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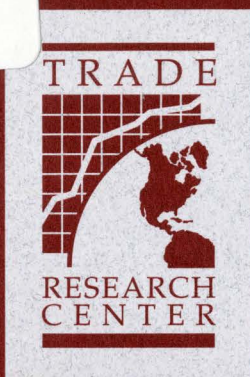
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U.S. Live Cattle and Beef Trade with Canada and Mexico: Effects on Feeder Cattle Price

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John M. Marsh

Research Discussion Paper No. 6
October, 1997

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*John M. Marsh, Professor
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U.S. Live Cattle and Beef Trade with Canada and Mexico: Effects on Feeder Cattle Price

Abstract

Since the enactment of NAFTA (1994), U.S. beef producers have been uncertain as to its price effects in the domestic market. The Canadian Free Trade Agreement and NAFTA basically eliminated tariff and non-tariff barriers, opening the U.S. market up to more cattle and beef imports but expanding U.S. beef exports to Canada and Mexico as well. The trend has been, since the latter 1980's, for U.S. net live cattle imports (Canada and Mexico) to increase, net beef exports to Canada to decrease, but net beef exports to Mexico to increase. Although health regulations and nonreciprocal beef grading agreements (i.e., Canada) prevent fully integrated markets, relaxation of trade barriers permits pre-NAFTA and post-NAFTA price-effect comparisons. A statistical analysis was performed comparing the cattle and beef trade impacts on U.S. feeder price for the 1988-1993 and 1994-1996 periods. Results show a relatively small average reduction in the U.S. feeder price after NAFTA (-\$0.53 cwt per year) compared to a very small average increase in price prior to NAFTA (\$0.01 cwt per year). The price reduction after NAFTA was, however, confounded by delays in Canadian packer expansion, devaluation of the Mexican peso, and drought conditions in northern Mexico.

U.S. Live Cattle and Beef Trade with Canada and Mexico: Effects on Feeder Cattle Price

Since formalization of the North American Free Trade Agreement (NAFTA) in January of 1994, U.S. beef producers have been concerned about its market impacts. Some producers view NAFTA as a positive agreement since reductions in trade barriers provide greater opportunities for U.S. exports of beef to Canada and Mexico. Other producers may not share the export enthusiasm due to likely increases of beef imports from Canada and live cattle imports from Canada and Mexico. Such increases are considered to have a negative influence on market prices and could accentuate problems in any price deceleration stage of the cattle cycle. This was a widely held view in the depressed price period of 1994 to 1996 (Peck, Greer, and Marsh). The seeming dilemma between exports and imports tends to complicate policy recommendations for the beef industry as a whole; i.e., recommendations range from approval of NAFTA's reductions in tariff and nontariff barriers to re-implementing some form of import controls.¹

In this article I analyze the effects of U.S.-Canadian and U.S.-Mexican beef and live cattle trade on U.S. feeder cattle prices. The price effects are evaluated for both pre-NAFTA and post-NAFTA periods as well as for the total period. Feeder prices analyzed are USDA prices obtained from the major terminal market, Oklahoma City. Generally, prices among U.S. feeder cattle markets are spatially and economically linked via transportation costs and regional supply and demand conditions; thus, with competition, it is expected that trade factors significantly impacting one regional market could result in transmitting price effects to others. A priori, Canadian live cattle trade would be expected to have a stronger impact in markets of the northern tier states (Marsh and Peck

1996), while Mexican live cattle trade would demonstrate a stronger impact in the southern markets (Peel 1996). The years evaluated in the study are 1988 through 1996, with the pre-NAFTA and post-NAFTA periods designated as 1988–1993 and 1994–1996, respectively. Although beef export trade with the Pacific Rim countries and beef import trade with Australia and New Zealand are highly important, the study holds these trade relationships constant and focuses on the North American (NAFTA) aspect.²

BACKGROUND

Until 1994, the U.S. beef and live cattle trade with Canada and Mexico received relatively minor attention, at least publicly. Though tariff and quota restrictions existed in various years, U.S. trade problems usually involved (and still do today) health restrictions for live cattle movements across the borders. Costs incurred were those necessary to comply with sanitary health regulations such as vaccinations, testings, and certification processes. Also, if domestic cattle deliveries at U.S. feedlots or beef packing plants were displaced due to live cattle imports, they were usually considered disruptive only on a temporary basis and therefore imposed minimal costs on marketing.³ In essence, during the 1980s and early 1990s, any short-term costs resulting from the Canadian and Mexican beef and live cattle trade were generally considered inconsequential since they were overshadowed by increasing domestic cattle prices.

Increases in U.S. cattle prices primarily occurred during the period of 1986 to 1993, and reflected certain economic trends in the market. Increases in nominal cattle prices were dramatic in that Oklahoma City feeder steer price (medium no. 1, 500–550 pounds) increased from \$63.84 cwt in the second quarter of 1986 to \$104.17 cwt in the second quarter of 1993. Likewise real prices

(constant 1982-84 dollars) significantly increased from \$58.20 cwt to \$72.09 cwt in the same period. The economic factors responsible for the price increases included declines in domestic beef production and U.S. beef imports, increasing consumer incomes, relatively low feed grain prices, increasing U.S. beef exports, and excess capacity in the beef packing industry. Concurrently, during this period of increasing beef prices, live cattle imports from Canada and Mexico were trending upward, i.e., from 1.4 million head in 1986 to 2.5 million head in 1993 (Figure 1). The trend was basically due to larger Canadian and Mexican cattle inventories, favorable exchange rates, increasing U.S. cattle prices, trade liberalization, and excess demand by U.S. cattle finishers and beef packers. The result was a 63 percent increase in U.S. feeder cattle price accompanied by nearly a 79 percent increase in live cattle imports. By 1995, live cattle imports on a meat equivalent basis constituted about 7.6 percent of U.S. commercial beef production; in 1986 this percentage was about 4.1 percent.

The year 1994, however, was marked by a serious set-back in live cattle prices, a decline that continued through the first half of 1996. For example, USDA data show that in March of 1994 Oklahoma City feeder steer price (medium no. 1, 500-550 pounds) was \$102.69 cwt; by October of the same year feeder price had fallen to \$84.58 cwt, and by May of 1996 feeder steer price had further declined to \$58.44 cwt. Reasons for the price decline included increasing red meat and poultry supplies, decreasing beef market share, increasing meat packer margins, increases in feed grains prices, and regional drought conditions. Nevertheless, in spite of the price decline, U.S. live cattle imports continued to increase, i.e., from 2.08 million head in 1994 to a record 2.79 million head in 1995. The majority of the increase reflected large 1995 imports of Mexican stocker and feeder cattle caused by drought conditions in northern Mexico and devaluation of the peso. The year 1996 experienced a significant decline in live cattle imports from Mexico (falling by 72 percent); however

Canadian imports were up by 33 percent due to delays in slaughter capacity expansion in southern Alberta (Hayes, Hayenga, and Melton).

Thus, in summary, the data reveal two asymmetric periods of cattle price behavior that were accompanied by similar trends in U.S. live cattle imports. From 1986 to 1993 feeder steer price increased by 63 percent, which was commensurate with a 79 percent increase in live cattle imports. Then, from 1994 through 1996 feeder steer price declined by about 21 percent, while through 1995 live cattle imports still increased by nearly 34 percent. Thereafter, through 1996 imports declined as increased imports of Canadian slaughter cattle were offset by declining imports of Mexican feeders. For example, live cattle imports were a record 2.79 million head in 1995 and then declined to 1.97 million head in 1996.

TRADE RESTRICTIONS

The above market patterns bear a relationship to pre-NAFTA and post-NAFTA price behavior in the U.S. beef industry. Prior to the 1994 NAFTA, U.S. beef price behavior *vis à vis* beef and live cattle trade was, in part, influenced by tariff and non-tariff barriers (USDA 1992). There have been substantially reduced barriers since NAFTA (Peck, Greer, and Marsh 1996). However, the price effects associated with NAFTA may be difficult to isolate since U.S. trade with Canada and Mexico was being liberalized during the 1980s due to changes in trade policies and economic conditions (Peck, Marsh, and Greer; Peel; Williams and Garcia-Vega). In 1989, the Canadian-U.S. Free Trade Agreement (CUSTA) virtually eliminated tariffs and quotas relating to live cattle and meat, and in addition, exempted each country from their existing meat import laws (External Affairs Canada 1987). Prior to 1989, U.S. import tariffs on Canadian feeder and slaughter cattle were 1.7 cents per

kg. and for wholesale beef they averaged 3.9 cents per kg. (U.S. International Trade Commission 1988). In the mid-1980s Mexico unilaterally made changes in export and import policies so as to export more feeder cattle to the U.S. and import more U.S. feed grains and beef and variety products (Williams and Garcia-Vega). For exports this included Mexico's elimination of export quotas and licenses on feeder cattle. After implementation of NAFTA, remaining tariffs on beef products and livestock on both sides were suspended. In 1990, the U.S. had established tariffs of 2.2 cents per kg. on live cattle imports and 4.4 cents per kg. on fresh, chilled, and frozen beef imports from Mexico. In 1992, Mexico had implemented a 15 percent import tariff on live slaughter animals, a 20 percent import tariff on fresh/chilled beef, and a 25 percent import tariff on frozen beef (Foreign Agricultural Service 1995).

BASIC MODEL AND ESTIMATION

Various models exist to explain the economic behavior of beef and live cattle prices (Brester and Marsh; Marsh; Wohlgenant). They range from complete demand systems that incorporate multiple commodities and theoretical restrictions to incomplete demand systems that involve less direct commodity interrelationships and fewer theoretical restrictions. The current NAFTA impacts are based upon a structural model of demand, supply, and trade relationships in the boxed beef, slaughter cattle, and feeder cattle sectors. The conceptual model is presented in the appendix. Only the results of the feeder cattle sector are reported here since the purpose is to emphasize Canadian/Mexican effects on U.S. cow-calf producers.

The conceptual model represents an incomplete demand system that allows for dynamic behavior in both the regression means and structures of the disturbance terms. Quarterly time-series

data from 1979 through 1996 were used in estimating the structural parameters. The model is specified as a partial adjustment hypothesis, allowing for price lags due to biological growth and market expectations. In the empirical estimation nonstochastic difference equations are used as instrumental variables in conjunction with autoregressive disturbances (Rucker, Burt, LaFrance). Consequently, due to parameter nonlinearities, least squares estimates are obtained from a nonlinear least squares algorithm (Burt, Townsend, and LaFrance).

From the structural model (given in appendix), interim multipliers are derived in order to estimate the effects of North American beef and live cattle trade on U.S. cattle prices. Interim multipliers are based on cumulative dynamics of the intermediate run, and are calculated using estimated parameters of a set of reduced form equations. A reduced form equation exists for each market-level price, which expresses each price as a function of a set of exogenous factors relevant to the live-to-wholesale beef market. Thus the reduced form equation for feeder steer price also incorporates economic information specific to the boxed beef and fed cattle markets; i.e., demand and supply factors which affect boxed beef cut-out values and slaughter steer prices would extend to prices of feeder cattle (Marsh 1988).

The following reduced form equation represents the empirical specification of feeder steer price:

$$(1) \quad P_{fd} = f(D, Q_{FD}, Q_{NFD}, Q_{SB}, Y, MC, BPV, P_{CN}, INV, Q_{EX-IM}, Q_{IM-EX}, P_{fd-1}, \mu),$$

where P_{fd} is the price of feeder steers; D is the set of quarterly binaries for seasonal intercept shifts; Q_{FD} and Q_{NFD} are domestic wholesale production of fed and nonfed beef, respectively; Q_{SB} is wholesale production of pork and poultry; Y is disposable income; MC is an index of marketing costs; BPV is value of steer by-products; P_{CN} is the price of corn; INV is the inventory of feeder cattle

outside feedlots; Q_{EX-IM} is U.S. net exports of fed beef; Q_{IM-EX} is U.S. net imports of slaughter and feeder cattle from Canada and Mexico; P_{fd-1} is the price of feeder steers lagged one quarter (the partial adjustment term); and μ is the disturbance term with assumptions of zero mean and constant variance. However, μ may be time-wise autocorrelated due to factors such as seasonality and systematic components of stochastic processes (Wallis 1972).

The presence of the lagged dependent variable, P_{fd-1} , characterizes equation (1) as a partial adjustment process with implied geometric distributed lags on the independent variables (Pindyck and Rubinfeld). Consequently, the response of U.S. feeder price to changes in Canadian and Mexican live cattle and beef trade can be calculated by dynamic multipliers; in the present analysis interim (or annual) multipliers are used since trade effects are analyzed year by year. To demonstrate, let a multiplier be derived from a simple relationship between feeder steer price (P_{fd}) and net beef exports (Q_{EX-IM}):

$$(2) \quad P_{fd} = \alpha + \beta Q_{EX-IM} + \lambda P_{fd-1} + \mu, \quad 0 < \lambda < 1$$

where α , β , and λ are structural parameters with λ noted as a partial adjustment coefficient. Because of the difference equation term λP_{fd-1} , the regression mean is inherently dynamic, involving several quarters for feeder steer price to reach a long-run equilibrium given a change in U.S. beef exports. The price effects from a trade shock, as measured by the export multiplier, conceptually last for an infinite number of periods and are given by the partial derivative process:

$$(3) \quad \frac{\partial P_{fd}}{\partial Q_{EX-IM_{\tau-j}}} = \beta (1 - \lambda - \lambda^2 - \lambda^3 - \dots), \quad j = 0, 1, 2, \dots$$

$$\tau = 1, 2, \dots, T$$

For a period of one year (four quarters) the multiplier would be:

$$(4) \quad \frac{\partial P_{fd}}{\partial Q_{EX-IM_{t-4}}} = \beta(1 + \lambda + \lambda^2 + \lambda^3) + \pi.$$

The interim multiplier (π) is a point estimate based upon cumulative quarterly effects with $\beta \times 1$ representing the first quarter marginal impact. In equation (4) it is assumed other market factors are held constant through out time.⁴

TRADE CONCEPT

The economic principle underlying trade is relatively simple regarding the expected benefits and the expected costs. In practice, however, trade relations historically have been inundated with political, cultural, and economic complications. As far back as Adam Smith's treatise, *The Wealth of Nations* (1776), free international trade has been viewed as an important means for nations to increase their domestic product. It was hypothesized, given endowments of resources, that real growth would occur as nations specialized in producing and exchanging those goods with relatively low opportunity costs, or where they maintained a comparative advantage. Income distribution among nations would be reflected, in part, by terms of trade. Indiscriminate protectionist policies established via tariff and nontariff barriers, according to free market advocates, were basically viewed as counter-productive—and of course, such views are held today. Some of the economic costs (besides the normal transactions and transportation costs) may involve dislocation factors such as exiting of some firms and subsequent unemployment problems. Over time, however, economic theory states that resources will be absorbed by established efficient industries and by new industries emerging as a result of economic growth. Some rational arguments are put forth, however, for trade restrictions and

they include national security, infant industries, diversity of industry by LDCs, and selling below cost (Gottheil).

The U.S. beef and live cattle trade patterns are somewhat complex, but nevertheless reflect economic principles germane to international specialization. For example, historically the U.S. has been a deficit producer of lower quality beef such as processing or ground beef. Conceptually, after adjusting for exchange rates and transportation costs, this means a ground beef price equal between the U.S. and Australia/New Zealand would yield U.S. excess demand for ground beef and Australian/New Zealand excess supply of ground beef. Under the auspices of the 1979 U.S. Meat Import Law, beef exports from Oceania have usually responded to price incentives, increasing (decreasing) as U.S. prices have increased (decreased). In contrast, after adjusting for exchange rates and transportation, the U.S. has generally been a surplus producer of high quality, fed beef (choice and prime), while the major trading partner Japan has been production deficit (excess demand) for fed beef. The U.S. surplus has increased since the latter 1980s, as evidenced by significant increases in boxed beef exports to the demand/income-growing countries of the Pacific Rim (Capps et al.). For example, in 1988 U.S. beef exports to Japan were 503.5 million pounds, and by 1996 they had increased to 1,015.8 million pounds (Figure 2).

The U.S. beef and live cattle trade with Canada and Mexico reflects several factors. Mexico has a comparative advantage in producing lightweight stocker/feeder cattle for export to the U.S., which satisfies excess demand requirements of the southwest and southern plains feedlots. In turn, the U.S. is a net exporter of fed beef to Mexico which meets excess demand requirements of Mexican consumers for select and choice grade quality beef (Peel 1996). Mexican production of fed beef is

relatively expensive due, in part, to high costs of grain even though NAFTA has facilitated Mexican imports of U.S. feedgrains (Williams and Garcia-Vega).

The U.S. is a net importer of both live cattle and wholesale beef with respect to Canada. U.S. live cattle exports consist of feeder and slaughter cattle and some breeding stock. Live cattle exports, however, constitute less than one percent of commercial cattle slaughter. Live cattle imports from Canada mainly consist of slaughter cattle (averaging about 97 percent for 1995 and 1996), primarily to satisfy demand requirements of beef packers in the northern tier states and Colorado; the much smaller quantities of feeder cattle imports satisfy demand requirements of northern and midwest state feedlots. U.S. net imports of live cattle from Canada have significantly increased since the latter 1980s, i.e., from 487.5 thousand head in 1988 to 1,509.1 thousand head in 1996, or slightly over a three-fold increase.

The U.S.-Canadian wholesale beef trade basically involves similar quality products within the framework of a non-reciprocal grading system. Essentially, select and choice grade beef are traded both ways, although relatively more U.S. select grade may move north (eastern Canada) and relatively more Canadian choice equivalent may move south (western U.S.) due to premiums and discounts (Hayes, Hayenga, and Melton).⁵ Nevertheless, the product forms are somewhat different. A 1994 Colorado Department of Agriculture study indicated about 75 percent of U.S. beef exports to Canada are high value, boneless cut variety and 13 percent offal, while U.S. beef imports from Canada were 39 percent carcasses, 30 percent boneless cuts, and 20 percent trimmings (Larsen and Rubingh). Much of the Canadian beef entering the U.S. serves the deficit west coast markets while U.S. beef exports are destined for the deficit eastern provinces of Canada. As in the case of live cattle, U.S. beef imports have grown. In 1988, U.S. beef imports from Canada were 172.0 million pounds and by 1996

they had increased to 585.8 million pounds, or about a 341 percent increase. During this same period U.S. beef exports to Canada also grew, from 52.6 million pounds in 1988 to 295.4 million pounds in 1996, or about a 462 percent increase (Figure 3).

TRADE IMPACTS

In this section the estimated impacts on feeder steer prices due to changing U.S. beef trade with Canada and Mexico are discussed. The years analyzed include 1988 to 1996. The trade effects are evaluated under the assumption that other important market factors of supply and demand are held constant (i.e., beef substitutes, feedgrains, cattle inventories, etc.). The effects of year-to-year changes in net imports of live cattle and boxed beef are analyzed for periods of pre-NAFTA, post-NAFTA, and as well as the total period. U.S. beef trading with international markets such as the Pacific Rim countries (Japan, South Korea, Taiwan, etc.) are held constant. Econometric multipliers based on the principle of equation (4) are applied to annual changes in USDA trade data. The price results are given in both percentage and dollar per cwt terms. Since U.S. net imports of wholesale beef are reported in carcass weight pounds, net imports of live cattle are converted to a carcass weight equivalent (Peck, Marsh, and Greer). The reasoning is that live cattle are processed into wholesale beef, a critical quantity variable in determining boxed beef, slaughter steer, and feeder steer prices (Marsh 1988).

Table 1 gives the import and export data on which the analysis is based. Table 2 presents the feeder price impacts of the live cattle trade, while Table 3 gives the feeder price results for trade in boxed beef. Table 4 summarizes the price effects for the period prior to NAFTA (1988–1993) and for the period after NAFTA (1994–1996). As a precaution, results for these two periods require

careful interpretation since the post-NAFTA period is relatively short, i.e., insufficient time has elapsed for the market to adjust to the emerging dynamics of trade. For example, the impacts on Mexican fed beef production from importing more U.S. feedgrains, the effects of Canadian beef packing expansion, or feedback effects on U.S. beef exports from post-NAFTA growth in the Canadian and Mexican economies require more than two years of observations.

The results show that the trade price effects are volatile but demonstrate relatively small marginal impacts (Tables 2 and 3). The volatility is consistent with historically large shifts in U.S. net imports and exports of live cattle and beef (Table 1), so indicated by standard deviations that are large relative to their means. For example, for the period 1988–1996, the mean increases in net live cattle imports from Canada and Mexico were 27.85 and 5.45 percent, respectively, while their respective standard deviations were 39.14 and 48.25 (Table 2). These trade figures may reflect inter-country differences in beef and live cattle prices, production costs, exchange rates, internal macro policies, and forage and weather conditions. The small price impacts for Canada and Mexico (discussion following) reflect NAFTA beef trade as a proportion U.S. domestic fed beef production. For example, in 1996 U.S. net live cattle imports (carcass weight equivalent) constituted about 5.0 percent of domestic beef production, while U.S. net beef exports to Canada and Mexico were about 0.5 percent of domestic beef production.

Live Cattle Effects

For the period 1988 to 1996, the U.S. realized a negative price position in live cattle trade with respect to Canada and Mexico (Table 2). For example, the “sum” and “mean” rows show U.S. feeder price declined by about \$3.69 cwt due to trade with Canada, or by an average of \$0.46 cwt per year. Similarly, U.S. feeder price declined about \$1.74 cwt from trade with Mexico, or by an

average of \$0.22 cwt per year. The data in Table 1 reveal the source of the price declines as U.S. *net* live cattle imports trended upward from 1.01 million head in 1988 to 2.7 million head in 1995, for a 167 percent increase. This trend is attributed to increasing cattle inventories in Canada and Mexico, relatively favorable U.S. cattle prices and exchange rates, and excess demand in the U.S. cattle finishing and beef packing industries (Lesser). In 1995, an import surge of feeder cattle from Mexico occurred due to severe Mexican drought conditions and devaluation of the peso. Likewise, in 1996 an import surge of slaughter and feeder cattle from Canada occurred due to delays in capacity expansion of the two major Alberta packing firms (Iowa Beef Processors and Cargill), resulting in a large southern movement of feeder and fed cattle (USDA 1997).

Although the marginal price impacts of live cattle trade are relatively small, there appears to be a certain degree of price risk. For example, price effects from net live cattle trade with Canada and Mexico show standard deviations of \$0.78 cwt and \$0.93 cwt, respectively. Applying these figures to a 95 percent confidence interval indicates that U.S. price changes, due to Canadian and Mexican cattle trade, ranged from -\$2.31 cwt to +\$1.38 cwt (Canada) and from -\$2.43 cwt to +\$1.99 cwt (Mexico) about their respective means.⁶ For a 650 pound feeder steer, this amounts to -\$15.80 to +\$12.94 per head around the mean return using the Mexican negative and positive interval points.

Boxed Beef

The results of U.S. beef export trade for the 1988–96 period (“sum” row, Table 3) indicate the net price position is negative with respect to Canada (-\$1.13) and positive with respect to Mexico (\$2.58 cwt). This amounted to a respective decline of \$.14 cwt and an increase of \$.32 cwt per year (“mean” row). The standard deviations of the price impacts for both countries are high (relative to their means) at \$1.08 cwt and \$0.99 cwt, respectively. The U.S. has consistently been a net importer

of beef with respect to Canada, with the deficit increasing from 119.4 million pounds in 1988 to 290.4 million pounds in 1996. As in the case of trading live cattle, the Canadian standard deviation (\$1.08 cwt) also suggests a certain feeder price risk from trading wholesale beef. For example, a 95 percent confidence interval indicates that U.S. price effects with Canada fell between -\$2.70 cwt and +\$2.41 cwt. around the mean, or between -\$17.55 and +\$15.67 per head for a 650 pound feeder.

The U.S. wholesale beef trade position with Mexico has always involved a net surplus. Quantities of beef imports from Mexico are quite small and consist of ground beef or select-standard grade beef cuts (Peck, Greer, and Marsh). Overall, the U.S. beef trade surplus with Mexico has demonstrated an upward trend, from 37.4 million pounds in 1988 to 223.0 million pounds in 1994. The surplus then declined to 92.3 million pounds in 1995 due to the peso devaluation, but recovered to 172.2 million pounds in 1996 as the Mexican peso gained purchasing power. Consequently, the sum of the marginal price effects for 1988–1996 show a total feeder price increase of \$2.58 cwt, or an annual average gain of \$0.32 cwt. However, the large standard deviation (\$0.99 cwt) indicates the probability of relatively large price swings; i.e., the probability is 95 percent that the U.S. price effects from beef trade with Mexico were -\$2.02 cwt below and +\$2.66 cwt above the mean.

Pre- and Post-NAFTA

The feeder price impacts involving trade in the pre-NAFTA and post-NAFTA periods are given by the summarized data in Table 4. For live cattle, U.S. trade with Canada and Mexico resulted in marginal negative price effects regardless of the periods. It appears that the total price effects with Canada were more negative prior to NAFTA (-\$2.247 cwt) than after NAFTA (-\$1.445 cwt). For Mexico, the price effects were more negative after NAFTA (-\$1.035 cwt) than before NAFTA (-\$0.704 cwt). As stated earlier, the U.S.-Canadian Free Trade Agreement (1989) eliminated most

trade barriers other than health regulations. When adjusting the price effects to a per year basis (a more equitable comparison), Canada and Mexico were similar in that the reductions were greater after NAFTA. For example, annual feeder price reductions with respect to Canada and Mexico respectively were \$0.375 cwt and \$0.117 cwt prior to NAFTA and respectively were \$0.723 cwt and \$0.518 cwt after NAFTA. However, conclusions about NAFTA require careful interpretation. Causality from U.S. import anomalies may be more related to the 1995 delays in Alberta beef packer expansion and to the 1995 Mexican drought and peso devaluation problems rather than to liberalized trade.

For the boxed beef trade, the pre- and post-NAFTA estimates reveal substantial changes with respect to both Canada and Mexico. The Canadian effects switch from positive to negative for the respective periods, i.e. \$0.04 cwt to -\$1.17 cwt (total) and \$0.01 cwt to -\$0.59 cwt (annual). The negative price effect for the 1994–96 period reflects the fact that U.S. net beef exports to Canada declined by 113.9 million pounds over this period. The pre-NAFTA period for Mexico was characterized by an annual price increase of \$0.521 cwt while the post-NAFTA period switches to a decline in annual price of \$0.274 cwt. Two factors may account for the difference, each of which reduced net exports to Mexico. First is the fact that, under NAFTA, the U.S. immediately suspended its 4.4 cents per kilogram (2 cents per pound) tariff on beef and veal imported from Mexico (likewise, Mexico immediately suspended its 20–25 percent tariff on imports of U.S. beef). And second, probably the largest factor, the weak peso in 1995 greatly reduced the purchasing power of the currency which reduced the demand for U.S. beef. For example, in 1994 Mexico imported 223 million pounds of U.S. beef, but in 1995 these imports had declined to 92.3 million pounds, or a 58.6 percent decrease.

CONCLUSIONS

U.S. beef cattle producers have been concerned about increasing live cattle imports from Canada and Mexico since the implementation of NAFTA. Large imports of feeders/stockers from Mexico in 1995 and large imports of slaughter cattle from Canada in late 1995 and 1996 coincided with low prices in the U.S. cattle cycle. Live cattle prices declined significantly from mid-1994 through 1996. At issue for trade is whether post-NAFTA cattle imports are an *association* or a *cause-effect* in U.S. beef price behavior. Likewise, whether by association or by cause-effect, cattle prices declined as U.S. net boxed beef exports to both Canada and Mexico declined relative to their 1992–93 levels. In the work presented, cattle price impacts attributed to net live cattle imports and net beef exports in the pre-NAFTA and post-NAFTA periods were analyzed. Results show there were greater price declines, though small, occurring after NAFTA.

Considering NAFTA beef trade in total, the summation of annual price effects for both net cattle imports and net beef exports in Table 4 results in a \$0.039 cwt mean increase in feeder price prior to NAFTA and a \$2.10 cwt mean decrease in feeder price since NAFTA. However, these intertemporal price adjustments are unlikely due to NAFTA policies per se. Pre- and post-NAFTA differences were masked by the 1989 Canadian Free Trade Agreement, North American economic growth, currency devaluation and drought problems in Mexico, and Canadian exports of surplus fed cattle due to delayed packer capacity expansion. Further evidence (data) from additional post-NAFTA years will be needed to form more definite conclusions about trade effects on U.S. beef producers.

Table 1. U.S. Beef and Live Cattle Import and Export Data

Year	Cattle Imports		Cattle Exports		Beef Exports		Beef Imports	Beef Totals (All Countries)	
	CA	MX	CA	MX	CA	MX	CA	EX	IM
1988	487.5	844.2	194.8	126.6	52.6	37.4	172.0	690.0	2,405.8
1989	547.7	873.6	102.5	66.6	98.2	74.7	239.3	1,022.6	2,178.4
1990	873.8	1,261.2	72.7	47.2	191.1	72.9	222.4	1,066.4	2,355.9
1991	907.7	1,034.2	188.4	122.5	258.9	172.8	223.0	1,188.5	2,406.5
1992	1,273.2	982.0	195.0	126.8	249.4	194.9	331.1	1,323.8	2,439.8
1993	1,202.3	1,296.6	93.0	60.4	243.5	120.0	407.4	1,275.0	2,401.3
1994	1,010.3	1,072.1	139.8	90.9	285.7	223.0	462.2	1,610.8	2,370.7
1995	1,132.7	1,653.4	67.4	14.6	312.0	92.3	445.6	1,821.0	2,104.0
1996	1,509.1	456.3	40.7	115.2	295.4	172.2	585.8	1,878.2	2,072.2

Notes: All live cattle numbers are in thousands of head and beef imports and exports are in millions of pounds (carcass weight). The terms "CA" and "MX" refer to Canada and Mexico, respectively. The term "Beef Totals" in the last two columns indicate U.S. beef exports (EX) and imports (IM) of beef to *all* countries.

Table 2: Annual Feeder Price Impacts from Changes in U.S. Net Live Cattle Imports, Canada and Mexico

Year to Year Changes	% Change CA Net Imports	Price % Change	Price cwt Change	% Change MX Net Imports	Price % Change	Price cwt Change
1988-89	+64.7	-0.830	-\$0.703	+12.5	-0.276	-\$0.234
1989-90	+66.1	-1.804	-\$0.940	+50.5	-1.224	-1.061
1990-91	-10.6	+0.174	+\$0.160	-24.9	+0.870	0.802
1991-92	+75.7	-1.835	-\$1.701	-6.2	+0.181	+0.168
1992-93	-11.8	+0.303	+\$0.262	+44.5	-1.237	-1.070
1993-94	-21.5	+0.736	+\$0.675	-20.6	+0.764	+0.691
1994-95	+22.4	-0.607	-\$0.505	+67.0	-1.959	-1.630
1995-96	+37.8	-1.428	-\$0.940	-79.2	+0.904	+0.595
SUM	222.8		-\$3.692	43.60		-\$1.739
MEAN	27.85		-\$0.462	5.45		-\$0.217
Standard Deviation	39.14		\$0.780	48.25		\$0.934

Notes:

The table is divided into Canadian (CA) and Mexican (MX) cattle import effects on the left side and right side, respectively. The positive signs in the "% Net Imports" columns mean U.S. net imports increased while the negative signs mean U.S. net imports decreased. Net imports are U.S. live cattle imports from CA and MX less U.S. live cattle exports to CA and MX. Price changes in the "Price cwt Change" columns are the "Price % Change" columns multiplied by Oklahoma City feeder prices for the years. The last three rows refer to the sum, mean, and standard deviation of the appropriate column headings.

Table 3: Annual Feeder Price Impacts From Changes in U.S. Net Beef Exports, Canada and Mexico

Year to Year Changes	% Change CA Net Exports	Price % Change	Price cwt Change	% Change MX Net Exports	Price % Change	Price cwt Change
1988-89	-18.2	-0.547	-\$0.463	+99.9	+0.935	+\$0.792
1989-90	+77.8	+1.821	+\$1.549	-2.4	-0.030	-\$0.026
1990-91	+214.7	+1.116	+\$1.070	+136.9	+1.655	+\$1.534
1991-92	-227.6	-1.095	-\$1.015	+12.3	+0.286	+\$0.265
1992-93	-100.5	-1.071	-\$0.926	-38.5	-0.981	-\$0.849
1993-94	-7.7	-0.189	-\$0.173	+85.8	+1.539	+\$1.411
1994-95	+24.3	+0.486	+\$0.404	-58.6	-1.478	-\$1.230
1995-96	-17.2	-2.394	-\$1.576	+86.6	+1.036	+\$0.682
SUM	-154.5		-\$1.13	32.20		+\$2.579
MEAN	-19.31		-\$0.141	40.25		+\$0.322
Standard Deviation	134.06		\$1.080	71.41		\$0.994

Notes:

The table is divided into Canadian (CA) and Mexican (MX) beef export effects on the left side and right side, respectively. The positive signs in the "% Net Exports" columns mean U.S. net exports increased while the negative signs mean U.S. exports decreased. Net exports are U.S. beef exports to CA and MX less U.S. beef imports from CA. Price changes in the "Price cwt Change" columns are the "Price % Change" columns multiplied by Oklahoma City feeder prices for the years. The last three rows refer to the sum, mean, and standard deviation of the appropriate column headings.

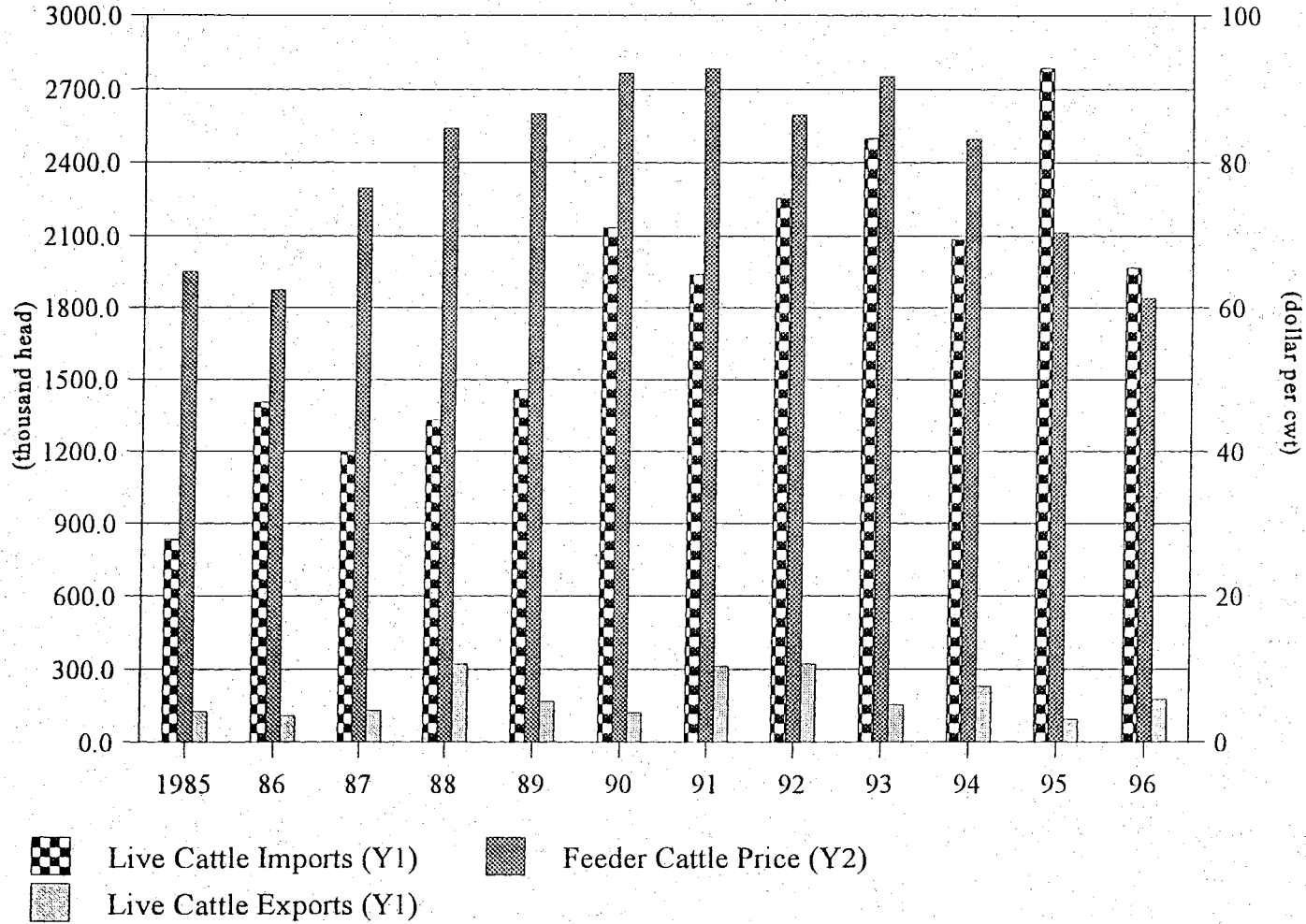
Table 4: Feeder Price Effects of Pre-NAFTA and Post-NAFTA Years, Live Cattle and Beef Trade Summary

Years	Net Cattle Imports (CA)	Net Cattle Imports (MX)	Net Beef Exports (CA)	Net Beef Exports (MX)
-----(\$ per cwt)----- ---				
1988-1993 total	-2.247	-0.704	+0.042	+3.127
annual	-0.375	-0.117	+0.010	+0.521
1994-1996 total	-1.445	-1.035	-1.172	-0.548
annual	-0.723	-0.518	-0.586	-0.274

Notes:

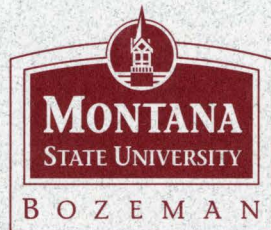
Data are based on a summary of price impacts in Tables 2 and 3. Figures are in dollars per cwt with associated positive or negative changes. The years 1988-93 are pre-NAFTA and the years 1994-1996 are post-NAFTA. The terms "CA" and "MX" refer to Canada and Mexico, respectively. In the "years" column, "total" is the sum of marginal price impacts for the relevant years while "annual" is the average per year.

Figure 1. U.S. Live Cattle Imports, Exports, and Feeder Cattle Price



FOOTNOTES

1. Concern about beef import controls were incorporated in policy resolutions adopted at the December, 1996 Montana Stockgrower's Annual Convention, and in policy recommendations made to the annual National Cattlemen's Beef Association convention in February, 1997.
2. It is recognized that such relationships are interactive. For example, changes in import quantities of Canadian and Mexican cattle slaughtered in the U.S. could affect ground beef imports (from Australia and New Zealand). Or, changing export demand in the Pacific Rim could affect U.S. beef prices and hence Canadian and Mexican exports of live cattle to the U.S.
3. Larsen and Rubingh indicate that in 1994, 10-14 percent of Colorado cattle slaughter consisted of Canadian fed cattle. Thus, at times, one-to-two week marketing delays occurred for domestic feeders selling to Colorado packing plants.
4. Thus π may represent more of a maximum effect since other market interactions are conceptually restricted to zero. For example, an increase in beef exports may increase feeder cattle price, and a price increase elicits a supply response which could mitigate π .
5. Canadian boxed beef graded AA or AAA currently sells in the U.S. at a no-roll discount, while U.S. boxed beef with a USDA select or choices grade sells in Canada also at a discount. The Canadian AA and AAA grade are equivalent to the USDA select and choice grades, respectively. Canadian beef shipped in to the U.S. in the form of carcasses can receive the USDA grade and are counted as part of U.S. production.
6. The confidence interval, given the sample size, gives a specific probability (i.e., 95 percent) that a random variable falls between upper and lower bounds about its mean value. The probability is based on a selected level of significance, i.e., $\alpha = 0.05$ or $\alpha = 0.10$. The formula is $I(Y) = \bar{Y} \pm (t)S_y$, where $I(Y)$ is the interval estimate for the random variable Y , \bar{Y} is its mean value, (t) is the t statistic based on a selected level of significance, and S_y is the standard deviation of Y . For the means and standard deviations of the price changes in Table 2, a significance level of $\alpha = .05$ gives the t value of 2.365.



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