

# **THE NORTH AMERICAN LIVESTOCK INDUSTRY: A U.S. PERSPECTIVE**

*David P. Anderson, James Mintert, and Gary W. Brester*

## **INTRODUCTION**

Livestock and meat trade flows among North American countries have generated tensions over the last few years. In the cattle sector, falling cattle prices and producer profits from 1994-96 generated concerns as market participants questioned the impacts of trade liberalization on those prices. In the hog and pork sector, trade tensions have been less contentious and overshadowed by rapid structural changes. The growth of large integrated contract producers has been the focus of many industry concerns.

This paper examines the U.S. beef and pork production, processing, and consumer demand sectors by detailing industry structure, changes, and performance. Economic advantages are identified where possible for each industry. Similarities and differences between the U.S. and Canadian industries are presented.

## **THE U.S. CATTLE AND BEEF INDUSTRY**

The United States has the fourth largest inventory of cattle and buffalo in the world (USDA,b), only exceeded by China, India, and Brazil. Although other countries have larger inventories, the United States leads the world in beef production. The infrastructure and knowledge which supports this industry provides a competitive advantage for supplying increasing world beef demand.

The initial beef production component in the U.S. is a cow/calf operation which maintains breeding herds and produces calves. Cow/calf production occurs in all 50 states. Texas is the largest cow/calf state with 5.4 million beef cows. The top 10 beef cow states are located primarily in the Plains and South. They include Texas, Missouri, Oklahoma, Nebraska, South Dakota, Montana, Kansas, Kentucky, Tennessee, and Florida. In general, calves are weaned between 450 and 650 pounds and sold to stocker/backgrounding operations or directly to feedlots. Some cow-calf operators retain ownership of calves throughout the feeding stage.

Backgrounding or stocker operations include those which graze calves on rye grass winter pastures in the Southeast, winter wheat pastures in the Southern Plains, and other grass feeding programs in the West, Midwest, and Northern Plains. In these operations, calves are overwintered on a feed source to be sold at heavier weights in the spring. In some areas these “feeders” may be held into the summer to take advantage of additional spring and summer grasses. In these cases, feeders are then sold to feedlots as yearlings. Stocker/background programs represent a U.S. production advantage because they provide feeding alternatives which increase industry flexibility.

Feeder cattle, yearlings, and/or calves are eventually sold to feedlots which use concentrated (grain) feeding rations to produce slaughter weight steers and heifers. Virtually all slaughter steers and heifers are grain fed in the United States. The primary nonfed component of beef production are cull cows and bulls, the majority of which are used for production of ground beef. Feeding periods vary with respect to weather, breeds, and economic conditions, but can range from 100 to 240 days.

A 10-12 year cycle of U.S. cattle inventories has occurred regularly since before the turn of the century. The cycle is primarily the result of biological production timing and economic conditions. U.S. cattle inventories totaled 98.5 million head on January 1, 1998. This marked the second year of declining inventories following the last cycle peak of 103.5 million head in 1996. Prior to the 1980s, the long-term trend in the U.S. cattle sector was for cyclical inventories to increase. However, the cattle inventory peak during the 1979-90 cycle failed to exceed the previous cycle's peak, and the 1990 cattle inventory estimate marked the first time an inventory trough fell below the previous cycle's trough. This shift was one of many signals indicating that aggregate U.S. beef demand was not increasing as it had in the past.

### **Western States**

Perhaps the most interesting and controversial area of cattle production in the U.S. occurs on western public lands (California, Oregon, Washington, Nevada, Idaho, Montana, Wyoming, Colorado, Utah, Arizona, and New Mexico). Large areas of these states are owned by the Federal government and are well suited for grazing livestock. These 11 public land states contain about 19 percent of the beef cows in the United States. Many ranches use combinations of public, private, and state grazing lands. Public lands are generally administered by the U.S. Forest Service, the Bureau of Land Management, the U.S. Department of Agriculture, and the Department of the Interior. Animal unit months (aums) of grazing totaled 16.8 million on Forest Service and Bureau of Land Management lands in 1990.

The first public land grazing fees were proposed in the 1870s, but were not enacted for 30 years (Foss, 1959). Since then, the level of grazing fees has been a controversial subject. Public land grazing fees are determined by a formula that considers the value of forage, cattle prices, and production cost inflation. Public grazing fees are controversial because they appear to be low relative to private lease rates. In recent years public grazing fees have ranged between \$1.30 and \$2.00 per aum whereas private lease rates have ranged between \$4.00 and \$13.00 per aum in Western states (USDA,d). Although public grazing lease rates are lower than private lease rates per aum, studies show that other costs (e.g., labor, water, death losses) are generally higher on public than private land, and that grazing quality and productivity of public lands are often lower than on private lands (Torell et al., 1993).

Public land leases are often tied to the land base of privately-owned ranches. Although such leases are not legally bound to private property, public land leases are often

transferred with private ranches. Research suggests that the value of lower public lands grazing fees are capitalized into the value of private ranches (Torell and Doll, 1991). As a result, raising public land lease rates could cause a decline in the value of some ranches.

Various proposals to increase fees have been proposed. One study estimates the own-price elasticity of demand for public land grazing ranges from -0.10 to -0.42 implying that the quantity demanded of public land grazing is relatively unresponsive to fee increases (Anderson and Richardson, 1993). In addition to controversy surrounding grazing fees, environmental groups argue for reductions in public land grazing throughout the West. Availability of public grazing is likely to decline as riparian areas are fenced to protect fish habitats, and hunting and fishing enthusiasts promote the development of additional wildlife habitats. Differences between private and public land lease rates are expected to cause more controversy and division between producers and environmental groups and between public land ranchers and cattle producers in other parts of the country.

### **Feedlot Production**

Historically, most cattle feeding was done by farmer-feeders in the Corn Belt. However, cattle feeding has migrated to specialized feedlots located in the Southern Plains. Farmer-feeders currently possess less than 5 percent of U.S. cattle feeding capacity. Relatively dry climates, plentiful feed supplies made possible by irrigation, and improved transportation technologies and infrastructures which allow less bulky, perishable meat products to be shipped to population centers have stimulated the migration of both cattle feeding and slaughtering to less-populated regions of the Plains.

Economies of size provided the motivation for the rapid consolidation of the feedlot industry that continues today. Feedlots larger than 32,000 head marketed 18.5 percent of the fed cattle in 1977. In 1997 feedlots the same size marketed 41 percent of fed cattle. Several key issues have driven consolidation and increased feedlot capacities. Economies gained by larger cattle feeding operations include full utilization of feed mills, cost savings in volume purchases of feed, and both labor and marketing efficiencies. In addition, specialized feedlots are able to increase turnover rates (the number of cattle marketed relative to feedlot capacity). For example, farmer-feeders generally have a turnover rate of one, which means they feed one pen or set of cattle each year. Specialized feedlots may have turnover rates of 2.5 or more which spreads fixed costs over more cattle, thereby leading to lower production costs.

### **THE CANADIAN CATTLE AND BEEF INDUSTRY**

The Canadian cattle sector is much smaller than that of the United States. For example, Canadian cattle inventories totaled 13.2 million head in 1998 which represents only 13 percent of U.S. inventories. Cattle inventories are in their second year of decline after peaking at 13.4 million head in 1996. However, total cattle inventories have increased since the early 1980s, whereas U.S. cattle inventories peaked in 1975. Cattle feeding in the

Western provinces expanded throughout the 1990s, while total cattle inventories were declining in the Eastern provinces.

Alberta's cattle feeding industry has expanded rapidly in recent years because of good access to feeder cattle supplies, a relatively dry climate, low population densities, and declining feed costs. Currently, the size of Alberta's cattle feeding industry trails just three U.S. states. The driving force in the expansion of cattle feeding in the Western provinces has been declining feed grain prices. The Canadian Plains produce large quantities of barley and wheat. The removal of federal transportation subsidies to port markets reduced grain prices in the interior of the country and caused producers to look for alternative market outlets, such as cattle and hog production. Concurrently, feed supplies were further boosted when adverse weather damaged the quality of the 1992-93 wheat crop resulting in a sharp increase in feed wheat (Alston, Gray, and Sumner, 1996). The supply of feed wheat further increased the following year because of unusually wet growing conditions.

The Canadian cattle feeding industry appears to have fewer backgrounding opportunities relative to the United States and, therefore, tends to place calves in feedlots at relatively lighter weights. This observation is supported by live cattle export data which indicate most Canadian slaughter cattle are exported to the United States during the first portion of each year. These marketings are consistent with feeding periods necessary to feed calves that have not been backgrounded, given traditional calving seasons. Thus, the Canadian feeding industry may be less flexible than the United States sector in terms of responding to market signals. Backgrounding opportunities may provide the United States with cost of gain competitive advantages during periods of high feed grain prices. It also provides the opportunity for a smoother flow of feeder cattle placements throughout the year.

The types of cattle produced in the United States and Canada are somewhat different. Anecdotal evidence indicates that the Canadian industry has a relatively higher percentage of Continental breeds (e.g., Charolais) than the United States. Perhaps because of the Continental breeds prevalence, grading data indicate that a lower percentage of Canadian cattle grade AAA (approximately equivalent to U.S. Choice) than in the U.S (Alberta Cattle Feeders). But Canadian cattle may produce more consistent carcasses than U.S. cattle because of the reliance on Continental breeds. The apparent differences in grading characteristics of Canadian and U.S. cattle suggest there is an opportunity for market segmentation and specialization which could lead to greater reliance on U.S. cattle for higher quality table cut beef and more reliance on Canadian cattle for carcasses capable of grading Select in the U.S.

## **THE MEXICAN CATTLE INDUSTRY**

Total Mexican cattle inventories (including dairy and dual purpose animals) are approximately one-third the size of U.S. inventories. The United States and Mexico have a long history of cattle movements between the two countries. In general, light weight

calves are exported to the United States for placement in backgrounding and feedlot operations. Over the last 10 years, Mexico's annual exports averaged approximately one million head. However, 1.65 million head were exported in 1995. The increase during 1995 was primarily caused by two factors. First, Mexico's economic crisis resulted in a devaluation of the peso and large increases in interest and inflation rates. Mexican cattle producers responded by selling larger numbers of feeder cattle and cows in the United States. Second, a severe multi-year drought in northern Mexico, which peaked in late 1994 and early 1995, also encouraged producers to export more calves to the United States. Nonetheless, increased exports generated concerns among U.S. cow/calf producers, particularly in the Southwest. These concerns were further exacerbated by uncertainties regarding the impact of the recently enacted North American Free Trade Agreement (NAFTA). Although some argued that much of the decline in U.S. feeder cattle prices was attributable to NAFTA, research suggests that only a small portion of the decline (ranging from  $-\$0.32$  to  $-\$1.03$  per cwt for 400-500 pound steers) was caused by increased cattle exports from Mexico (Peel and Cockerham, 1995). The aggregate impact of the larger feeder cattle imports was muted by the fact that, in the short run, cattle feeders benefited from the modest reduction in feeder cattle prices attributable to the import increase.

Mexican cattle exports to the United States have declined dramatically since 1995. In 1996, Mexican cattle exports to the United States were only 456,246 head, a 72 percent decline from 1995 and the smallest level since 1984. But during 1997, cattle imports from Mexico rebounded to 669,409 head, a one year increase of 47 percent. Long term, cattle imports from Mexico to the United States are likely to stabilize somewhere between the 1997 level and the long term historic average of 1 million head.

U.S. beef exports to Mexico are expected to grow over time, but will remain sensitive to Mexican economic conditions. After experiencing a sharp decline during 1995 as a result of economic upheaval in Mexico, U.S. beef exports rebounded in 1996 and 1997. U.S. beef exports to Mexico during 1997 reached 312 million pounds, an increase of 239 percent since 1995. Moreover, when converted to a liveweight equivalent, 1997 U.S. beef exports to Mexico were equivalent to 445,000 head of slaughter cattle. Long term, the relative size of cattle and beef trade will depend upon economic conditions in Mexico. Since the United States has a comparative advantage in grain fed beef production, Mexico is expected to continue shipping feeder cattle north for feeding and processing, and the United States will likely increase boxed beef exports to Mexico over time.

## **THE BEEF PACKING SECTOR**

The beef packing industry has experienced considerable consolidation over the past two decades, primarily the result of companies implementing low-cost processing strategies through the capture of economies of size. Moreover, beef slaughtering and processing companies are increasingly global in nature. For example, IBP and Excel maintain packing facilities in the United States and Canada. These plants not only supply Canadian domestic and foreign trade needs, but also provide flexibility in terms of

supplying carcass beef to processing plants in the United States. Given this environment, relative changes in processing costs (e.g., regulatory differences) could result in either U.S. cattle moving from Western states for slaughter in Canada or Canadian cattle moving from Western provinces into the United States.

## **U.S./CANADIAN CATTLE AND BEEF ISSUES**

### **Quality and Pricing Issues**

Beef slaughtering/processing plants must operate near design capacities to minimize slaughter and processing cost per head. Consequently, it becomes relatively more important to focus on maintaining a constant volume of slaughter cattle relative to seeking higher quality slaughter cattle. Although pens of cattle which are suspected to contain a higher percentage of animals grading Choice attract higher prices, the price differentials are small and economically insignificant from a cattle feeders perspective (Jones et al., 1992). Furthermore, it is unclear whether subjective quality evaluations of live cattle based upon visual inspections are correlated with the quality of end-products produced by those cattle. Thus, live weight cash market pricing creates little incentive for cow/calf producers, backgrounders, or feedlots to improve cattle quality. One attempt to solve the quality issue is the movement toward value-based marketing in the form of pricing grids. Pricing grids establish premiums and discounts based upon end-product quality characteristics. Further adoption of such systems should provide pricing signals that increase incentives for improving quality.

The 1995 Beef Quality Audit (Smith et al., 1995) recognized five major beef quality concerns. They were:

- low uniformity and consistency;
- low palatability;
- low tenderness;
- too much external fat; and
- too high a price for value received.

These concerns strongly indicate that cattle prices must be tied more closely to end-product quality characteristics (Schroeder et al., 1998). Until value-based marketing systems are widely adopted, the quality of U.S. beef is likely to continue to be relatively variable. Whereas quality consistency is a U.S. disadvantage, it appears to be an advantage for Canadian beef. Canada's heavier reliance on Continental breeds which perform well in colder climates has contributed to a more uniform, consistent product—although the average quality of Canadian beef may be slightly lower than that of the United States.

The sharp decline in cattle and calf prices in 1994-96 ignited debate regarding the effects of beef packing concentration (market power) and captive supplies on cattle prices. In 1980, the four-firm concentration in the beef packing sector was 36 percent of steer and heifer slaughter, but increased to 82 percent by 1994 (USDA, c). Many cattle producers

believe that concentration in the beef packing sector allows packers to reduce slaughter cattle prices through the use of market power. However, most research on this topic indicates that, although packers have been able to exercise some market power, it has had a very small impact on prices received by producers (Ward and Schroeder, 1996). But, concentration has also led to increased plant and industry efficiencies that may allow packers to bid more for cattle than would otherwise be the case (Azzam and Schroeter, 1995).

Captive supplies refer to cattle which are either contractually committed to packers more than two weeks in advance, or are directly owned by packers. The impact of captive supplies on the market price of cattle is unclear. On one hand, a packer with large captive supplies may be likely to bid less aggressively for additional cattle which could lower prices. On the other hand, captive supplies reduce the number of cattle available to other packers which may have a positive influence on cattle prices. Research has shown that in some cases, captive supplies have a negative impact on cash cattle prices, but the impact is very small (Ward, Schroeder, Barkley and Koontz, 1996).

Packer concentration will remain high in the future. Firms which operate packing plants in both the United States and Canada will allow for increased coordination of cattle supplies between the two countries. Emphasis will likely remain on running plants efficiently to keep slaughter and processing costs per head low. Greater use of grid pricing and marketing alliances in the cattle sector should lead to greater emphasis on producing cattle with desirable quality traits.

### **Environmental Regulations and Costs**

The 1972 Clean Water Act designates feedlots with greater than 1,000 head capacities as point sources of pollution and requires that manure management processes follow National Pollution Discharge Elimination System (NPDES) rules (Outlaw, et al., 1993). This designation results in significant costs and levels of management required to maintain a NPDES permit. NPDES permits require that feedlots have a pollution prevention plan that includes a retention facility or basin designed to capture and hold all contaminated runoff and process water for a minimum of 21 days, a waste management plan, an erosion control plan, an employee training plan, a regular inspection program, and a record keeping system. In addition, any existing retention facility must be certified by a professional engineer or ground water scientist as having no hydrologic connection to nearby waterways (Smolen and Caldwell, 1993).

Feedlots with fewer than 1,000 head capacities are designated as nonpoint sources of pollution. In general, the waste management options available to this type operation are less costly and management intensive. According to Sweeten and Melvin (1985), best management practices (BMPs) that could be utilized by smaller feedlots include:

- locating feeding facilities away from streams or drainage channels;

- diverting outside runoff away from feedlot surfaces using diversion terraces and roof gutters;
- collecting solids contained in feedlot surface water runoff;
- installing grass filter strips which are at least twice as large as the feedlot if the feedlot is located near a body of water; and
- installing a runoff holding pond if the water quality risk is high.

Unconfined cattle production is also treated as a nonpoint source of pollution. This type of production accounts for one-half of the almost 109 million metric tons of animal manure generated each year in the United States (Sweeten and Melvin, 1985). In unconfined livestock operations, manure and sediment runoff can be significant, particularly where livestock are free to graze along streams and ponds (EPA). BMPs that help control pollution from these sources include:

- installing electric wire fences along streams and providing environmentally sound stream crossings;
- rotating cattle among several smaller-sized loafing areas to allow vegetative cover to regenerate;
- providing adequate storage for manure supplies; and
- applying manure nutrients to land only as needed by crops.

The current U.S. administration is proposing new, stringent water pollution regulations. It appears that these regulations will classify additional livestock operations as point source polluters. Some indications of future policy point toward zero discharge rules similar to other industries. Although such actions will certainly impose additional costs on livestock industries, it will also provide additional incentives to construct livestock facilities in relatively arid regions.

### **Feed Availability and Costs**

The 1996 farm bill eliminated many feed grain policy instruments. The elimination of acreage bases will increase both feed grain production and crop selection flexibility. Both events will increase feed grain supplies, lower associated prices, and reduce livestock feeding costs. Initial evidence indicates that feed grain acreage may increase in the Southeast—which is nearer pork and poultry production regions.

### **Food Safety**

No single issue may be of more long term importance to the meat industry (especially the beef sector) than food safety. Increased scrutiny of the safety of the U.S. food supply has followed in the wake of recent food-borne illness outbreaks (e.g., *E. coli* 0157:H7 outbreaks in the Pacific Northwest in 1993 and Hudson Foods in 1997) and the recent, well-publicized agricultural products libel suit initiated by Texas cattle producers. The response of the meat industry to food safety issues will be critical for maintaining market share of consumer food expenditures.

Until recently, U.S. meat inspection procedures used by USDA's Food Safety and Inspection Service (FSIS) had changed little since their inception in the early 1900s. Inspection procedures were primarily based on organoleptic (sight, smell, and feel) approaches for detecting unsafe carcasses. These methods have been criticized as inadequate to identify and control food-borne pathogens, chemical contaminants and other potential hazards on individual carcasses. On July 6, 1996, FSIS released the final ruling on the Pathogen Reduction, Hazard Analysis, Critical Control Point (HACCP) Systems regulation. The regulation represents the most significant change in the meat inspection system since its inception. HACCP involves the identification of hazards and critical control points in the production process where hazards can be reliably monitored and controlled, and the implementation of outcome-based verification systems to ensure that controls are effective (Crutchfield et al., 1997). All U.S. meat and poultry plants are required to develop HACCP plans in addition to existing regulations.

In addition to new HACCP regulations, interest in developing "traceback" programs has been increasing. Traceback programs provide for identification and monitoring of individual animals from the cow/calf level through the slaughtering process. The goal of traceback is to identify, reduce, and eliminate pathogen contamination throughout the marketing system by locating and correcting problems before they can spread through the processing sector. Traceback is a controversial subject with producers in the United States. Many see it as an additional regulation which may not significantly improve the safety of meat products. Anecdotally, it appears Canadian producers may be approaching traceback more optimistically than their U.S. counterparts. For example, the Alberta Cattle Feeders have reacted favorably to traceback proposals, if they help ensure product quality

### **Status of Beef and Cattle Trade between the U.S. and Canada**

Beef and cattle trade between the United States and Canada has been dramatically influenced by two watershed events—the 1989 Canada-U.S. Free Trade Agreement (CUSTA) and the elimination of grain transportation subsidies in Canada. The CUSTA eliminated tariffs on live cattle and beef products and eliminated quota restrictions between the two countries. Consequently, live cattle imports from Canada (primarily from Alberta) have increased more than threefold since 1989. Elimination of grain transportation subsidies has resulted in increased feed availability and lower feed grain prices in the western Canadian Plains.

Following adoption of the CUSTA, both Excel and IBP purchased and expanded slaughter capacities in Alberta. The investments are the result of expected increases in cattle feeding in the area, and the potential markets represented by the Pacific Rim for which transportation advantages are available. However, U.S. midwest beef packers have a locational advantage to eastern Canadian beef markets relative to western Canada's packing industry. Trade between the United States and Canada has been manifested by increases in live cattle movements from Canada to the United States in the West, and

increases in boxed beef trade from the United States to Canada in the East. Thus, the CUSTA and elimination of grain transportation subsidies have allowed for a more efficient use of transportation and feeding resources.

Historically, the United States imported significant quantities of feeder and slaughter cattle from Canada. In 1987, the United States imported 244,710 head which increased to 1.5 million head by 1996 before dropping back to 1.4 million head in 1997. The United States exports only minor amounts of live cattle to Canada. For example, in 1997 U.S. cattle exports to Canada totaled just 41,189 head. Nonetheless, this situation is expected to change as increased Canadian cattle feeding and slaughtering could lead to smaller cattle exports from Canada to the United States and might even lead to some increases in feeder cattle exports from the United States to Canada.

### **Issues Inhibiting U.S. - Canadian Beef Trade**

Canada and the United States lack reciprocal grading standards (Hayes, Hayenga, and Melton, 1996). Thus, Canadian boxed beef is sold in the United States as ungraded or “no roll” beef which is often sold at a substantial price discount to Choice beef. However, the problem is partially circumvented by the export of Canadian beef carcasses to the United States where they receive USDA grades and are subsequently sold as boxed beef. Nonetheless, it would be more efficient to export Canadian boxed beef rather than beef carcasses. Likewise, U.S. boxed beef is sold in Canada at “ungraded” beef discounts.

Sanitary and phytosanitary regulations have historically increased costs of trading live cattle between the two countries. For example, U.S. Federal and State regulations require that cattle imported from Canada be tested for brucellosis and tuberculosis. Canada requires tests for anaplasmosis, brucellosis, and tuberculosis for live cattle imports from the United States. Both the North American Free Trade Agreement (NAFTA) and the GATT/Uruguay Round trade agreements specify that sanitary regulations must be based on science and that procedures used for risk assessment must meet internationally accepted standards. Therefore, it is possible for sanitary restrictions to be waived if animals are sourced from areas which are known to be disease-free.

### **Expected Impacts of Further Reducing Trade Barriers**

Although the western Canadian cattle feeding industry has a slight cost advantage over the United States, the lack of grading equivalency forces Excel and IBP to export carcasses (rather than boxed beef) to the United States. The net effect is an increase in the effective cost of beef processing in Canada. Unifying grading standards would, in general, reduce slaughtering/processing/distribution costs in North America and lead to larger trade flows between the United States and Canada. In general, larger volumes of higher quality beef from the United States would likely be shipped to Canada whereas larger volumes of Select grade beef would likely be shipped from Canada to the United States. Long term, if Canadian slaughtering and processing costs are competitive with the United States, slaughter and feeder cattle exports from Canada to the United States could decline as a

greater proportion of the cattle are slaughtered and processed in Canada and boxed beef is exported.

### **The Montana Pilot Project**

Montana's cattle industry consists primarily of feeder cattle production. Feeder cattle are generally exported to midwest cattle feeding regions. However, increased cattle feeding in Alberta presents a viable alternative marketing outlet for Montana feeder cattle. Thus, the Montana Pilot Project seeks to reduce unnecessary sanitary trade barriers (those which cannot be justified by science) and lower trading transactions costs (Young and Marsh, 1997). Under the pilot project, the U.S. Animal and Plant Health Inspection Service would waive Federal test requirements for brucellosis and tuberculosis for Canadian cattle entering Montana. The State of Montana would also eliminate requirements that imported cattle be vaccinated for brucellosis. Neither disease exists in these two regions. However, the tests must be performed on Canadian cattle which are subsequently moved to other States. Canada will place cattle imported from Montana into special feedlots while waiving required tests for anaplasomosis, brucellosis, and tuberculosis. Such tests generally cost \$25/head. These cattle must be kept separate from others and sold only to packers. The Montana pilot project indicates an opportunity exists to market some U.S. feeder cattle from northern Plains and Mountain states to feedlots in the Canadian Prairie, if sanitary trade barriers decline.

### **Driving Forces in U.S./Canadian Beef and Cattle Trade**

Several driving forces with respect to U.S./Canadian beef and cattle trade have emerged:

- elimination of grain transportation subsidies has increased cattle feeding activity in Western Canada and provided cost advantages;
- trade liberalization represented by CUSTA, NAFTA, and GATT has increased trade between the United States and Canada as well as Pacific Rim countries;
- expanded slaughtering capacity in Western Canada will further boost cattle feeding in the region and may reduce feeder cattle exports from Canada to the United States and, possibly, increase feeder cattle exports from United States to Canada; and
- competition between United States and Canadian beef for export market shares could increase.

Efforts to reduce unnecessary sanitary and phytosanitary regulations and unify grading standards between the U.S. and Canada could improve efficiency of the North American beef industry.

## **Exchange Rates**

Perhaps one of the most interesting changes in the U.S.-Canada livestock dynamics is exchange rates. The Canadian dollar weakened considerably versus the U.S. dollar in the early to mid 1990s. The exchange rate declined from US\$0.85/Canadian\$ in 1990 to US\$0.72 by 1996. The sharp decline in the Canadian dollar's value in 1992 and 1993 encouraged increased cattle movements to the United States and growth in the Canadian cattle feeding industry.

## **CATTLE AND BEEF SUMMARY**

In many ways the cattle industries in Canada and the United States are similar. The two countries are the world's major suppliers of grain fed beef. Exports are very important to Canada, and are gaining importance for the United States. Both countries see trade as a way to boost sales in response to declining or stagnant domestic demand and are relying on income growth in Asia to foster export growth. Food safety concerns are becoming more important to consumers in the United States, Canada, and importing countries.

Major changes in the location of beef production are not expected. U.S. cow-calf production in some western states may decline if environmental groups opposed to grazing on public lands are successful in substantially raising lease rates or reducing stocking numbers, but the overall impact on the industry may be negligible. U.S. cattle feeding will continue to be concentrated in the Plains states as farmer-feeders continue to exit the industry. Cattle feeding in the Canadian Prairie provinces will continue to grow, primarily because of feed cost advantages. Long term, boxed beef exports from Canada to the United States could grow if Canadian slaughtering/processing costs are competitive with the United States and U.S./Canadian grading standards are unified.

## **THE U.S. HOG AND PORK INDUSTRY**

Worldwide pork production increased 128 percent from 1975 to 1996. Pork production in China, the world's largest pork producer, accounted for over one-half of world pork production in 1996 and increased 450 percent from 1975. Large production gains were also realized in the United States, Canada, the European Union (EU), and Taiwan. Only in the Former Soviet Union (FSU) did pork production decline during this period. The United States is the world's third largest pork producer (following China and the EU). Although world pork production is larger than for any other species, quantities of pork traded worldwide are less than 50 percent of world beef and poultry trade. Nonetheless, world pork trade has slowly trended upward from 1.8 million metric tons in 1990 to 2.3 million metric tons in 1996. The 1996 level represents just 2 percent of world production.

The United States became the third largest pork exporter in the 1990s. The United States share of world pork trade grew significantly during the 1990s, rising from just 6 percent in 1990 to 19 percent in 1996. Historically, major U.S. markets included Japan,

Canada, and Mexico. However, since 1994, FSU has emerged as the second largest importer of U.S. pork (following Japan). Japan accounts for more than one-third of world pork imports, and is the largest market for the U.S. pork industry. Canada is the world's fourth largest pork exporter. In contrast to the United States, Canada's share of world pork trade actually declined modestly during the 1990s, falling from 14 percent in 1990 to 12 percent in 1996.

United States per capita pork consumption has experienced some variability over the past two decades, but no discernible long term trend. Per capita consumption averaged 52 pounds (retail weight) during the 1980s, and just over 51 pounds during the 1990s. Although real U.S. retail pork prices varied over this period, they trended downward as prices in the 1990s averaged 10 percent less than in the 1980s.

### **U.S. Hog & Pork Production Trends**

Hog slaughter and pork production in the United States have both trended up since the mid-1980s. Commercial hog slaughter in the United States during 1986 totaled 79.6 million head. By 1997, U.S. hog slaughter had climbed to nearly 92 million head, an increase of 16 percent over the 1986 level. Furthermore, growth accelerated sharply during 1997 and, as a result, U.S. commercial hog slaughter during 1998 is expected to establish a new record, ranging from 99 to 99.5 million head. At the end of 1998, U.S. hog slaughter will have exceeded 95 million head for just the fourth time in history with three of those four years occurring in the 1990s.

U.S. pork production has been growing for a longer period of time than hog slaughter because of increases in average dressed carcass weights. Annual U.S. pork production has been increasing consistently since a brief production downturn in the mid-1970s. Commercial pork production in the U.S. totaled 11.3 billion pounds in 1975 and 17.2 billion pounds in 1997, an increase of 52 percent. Fifty-five percent of the production increase occurred from 1986 through 1997. A large increase in hog slaughter is expected to push 1998 pork production up to a range of 18.8 to 19 billion pounds, a one year increase of 9 percent and 66 percent above the 1975 level.

Pork production increases have resulted from the industry's transition towards slaughtering hogs at heavier weights, in addition to the hog slaughter increases. From 1975 to 1997, when U.S. hog slaughter increased by 34 percent, pork production increased 52 percent. The difference was attributable to slaughtering hogs at heavier weights. Carcass weights in the United States averaged 165 pounds in 1975. By 1997, carcass weights rose to an average of 187 pounds. From 1975 through 1997, carcass weights increased at an average rate of 0.5 percent per year. The trend toward slaughtering hogs at heavier weights is attributable to improved genetics, which allows producers to feed hogs to heavier weights without fat levels rising to unacceptable levels, and packers recognition that slaughter costs for heavier hogs (per head) are virtually the same as for lighter hogs. This means slaughter costs per hundredweight of pork produced are lower for heavier hogs. Prices paid by U.S. packers to hog producers increasingly

reflect their desire for heavier hogs that are also lean. U.S. hog producers are responding to packers' price signals by marketing hogs at heavier weights.

### **U.S. Hog Sector Productivity**

Productivity growth has had a big impact on the U.S. pork production sector. One way to estimate the U.S. pork sector's aggregate productivity change is to examine the change in the breeding herd's size relative to changes in hog slaughter and pork production. For example, the U.S. hog breeding herd in 1975 averaged 7.5 million head. By 1997, the breeding herd averaged just 7 million head, despite a 34 percent increase in hog slaughter over the period. Improvements in technology and management from 1975 through 1997 produced steady increases in the number of pigs per litter (up 20 percent), the number of hogs slaughtered per sow in the breeding herd (up 43 percent) and pork produced per sow in the breeding herd (up 63 percent). The productivity increases have allowed for increases in pork production without concurrent increases in the breeding herd. Pork production per sow has been increasing at about twice the rate of dressed beef production per cow. Differences in aggregate productivity measures between the two red meat sectors suggest consumers will ultimately experience a decline in the pork/beef price ratio, which could lead to pork gaining market share at the expense of the beef sector. The U.S. (and Canadian) pork industries may be poised for future pork productivity increases (Brester, Schroeder, and Mintert, 1997) which could significantly reduce real U.S. retail pork prices (and Canadian prices as well) and thereby encourage greater domestic consumption. However, given that both the U.S. and Canadian markets are relatively mature, neither appears to be poised for tremendous growth. If world pork trade continues to grow, it is likely that export demand for U.S. and Canadian pork will play a major role in any future expansion of the North American pork industry.

### **Number of U.S. Hog Farms Declining**

The major story in the U.S. hog sector continues to be increasing consolidation of production units. The long term decline in the number of hog farms is nothing short of astounding. Rhodes (1995) points out that, in 1940, there were 3,768,000 hog production operations in the U.S. By 1980 the number of firms declined to 674,800 and, by the end of 1997, the number of hog producers had dwindled to just 138,690, a decline of 79 percent in less than two decades. Not surprisingly, the remaining firms are growing in size. USDA data, which likely understates commercial hog farms' size increases because of the inclusion of very small hog operations, indicates the average number of marketings per operation more than tripled during this time frame. Growth of very large firms has been rapid during the last two decades. Rhodes indicates that so few firms marketed over 50,000 head in 1974, that they were considered anomalies. By 1993, firms in this size category were marketing 13 percent of live hogs in the U.S.

The move towards increasing firm size appears to have been driven by several factors. Rhodes indicates that the transition from firms producing hogs at a single site to producing hogs at many sites played an important role. Effectively, it meant that firm size

was no longer limited to the number of hogs that could be situated at a single location. In turn, removal of this impediment to firm growth helped attract capital to an industry that, historically, produced above average investment returns for well managed firms. The introduction of new technology and improved management techniques also made it possible for single firms to efficiently manage much larger single and multi-site hog operations. And, in many cases, multi-site firms employ contract production as a means to expand total firm size quickly without commensurate capital investments.

### **Location of U.S. Hog Production**

The location of hog production in the United States has also changed. The North Central region long dominated U.S. hog production. In the mid-1960s, three-fourths of the U.S. hogs and pigs inventory was located on hog farms in this region. Despite significant growth in hog production in other parts of the U.S., more than 75 percent of all hogs in the United States were still on farms in this region in the early 1990s. However, in the mid-1990s the North Central states were clearly losing market share and, by 1996, the North Central region's market share fell to just 67 percent of all hogs in the U.S. By far the biggest gain in market share took place in North Carolina, whose share of the U.S. hog inventory rose from 2 percent in the mid-1960s to 17 percent in 1996.

On a state basis, Iowa's share of U.S. hog inventories declined from 25 percent in 1965 to 21 percent in 1996 and Illinois' share fell from 13 percent to 8 percent in the same period. Although dramatic growth occurred during the early 1990s (in percentage terms) in states such as Oklahoma and Colorado that, historically, have been minor pork producers, their share of the U.S. hog inventory is still modest. For example, Oklahoma's market share increased from less than 1 percent in the mid-1960s to 2 percent in 1996 and 3 percent in 1997.

Whether or not the North Central region is destined to lose additional market share is unclear. The most recent USDA hog inventory estimates indicate that Iowa, Illinois and Minnesota all experienced market share gains in 1997 (USDA, a). Several other North Central states also exhibited modest market share growth during 1997. As a result, market share for the North Central region as a whole grew from 67 percent in 1996 to 76 percent in 1997. Research indicates there are significant economies of size in hog production (Boehlje et. al., 1995). Whether or not North Central states gain or lose market share could hinge on their ability to increase firm size such that new technology can be adopted efficiently. Failure to do so will mean hog production will gravitate towards regions where producers adopt low cost technology.

Environmental concerns and a desire to move production sites towards less populated regions have encouraged some firms to locate slaughter plants and production facilities in the Southern Plains and the Mountain States. Examples include Seaboard's decision to locate a new slaughter plant at Guymon, Oklahoma with production facilities located in several nearby counties, and Circle Four's decision to locate in southern Utah. Despite the lower population density in the Southern Plains compared to both North

Central states and North Carolina, several firms have found it difficult to gain local approval for new construction because of the opposition of local residents. Long term, it appears the Southern Plains region is well positioned to gain hog production market share as more populated regions with higher annual rainfall totals lose market share.

In response to concerns expressed by citizens and environmental groups, several states have either legislated, or are discussing, moratoriums on new facility construction. Discussions about changing environmental standards are taking place at both state and federal levels. Clearly new facilities and, possibly, existing facilities will face a much more stringent set of environmental standards in the future. The adoption of new environmental standards will certainly increase future production costs for the hog industry.

### **U.S. Hog Slaughtering Industry**

Hogs in the United States are primarily slaughtered in Iowa, Minnesota, South Dakota, Nebraska and Missouri, in the Western Corn Belt; Illinois and Indiana, in the Eastern Corn Belt; and North Carolina and Virginia, in the East. Collectively, these nine states slaughtered 82 percent of U.S. hogs during 1997. As recently as 1994, 33 percent of U.S. hog slaughter took place in Iowa. By 1997 Iowa's share of hog slaughter declined to 26 percent. Concurrently, North Carolina's share of hog slaughter rose from 7 to 10 percent. Oklahoma's market share rose from less than 1 percent in 1995 to 3.5 percent in 1997, as a result of Seaboard's Guymon, Oklahoma plant coming on line.

Concentration in the hog slaughter sector has been increasing over time. In the early 1980s, the four largest packers were responsible for approximately one-third of U.S. hog slaughter. By the early 1990s, the four-firm concentration ratio was 44 percent. Mergers and acquisitions led to another increase in the four-firm concentration level by 1996, as the four largest firms' hog slaughter market share rose to 56 percent.

### **Future Location of U.S. Pork Plants**

Most of the packing plants in the North Central states have been in operation for a long time. New plant construction has occurred primarily outside the North Central states. Seaboard constructed a new facility in Guymon, Oklahoma and is considering construction of another plant in the Southern Plains. Smithfield expanded their large Bladen county plant in North Carolina. If hog production continues to grow outside the North Central states, construction of new pork slaughter/processing facilities will likely follow.

## **THE CANADIAN HOG AND PORK INDUSTRY**

Canada's pork production sector is about one-fifth the size of the U.S. pork industry. However, the Canadian hog sector has also been growing in recent years. Total hog marketings in Canada grew from 15.4 million head in 1991 to 18.1 million in 1996. Like the United States, the number of Canadian farms with a hog enterprise has been declining over time. From 1971 through 1996, the number of Canadian hog farms declined

from 122,481 to 21,105, a decline of 83 percent. The average inventory per farm increased nearly 700 percent over the period. According to Srivastava and Bamford (1998), single-site, farrow-to-finish hog farms still dominate Canadian hog production. The average farm size is near 250 sows, but 1200 sow units are becoming commonplace and even larger units are being built in some locales.

Canadian per capita pork consumption has been relatively flat since 1985. For example, per capita consumption averaged 48 pounds during the 1985-89 period, and 47 pounds from 1990-96. Real Canadian retail prices have trended downward over the same period. Given that real per capita income increased in Canada (and the United States) over this period, it appears that U.S. and Canadian consumers' demand for pork is relatively weak. This is not surprising given the maturity of the pork market.

### **Canadian Hog Production**

Over one-half (55 percent) of Canadian hog marketings in 1996 were produced in the Central provinces of Ontario and Quebec. Approximately 40 percent of Canada's hogs were produced in the Prairie provinces of Alberta, Manitoba and Saskatchewan. Although the share of Canadian hog marketings produced by the eastern Canadian provinces and the Prairie provinces did not change appreciably from 1991 to 1996, elimination of grain transport subsidies effectively lowered feed costs in the Prairies. The Prairie provinces' feed cost advantage, relatively arid environment, and low population densities, suggests that production could expand, resulting in a shift in their Canadian market share and, possibly, their market share of North American hog production.

### **Canadian Hog Slaughter Industry**

The number of Canadian hog slaughtering and processing plants has been declining and individual plant capacities have been increasing. However, Canadian plants are generally smaller than U.S. plants. For example, Canada has only 14 plants with slaughter capacity exceeding 10,000 head per week and only one plant which exceeds 30,000 head per week. The reduction in the number of plants and increasing capacity of the remaining plants means Canada's hog slaughtering industry, like the U.S. slaughter sector, is becoming more concentrated. The three largest Canadian hog slaughtering firms account for 47 percent of all Canadian hog slaughter.

In recent years, approximately 60 percent of Canada's hog slaughter occurred in Ontario and Quebec, and one-third of Canadian hog slaughter took place in the Prairie provinces of Manitoba, Saskatchewan, and Alberta. From 1991 through 1995, Quebec provided 34 and Ontario 26 percent of Canadian hog slaughter, respectively. But this pattern changed in 1996 and 1997 when Ontario's share dropped to 20 percent and Quebec's share rose to 41 percent, partly because of a lengthy strike at one of Maple Leaf Foods' plants located in Ontario.

Research by Martin, Ball and Alexiou (1997) indicates that a high cost structure has inhibited growth in the Canadian slaughter/processing sector. Small plant sizes, single (instead of double) shift operation of plants, slaughter weights below those of the United States, and higher wage rates all combine to push Canadian slaughter and processing costs well above costs of their U.S. based counterparts. The magnitude of the cost differentials (estimated by Martin, Ball, and Alexiou and further interpreted here) could exceed \$6/cwt. (live weight, U.S. dollars). Nonetheless, several major packing companies have recently expanded their slaughter capacities which will likely reduce per head slaughtering costs.

## **U.S. AND CANADIAN HOG AND PORK TRADE**

Increased Canadian hog marketings were accompanied by a dramatic increase in live hog exports to the United States. From 1991 through 1997, Canadian hog exports to the U.S. grew from 1.1 to 3.2 million head. Canadian live hog exports to the U.S. totaled 15 percent of Canadian hog marketings in 1996. In essence, 64 percent of the increase in Canadian hog marketings from 1991 to 1996 were exported to the United States. Live hog imports from Canada averaged 0.9 percent of United States commercial hog slaughter from 1991 through 1994. But the relative importance of total live hog imports from Canada increased rapidly, equaling 1.8, 3.0, and 3.5 percent in 1995, 1996, and 1997, respectively, of U.S. commercial hog slaughter. Parenthetically, 31 percent of Canada's 1997 live hog exports to the United States were feeder pigs, which were subsequently fed to slaughter weight in the United States, and the remainder were slaughter hogs shipped directly to U.S. packers.

Until recently, Canadian hog producers were required to use provincial hog marketing boards acting as single-desk sellers. The boards are producer controlled and financed by per head levies on all hogs sold (the levies vary from \$1.25 to \$3.25 per head depending upon the province). The majority of hogs are sold using formula prices linked to U.S. midwest hog prices adjusted by exchange rates and transportation costs. The boards generally pool prices on a weekly basis, receive payments from packers, and distribute payments to producers. In addition, many boards provide assembly, transportation, insurance, and market information services to producers. Recently, marketing boards in Manitoba, Saskatchewan and Alberta have lost their monopoly power over hog marketings. Some provinces have retained marketing boards, but producers in the three Prairie provinces have the flexibility to sell hogs directly to slaughtering plants.

The increase in producers marketing flexibility appears to be one reason why Canadian live hog exports to the U.S. have been growing. Differences in prices received by hog producers in the United States and Canada are large and likely explain most of the growth in live hog shipments to the United States (although a work stoppage at a major Ontario slaughter facility likely provided a one-time live hog export boost in 1997). For example, from 1993 through 1997 hog prices in the provinces of Alberta, Manitoba, and Ontario averaged \$40/cwt (live weight, U.S. dollars) compared to the Iowa-S. Minnesota direct hog price average of \$47/cwt. The 15 percent price discount in Canada compared to the United States encouraged Canadian hog producers to ship increasing quantities of live

hogs south for slaughter in the United States. Significantly, the average price differential between the three Canadian provinces and the Iowa-S. Minnesota direct market is near the difference in slaughtering/processing costs between the United States and Canada estimated by Martin, Ball and Alexiou. These results suggest that increases in Canadian hog slaughtering and processing efficiency could lead to significant reductions in live hog exports from Canada to the United States.

The United States is Canada's largest export market as it accounts for 70 percent of Canadian non-processed pork exports and 80 percent of Canadian processed pork exports. Japan, FSU, Hungary, South Korea, Brazil, Hong Kong, Australia, and New Zealand are other important markets. Although the United States both exports and imports pork products, it has recently become a net exporter of fresh and processed pork, exporting 2.4 percent of U.S. commercial pork production in 1997. If imports of live hogs from Canada are included and adjusted to carcass weight, imports of pork products and live hogs into the United States during 1997 were essentially equal to pork product exports. Canada and the United States compete primarily with Denmark, the Netherlands, and Taiwan to supply pork to importing countries.

#### **WHERE WILL HOGS BE PRODUCED IN THE FUTURE?**

A recent study by Martin, Kruja and Alexiou (1998) compared hog production costs around the world, including the United States and Canada. In the absence of trade restrictions, pork production is expected to gravitate towards regions with the greatest comparative advantage. Relative production costs are a reasonable proxy for comparative advantage. Using a 1200 sow farrow-finish model based upon previous work by Boehlje et al. (1995), that, essentially, holds technology constant, but allows feed, labor, interest and other variable costs to fluctuate by production location, they conclude the Canadian Prairie Provinces are the lowest cost region in the world to produce hogs. A significant component of the cost advantage identified in this study is related to feed costs, which have declined in the Prairie provinces since the elimination of grain freight subsidies in 1995. Interestingly, they also conclude that Denmark and the Netherlands, large net pork exporters, are high cost production regions. Although this study indicates production costs are significantly higher in the United States than in Canada, perhaps the most important conclusion is that North American production costs are lower than elsewhere in the world, which could lead to a long term expansion in pork exports from both the United States and Canada to importing nations.

#### **U.S./CANADIAN TRADE ISSUES**

During the 1980s, several contentious pork trade issues surfaced between the United States and Canada. However, as the U.S. pork industry has become more export oriented, the desire to impose trade restrictions has waned. During the 1990s, the United States imposed a countervail duty on hog imports from Canada that ranged from 0.45 to 1.34 cents per pound. The duty was imposed to offset Canadian farm subsidies which the United States viewed as providing an unfair trade advantage to Canadian hog producers.

However, changes in Canadian farm policies have virtually eliminated the need and demand for such duties.

A second trade issue involves the direct movement of U.S. hogs to Canadian packing plants. Currently, U.S. live hog exports to Canada must be certified disease free prior to shipping. Then, hogs must be quarantined for 30 days while tests for brucellosis and pseudorabies are performed. Pseudorabies exists in some U.S. states, but not in Canada. However, 27 U.S. states have been recognized as being free of pseudorabies. The issue is being discussed and several changes have been proposed to the Canadian Health of Animals regulations. If the proposals are accepted, U.S. live hogs could be directly shipped to certain Canadian packing plants if they are sourced from pseudorabies free states, transported only through pseudorabies free states in trucks that have been disinfected, transported through Canada for less than eight hours, and slaughtered within 24 hours of entering the country. The new rules would probably have the largest impact on Ontario packing plants as they attempt to acquire live hogs from less distant sources. However, little importation of live hogs from the United States is likely until the Canadian pork packing sector becomes more efficient.

### **Driving Forces in Canadian Hog and Pork Production**

Removal of grain transportation subsidies has increased feed supplies in Western Canadian provinces causing increased hog production. In response, Moose Jaw Packers in Saskatchewan and JM Schneider in Manitoba have doubled their capacity in the last three years. The availability of inexpensive feed supplies provides Canadian hog producers with a competitive cost advantage. In addition, sizable land masses and low population densities obviates waste disposal and environmental concerns related to hog production. However, the United States has lower wage costs, lower cut and kill costs, and lower marketing costs relative to Canada. Recent trade liberalization has led to increased competitiveness in export markets. In addition to quality, costs must remain competitive to avoid losing market share.

Increased growth of the Canadian hog industry will require changes that reduce other costs if producers are to take advantage of lower feed costs and fewer waste disposal and nuisance problems. Quality assurance will also be an important issue. HACCP plans are used in many plants at this time. In the United States, such plans will be mandatory in addition to other current inspection regulations. Although such plans may improve quality and provide assurances to consumers regarding food safety, such measures are not without costs. The relative costs of all regulations (both HACCP and other regulations) between the United States and Canada could be an important determinant of future competitiveness.

### **CONCLUSIONS**

The Canadian and North American Free Trade agreements increased meat and live animal trade flows across the North American continent and also generated tensions

among market participants. Elimination of grain transportation subsidies in Canada has reduced feed grain prices in the Prairie Provinces and encouraged growth in both the Canadian hog and cattle feeding sectors. The result has been increased movement of live hogs and cattle from Canada to the United States. Concurrently, beef and pork exports from the United States to both Canada and Mexico grew.

Although accurate production cost data are difficult to obtain, it appears the United States and Canada have a comparative advantage in grain fed beef and pork production relative to the rest of the world. Consequently, future growth in world meat trade will likely benefit Canadian and U.S. beef and pork producers. If U.S. and Canadian grading standards are unified and the Canadian processing sector becomes more efficient, boxed beef exports to the western United States could increase while U.S. packers may gain a larger share of the eastern Canadian market.

Increased efficiency in the Canadian pork processing sector could also have a big impact on future pork trade. Canadian producers have had strong incentives to export hogs to the United States since Canadian prices have been substantially lower than U.S. prices. The difference was partially attributable to higher processing costs in Canada. Thus, efficiency increases in the Canadian hog processing sector could lead to a reduction in live hog exports from Canada to the U.S. and an increase in pork product exports. Efficiency gains are probably eminent given recent expansions in the Canadian slaughter sector.

Consolidation, concentration, and further vertical coordination will continue in both the U.S. and Canadian beef and pork industries as producers and processors seek to reduce transactions costs, improve marketing efficiencies, and meet increasing consumer demands for product quality, consistency, convenience, and price competitiveness. The pork sector is currently experiencing this trend, and the beef sector will likely follow in order to remain competitive at the retail counter.

Finally, although opportunities exist for new, convenient beef and pork products, markets for both commodities in Canada and the United States are relatively mature. Given increased concerns regarding the intake of dietary fat and cholesterol, and aging domestic populations, future growth in the U.S. and Canadian beef and pork sectors will likely be provided by increasing exports. Specifically, growing incomes in developing countries provide the opportunity for consumers in those countries to obtain more protein from animal sources. Both the United States and Canada are well-positioned to supply expected increases in demand for animal protein in developing countries. For that to happen, policy makers and the red meat industry need to work hard to increase market access and meat supply safety while ensuring the industry retains its cost competitiveness.

**REFERENCES**

- Agriculture and Agri-Food Canada, Red Meats Section. Annual Livestock Market Review. Various issues.
- Alberta Cattle Feeders Association. 1998. Canadian Beef Grading Agency. April.
- Alston, J.M., R. Gray, and D.A. Sumner. 1994. "The Wheat Wars of 1984." *Canadian Journal of Agricultural Economics*. 42:231-251.
- Anderson, D.P. and J.W. Richardson. 1993. "Demand for Public Grazing." Unpublished mimeograph.
- Azzam, A.M. and J.R. Schroeter. 1995. "The Tradeoff Between Oligopsony Power and Cost Efficiency in Horizontal Consolidation: An Example from Beef Packing". *American Journal of Agricultural Economics*. 77: 825-836.
- Boehlje, M., M. Boland, L. Clark, T. Cline, K. Foster, J. Hale, C. Hurt, D. Jones, S. Nichols, A. Schinckel, and W. Singleton. 1995. "Positioning Your Pork Operation For The 21st Century." Purdue Cooperative Extension Service, W. Lafayette, Indiana.
- Brester, G., T. Schroeder and J. Mintert. "Challenges to the Beef Industry." *Choices*, 12(4)1997:20-21& 24-25.
- Crutchfield, S., J.C. Buzby, T. Roberts, M. Ollinger, and C.-T.J. Lin. 1997. An Economic Assessment of Food Safety Regulations: The New Approach to Meat and Poultry Inspection. USDA, ERS. Agricultural Economic Report Number 755. July.
- Faminow, M. 1997. "The Brazilian Cattle Sector: Status, Prospects, and Controversies." *Canadian Journal of Agricultural Economics*. 45: 179-199.
- Foss, P.O. 1959. "The Determination of Grazing Fees on Federally-Owned Range Lands." *Journal of Farm Economics* 31:535-547.
- Gould, D.M. "Mexico's Crisis: Looking Back to Assess the Future." *Economic Review*. Federal Reserve Bank of Dallas. Second Quarter 1995.
- Gruben, W.C. "Policy Priorities and the Mexican Exchange Rate Crisis." *Economic Review*. Federal Reserve Bank of Dallas. First Quarter 1996.
- Hayes, D.J., M.L. Hayenga, and B.E. Melton. 1996. "The Impact of Grade Equivalency on Beef and Cattle Trade Between the U.S. and Canada." *U.S. Meat Export Analysis and Trade News*. February.

- Jones, R., T. Schroeder, J. Mintert and F. Brazle. 1992. "The Impacts of Quality On Cash Fed Cattle Prices." *Southern Journal of Agricultural Economics*, 24(2), December:149-162.
- Martin, L., R. Ball and J. Alexiou. 1997. Cost Competitiveness of the Canadian Pork Processing Industry. George Morris Centre, University of Guelph, December.
- Martin, L. Kruja, and J. Alexiou. Prospects for Hog Production and Processing In Canada. George Morris Centre, University of Guelph, March 3, 1998.
- Outlaw, J.L., R.B. Schwart, Jr., R.D. Knutson, A.P. Pagano, A.Gray, and J.W. Miller. 1993. "Impacts of Dairy Waste Management Regulations." Agricultural and Food Policy Center Working Paper No. 93-4, Texas A&M University, May.
- Peel, D.S. and L. Cockerham. 1995. "U.S. Price Impacts of Feeder Cattle Imported From Mexico." Western Livestock Round-Up. December.
- Rhodes, V. J. 1995. "The Industrialization of Hog Production." *Review of Agricultural Economics*, 17(2), May:107-118.
- Schroeder, T.C., C.E. Ward, J. Mintert and D.S. Peel. "Beef Industry Price Discovery: A Look Ahead." Research Bulletin 1-98, Research Institute on Livestock Pricing, Virginia Tech. University, Blacksburg, VA. March 1998.
- Smith, G.C., J.W. Savell, H.G. Dolezal, T.G. Field, D.R. Gill, D.B. Griffin, D.S. Hale, J.B. Morgan, S.L. Northcutt, and D. Tatum. 1995. Improving the Quality, Consistency, Competitiveness, and Market-Share of Beef. The Final Report of the Second Blueprint for Total Quality Management in the Fed-Beef (Slaughter Steer/Heifer) Industry. National Beef Quality Audit. Conducted by Colorado State University, Texas A&M University, and Oklahoma State University for the National Cattlemen's Association. December.
- Smolen, M.D. and L.W. Caldwell. "CAFO Education Program." Presented Paper at the Great Plains Animal Waste Conference on Confined Animal Production and Water Quality, Denver, CO, October 19-21, 1994.
- Srivastava, R. and J. Bamford. A Multi-Country Study of Vertical Coordination in the Hog/Pork Industry. Agr-Food Chain Analysis Section, Agriculture and Agr-Food Canada, January 19, 1998.
- Sweeten, J. M. and S. W. Melvin. "Controlling Water Pollution from Nonpoint Source Livestock Operations." Presented Paper at a National Conference on Perspectives on Nonpoint Source Pollution, Kansas City, MO, May 19-22, 1985.

- Torell, L.A. and J.P. Doll. 1991. "Public Land Policy and the Value of Grazing Permits." *Western Journal of Agricultural Economics*, 16(1): 174-184.
- Torell, L.A., L.W. Van Tassell, N.R. Rimbey, E.T. Bartlett, T. Bagwell, P. Burgener, and J. Coen. 1993. *The Value of Public Land Forage and the Implications of Grazing Fee Policy*. Department of Agricultural Economics and Agribusiness. New Mexico State University. Agricultural Experiment Station Bulletin 767.
- U.S. Department of Agriculture (a). *Hogs and Pigs*. Various issues.
- U.S. Department of Agriculture (b). *Meat Animals-Production, Disposition and Income*. Various issues.
- U.S. Department of Agriculture (c). *Livestock Slaughter*. Various issues.
- U.S. Department of Agriculture (d), National Agricultural Statistics Service. *Agricultural Prices*. Various Issues.
- U.S. Environmental Protection Agency (EPA). 1992. "Managing Nonpoint Source Pollution." Final Report to Congress on Section 319 of the Clean Water Act (1989), EPA-506/9-90, Office of Water, Washington, D.C., January.
- Ward, C.E. 1996. *Concentration, Captive Supplies and Price Discovery*. Livestock Round-Up. Livestock Marketing Information Center. March.
- Ward, C.E., T.C. Schroeder, A.P. Barkley, and S.R. Koontz. 1996. "Concentration in the Red Meat Packing Industry—Chapter 3 Role of Captive Supplies in Beef Packing." USDA, Grain Inspection, Packers and Stockyards Administration. February.
- Young, L.M. and J.M. Marsh. 1997. "Live Cattle Trade Between the United States and Canada: Effects of Canadian Slaughter Capacity and Health Regulations." Research Discussion Paper No. 7, Trade Research Center, Montana State University, Bozeman. December.