AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

378.786
T73
R-5

TRADE RESEARCH CENTER

Montana State University
Bozeman

GATT Policies and Effects on the U.S. Beef Market

Waite Library
Dept. of Applied Economics
University of Minnesota
1994 Buford Ave - 232 ClaOff
St. Paul MN 55108-6040 USA

John M. Marsh

Research Discussion Paper No. 5
September, 1997

Objective Analysis
for Informed
Decision Making

378.786
T73
R-5

GATT Policies and Effects on the U.S. Beef Market

John M. Marsh, Professor
Montana State University

Research Discussion Paper No. 5
September, 1997

The purpose of research discussion papers is to make research findings available to researchers and the public before they are available in professional journals. Consequently, they are not peer reviewed.

GATT Policies and Effects on the U.S. Beef Market

Abstract

The Uruguay Round (UR) of multilateral trade negotiations brought agriculture into the general discipline of the General Agreements on Tariffs and Trade. The UR Agreement contains specific provisions for world trade in beef, and therefore is of major importance to the U.S. beef industry. These provisions or policy changes are specific to the Pacific Rim countries and include beef tariff reductions by Japan and beef quota increases by South Korea. In addition, policy changes are with respect to the European Union (EU), whereby EU's maximum allowable subsidized beef exports are to be reduced. An analysis of the impact of these policies on U.S. boxed beef and slaughter steer prices was conducted. A supply-demand economic model of U.S. wholesale, slaughter, and feeder cattle sectors integrated with trade factors permitted a reduced form solution for multiplier analysis. Holding NAFTA effects constant, baseline and GATT effects were estimated from the multipliers, the results showing UR policies enhancing fed beef demand in the Pacific Rim. These were net effects, accounting for increased imports under the GATT modified U.S. Meat Import Law and allowing for a U.S. fed beef supply response. Specifically, over the implementation period of 1995-2000, the net increases in boxed beef price and slaughter steer price were $7.63 cwt and $5.60 cwt, respectively, with the GATT contribution amounting to 38 percent of these totals.

Introduction and Background

The purpose of this article is to evaluate the effects of the Uruguay Round (UR) of the General Agreement on Tariffs and Trade (GATT) on U.S. beef prices. The focus is on UR policy changes specific to the Pacific Rim countries of Japan and South Korea, major export markets for U.S. agricultural products. In addition, the effects of policies reducing export subsidies in the European Union (EU) are considered. The EU is also a major producer and exporter of agricultural products in the world market.

The Uruguay Round of multilateral trade negotiations completed in April, 1994, brought agriculture into the general discipline of the General Agreements on Tariffs and Trade. With the establishment of the World Trade Organization (WTO), the UR kept open the impetus for further agricultural reform covering outstanding issues such as market access, domestic subsidies, export competition, and sanitary and phytosanitary provisions of state trading (USDA, December 1996). An implementation period of 1995-2000 was established in the UR. The major provisions of the UR agreement were to convert nontariff barriers (quotas) to tariffs (tariffication), include safeguards for import surges, establish minimum access commitment, reduce domestic subsidy supports, provide special tariff allowances for developing countries, and continue the reform process prior to the end of the implementation period (USDA, December 1996).

The UR agreement contains specific provisions for world trade in beef, and therefore is of major importance to the U.S. beef industry. These provisions, commensurate with a growing world demand for animal source proteins, will likely increase export opportunities as well as risks for U.S. beef producers. The beef trade provisions of GATT that are important to the U.S. include (BEEF Magazine 1995; Brester and Wohlgenant 1997): 1) Japan reducing its beef import tariff from 50 percent to 38.5 per cent in equal installments over the 6-year implementation period; 2) South Korea expanding its annual quota on beef imports from 106,000 metric tons to 225,000 metric tons by the year 2000; 3) the European Union reducing its exports of subsidized beef from the 1991-92 level of 1.24 million metric tons to 817,000 metric tons by the year 2000; and 4) the U.S. replacing its quota provision of the 1979 Meat Import Law with a tariff rate quota of 31.1 percent that declines to 26.4 percent by the year 2000.

In essence, the GATT provisions increase export potential for U.S. fed beef as well as larger U.S. imports of processing and ground beef from Australia and New Zealand. The latter had previously been capped at absolute quota levels in the 1979 Meat Import Law. The beef export potential from reductions in trade barriers compliments the increasing global demand for animal source proteins. U.S. producers also reap other benefits (of reducing nontariff barriers) such as WTO evaluation of food safety issues being based on scientific merit and not political factors. An example would be the long standing European hormone ban on imported U.S. table cut beef, which recently has resulted in a favorable ruling for U.S. producers (USDA, August 1997). Though U.S. beef producers primarily regard these opportunities as positive, they are also aware that greater access does not automatically imply increasing market share. For example, recent

increases in beef slaughter and fabrication capacity in Canada pose greater competition in the Pacific Rim (Hayes, Hayenga, and Melton). In addition, product quality and food safety, improved customer service, and better marketing strategies will be keys in exploiting the GATT provisions.

Changes in Beef Exports

The U.S. is a major world producer as well as exporter of beef. In 1996, of the top 10 beef countries, the U.S. constituted 35 percent of world beef production (ranked first) and 28 percent of world beef exports (ranked second). Australia's exports were first at 34 percent (USDA, June 1997). The U.S. position evolved throughout the 1980's. For example, in 1985, total U.S. beef exports were 331.8 million pounds; by 1990, they were 1.01 billion pounds, and by 1996, exports had increased to 1.87 billion pounds (Figure 1). These exports constituted 1.4 percent, 4.0 percent, and 7.4 percent of domestic beef production, respectively. The largest gains were made in the Pacific Rim countries (particularly Japan) and in Canada and Mexico. The U.S. market share for beef in the Pacific Rim was primarily established through rapid income growth in the Asian nations, changing tastes and preferences for high quality beef, upgrading diets with more animal source proteins, and gradual relaxation of trade barriers
(Capps, et al). Likewise, U.S. beef export gains to Canada and Mexico reflected growing economies, the Canadian Free Trade Agreement, Mexico's elimination of import tariffs under the North American Free Trade Agreement (NAFTA), and the high cost of producing Mexican fed beef.

USDA trade data documents the U.S. export market gains. In 1985, U.S. beef exports to Japan were 259.6 million pounds, to Canada they were 24.9 million pounds, and to Mexico they were 4.71 million pounds. By 1996, U.S. beef exports to these respective countries had increased to 1,015.8 million pounds, to 295.4 million pounds, and to 172.2 million pounds (Figure 2). In 1996, Japan constituted 54.1 percent of total U.S. beef exports, Canada 15.7 percent and Mexico 9.2 percent. However, the Asian market of South Korea has also gained in relative importance, constituting 10.9 percent of the U.S. beef export market. Other beef (including variety meat) export markets that have gained in importance are Russia, Hong Kong, and Taiwan.

Changes in Beef Imports

When analyzing U.S. beef exports, it is imperative to evaluate its counter side, beef imports (Figure 1). U.S. beef exports and imports differ both in terms of quantity and quality. The majority of U.S. beef exports (excluding variety meats and veal) are primals and subprimals of select, choice, or prime grade quality. Export grade depends upon the importing country's preference. For example, Japan normally purchases more high choice and low prime grade beef from the U.S. than does Canada or Mexico. Canada tends to import more select to low choice beef from the U.S. while Mexico primarily imports select beef and significant quantities of variety meats. However, with increasing tourist trade and incomes, Mexico has been purchasing more U.S. choice beef (Peel). The majority of U.S. beef imports are processing or ground quality from Australia and New Zealand that meets the requirements of fast food service. Beef imports from Canada are primarily AA and AAA grades which are comparable to U.S. select and choice grades, respectively. However, product forms between the two countries differ. For example, a Colorado

Department of Agriculture study indicates that in 1994 U.S. beef imports from Canada were 39 percent carcasses, 30 percent boneless cuts, and 20 percent trimmings. In comparison, approximately 75 percent of U.S. beef exports to Canada consist of high value, boneless cut varieties and 13 percent offal (Larsen and Rubingh). Canada ships ungraded carcasses to the U.S. in order to receive the USDA grades; however if shipping boxed beef, the product is sold in the U.S. at "no roll" discounts. U.S. boxed beef shipments, primarily to eastern Canada, do not receive the Canadian beef grades and therefore are sold at a retail discount. This configuration is due to the absence of a reciprocal grading agreement between the U.S. and Canada (Hayes, Hayenga, and Melton).

The trend in U.S. beef imports has not been as dramatic as beef exports. For example, in 1984, U.S. beef imports were 1.85 billion pounds and by 1996 imports had increased to 2.07 billion pounds, or about a 12 percent increase. Of the total beef imports in 1996, about 51 percent were from Australia and New Zealand and about 28 percent originated from Canada. The remainder primarily consisted of canned beef products from Central and South America. The latter are not included in the tariff-quota provisions of the U.S. Meat Import Law as revised under GATT.

In summary, the rapid growth in U.S. beef exports (relative to beef imports) is expected to position the U.S. as a net exporter of beef in the near future (excluding carcass weight equivalent of net live cattle imports). Such a net surplus, if realized, would be unprecedented since the 1940's. USDA data for 1994 show exports at 1.61 billion pounds and imports at 2.37 billion pounds for a 761 million pound deficit. But 1997 projections indicate beef exports may be at 2.05

billion pounds and beef imports at 2.13 billion pounds, reducing the deficit to 80 million pounds (USDA, February 1997).

Modeling GATT Effects

In order to estimate the GATT effects of the Pacific Rim market on U.S. beef prices, a model including domestic and international factors must be considered. A reduced form model, based on a demand-supply structure, is specified for boxed beef price, fed steer price, and feeder steer price. The structural model is given in the appendix. The equations are of an incomplete demand systems nature, allowing for modeling of the dynamics of the regression means and of the disturbance terms. Each market sector (wholesale, slaughter, and feeder) is specified to account for factors unique to that level, but the levels are interlinked as well. For example, the fed cattle market not only depends upon factors such as slaughter supplies, dressed weights, and by-products, but also upon boxed beef prices in the wholesale market and feed grain prices in the input market (cattle finishing). It is assumed, and so empirically verified, that a simultaneous equations relationship exists among prices in the wholesale beef, fed slaughter, and feeder cattle markets (Marsh 1988).

In the current analysis, the international factors relevant to the beef and live cattle markets are kept to a parsimonious specification. That is, factors that affect live cattle and boxed beef trade (tariffs, quotas, exchange rates, etc.) are implicit in net import and net export behavior. The U.S. live cattle trade is mostly relevant to NAFTA since exchange of breeding stock and slaughters and feeders deals with Canada and Mexico. The wholesale beef trade involves both NAFTA and

GATT since U.S. beef exports are primarily to the Pacific Rim and North America while U.S. imports are primarily from Oceania and Canada. When analyzing the GATT impacts, the NAFTA provisions of Canada and Mexico are held constant. Though Japan and South Korea are important markets for U.S. by-products, changes in by-product exports were not analyzed in the study.

The following equation represents the empirical basis for estimating conditional beef and live cattle prices. The equation represents a set of reduced forms solved from a structural model of equilibrium demands and supplies in the livestock-beef sector (appendix). In the analysis that follows only two sectors, boxed beef and fed cattle, are considered (feeder cattle are addressed in the conclusion section).

$$1) \qquad P_j = f(\bar{D}, Q_{fd}, Q_{nfi}, Q_{pk}, Q_{pl}, Y, MC, Q_{ex\text{-}im}, BPV, Q\#_{im\text{-}ex}, P_{cn}, P_{j\text{-}1}, \mu_j), \qquad j = 1,2$$

where P_j = the price of choice boxed beef (Central Illinois) or the price of choice fed slaughter steers (Nebraska direct), dollars cwt; $\bar{D}$ = binary variables that allow for seasonal intercept shifts; Q_{fd} = domestic production of fed beef, carcass weight, million pounds; Q_{nfi} = domestic production of nonfed beef plus U.S. nonfed beef imports, carcass weight, million pounds; Q_{pk} = domestic production of pork, carcass weight, million pounds; Q_{pl} = domestic poultry production, ready-to-cook weight, million pounds; Y = disposable personal income, billions of dollars; MC = index of marketing costs (1967 = 100); $Q_{ex\text{-}im}$ = U.S. net exports of fed beef (U.S. beef exports less beef imports from Canada), carcass weight, million pounds; BPV = farm by-product values, cents per pound; $Q\#_{im\text{-}ex}$ = U.S. net imports of live cattle from Canada and Mexico (U.S.

live imports less U.S. live exports), thousand head; P_{cn} = price of #2 yellow corn, Chicago, dollars per bushel; P_{j-1} = boxed beef price or fed steer price lagged one period; and μ_j are the random disturbance terms. The error terms are assumed to have zero mean, constant variance, and zero covariance across equations, but may be autocorrelated within equations (Green). Quarterly data from 1979 through 1996 are used to estimate the model. The specification of any P_{j-1} is in the form of a nonstochostic difference equation, which serves as an instrument variable in conjunction with the autoregressive form of μ_j (Rucker, Burt, and LaFrance). Consequently, least squares estimates of the model were obtained from a nonlinear least squares algorithm to account for parameter nonlinearities (Burt, Townsend, and LaFrance).

Multipliers

Of particular interest in the model are the impacts of net beef exports on U.S. boxed beef and live cattle prices as related to the recent UR provisions. These effects are estimated via dynamic multipliers incorporating various lengths of run. The multipliers are a nonlinear function of the equation slope coefficients of $Q_{ex\text{-}im}$ and the difference equation coefficients of P_{j-1}. It is assumed that policy shifts regarding exports result in beef price changes that asymptotically approach an equilibrium. The justification for noninstantaneous (or partial) adjustments in prices include biological growth, institutional constraints, and buyers and sellers acting upon market expectations. An example of the multiplier process is given by the simple equation:

$$2) \qquad P_t = \alpha + \beta\, EX_t + \lambda\, P_{t-1} + \mu_t$$

$$t = 1,2,....N$$

where P_t = beef price, EX_t = net beef exports, P_{t-1} = beef price of the previous quarter, and μ_t is the error term. The parameters α, β, and λ are the intercept, slope, and difference equation coefficients, respectively. The equation represents a simple partial adjustment process in explaining beef price (Nerlove). The dynamics of quarterly beef price, given a permanent shift in net beef exports, are given by the partial derivative:

$$3) \qquad \frac{\partial P_t}{\partial EX_{t-j}} = \beta\ (1 + \lambda + \lambda^2 + \lambda^3 + ...) \qquad j = 1,2,..... \qquad 0 \le \lambda < 1.0$$

which is the sum of an infinite series for geometric lags (Pindyck and Rubinfeld). Thus, if U.S. net beef exports shifted by Δ EX units, an interim multiplier effect of four quarters would be:

$$4) \qquad \frac{\partial P_t}{\partial EX_{t-4}} = \beta\ (1 + \lambda + \lambda^2 + \lambda^3)\ \Delta EX;$$

while the long-run or equilibrium multiplier for ΔEX units would be:

$$5) \qquad \frac{\partial P_t}{\partial EX_{t-j}} = \left(\frac{\beta}{1-\lambda}\right) \Delta EX.$$

GATT Export Provisions

The UR provisions of GATT applied to agriculture generally involve reducing existing tariffs and tariffication of current quotas. The changes were for an implementation period of 1995-2000, of which at that time further negotiations would ensue. Certain policy actions taken by the Pacific

Rim countries (Japan and South Korea) and relaxation of trade restrictions by the EU form the basis of the current GATT analysis. These policies and their quantity implications include:

a) Japan is to reduce its tariff on beef imports from 50 percent to 38.5 in equal annual installments over a six-year period. This would increase annual U.S. beef exports to Japan by 53,000 metric tons.

b) South Korea is to expand its annual quota of beef imports by 119,000 metric tons by the year 2000. Assuming a U.S. market share of 40 percent, the U.S. increase would be an annual 47,600 metric tons.

c) The EU's maximum allowable subsidized beef exports will be reduced by 507,000 metric tons by the year 2000, or an annual 84,500 metric tons. Assuming a U.S. market share of 25 percent, the potential U.S. increase would be an annual 21,125 metric tons.

d) Under GATT the U.S. Meat Import Law is modified to allow for a tariff quota of 31.1 percent, which is reduced to 26.4 percent after six years. This amounts to an estimated increase of 84,260 metric tons of U.S. beef imports at the end of the implementation period, i.e., from a 572,360 metric ton trigger quota in 1993 to 656,621 metric tons established under the tariff-quota.

As noted, *ceteris paribus*, the GATT provisions imply expansion of U.S. fed beef exports as well as increasing beef imports. Estimates of these potential increases in beef exports assumes that the U.S. maintains its export market share equivalent to the 1995-96 period. This implies there may be additional costs of product promotion and quality, customer service, and marketing; however, they are not included in the analysis.

Estimated Price and Revenue Effects

Estimation of expected price effects from the recent GATT policies involves the wholesale (boxed beef) and fed (slaughter) sectors. The procedure is to apply long-run or equilibrium multipliers to estimates of permanent shocks in trade. The shocks involve Japan reducing its tariff on beef imports, South Korea increasing its beef import quotas, the EU reducing its beef export subsidies, and the U.S. increasing its beef imports under the tariff-quota law. Liberalization of the first three policies affects U.S. exports of table cut beef, while the tariff-quota of the latter affects imports of processed or ground beef. Theoretically, reducing the Asia-Pacific and EU trade constraints is tantamount to increasing export demand for U.S. fed beef; thus, for a less than perfectly elastic wholesale supply, the price of U.S. boxed beef would increase. Holding packer margins constant, there would be a subsequent increase in the derived demand for fed cattle. The extent of increases in boxed beef and fed steer prices would be a function of demand and supply elasticities implicit in the econometric multipliers. On the other hand, increases in supplies of ground beef (imports) would reduce choice boxed beef and fed steer prices since nonfed beef is a substitute for fed beef in retail consumption (Brester and Wohlgenant, 1991).

Simplifying assumptions are made concerning the GATT changes for the Pacific Rim and EU regions. Specifically, the estimated quantity changes given above are those to be experienced by the year 2000, rather than *as initial* changes in 1995. Consequently, the dynamics are handled by dividing expected end-trade quantities by 6 years, and then applying those figures to the long-run multipliers. With this procedure quantity changes are then assumed to take place by equal installments over the 1995-2000 period. The results may generate conservative price effects;

however, to allocate end-trade quantities all to the initial year of the Uruguay Round would overestimate the multiplier impacts given by equations (4) and (5). Other important assumptions include holding constant the effects of the North American Free Trade Agreement (NAFTA) and domestic shifters of boxed beef and fed cattle prices.

The estimated responses of boxed beef and fed cattle prices to more liberal trade are partitioned into baseline and GATT scenarios. Price impacts are first evaluated via trend projections without incorporating the recent GATT provisions. This relationship is based on a linear trend regression of U.S. beef exports to Japan for the years 1985-1994, a period of robust growth. The regression indicated an export growth rate of 72.688 million pounds of beef per year. The price impacts are then evaluated according to GATT-induced exports, permitting a total export demand response of baseline plus GATT.

Normally, in the livestock sector market price changes on the demand side result in lagged responses on the supply side. In the current analysis, the GATT implementation period of 1995-2000 allows sufficient time for biological production responses to occur. That is, projected growth in beef export demand and resulting price increases provide an incentive to expand the beef cow herd and commercial beef production. Consequently, the expected beef price increases are adjusted downward in relation to the elasticity of fed cattle supply (Marsh 1994).

Table 1 presents the U.S. beef export and import changes as well as the expected supply response associated with baseline and GATT projections. Table 2 gives the expected impacts on boxed beef

and slaughter cattle prices (real and nominal) resulting from the trade quantity changes. For the GATT policy column, price effects are specific to export markets of Japan, South Korea and the European Union. It should be noted that the price impacts are conditional, dependent upon the statistical properties of the estimated reduced form parameters and approximations of beef quantity changes due to recent GATT policies. Overall therefore, the point estimates approximate the true (but unknown) price effects given the structural model, information about Pacific Rim and EU policies, tariffication of the U.S. Meat Import Law, and domestic production response to export demand changes.

Results

In Table 2, summation of the baseline and GATT effects shown in the "Total" column indicate boxed beef price (PBOX) would increase nominally by $10.51 cwt and slaughter steer price (PSLT) would increase nominally by $7.56 cwt, excluding the offsets of imports and supply response. Real prices would increase, respectively, by $6.69 cwt and $4.81 cwt. Tariffication of the U.S. Meat Import Law would reduce nominal boxed beef and fed slaughter prices by $.63 cwt. and $.54 cwt, respectively. In addition, likely expansion of the beef cow herd would reduce the respective nominal prices by another $2.24 cwt and $1.42 cwt. Consequently, the very last column indicates that the *net* increase in nominal boxed beef and fed slaughter prices would be $7.63 cwt and $5.60 cwt, respectively, for baseline and GATT projections of exports.

The supply response factor is obviously not trivial. Recent work estimating supply response in the fed cattle industry indicates that elasticity of fed cattle supply with respect to slaughter price is .61

in the intermediate run and 3.24 in the long run (Marsh 1994). The long-run partial derivative (not shown) indicates there is a 104.625 thousand head change in marketings for every $1 cwt change in real slaughter price. Thus, for the forecasted $4.81 cwt increase in real slaughter price fed marketings would increase by 503.246 thousand head, or producing 372.402 million pounds of extra fed beef assuming an average of 740 pounds carcass weight.

The contribution of GATT to the export price effects is relatively small compared to the total, but not inconsequential. For example, prior to adjusting for imports and supply response, the nominal baseline effect for fed cattle was $4.68 cwt and the nominal GATT effect was $2.88 cwt, or GATT's proportion of the total being 38 percent. The *net* total after adjusting for beef imports and supply response is $5.60 cwt for the price of fed cattle. Thus, the expected net increase in fed cattle price due to policies of the Uruguay Round would be $2.13 cwt. A recent study by Brester and Wohlgenant (1997), using a linear elasticity model, indicated recent GATT policies would increase fed cattle price in the range of $0.62-$5.46 cwt (above the average price of 1990-94) and feeder cattle price by approximately the same range. Research conducted by the Food and Agricultural Policy Research Institute (FAPRI) indicated that by 1999 fed cattle prices would be about $2 cwt higher than without the GATT agreement. However, after adjusting for domestic supply response, by the year 2002 they indicated fed cattle price would increase by only $.49 cwt.

Conclusions

The recent Uruguay Round of GATT established certain provisions that will impact U.S. beef producers. Liberalization of trade via reductions in quota and tariff restrictions in the Pacific Rim implies expanding U.S. beef exports; likewise, tariffication of the U.S. Meat Import Law will result in increased beef imports. The current study utilized equilibrium multipliers to derive the conditional effects on U.S. boxed beef and slaughter cattle prices from certain GATT provisions. Due to the provisions, GATT will permit an extra 268.4 million pounds of U.S. fed beef exports beyond the baseline estimate of 436.1 million pounds. The tariff quota of the U.S. Meat Import Law will also permit an extra 185.8 million pounds of nonfed beef to be imported into the U.S. The long run supply response in the domestic market from the export demand stimulus would be 372.4 million pounds. Taken together, the *net* effect of growth in export demand over the period 1995-2000 would be to increase nominal boxed beef price by about $7.63 cwt and fed cattle price by about $5.60 cwt. About 38 percent of the price increases or $2.90 cwt and $2.13 cwt, respectively, would be attributed to the Uruguay Round. Excluding adjustments for beef imports and supply response, GATT's contribution at the slaughter level would be about $2.88 cwt, with Japan, South Korea, and the EU accounting for $1.25 cwt, $1.13 cwt, and $.50 cwt, respectively.

Though there are opportunity costs associated with trade liberalization, it appears recent GATT policies would be favorable to U.S. meat packers and cattle feeders due to higher boxed beef and fed slaughter prices. The net increases of $2.90 cwt for boxed beef price and $2.13 cwt for fed slaughter price expected from GATT represent 2.7 percent and 3.2 percent of their respective 1995 price levels. If using 1995 fed beef production of 20.21 billion pounds and steer and heifer

slaughter of 28.67 million head, GATT policies would increase boxed beef revenue by 586.1 million dollars and slaughter cattle revenue by 671.7 million dollars.

Growth in Pacific Rim demand for U.S. fed beef also has implications for cow-calf producers. Although this sector was not analyzed, impacts on cow-calf producers are merely extensions of changes in the slaughter market. That is, the derived demand for feeder cattle is a direct function of slaughter price received by cattle finishers. The relationship occurs thru a multiplier effect of fed steer price on feeder steer price. Specifically, a price transmission relation (1979-1996 quarterly data) regressing the price of 600-650 lb feeder steers on fed cattle price, feeder cattle inventories, the price of corn and lagged feeder steer price gave fed price multipliers of $.504 cwt in the short run and $1.22 cwt in the long run (not shown). Using the long run multiplier, the net effect of the $2.13 cwt GATT impact (on slaughter price) transmits to a $2.60 cwt impact on feeder price. Using the 1995 feeder cattle supply (outside feedlots) of 45.107 thousand head and an assumed average weight of 600 pounds, the extra revenue generated in the feeder production sector would be $703.7 million.

Table 1. Estimated Changes in Beef Export and Import Quantities of the 1994 Uruguay Round of GATT

TRADE QUANTITY CHANGES				
Country	Baseline Exports	GATT Exports	U.S. Imports	U.S. Supply Response
U.S.	72.688	$\sum$ = 44.734	30.965	62.119
Japan		19.478		
South Korea		17.493		
European Union		7.763		

NOTES: All quantities are in million lbs., carcass weight, and represent annual increases over the 1995-2000 implementation period. The Baseline Exports column means U.S. exports of beef that would have taken place without the recent Uruguay Round. The GATT Exports column shows increases in U.S. beef exports to Japan, South Korea, and the European Union described in the Country column. Numbers are calculated as total pounds for the implementation period divided by 6. For example, Japan's reduction of import tariffs would increase U.S. exports over this period by 53,000 metric tons. Thus, 53,000 metric tons x 2205 lbs ÷ 1,000,000 lbs ÷ 6 years = 19.478 million lbs per year. The $\sum$ (summation) figure for the U.S. in the GATT Exports column is the summation of exports to Japan, South Korea, and the European Union. The U.S. supply response is the increase in long-run supply of fed cattle multiplied by average carcass weight. This is 403.665 thousand head x 740 lbs. dressed weight ÷ 6 years, or 62.119 million pounds.

Table 2. Effects of Baseline and GATT Policies for Beef Export Demand on U.S. Boxed Beef and Live Cattle Prices

TRADE QUANTITY						
PRICE/Country	Baseline	GATT	Total	Import Response	Supply Response	Net Total
PBOX	$4.143	$2.550	$6.693	-$.403	-$1.428	$4.862
	6.505	4.004	10.508	-.633	-2.242	7.630
Japan	----	1.110	----			
		1.743				
South Korea	----	.977	----			
		1.565				
EU	----	.443	----			
		.696				
PSLT	$2.980	$1.834	$4.814	-$.341	-$.907	$3.566
	4.679	2.879	7.558	-.535	-1.424	5.600
Japan	----	.798	----			
		1.253				
South Korea	----	.717	----			
		1.126				
EU	----	.318	----			
		.499				

NOTES: All figures are in dollars per cwt. The numbers in the top rows are in real dollars (1982-84 constant dollars) and the numbers in the bottom rows are in nominal dollars (real dollars multiplied by 1996 CPI = 1.57). PBOX is boxed beef price and PSLT is slaughter steer price. In the GATT column, the price effects are specific to Japan, South Korea, and the European Union. Total in column 4 is the Baseline plus GATT columns. The prices in the Net Total (last) column are prices in the Total column (4) plus the price reductions in the Import Response and Supply Response columns.

Figure 1 U.S. Beef Exports, Imports, and Production

(billions of pounds)

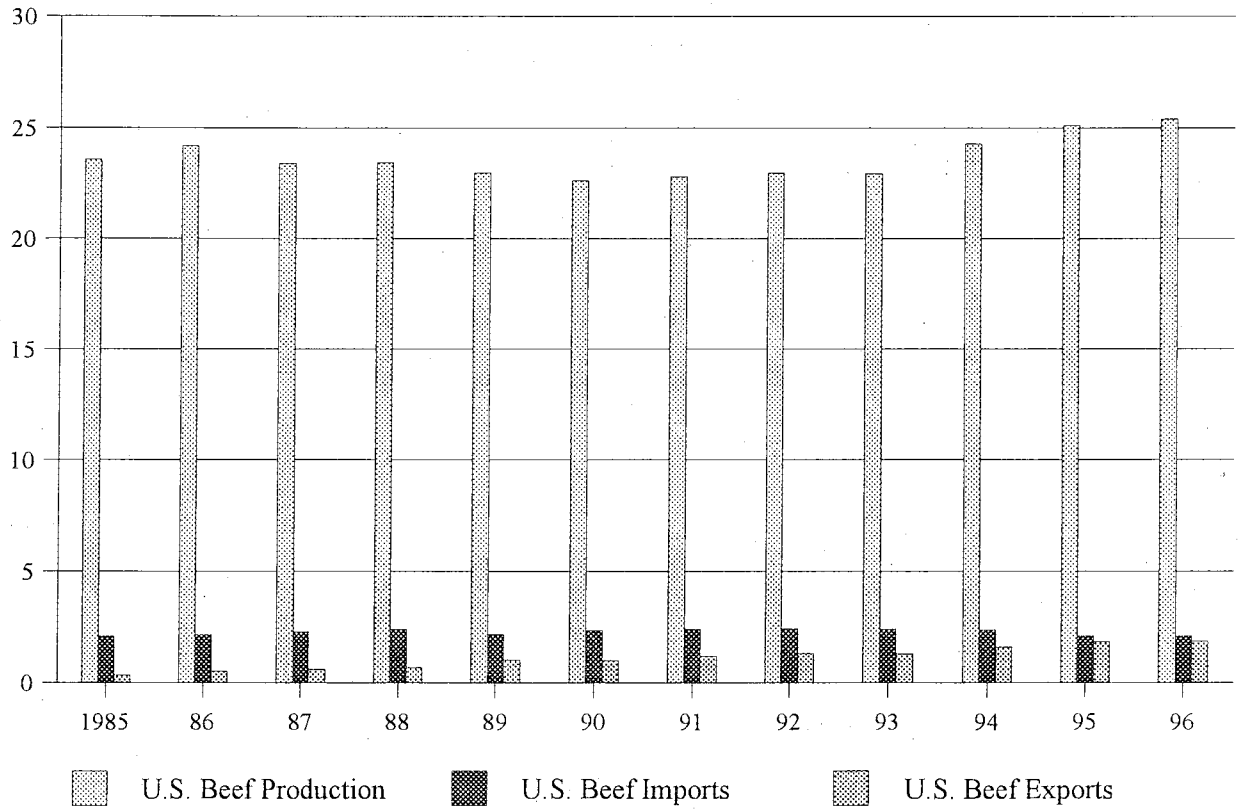
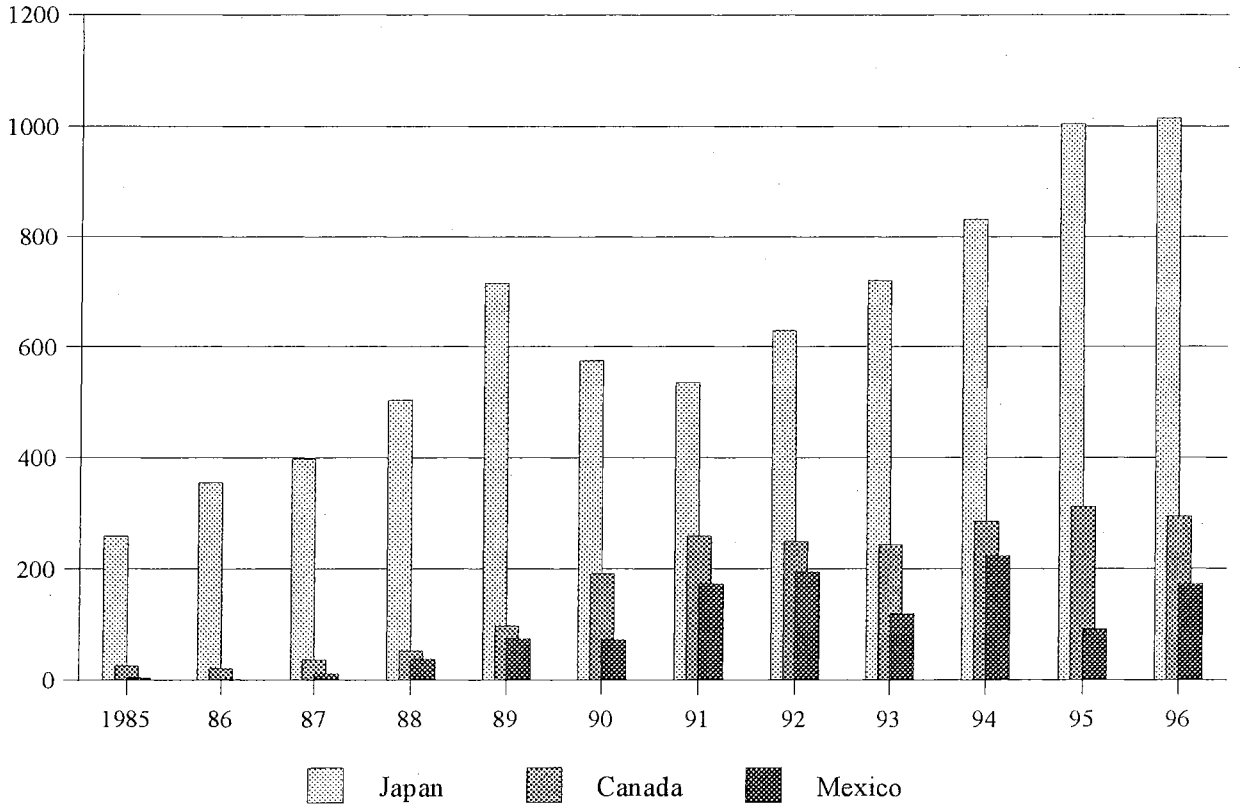


Figure 2 U.S. Beef Exports to Japan, Canada, and Mexico

(millions of pounds)



Appendix. Structural Demand and Supply Equations Underlying Reduced Form Model of Prices

The following equations represent the theoretical model, with the variable definitions given in table form.

Boxed Beef:

(1) $Q_{fd}^{d} = f_1(D, P_{bx}, P_{pk}, P_{plt}, Y, MC)$ (domestic fed beef demand)

(2) $Q_{fd}^{s} = f_2(D, P_{bx}, P_{sl}, MC)$ (domestic fed beef supply)

(3) $Q_{nfi}^{d} = f_3(D, P_{bx}, P_{pk}, P_{plt}, Y, MC, Z)$ (domestic nonfed beef demand)

(4) $Q_{nfi}^{s} = f_4(D, P_{bx}, P_{sl}, MC, Z)$ (domestic nonfed U.S. beef supply)

(5) $Q_{ex-im}^{fd} = f_5(D, P_{bx}, P_{pk}, P_{plt}, Z)$ (net export demand for fed beef)

$Q_{fd}^{d} = Q_{fd}^{s} = Q_{fd}$ (market clearing)

$Q_{nfi}^{d} = Q_{nfi}^{s} = Q_{nfi}$ (market clearing)

Slaughter Cattle:

(6) $Q_{sl}^{d} = g_1(D, P_{sl}, P_{bx}, BPV, MC)$ (domestic demand)

(7) $Q_{sl}^{s} = g_2(D, P_{sl}, P_{fr}, P_{cn})$ (domestic supply)

(8) $Q_{im-ex}^{sl} = g_5(D, P_{sl}, P_{bx}, BPV, Z)$ (U.S. net import demand for live cattle)

$Q_{sl}^{d} = Q_{sl}^{s} = Q_{sl}$ (market clearing)

Feeder Cattle:

(9) $Q_{fr}^{d} = h_1(D, P_{fr}, P_{sl}, P_{cn}, MC)$ (domestic demand)

(10) $Q_{fr}^{s} = h_2(D, P_{fd}, P_{cn})$ (domestic supply)

(11) $Q_{im-ex}^{fr} = h_5(D, P_{fd}, P_{cn}, P_{sl}, Z)$ (U.S. net import demand for feeder cattle)

$Q_{fr}^{d} = Q_{fr}^{s} = Q_{fr}^{\#}$ (market clearing)

The model basically consists of domestic demands and supplies at the wholesale, slaughter, and feeder market levels, along with net export and net import demands of beef and live cattle, respectively.

Variable Definitions

Boxed Beef:

Q^d_{fd}, Q^s_{fd}, Q_{fd} = domestic fed beef quantities demanded, supplied, and equilibrium, respectively, carcass weight, million pounds.

Q^d_{nfi}, Q^s_{nfi}, Q_{nfi} = domestic and imported nonfed beef quantities demanded, supplied, and equilibrium, respectively.

Q^{fd}_{ex-im} = net export demand for U.S. fed beef, U.S. exports less Canadian fed beef imports, carcass weight, million pounds.

D = seasonal dummy variables; D2 = second quarter; D3 = third quarter; D4 = fourth quarter ... (D1 = first quarter is omitted).

P_{bx} = equilibrium price of boxed beef, Central U.S., choice 2-4 cut-out value, dollars per cwt.

P_{pk}, P_{plt} = equilibrium wholesale prices of pork and poultry (chicken), respectively, dollars per cwt.

P_{sl} = equilibrium price of Nebraska direct slaughter steers, 1100–1300 pounds, choice 2-4 grade, dollars per cwt

Y = personal disposable income, billion dollars.

MC = marketing cost index (1967 = 100).

Z = set of exogenous variables shifting export-import quantities.

Fed Cattle:

Q_{sl}^{d}, Q_{sl}^{s}, Q_{sl} = domestic slaughter cattle quantities demanded, supplied, and equilibrium, respectively, thousand head.

Q_{im-ex}^{sl} = U.S. net import demand for slaughter cattle, imports from Canada and Mexico less U.S. exports, thousand head.

BPV = value of edible and inedible beef by-products, cents per pound.

P_{cn} = price of #2 yellow corn, St. Louis, dollars per bushel.

P_{fr} = price of medium #1 feeder steers, Oklahoma City, 600–700 pounds, dollars per cwt.

Feeder Cattle:

Q_{fr}^{d}, Q_{fr}^{s}, $Q_{fr}^{\#}$ = domestic quantities demanded, supplied, and equilibrium, respectively, of cattle outside feedlots, thousand head.

Q_{im-ex}^{fr} = U.S. net import demand for feeder cattle, imports from Canada and Mexico less U.S. exports, thousand head.

REFERENCES

Beef Magazine. "What Cattlemen Get From GATT." February 1995.

Brester, G.W. and M.K. Wohlgenant. "Estimating Interrelated Demands for Meats Using New Measures for Ground and Table Cut Beef." *American Journal of Agricultural Economics* 73 (1991): 1182-1194.

Brester, G.W. and M.K. Wohlgenant. "Impacts on the GATT/Uruguay Round Trade Negotiations on U.S. Beef and Cattle Prices." *Journal of Agricultural and Resource Economics* 22 (1997): 145-156.

Burt, O., Townsend, S. and J. LaFrance. "Instruction Manual for DYNREG: A Nonlinear Least Squares Algorithm for Distributed Lag Models and/or Regression Models with Time Series Error Terms." Montana State University, January 1986.

Capps, O., R. Tsai, R. Kirby, and G.W. Williams. "A Comparison of Demands for Meat Products in the Pacific Rim Region." *Journal of Agricultural and resource Economics* 19 (1994):210-24

Greene, H.W. *Econometric Analysis*. New York: Macmillian Publishing Co, 1993.

Hayes, D., J. Hayenga, M., L. and B.E. Melton. "The Impact of Grade Equivalency on Beef and Cattle trade Between the United States and Canada." Meat Export Research Center, Iowa State University, February 1997.

Larsen, T. and J. Rubingh. "Analysis of the Impact of Canadian Slaughter Cattle Imports on the Colorado and U.S. Slaughter Cattle Industry." Colorado Department of Agriculture Markets Division, January 1995.

Marsh, J.M. "The Effects of the Diary Termination Program on Live Cattle and Wholesale Beef Prices." *American Journal of Agricultural Economics* 70 (1988): 919-928.

Marsh, J.M. "Estimating Intertemporal Supply Response in the Fed Beef Market." *American Journal of Agricultural Economics* 76 (1994): 444-53.

Nerlove, M. "Lags in Economic Behavior." *Econometric* 40 (1972): 221-51.

Peel, D.S. "U.S. and Mexican Cattle and Beef Trade." Paper presented at *NAFTA and Agriculture: Is the Experiment Working*, A Tri-National research Symposium, San Antonio, TX, Nov 1-2, 1996.

Rucker, R.R., O.R. Burt, and J.T. LaFrance. "An Econometric Model of Cattle Inventories." *American Journal of Agricultural Economics* 66 (1984): 131-44.

United States Department of Agriculture. "Agriculture and the WTO: The Road Ahead." *Agriculture Outlook*, December 1996.

United States Department of Agriculture. "Livestock, Dairy and Poultry Situation and Outlook." LDP-M-38, February 1997.

United States Department of Agriculture. "International Meat Review." June 11, 1997.

United States Department of Agriculture. "International Meat Review." August 20, 1997.

Waite Library
Dept. of Applied Economics
University of Minnesota
1994 Buford Ave - 232 ClaOff
St. Paul, MN 55108-6040 USA

The publications and activities of the Northern Plains and Rockies Center for the Study of Western Hemisphere Trade, publicly known as the Trade Research Center, are available to all people regardless of race, creed, color, sex, disability, or national origin. All inquiries are welcome. John Antle, Director. Montana State University, Bozeman, Montana 59717.