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# U.S. Beef Product Prices and Trade Liberalization

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The U.S. exports fed beef and imports nonfed beef. These two beef products have sharply different demand characteristics and are weakly separable (Eales and Unnevehr). Therefore, international trade will have distinct and separate impacts in the two beef product markets, although linked by substitution effects. Analysis of the impact of beef trade on domestic prices will differ if we consider the product markets individually rather than as an aggregate.

This paper examines the domestic price implications of beef trade in the 1990s. We will show that the expected changes in beef trade will have strong, but different, price effects in fed and nonfed beef markets. Furthermore, these changes, and the nature of domestic demand, should lead to an increase in the total value of U.S. beef. These results should be of interest to the U.S. beef industry and to industry analysts.

The motivation for this analysis arises from recent changes in international beef markets. Both beef imports and exports have increased during the last two years due to negotiations between the U.S. and its trading partners. U.S. trade policies restrict beef imports, but the Canadian free-trade agreement removes barriers to Canadian beef. U.S. beef exports go mainly to Japan, which in 1988 agreed to major reductions in import restrictions. As a result, U.S. exports to Japan have grown rapidly and we expect them to increase.

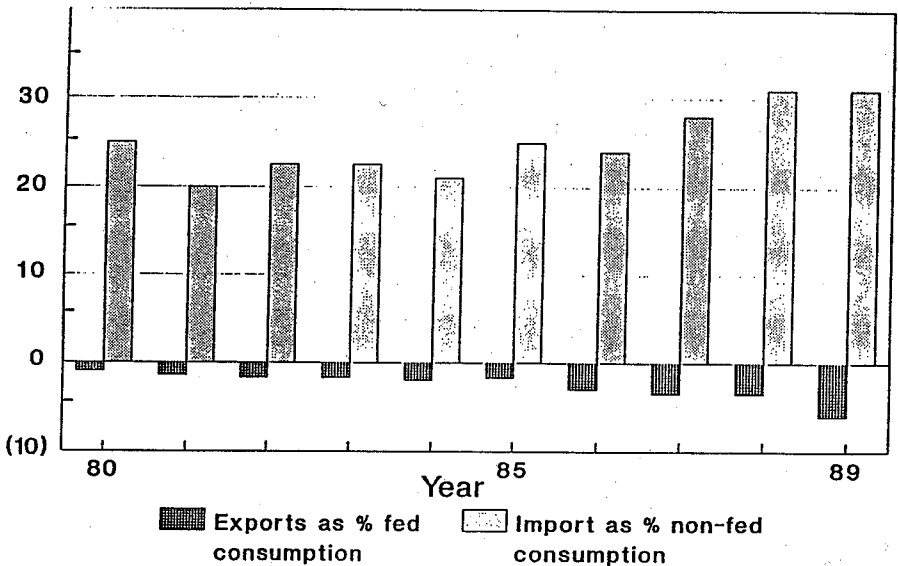
These changes in beef trade make it timely to consider the implications for fed and non-fed beef prices in the U.S. In the 1970s, several researchers (Houck; Freebairn and Rausser; Arzac and Wilkinson) examined the price effect of U.S. beef imports, but did not include exports, because they were small at the time. A recent article by Van der Sluis and Hayes estimated the impact of increased exports on U.S. domestic beef prices, using ad hoc demand elasticities. This article uses estimates of domestic demand parameters for fed and non-fed beef derived from an Almost Ideal Demand System (AIDS). We will explicitly consider the contradictory effects of exports and imports on domestic prices.

**A Review of Beef Trade Flows and Trade Policies**

The importance of trade flows and the impact of trade policies differs between the fed and nonfed beef markets. U.S. imports of beef are primarily nonfed beef, of which 80 percent is ground into hamburger (*Western Livestock Marketing Information Project*, personal communication). Imports have been from seven percent to nine percent of total consumption in the 1980s, and have remained relatively stable at about two billion pounds carcass weight. However, these imports are a much larger percentage of the nonfed market (Figure 1), averaging about 25 percent during the 1980s. This percentage has risen as domestic nonfed production declined in recent years. Nonfed production will continue to be a low proportion of total beef production during the 1990s (USDA, 1990) and imports should remain a large proportion of domestic nonfed beef consumption.

The U.S. exports a small but growing amount of fed beef. Fed beef exports have risen from 200 million pounds to over one billion pounds (carcass weight) during the 1980s. These small quantities are only one percent to two percent of total beef consumption, but a somewhat higher percentage of fed beef consumption. Exports were equal to about three percent of fed beef consumption during most years in the

Figure 1:  
*U.S. Beef Exports and Imports as Percent of Consumption in Domestic Fed and Non-Fed Beef Markets*



1980s (Figure 1). However, the proportion has been growing, and reached six percent in 1989.

Trade policies restrict beef trade flows in both directions. The U.S. government has regulated imports of beef under the Meat Import Law since 1964. This law sets a quota for beef imports from a formula that allows imports to grow with the size of the domestic market. In 1979, regulators revised the formula to include a countercyclical term, which adjusts imports inversely to domestic cow beef production (Simpson).

An important question is whether the quota has been binding on the level of imports. If so, this would indicate whether the removal of quotas would increase imports. In practice, the quota can be suspended to allow more imports when domestic consumer prices are high. This occurred in the early 1970s and more recently in 1979. However, in some recent years, supply in exporting countries has been inadequate to meet the quota. As a result, the quota was binding in only four years between 1980 and 1989 (USDA, FAS, 1985).

Imports are likely to increase in the future, even without a change in the U.S. Meat Import Law, for two reasons. First, the 1988 Canadian free trade agreement allows imports of Canadian beef to enter outside the quota. Imports from Canada in 1989 were 40 percent higher than in 1988. In addition, other exporters can now capture some of what used to be Canada's share of the quota (USDA, 1989). Second, although GATT does not allow import quotas, in practice countries employing import quotas for agricultural goods have not faced discipline (Hathaway). However, various countries are challenging agricultural trade restrictions under the GATT rules. For example, Australia successfully contested U.S. sugar import quotas in 1989. Australia has complained publicly about the U.S. beef quota, but has not pursued the issue because Australian beef supply is now at a cyclical low. The U.S. beef import restrictions are a likely target for future challenge, and any reduction in the current restrictions on U.S. imports will create potential for further increases in imports.

On the export side, U.S. exports go primarily to Japan, although small quantities go to Canada and South Korea. In the past, Japan has restricted beef imports through a complex system of quotas and state trading requirements. The U.S. has negotiated reductions in import restrictions since the 1960s, with major agreements in 1978, 1984, and 1988. The most recent agreement has made substantial changes in Japanese beef import policy. First, the state trading agency no longer has a monopoly on trade. Second, import quotas increased in the late 1980s, from 472 million pounds in 1987 to 869 million pounds (product weight) in 1990. Third, in April 1991 the quota was replaced by a 70 percent tariff, which will be reduced to 50 percent by 1993. Japan has the option of adding 25 percent to the tariff during 1990-1993 if imports reach 120 percent of the previous year's level. After 1993, the tariff on beef will be subject to negotiation under the GATT.

Although 50 percent is a large tariff, it is much lower than the 1988 quota's tariff equivalent of 100 to 190 percent (Wahl et al.) Thus, exports to Japan are likely to increase. We can see the impact on U.S. trade already: 1989 exports to Japan under the quota increased 50 percent over the previous year.

This review of trade and trade policies has shown that traded quantities are an increasing proportion of domestic markets for both fed and nonfed beef. Changes in the exports of fed beef are particularly dramatic. Recent changes in trade policies create the potential for further growth in both imports and exports. Therefore it is timely to examine the price effects of traded quantities in both product markets.

### *A Simplified Model of Impacts of Trade on U.S. Beef Prices*

We use a simple comparative static framework to highlight the importance of considering the two beef product markets separately when examining the impacts of trade flows on U.S. beef prices. The size and structure of the cattle inventory largely determines fed and nonfed supply within any given year. Thus, supply is very inelastic.

To model the impacts of trade on the domestic nonfed beef market, consider Figure 2a. Without trade, the intersection of domestic supply and demand would give market price  $P_{NF}^D$ , the autarky price. Trade flows alter the market equilibrium in two ways. First, imports increase the supply of nonfed beef from  $S_{NF}$  to  $S_{NF}'$ , by an amount less than or equal to the quota. This effect reduces the price of nonfed beef. Second, exports reduce the supply of fed beef from  $S_F$  to  $S_F'$ , causing the fed beef price to rise and consumers to substitute nonfed for fed beef. We show this substitution by a rightward shift in the nonfed beef demand curve from  $D_{NF}$  to  $D_{NF}'$ . This would cause the price of nonfed beef to rise. The price after trade is  $P_{NF}'$ . Trade has a similar effect on the fed beef market, but in the opposite direction (Figure 2b). The net effect of both trade flows on beef product prices depends on their relative volume and own-and cross-price flexibilities. Prices after trade in each market may be either higher or lower than the autarky prices.

As drawn in Figures 2a and 2b, the quantities imported and exported do not respond to U.S. prices. While there is undoubtedly some response of trade flows to U.S. prices, our assumption that quantities traded are determined exogenously is close to reality. Either the quota or excess supply in Australia restricts non-fed beef imports. This supply excess does not respond to U.S. prices in the short run. Excess demand in Japan determines fed beef exports, and Japanese prices do not follow U.S. prices due to the high tariff barrier.

Obviously domestic beef supply response to changes in prices caused by international trade will mitigate the short run price effects. However, beef supply responds to permanent price changes with a considerable lag. The lag reflects the biological constraints of the production process and the size of the cow herd. Slaughter numbers decline for a few years following higher prices because producers retain heifers to increase the breeding herd. This lag between prices and supply response leads to

Figure 2a:  
Non-Fed Beef Market With and Without Trade

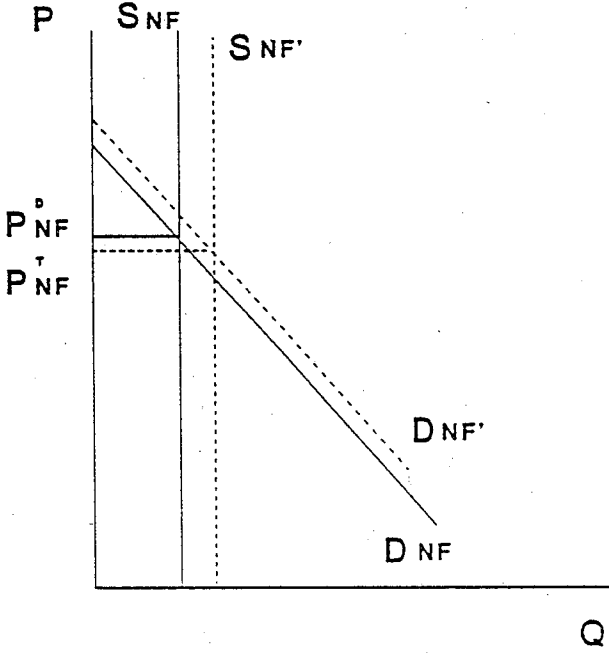
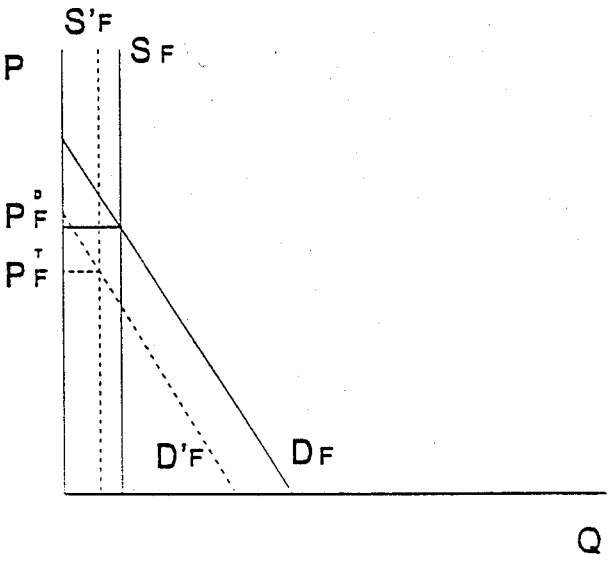


Figure 2b:  
Fed Beef Market With and Without Trade



cycles in cattle prices, slaughter, and inventory that average 10 years in length (USDA, 1988). Cattle inventory reached a cyclical low in 1989, and a new cycle began in 1990 with herd rebuilding and reduced domestic slaughter (USDA, FAS, 1990).

In examining the effects of traded quantities on U.S. product prices, we will ignore the impact of supply response. So, the estimated price effects represent upper limits. This seems reasonable because, if prices increase in the 1990s, as predicted below, the herd rebuilding phase of the cycle that started in 1990 should last longer than four years. Thus, it may be reasonable to assume little or no domestic supply response, for the first half of the next decade, to price increases caused by increased trade flows.

To estimate the effects of trade on the individual product markets, we inverted a matrix of elasticity estimates from an AIDS model of meat products to yield own- and cross-price flexibilities for fed and nonfed beef (Eales and Unnevehr). Table 1 shows the estimated elasticities from the AIDS models, as well as the price flexibilities obtained from inverting the elasticity matrix. Note that the demand for fed beef is inelastic, resulting in a relatively large price flexibility, and hence a relatively large change in price for an increase in exports.

Table 1.  
*Beef Elasticities and Flexibilities*

	Fed beef		Nonfed beef		Aggregate beef
	Own-price	X-price with nonfed beef	Own-price	X-price with fed beef	Own-price
Elasticity <sup>a</sup>	-0.634	0.384	-2.593	1.593	-0.570
Flexibility <sup>b</sup>	-3.018	-0.529	-0.702	-1.244	-2.634

a. Estimated from two AIDS models of meat demand, one specifying meat products separately and one specifying meat aggregates. See Eales and Unnevehr for details of estimation.

b. Obtained from inverting the complete matrix of own- and cross-price elasticities.

The change in price from the level that would have prevailed under autarky is calculated for nonfed and fed beef according to the following:

$$\begin{aligned} \Delta P_N &= f_{NN} \Delta Q_N + f_{NF} \Delta Q_F \\ \Delta P_F &= f_{FF} \Delta Q_F + f_{FN} \Delta Q_N \end{aligned} \tag{1}$$

where  $\Delta$  represents percentage changes;  $f_{ij}$ , the flexibility of  $P_i$  with respect to  $Q_j$ ; while the subscript, N, refers to nonfed beef and F to fed beef. Changes in quantities are trade flows as a percent of domestic consumption. We also calculated changes in prices relative to observed 1989 prices, and in that case changes in domestic consumption are the changes in trade flows relative to 1989, as a percent of domestic consumption.

To calculate the effect of trade on the aggregate beef price, a quantity-weighted average of the effects in the product markets is taken:

$$\Delta P_B^1 = \frac{Q_F}{Q_F + Q_{NF}} \Delta P_F + \frac{Q_{NF}}{Q_F + Q_{NF}} \Delta P_{NF} \quad (2)$$

To demonstrate the importance of considering individual products rather than aggregate beef demand when assessing the impact of trade, the aggregate beef price effect is also computed directly, using the elasticity from an aggregate meat demand AIDS model (Table 1):

$$\Delta P_B^2 = f_{BB} \Delta Q_B \quad (3)$$

where  $\Delta Q_B$  equals the change in total beef consumption due to both exports and imports. A comparison of the results from equations 2 and 3 will reveal how much estimated price impacts differ when we consider individual beef products rather than the aggregate beef market.

### *Simulation Results: Future Impacts of Trade on U.S. Beef Prices*

To look at the impact of projected changes in trade volumes, we must make assumptions about how much trade will increase in response to policy changes. Little recent work has been done on the impact of the U.S. beef import quota. Chambers, et al. estimated that without the quota, beef imports would have been two percent higher in the late 1970s. To estimate the upper bound for the effect of imports in the U.S. market, we assumed a 10 percent increase in imports.

More information is available about the impact of the 1988 agreement with Japan. Estimates of how much exports will increase depend on assumptions about Japanese supply and demand, and U.S. and Australian export supply response. Wahl, et al. estimated a complete model of Japanese supply and demand to project the increase in imports. Their results show that Japanese beef imports will reach 2,644 million pounds (carcass weight) by 1997. If the U.S. continues to supply half of the Japanese market (USDA, ERS), then total U.S. beef exports will increase 56 percent.

With a 10 percent increase in imports and 56 percent increase in exports, the U.S. would still be a small net importer of beef at 1989 levels of domestic production. Imports' share of nonfed consumption would increase from the current 31 percent to 34 percent. The rising level of exports would equal 10 percent of domestic fed beef consumption, up from the current six percent.

We show the projected price effects of these changes in trade in Table 2. We derived these estimates from the equations presented above. For example, we derived the estimated change in the nonfed beef price compared to the autarky price from equation 1:

$$\Delta P_N = \{-.702 (34)\} + \{-1.244 (-10)\} = -11$$



where we took the flexibilities from Table 1. The percentage changes in traded quantities are those estimated above.

Table 2 shows that the large increase in exports will have the effect of increasing fed beef prices by 12 percent compared to autarky and 10 percent compared to 1989 levels. Nonfed beef prices would be 11 percent lower than autarky prices. However, they would be three percent higher than 1989 levels due to the increased substitution of nonfed for higher-priced fed beef. The projected changes in trade will raise the overall value of beef eight percent in comparison to 1989, even though the U.S. will remain a net importer. Note that the aggregate model predicts only a four percent increase in value over 1989.

Table 2.  
*Price Effects of Future Beef Trade*

Percent change compared to	Aggregate model	Disaggregate model		
	$\Delta P_B^a$	$\Delta P_B^b$	$\Delta P_N^c$	$\Delta P_F^d$
Autarky	-8	5	-11	12
1989	4	8	3	10

- a. Change in "beef" price calculated from Equation 3 in the text.
- b. Change in "beef" price calculated from Equation 2 in the text.
- c. Change in nonfed beef price calculated from Equation 1 in the text.
- d. Change in fed beef price calculated from Equation 1 in the text.

The difference between the two predicted aggregate prices arises because the fed beef flexibility and fed beef consumption's share of the market are relatively large. Thus, any increase in exports has a larger positive effect on the aggregate domestic price of beef than the reduction in price caused by an increase in imports of similar magnitude. This illustrates the importance of disaggregating the price impacts of trade in the fed and nonfed beef markets; looking at the impact of *net* imports on aggregate beef price can be misleading.

It is also interesting to consider the case of complete trade liberalization. If Japan began a free trade policy in beef, Wahl, et al. estimate that Japanese imports would climb to 4,408 million pounds. In that case, U.S. exports would more than double over current levels and our model predicts aggregate beef price would increase 17 percent over the 1989 price. This result is comparable to that of Tyers and Anderson, who show that U.S. beef prices would increase 15 percent following full trade liberalization.

### *Implications for the U.S. Beef Industry*

The U.S. beef industry is entering a new era of expanding trade, where export competition will overtake import policy in importance to U.S. producers. The 1988

Beef Market Access Agreement with Japan will increase domestic prices of both fed and nonfed beef over their 1989 levels, *ceteris paribus*. By importing low quality (nonfed) beef and exporting high quality (fed) beef, the U.S. can exploit its comparative advantage in fed beef, and raise the total value of domestic beef production. Aggregate values will increase even if the U.S. remains a small net importer of beef.

The results have implications for industry strategy. Domestic demand parameters show that the price enhancing effects of exports is larger than the price depressing effects of imports. In addition, trade liberalization has the potential to increase exports more than imports. Thus, the industry would gain from liberalization of trade, although these gains would be tempered by the long run domestic supply response.

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