U.S. and Canada FTA and Its Agricultural Economic Ramifications

By

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INTRODUCTION

The General Agreement on Tariffs and Trade (GATT) was established in 1947 to reduce or eliminate economic barriers among participating nations. Agricultural trade has been largely excluded from preceding GATT negotiations by member nations in order to protect their domestic agricultural industries [Gleckler and Tweeten]. This unwillingness to address agricultural trade issues within GATT resulted in a proliferation of barriers to free, world agricultural trade. Therefore, bilateral trade between the United States and Canada suffered from this protective trade philosophy.

During the 1980s, U.S. imports of agricultural products from Canada were regulated through quotas, marketing orders, variable import levies, and numerous requirements pertaining to product standards, health, labeling, and packaging. Canada on the other hand, used import licensing requirements, supply management, health and labeling restrictions, marketing boards, and transportation subsidies to control its agricultural imports from the U.S.

Although there are selective benefits in these tactics, such restrictive trade policies created economic inefficiencies in the two countries. Both nations acknowledged these problems and sought to reduce trade barriers through negotiation of a bilateral Free Trade Agreement (FTA). The negotiations began in the mid-1980s and became law in each country in 1989. In essence, the FTA will eliminate all bilateral tariffs and other trade restrictions within 10 years under one of three alternative time schedules [Glenn and Normile]. Quantitative, health, labeling, and other nontariff barriers are to be identified and

eliminated through a process of consultations provided under the auspices of the FTA.

The aim of the bilateral FTA is to enhance the economic welfare in both nations. Theoretically, this improvement can be realized because each nation can increase its degree of specialization in the production and processing of goods for which it has an absolute and/or comparative advantage, and by marketing the increased output to the other nation. [Smith, Ricardio, and Hechscher-Ohlin]. Implementation of the FTA will benefit industry groups and geographic regions in both nations which are most cost competitive. However, those groups and regions which are least competitive may experience economic losses in the transitional, short run period.

The magnitude and distribution of the gains and losses to the agricultural sectors in the U.S. and Canada has not been quantified. Therefore, industry participants and policy makers lack objective knowledge about the size and distribution of economic benefits, and the costs of adjustment and dislocation. Due to this deficiency, much of the prior FTA agricultural research literature is descriptive and qualitative in nature [Guither, Normile, Schott, Schmidtz, Schuh and Warley].

Research Objectives

The purpose of this research is two fold. Primarily it analyzes the effects of the FTA on consumer and producer welfare. Secondly, changes are examined in the production, processing, and trade flow patterns for hogs, cattle, feed grains, oilseeds, and wheat commodities in selected geographic regions of the U.S. and Canada. The results for both the short-term FTA agreement and the long-run comparative advantage analysis

are compared to the pre-FTA environment (using 1987 as a base year). The U.S. is divided into seven major production and consumption regions, West, Plains, Midwest, North Central, Northeast, Southeast and South. Likewise, Canada is divided into two regions, the East and West [Authors.] All commodities, however, were not produced and processed in each U.S. region. The remainder of this paper delineates the quadratic programming model and data, and presents the results and conclusions.

MATHEMATICAL PROGRAMMING MODEL

Competitive market equilibriums were simulated via a quadratic programming model (QP) through the inclusion of proportional regional linear demand relationships for pork and beef. The QP model identifies the production, processing, and transportation of livestock and grain commodities across regions and between the two countries. The transportation of commodities between the U.S. and Canada simulates the international trade flow patterns for the pre-FTA and the short-term and long-run FTA models. The objective function for the U.S.- Canada trade is mathematically formulated as follows:

$$\text{Max. } Z = \sum_{j}\sum_{l}\int_{o}^{MD^{*}_{lj}} P_{lj}\ \partial MD_{lj} - \sum_{i}\sum_{r}\sum_{l} CLR_{lri}\ LR_{lri} - \sum_{k}\sum_{l} CLP_{lk}\ LP_{lk}$$

$$- \sum_{k}\sum_{i}\sum_{l} CLX_{lik}\ LX_{lik} - \sum_{j}\sum_{k}\sum_{i} CMX_{lkj} MX_{lkj} - \sum_{i}\sum_{g} CGR_{gi}\ GR_{gi}$$

$$- \sum_{j}\sum_{d}\sum_{i}\sum_{g} CGX_{gidj}\ GX_{gidj} - \sum_{i}\sum_{i}\sum_{g} CFX_{gii}\ FX_{gii}$$

The objective function measures maximum producer and consumer surplus accruing to pork and beef consumers, as well as landowners in the regions of the two nations. Therefore, the structure of the QP model is consistent with the underlying assumptions of theoretical trade models [Samuelson, and Takayama and Judge]. The first term of the objective function represents the total area under the linear demand curve, $P_{ij} = \alpha_{ij} - \beta_{ij} MD_{ij}$. All remaining negative terms in the objective function are the summation of explicit costs for the activities in the model. These costs determine underlying implicit aggregate supply functions for each commodity [Hazell and Norton]. The net difference between the area under the demand curve and the area under the implicit supply curves, (total cash costs), is therefore aggregate consumer and producer surplus.

Eight general constraints are included in the model [authors]. Available land resources by region, and quantities of grain demanded at export points, by livestock other than hogs and cattle, and by food and oilseed processors were exogenously constrained. Commodity balance and accounting rows comprise the remaining constraints. The short term and long run FTA strategies are introduced into the model by modifying objective function coefficients and constraint values.

Data Requirements

Coefficients in the objective function include cost data for grain and livestock production, livestock processing and transportation, and regional parameters for the intercepts and slopes of the pork and beef demand functions. Crop yields, feed rations, and dressing percentages for hogs and cattle slaughtered were used as transformation coefficients

within the tableau of the model. Quantities of each grain demanded for the respective exogenous demands were calculated and used as right hand side values. All data were collected from secondary sources. However, expert opinion was used to supplement, verify, and support the secondary data [Alberta Agriculture, American Meat Institute, Futrell, Hein, Hutchinson, Illinois Cooperative Extension Service, Manitoba Agriculture, Seecharan, Statistics Canada, Van Stavern, and USDA]. Statistical methods were used to eliminate inconsistencies in the manner in which cost, production, and transportation data were collected and reported for respective regions in the two countries [authors]. Otherwise, these differences would bias the results.

RESULTS FOR PRE-FTA, AND SHORT TERM AND LONG RUN FTA MODELS

The results for the pre-FTA base model were used to validate the accuracy of the model by replicating the reported production, marketing, and trade levels within and between the U.S. and Canada (Table 1 - 3). Further, the results served as a bench mark for comparing and analyzing the solutions for the short term (FTA) and long run (Comparative Advantage) models. The following discussion focuses on three sectors of the agricultural economy: livestock producers, land owners, and pork and beef consumers.

Short-Term FTA Model

The base model coefficients were modified to reflect initial provisions of the FTA. Specifically, tariff rates on grains, livestock, and meat shipments between regions of the two nations were eliminated. Canadian transport subsidies on grain shipments originating in Western Canada bound for destinations in the U.S. demand regions were also removed.

Livestock Production

Hog production declined by more than 50 percent, while cattle production increased by more than 90 percent in the Eastern Canada region relative to the base model. The additional cattle output was processed into beef within Eastern Canada for shipment to the Northeast beef demand region of the United States. (Table 1).

In contrast to Eastern Canada, the North Central region of the U.S. specialized in hog production. Hog production increased by 8.7 million head and beef production declined by 2.24 million head, exactly the opposite of the changes in Eastern Canada. The added pork production was shipped to the Northeastern pork demand region in place of shipments from Eastern Canada in the base model (Table 1). The Southeast continued to produce hogs, and shipped pork into the Northeast.

Land Owner Welfare Changes

Grain production by region did not change significantly relative to the base model. Except for the North Central U.S., producer surplus as measured by the shadow price for the fixed land resources increased minutely in all other U.S. and Canadian regions (Table 2). The marginal increases in land values is attributed to the optimal use of the grain production from the fixed land base in the reorganized pork and beef feeding enterprises.

Consumer Welfare Changes

Consumer surplus aggregated from both nations increased by less than one percent relative to the base model (Table 3). However, variations were displayed in both the direction and magnitude of consumer surplus in individual demand regions. Consumer welfare declined

slightly in Eastern Canada, Western Canada, and Northeast U.S. regions, while minute increases were noted for Western, Southern, and Midwest U.S. demand regions. These variations in consumer welfare levels reflect modest changes in retail pork and beef prices across the respective demand regions.

Although the changes in pork and beef prices were small in magnitude, the direction of change was as expected based on spatial trade theory. Beef price spreads between Eastern Canada and Northeast U.S. demand regions were reduced. However, beef prices increased in the region where increased flows originate (Eastern Canada), and declined in the destination region (Northeastern U.S.).

Long-Run Comparative Advantage Model

Trade barriers were completely eliminated for this analysis, and the flows of commodities among regions was governed only by the Law of Comparative Advantage. Also eliminated are Canadian Import Licensing requirements for grain shipments originating in the U.S., Section 22 quota threats of the U.S. Agricultural Adjustment Act of 1933, all countervailing duties on corn and hogs, feed freight assistance programs, and the transportation subsidies on export grain originating in Western Canada. Cropland acreage was increased 10 percent above base levels in all grain production regions in this model to represent completely harmonized trade and domestic policies between the U.S. and Canada.

Livestock Production

Within the production regions of both the U.S. and Canada more specialization occurred relative to the base model. In Canada, hogs and cattle were produced in both regions in significant numbers. The

increase in the numbers of beef cattle produced in Canada replaced some production of cattle in the North Central and Plains regions of the U.S. Also, beef was shipped from Western Canada to the Western demand region in the U.S. (Table 1).

Both nations were self sufficient in pork production (Table 1). This finding reverses some of the trade patterns that appeared in the FTA model, reflecting the increase in crop acreage. That is, each nation had an adequate supply of feed grains to meet both existing exogenous grain demands and the increase in demand for feed by hog producers. In the U.S., the North Central region produced all hogs raised, thus eliminating production in the Southeast. Pork was shipped from the North Central production region to all other U.S. demand regions (Table 1).

Land Owner Welfare Changes

Grain production by region changed significantly relative to the base model. Because of the 10 percent increase in total acreage and the comparative advantage effects, the crop production mix changed in all regions; fallow acres appeared in some regions; and imputed land values declined (Table 2). For this solution, approximately 13 million, four million, ane one million acres of land were idled in the Southeast and Plains U.S. regions and in Western Canada, respectively. These acres were unused because the model reached a maximum level of producer-consumer surplus in the objective function, and could not be increased by more meat consumption. This is consistent with conditions of competitive spatial equilibrium where marginal cost is equal to price, and specialization has occurred.

The North Central region increased its concentration in the production of wheat, corn, and soybeans in this solution relative to the

levels for the base and FTA models. The other U.S. wheat region specialized in wheat production being the primary suppliers to local flour mills. Eastern Canada specialized in barley production and produced less corn (relative to the base and FTA models).

Producer welfare levels declined in all regions relative to the base model. Where land was untilled (acres were in the slack activities of the model), the imputed or marginal value of land was zero. These findings are consistent with conditions for competitive equilibrium in resource markets.

Consumer Welfare Changes

When summed for the two nations, aggregate consumer welfare increased by approximately 24 percent relative to the levels for both the base and FTA models (Table 3), which is consistent with expectations from spatial trade theory. The percentage of increase in welfare relative to the base model was relatively constant across all regions. Therefore, one region did not gain at the expense of others.

Consumer welfare level increased in all regions because consumer meat prices declined as consumption of both pork and beef increased. Furthermore, more pork and beef were produced due to the decline in feed grain prices. Because export and grain processing demands were exogenously determined in the model, the quantity of grain fed to livestock may be over estimated. Thus, the rate at which beef and pork prices declined, and the increase in consumer welfare may also be over estimated.

CONCLUSIONS

The Free Trade Agreement between the U.S. and Canada will cause the two countries to specialize in the production of agricultural products.

Although this conclusion is consistent with Ricardian and Heckscher-Ohlin theoretical trade models, specialization will not occur rapidly. Initially, only tariff restrictions on livestock commodities will be eliminated by the FTA. This change may allow beef producers in Eastern Canada to effectively compete with North Central U.S. beef producers to supply meat to the Northeast U.S. The North Central region may be compensated for the potential decline in beef shipments by shipping more pork into the Northeast. Ultimately, some resources may be shifted within the livestock producing and processing industries for these two regions to facilitate these changes.

In the short-term, specialization in grain production does not occur in any single region. Further, both consumer and producer welfare measures increase modestly. Thus, organized resistance to the initial provisions of the FTA from producer or consumer groups in either nation is unlikely.

The intermediate (results not reported in this paper) and long-run provisions of the FTA will precipitate many changes. For example, greater specialization occurs in both livestock and grain production. Resources will be reallocated within the grain and livestock production and processing industries for many of the regions. Some land may be idled in the Plains and Southeastern U.S. regions, and in Western Canada. Eastern Canada appears to effectively compete with many U.S. regions in production and processing of livestock and grain products. Imputed land values or producer surpluses decline, while consumer surpluses increase. Ultimately, these changes could trigger resistance to the trade liberalizations by producer groups whose resources are being reallocated.

TABLE 1:
PRODUCTION & SHIPMENTS OF PORK & BEEF, BASE, F.T.A. & COMP. ADV. MODELS

BEEF

REGION	MODEL SOLUTIONS BASE	F.T.A.	COMP. ADV.
		(000,000 lbs.)	
North Central to:			
Eastern Canada	0	0	911.7
Western Canada	0	0	0
Northeast	4,919.5	3,434.9	5,430.7
Midwest	8,298.5	8,301.5	9,155.8
South	5,832.4	5,834.5	3,900.6
Plains to:			
West	4,246.8	4,245.6	0
South	0	0	2,536.9
Eastern Canada to:			
Eastern Canada	1,633.9	1,631.6	870.3
Northeast	0	1,486.3	0
Western Canada to:			
Western Canada	663.6	660.6	722.4
West	635.7	638.8	5,393.3

PORK

North Central to:			
Eastern Canada	0	0	0
Western Canada	491.6	491.9	0
West	3,020.3	3,021.7	3,448.3
Northeast	0	1,279.0	3,480.8
Midwest	5,160.7	5,163.2	5,881.3
South	3,360.0	3,621.4	4,128.1
Southeast to:			
Northeast	1,513.9	1,773.6	0
South	259.7	0	0
Eastern Canada to:			
Eastern Canada	1,228.3	1,226.1	1,378.5
Northeast	1,545.9	0	0
Western Canada to:			
Western Canada	0	0	556.9

TABLE 2

IMPUTED CROPLAND VALUES; BASE, F.T.A., AND COMP. ADV. MODEL

REGION	MODEL SOLUTIONS		
	BASE	F.T.A.	COMP. ADV.
		----------($/acre)----------	
North Central	646.321	644.133	11.80
Southeast	382.826	389.710	Slack Ac.
Plains	313.854	319.679	Slack Ac.
U.S. Wheat	519.306	527.778	72.40
East Canada	589.386	597.675	44.32
West Canada	189.170	198.610	Slack Ac.

TABLE 3

CONSUMER SURPLUS BY REGION; BASE, F.T.A., AND COMP. ADV. MODELS

REGION	MODEL SOLUTIONS		
	BASE	F.T.A.	COMP. ADV.
		($000,000)	
East Canada	5,244.73	5,228.85	6,366.57
West Canada	2,122.98	2,111.69	2,587.08
West	13,197.00	13,207.62	16,436.90
Northeast	13,390.50	13,379.05	16,627.70
Midwest	22,720.70	22,735.30	28,223.80
South	15,881.00	16,345.44	19,746.80
Overall Consumer Surplus	72,556.91	73,008.95	89,988.85
Abs. Chg.	+ 451.04	+7,042.75	+9,938.15
% Change		+ 0.62	+ 24.0

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