses of various groups. The product of a weight and a money metric welfare measure (e.g., consumer and producer surplus) is assumed to reveal the relative influence of a group's ability to transfer policy support to itself. This concept is referred to as a political preference function. The PPF used in this analysis is a weighted, additive function of money metric welfare measures for various societal groups. It is the objective function which, through their policy choices, policy makers behave as though they seek to maximize.

This measure is used by Gardner in analyzing income redistribution in agriculture. In addition, agricultural economists have estimated political preference functions in

order to examine policy effects among various agricultural groups (Rausser and Freebairn). It is assumed that competition among groups for political influence and the desire of the political process to appease these groups give rise to an equilibrium where the gradients of the PPF with regard to policy instruments are zero. Based on this assumption, the weights are estimated empirically at the point where the gradients are zero for the observed level of policy instruments (Kennedy, von Witzke, and Roe).

Let $k+$ denote the other main countries. Producers are grouped according to commodities, with their welfare defined as the profit obtained through the production and marketing of that commodity. Producer quasi-rents, consumer utility, and the government budget are shown as functions of government policies using the expressions $\Pi_k(\mathbf{A}_k, \mathbf{A}_{k+})$, $\mathbf{U}_k(\mathbf{A}_k, \mathbf{A}_{k+})$, and $B_k(\mathbf{A}_k, \mathbf{A}_{k+})$, respectively, where $\mathbf{A}_k$ represents the actions of country k, and $\mathbf{A}_{k+}$ represents the actions of the other politically active countries. The budget weight is normalized to one, and the PPF—a function of government policies—is expressed as

$$(8) \qquad \mathbf{V}_k(\mathbf{A}_k, \mathbf{A}_{k+}) = \Pi_k(\mathbf{A}_k, \mathbf{A}_{k+}) \cdot \lambda_{Sk} + \mathbf{U}_k(\mathbf{A}_k, \mathbf{A}_{k+}) \cdot \lambda_{Qk} + B_k(\mathbf{A}_k, \mathbf{A}_{k+}),$$

where λ_{Sk} is a strictly positive $N \times 1$ vector that represents the relative political weights of the producer groups in country k, while λ_{Qk} is a strictly positive vector representing the relative political weights of the consumer groups in country k.

Differentiating (8) with respect to producer-oriented actions and consumer-oriented actions, represented by A_{Sk} and A_{Qk}, respectively, the first-order necessary conditions for a maximum are as follows:

$$(9) \qquad \begin{bmatrix} \dfrac{\partial \mathbf{V}_k}{\partial \mathbf{A}_{Sk}} \\[2ex] \dfrac{\partial \mathbf{V}_k}{\partial \mathbf{A}_{Qk}} \end{bmatrix} = \begin{bmatrix} \dfrac{\partial \Pi_k}{\partial \mathbf{A}_{Sk}} & \dfrac{\partial \mathbf{U}_k}{\partial \mathbf{A}_{Sk}} \\[2ex] \dfrac{\partial \Pi_k}{\partial \mathbf{A}_{Qk}} & \dfrac{\partial \mathbf{U}_k}{\partial \mathbf{A}_{Qk}} \end{bmatrix} \times \begin{bmatrix} \lambda_{Sk} \\[2ex] \lambda_{Qk} \end{bmatrix} + \begin{bmatrix} \dfrac{\partial B_k}{\partial \mathbf{A}_{Sk}} \\[2ex] \dfrac{\partial B_k}{\partial \mathbf{A}_{Qk}} \end{bmatrix} = \begin{bmatrix} \mathbf{0} \\[2ex] \mathbf{0} \end{bmatrix}.$$

Solving this equation for λ_{Sk} and λ_{Qk} yields the PPF weights for the base period.

Let $(\mathbf{A}_k^*, \mathbf{A}_{k+}^*)$ represent actions prior to an agreement, and $(\mathbf{A}_k^{**}, \mathbf{A}_{k+}^{**})$ represent actions agreed to by countries k and $k+$. In the situation where the main countries negotiate or cooperate with one another, no agreement will be reached or kept unless the value of the objective function occurring from the agreement for each country k, $\mathbf{V}_k(\mathbf{A}_k^{**}, \mathbf{A}_{k+}^{**})$, is at least as great as that prior to the agreement, $\mathbf{V}_k(\mathbf{A}_k^*, \mathbf{A}_{k+}^*)$. A necessary condition for a treaty is that there exists at least one pair of actions $(\mathbf{A}_k^{**}, \mathbf{A}_{k+}^{**})$ satisfying

$$(10) \qquad \mathbf{V}_k(\mathbf{A}_k^{**}, \mathbf{A}_{k+}^{**}) \geq \mathbf{V}_k(\mathbf{A}_k^*, \mathbf{A}_{k+}^*), \quad \forall\, k = 1, 2, \ldots, K.$$

Empirical Analysis

To model the effects of trade liberalization, the Modèle Internationale Simplifié de Simulation (MISS) is used. MISS is a simplified world trade model that simulates the effects of various policy actions (Mahé, Tavèra, and Trochet). For the purposes of this

examination, the world is divided into four regions: Canada (CAN), Mexico (MX), the United States (US), and the rest of the world. Eight commodity groups are included in the analysis: beef, corn, dairy, pork, rice, soybeans, sugar, and wheat.

The MISS model uses several identities to simulate the effects of policy changes on the sectors of production, derived demand, and final demand for the regions examined. The model operates on the principle of Walrasian equilibrium. Policy changes undertaken by a country cause adjustments in the world price levels, resulting in changes in supply and demand, and a rebalancing of world trade.

Initial world market equilibrium for commodity i occurs where total supply and initial stocks are equal to total derived and final demand. This equilibrium is shown as

$$(11) \qquad \sum_k S_{ik} + \sum_k I_{ik} = \sum_k D_{ik} + \sum_k Q_{ik}, \quad \forall i = 1, \ldots, N,$$

where S_{ik}, I_{ik}, D_{ik}, and Q_{ik} represent supply, initial stocks, derived demand, and final demand, respectively, for commodity i in country k.

Percentage changes in the supply and derived demand of commodity i are composed of supply price and derived demand price effects with respect to all commodities. These changes are represented by equations (12) and (13):

$$(12) \qquad s_{ik} = \sum_j (E^*_{ijk} p^S_{jk} + E^{**}_{ijk} p^D_{jk}),$$

and

$$(13) \qquad d_{ik} = \sum_j (F^*_{ijk} p^S_{jk} + F^{**}_{ijk} p^D_{jk}), \quad \forall i, j = 1, \ldots, N, \text{ and } k = 1, \ldots, K,$$

where s_{ik} and d_{ik} represent percentage changes in supply and derived demand for commodity i in country k; E^*_{ijk} and E^{**}_{ijk} represent supply elasticities for commodity i with respect to output and input prices of commodity j, while F^*_{ijk} and F^{**}_{ijk} represent derived demand elasticities for commodity i with respect to output and input prices of commodity j. Changes in domestic supply and derived demand prices for commodity j in country k are denoted by p^S_{jk} and p^D_{jk}, respectively.

The percentage change in the final demand of commodity k is composed of final demand price effects with respect to price changes for all commodities. These changes are represented by the equation

$$(14) \qquad q_{ik} = \sum_j G_{ijk} p^Q_{jk}, \quad \forall i, j = 1, \ldots, N, \text{ and } k = 1, \ldots, K,$$

where q_{ik} represents changes in demand for commodity i in country k, G_{ijk} represents the demand elasticities for commodity i with respect to consumer prices of commodity j, and changes in consumer prices for commodity j in country k are denoted by p^Q_{jk}.

Final world market equilibrium for commodity k occurs where the change in supply for each commodity is equivalent to the corresponding sum of changes in derived and final demand. Using the previous equations, this is specified as

$$(15) \qquad \sum_k S_{ik} s_{ik} = \sum_k D_{ik} d_{ik} + \sum_k Q_{ik} q_{ik}, \quad \forall i = 1, \ldots, N.$$

Table 1. Political Preference Function Weights

	United States		Canada		Mexico	
	Rank	Weight	Rank	Weight	Rank	Weight
Beef	8	0.99	4	1.03	10	0.97
Corn	5	1.07	9	0.95	2	1.27
Dairy	4	1.11	1	1.31	9	0.97
Pork	10	0.85	7	0.99	5	1.08
Rice	3	1.15	10	0.00	3	1.26
Soybeans	6	1.04	5	1.02	4	1.17
Sugar	2	1.18	3	1.07	6	1.03
Wheat	1	1.20	2	1.21	1	1.28
Consumer	9	0.98	8	0.96	7	1.02
Budget	7	1.00	6	1.00	8	1.00

The domestic/world price linkage is such that the domestic price depends on the world price, the exchange rate, domestic protection, and transportation costs. This is represented by the equation

$$(16) \qquad\qquad P_{ik}^{Z} = P_{i}^{W} C_{k} T_{ik}^{Z} W_{k},$$

or, in logarithmic terms where W_k is fixed,

$$(17) \qquad\qquad p_{ik}^{Z} = p_{i}^{W} + c_{k} + t_{ik}^{Z}, \quad \text{for } Z = (S, D, Q),$$

where P_{ik}^{Z} represents domestic price for commodity i in country k, P_{i}^{W} represents the world price for commodity i, C_k denotes the number of country k currency units per U.S. dollar, T_{ik}^{Z} is the protection coefficient for commodity i, and W_k denotes a margin coefficient representing transportation costs. Lowercase letters signify a percentage change in the respective quantity variables.

The empirical analysis is conducted using 1990 as the base year. The PPF weights for the United States, Canada, and Mexico are derived through the simulation of incremental changes in the observed policies from their base levels. The resulting changes in producer welfare, consumer welfare, and government budget expenditures are used as approximations of the partial derivatives in (9). When (9) is solved for λ_{Sk} and λ_{Qk}, the PPF weights are obtained. This is accomplished using the MISS model based on 1990 quantity data [U.S. Department of Agriculture (USDA) 1996], price data, protection coefficients, and margin coefficients (USDA 1994), and previously estimated elasticities (Gardiner, Roningen, and Liu). These approximated weights, normalized such that the budget weight is one, are presented in table 1.

The agricultural policy strategies analyzed assume a customs union among the NAFTA countries. To accomplish this, a common protection level is used that maintains the overall protection level versus the rest of the world. For example, the common producer protection level for a commodity is determined by taking a weighted average of the individual participant country protection levels, shown by the equation $TC_i = (\Sigma_k T_{ik} S_{ik})/(\Sigma_k S_{ik})$, where TC_i is the common producer protection level for commodity i,

Table 2. Welfare Changes Resulting from Economic Integration (mil. U.S. $)

	U.S.	Canada	Mexico	NAFTA
Social Welfare Function:				
Canada/Mexico	9.65	333.19	-288.72	54.12
Canada/U.S.	-439.90	442.75	-0.05	2.80
Mexico/U.S.	106.26	5.44	399.83	511.53
Canada/Mexico/U.S.	-223.18	453.79	282.03	512.64
Political Preference Function (w/intracountry compensation):				
Canada/Mexico	11.75	242.31	-563.63	-309.57
Canada/U.S.	-74.24	385.80	0.89	312.45
Mexico/U.S.	117.42	4.69	60.08	182.19
Canada/Mexico/U.S.	20.68	398.17	-84.83	334.02

Note: Numbers represent change from the status quo.

T_{ik} is the producer protection level for commodity i in individual customs union partici-pant country k, and S_{ik} is the aggregate production of commodity i in country k. The simulations utilize the actions status quo (SQ_k) and customs union (CU_k) for $k = US$, CAN, MX. Each country k has action choices of retaining the status quo (SQ_k) or joining an agricultural customs union (CU_k). In combination, these options result in four non-status quo scenarios: (a) economic integration between Canada and Mexico, (b) economic integration between Canada and the United States, (c) economic integration between Mexico and the United States, and (d) economic integration among the three NAFTA countries. Products of this analysis for each of these scenarios include changes in producer welfare, consumer welfare, and budget savings resulting from policy changes.

These changes in welfare are compared using a social welfare function (a political preference function with weights of one) and a political preference function using the estimated weights and allowing for budget compensation within countries. In the case of budget compensation, each government is allowed to provide compensation from budget savings to those sectors of its economy made worse off due to the policy liber-alization. Budget compensation given to a sector cannot exceed the amount of that sector's welfare loss. Because the weight of budget savings in the political preference function is one, a sector must have a PPF weight greater than one in order to receive compensation. Budget compensation is given in descending order of welfare weights. Finally, total budget compensation cannot exceed total budget savings. Note that budget compensation has no impact on the government objective when PPF weights are identical.

Welfare changes resulting from the four scenarios are presented in table 2. The use of the social welfare function to analyze the changes in welfare shows that the aggregate welfare is maximized when the three countries form a North American customs union. However, the results show that Canada is the only participant that would choose this option; the U.S. and Mexico would be better off to form a coalition that excludes Canada. The same results occur when the welfare is analyzed using a weighted political preference function and allowing for intracountry budget compensation.

In order to achieve a treaty such that overall welfare is maximized and each country is made at least as well off as prior to the agreement, Canada might be able to provide

Table 3. Percentage Changes in Domestic Prices Resulting from a North American Free Trade Agreement

	Producer Prices			Consumer Prices		
	U.S.	Canada	Mexico	U.S.	Canada	Mexico
Beef	-1.40	-0.44	5.83	-1.20	-1.24	5.03
Corn	4.50	4.55	-36.00	14.50	0.13	-23.50
Dairy	9.40	-55.50	57.76	1.80	-34.50	28.00
Pork	2.73	0.73	-20.36	3.43	3.43	-25.55
Rice	-1.00	70.29	33.10	1.19	1.19	-8.00
Soybeans	1.60	-5.04	-20.60	8.95	8.95	-0.04
Sugar	-9.70	37.98	27.40	11.50	69.46	-21.00
Wheat	0.80	-1.00	-0.40	4.39	-0.72	-19.15

compensatory payments to the United States and Mexico and still be better off than without an agreement. These countries could then pass the remuneration along to their most influential sectors that suffer a loss due to the agreement. In this case, the U.S. could compensate its sugar sector, while Mexico could compensate its wheat and corn producers. In this manner, by providing compensation to the other two countries from its budget savings, Canada might be able to create a solution where each of the countries is better off than with the status quo. The political feasibility of intercountry transfers is questionable. However, tradeoffs in the manufacturing or services sectors in exchange for concessions in the agricultural sector could approach compensation of this type.

Agricultural Impacts of a
North American Customs Union

The implementation of a North American customs union will have various consequences for agricultural producers and consumers in each of the three countries. Not surprisingly, producers with high protection levels, relative to those in other countries during the base period, will be worse off as a result of the customs union protection levels. Those with relatively low initial protection levels will benefit. This section provides selected indicators that result from forming the customs union. These include changes in producer and consumer prices, changes in production and consumption, and changes in welfare.

Changes in domestic prices resulting from the customs union are presented in table 3. The union, when viewed from a price perspective, hurts United States beef, rice, and sugar producers; Canadian beef, dairy, soybean, and wheat producers; and Mexican corn, pork, soybean, and wheat producers. From a consumer perspective, United States consumers pay more for all commodities except beef; Canadian consumers pay more for everything except beef, dairy products, and wheat; and Mexican consumers pay less for everything except beef and dairy products.

The changes in production and consumption, presented in table 4, are consistent with those expected as a result of the price changes, with a few exceptions. An increase in the U.S. wheat producer and consumer prices results in a decrease in wheat production and

Table 4. Percentage Changes in Production and Consumption Resulting from a North American Free Trade Agreement

	Production			Consumption		
	U.S.	Canada	Mexico	U.S.	Canada	Mexico
Beef	-1.29	-3.87	8.65	1.02	1.21	-16.54
Corn	1.95	1.19	-22.99	-2.53	-0.06	9.36
Dairy	4.04	-30.08	23.81	-0.30	7.91	-3.64
Pork	1.07	2.39	-0.65	-2.95	-2.96	37.59
Rice	-0.40	0.00	20.42	-0.30	-0.30	-0.51
Soybeans	1.52	-2.05	-9.38	-3.54	-3.37	0.02
Sugar	-5.04	10.14	5.90	-2.58	-11.89	15.19
Wheat	-0.44	-0.50	-2.73	0.53	0.15	5.08

Table 5. Change in Welfare for Various Sectors Resulting from a North American Free Trade Agreement (mil. U.S. $)

	U.S.	Canada	Mexico
Beef	-507.57	2.50	321.31
Corn	969.72	30.50	-970.80
Dairy	1,861.03	-1,610.68	2,512.18
Pork	252.31	30.63	-318.59
Rice	-17.89	0.00	21.00
Soybeans	87.28	-7.45	-84.95
Sugar	-197.53	10.89	215.24
Wheat	78.43	-42.59	-2.77
Consumer	-1,154.69	510.33	452.25
Budget	-1,594.27	1,529.66	-1,862.84
Social Welfare Function	-223.18	453.79	282.03
PPF w/o Compensation	20.68	-76.02	-84.83
PPF w/Compensation	20.68	398.17	-84.83

an increase in wheat consumption, while an increase in the Mexican consumer price of rice results in a decrease in rice consumption. These instances are likely due to the cross-price elasticity effects, perhaps with respect to corn.

Changes in producer welfare, as presented in table 5, are also consistent with those expected based on the change in prices. The only exception occurs in the case of Canadian beef. Overall, the U.S. consumer is worse off due to the new trade environment, while Canadian and Mexican consumers gain. As a result of adjusting policies to join this customs union, table 5 shows that the Canadian government experiences budget savings, while the United States and Mexico suffer budget losses resulting from their new protection levels. This would facilitate the potential cooperative solution mentioned earlier, resulting from Canada providing compensation to Mexico and the United States.

Conclusion

A North American customs union will affect the welfare of various agricultural interest groups in Canada, Mexico, and the United States as policies that distort trade among the three countries are reduced and eliminated. This examination has quantified the gains and losses to various agricultural sectors as a result of forming a customs union by the NAFTA participants. Although this analysis does not mirror the actual agreement, it indicates the effects of free trade among these nations.

The results are particularly useful when compared with the actual North American Free Trade Agreement. For the most part, sectors shown to be harmed as a result of these policies have received special attention within NAFTA. In light of the significant losses shown to occur in the Canadian dairy sector, it is interesting to note that dairy trade was not addressed by the Canada-United States Trade Agreement (CUSTA) (Normile and Goodloe), nor was a dairy agreement reached between Canada and Mexico under NAFTA (USDA 1993).

The results of this analysis provide two major implications for policy makers. First, although some sectors in each of the three countries are made worse off, this study indicates that a North American customs union will result in an overall welfare gain. Despite this overall gain—and the fact that Canada benefits significantly by cooperating with Mexico, the U.S., or both—Mexico and the United States would be better off by forming a customs union that excludes Canada. Policy makers should identify options that will maximize gains from trade through complete free trade among the NAFTA countries. One avenue for accomplishing this is through intercountry compensation, perhaps in the form of trade concessions in the manufacturing or service sectors. If intercountry compensation of some type is impossible or politically infeasible, the results of this analysis show that it is not in the best interest of Mexico and the U.S. to join a Canada-Mexico-U.S. customs union based solely on agriculture.

A second implication for policy makers involves the potential gains from a Mexico-U.S. coalition. The results of this study show that, from the standpoint of their agricultural sectors, Mexico and the U.S. should focus their negotiating energies on achieving agricultural free trade with one another. The United States must also keep in mind that increased Mexican economic growth resulting from trade liberalization will likely bring about greater future gains from trade.

If government officials are to use the results of this study in developing agricultural trade coalitions, they must be aware of the limitations of this research. First, the model is static. It does not account for long-run increases in demand that will occur as the result of free trade. Neither do the scenarios simulated in this model account for long-run adjustments in production that correspond with free trade. As various factors shift supply and demand, they will influence the effects of trade liberalization. In addition, the model uses a partial equilibrium framework and does not account for any effects outside the agricultural sector.

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