A Comparative Analysis of Regional Production Costs of Fed Beef Produced for the U.S. and Japanese Markets

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Abstract: This study compared and analyzed actual 1989 production costs for representative regional feedlots in the U.S. The results show that grain-surplus regions have lower total costs and poorer feeding efficiencies. The analysis suggests that Iowa has a comparative advantage in producing heavily marbled beef required by the Japanese market. Southwestern states have an advantage in producing leaner beef and stand to benefit if U.S. consumers develop a taste for Select-quality beef.

Key Words and Phrases: *Cattle production, Cattle feeding, Beef industry location, Competitiveness.*

The location of the U.S. cattle-feeding industry depends in part on the relative costs of shipping feed grains and feeder cattle and on regional prices of roughage and beef. As these economic conditions change, so do the optimal and actual industry locations. Despite the importance of beef-fattening facilities to local economies, there is surprisingly little public information on regional comparisons in terms of fed beef production costs. This study maintains that, for grain-intensive production systems, the comparative cost advantage is the most important factor determining the location of the cattle-feeding industry. Results of the study demonstrate that, in the absence of tax and environmental regulations that favor southwestern feedlots, the Corn Belt's share of fed cattle production would most likely increase due to its lower grain prices as compared to other producing regions.

This research is designed to study how regulatory changes could entice the cattle-feeding industry to return to the Corn Belt[1] and how the recent opening of the Japanese beef market, which demands a highly marbled beef, might affect the cattle-feeding industry in Iowa. More specifically, the objective of this study is to analyze data on costs of grain and feeder steers to determine the most profitable regional locations for producing beef for the U.S. and Japanese markets. Thus, the first section of this paper provides a general background on the development of the cattle-feeding industry in

Journal of Agribusiness, 11-1 (Spring 1993): 25-50.

the United States. The next section presents a comparative cost analysis of production factors among various production regions, including the Southern, Central and Northern Plains and the Corn Belt. The third section presents two scenarios of feeding cattle for the Japanese and U.S. markets based on the comparative cost analysis, and the final section presents some general conclusions.

The U.S. Cattle-Feeding Industry

Three U.S. regions market the majority of fed cattle: the West, generally described as lying west of the Continental Divide; the Plains, generally described as lying east of the Rocky Mountains and west of the Missouri River Valley; and the Corn Belt, comprised of corn-producing areas including the Missouri River Valley, east to and including the Ohio River Valley.

Each major region can be subdivided according to supplies of feeder cattle and feed sources. The West can be subdivided into two areas: the Southwest, made up of California and Arizona, and the Pacific Northwest, primarily made up of Washington and Idaho. The Plains can be subdivided into three areas: the Southern, Central and Northern Plains. The Southern Plains covers the Texas Panhandle (south of the Canadian River) to San Angelo. The Central Plains includes the Texas Panhandle (north of the Canadian River), northwestern Oklahoma and its panhandle, the southwestern one-third of Kansas and the southeastern one-fourth of Colorado. The Northern Plains includes northeastern Colorado, northern Kansas and the western two-thirds of Nebraska. The Corn Belt consists of Iowa, Minnesota, Illinois and the eastern one-third of Nebraska.

The U.S. cattle-feeding industry has gradually moved westward with changes in population growth and distribution and technological advances in transportation, animal health care, feeding practices and meat processing (Gustafson and Van Arsdall; Whitaker). Historically, cattle have been transported to feed sources instead of transporting feed to the cattle. Railroad routes and rates helped determine the original routes of cattle from range areas to feedlots and may have influenced feedlot location. But the development of the interstate and local highway systems and large-capacity trucks reduced transit time from days to hours, thereby reducing shrinkage and stress on cattle and making most areas accessible. By 1967, more than 97 percent of all cattle marketed were transported in trucks (Gustafson and Van Arsdall).

As late as 1964, more than 60 percent of all fed cattle were marketed from feedlots with less than 1,000-head capacity. By vertically integrating grain production with cattle feeding, farmer-feeders marketed grain crops, crop residue and off-season labor through fed cattle (Gustafson and Van Arsdall; Reimund *et al.*). Cattle feeding in the Corn Belt centered in Iowa from the late 1800s to the late 1960s (Whitaker; U.S. Department of Agriculture). From 1968 to 1970, Iowa had the largest cattle-on-feed numbers in the state's recorded history (Iowa Agricultural Statistics). Gradually, cattle feeding began shifting from the Corn Belt to the Southern Plains, where grain sorghum and corn production, spurred by irrigation, had created a feed-grain surplus. Mechanized systems for feed handling and animal waste disposal reduced the need for manual labor (Gustafson and Van Arsdall; Clary *et al.*). Biological advancements in pest control and medicine made it feasible to confine cattle in greater concentrations (Reimund *et al.*).

The Southern Plains has a drier climate, less population density and lower land costs than the Corn Belt. Pollution programs to control runoff from animal waste were initiated by federal and state agencies, thereby increasing capital requirements and the comparative advantage of larger feedlots because costs could be spread over more cattle per year (Reimund *et al.*). Although pollution regulations in the Southwest and the Corn Belt were similar, weather conditions, greater population density and higher land costs in the Corn Belt made these government regulations more restricting for Corn Belt feedlots than for southwestern feedlots (Landon *et al.*). Because of greater rainfall and higher humidity, runoff holding ponds in the Corn Belt feedlots were approximately twice the size of those in comparably-sized southwestern feedlots. In addition, special income tax provisions provided advantages to high-income individuals investing in cattle feeding, which permitted commercially run feedlots to manage risk through custom-feeding programs (Reimund *et al.*; Dietrich *et al.*).

Gee *et al.* found a significant difference in fed-beef costs between midwestern farmer-feeders and western commercial feeders for 1976-1977. They observed that Corn Belt farmer-feeders spent 68 percent of total costs for feeder cattle and feed, compared with 89 percent spent by western commercial feeders. The two greatest cost differences were in fixed costs (e.g., depreciation, interest on investment and taxes) and other direct costs (e.g., transportation, marketing and labor). These differences were attributable in large part to economies of size.

Cost advantages favoring larger-scale southwestern feedlots eventually affected industry location. By 1974, feedlots with less than 1,000-head capacity accounted for only 35 percent of all feeding operations and less than 400 U.S. feedlots marketed 50 percent of the 24.2 million cattle fed in 1976. The number of Iowa feedlots of 1,000 head or less decreased by 41 percent from 1962 to 1980, and Texas overtook Iowa for first place in feeding cattle. During the same period, the number of feedlots in the thirteen major cattle-feeding states decreased by 53 percent (U.S. Department of Agriculture; Krause).

Comparative Cost Analysis

The Data

The data for this study were obtained from selected feedlots located in the Corn Belt and Plains regions. The selected feedlots were considered to be representative of the feedlot operations found in the study regions. The database includes feedlot records on 2.23 million steers for the 1988-89 feeding period. Because there are few feedlots located in the West, it would be relatively easy to identify the feedlots by size and location. Thus, information was not available for this region due to potential disclosure problems.

The data for the Southern Plains are from feedlot records from seven feedlots that sold more than 212,000 steers. The Central Plains data are from closeouts on more than 1.474 million steers from feedlots that averaged slightly more than 50,000 head of steer marketings. The Northern Plains data are from closeouts on approximately 400,000 steers from feedlots that averaged slightly more than 19,000 head of steer marketings. The Corn Belt data are from closeouts on 31,000 steers in Nebraska, 77,000 steers in Iowa and 36,000 steers in the northwestern one-third of Illinois.

Using actual cost data from representative feedlots allows for a more detailed analysis than would be possible with regional averages. This is because some data, such as purchase weights and ration costs, become meaningless when averaged over producers with different feeding systems. However, the use of feedlot data has some obvious drawbacks:

1. Choice of representative feedlots is subjective and may allow the attributes of a particular feedlot to influence the data.
2. The feedlot records were collected for only one year, i.e., the 1988-89 feeding period.
3. Each feedlot used slightly different recording procedures, and it was necessary to use subjective judgments to make the various data series compatible.

Given the data limitations, the results should be interpreted only as a snapshot comparison of production costs and efficiencies for individual feedlots that were considered representative of the region in which they were located. The snapshot approach is useful only to the extent that it helps capture the way in which prices and productivity patterns should vary across regions due to cost differences. The danger of generalization based on this accounting procedure of cost analysis is apparent because of the lack of consistent time-series data to allow for statistical analysis and hypotheses testing. However, it would be a worthwhile effort to collect the type of data used in the study over time.

Comparing Regional Records

Total Initial Cost and Initial Weight. Total initial cost (TIC) is the beginning delivered cost of a steer, which includes the price of the steer plus the transportation cost for delivery to the feedlot. Initial weight (IW), often called pay weight, is the starting weight of the steer entering the feedlot used to determine the total initial cost. Initial cost is the value per hundred pounds of liveweight determined by [TIC/IW] • 100.[2]

Figure 1 presents average initial weights and costs of steers on a regional basis using averages for September, 1988, through August, 1989. In the Plains, initial weights became progressively heavier from south to north. In the Corn Belt, however, initial weights were comparable between Iowa and Illinois, but initial weights and costs per head in eastern Nebraska were more similar to those in the Northern Plains, where the heaviest initial weights occurred.

In 1989, approximately 30 percent of the steers in Iowa and northern Illinois weighed less than 600 pounds when entering the feedlot; in eastern Nebraska this figure was 12 percent. The Southern Plains placed approximately 20 percent of total feeder cattle weighing less than 600 pounds, the Central Plains placed 10 percent, and the Northern Plains placed 1 percent.

Ending Weight and Total Weight Gain. Ending weight (EW) is the weight of a steer at the time of exit from the feedlot, presumably for slaughter. Ending weight is the weight purchased if cattle are bought on a liveweight basis and is used to determine the break-even cost of the final product. Total weight gain (TWG) is the ending weight minus the initial weight: TWG = EW - IW. Figure 2 shows average total weight gained per steer by region.

The ending weights of steers exiting regional feedlots in 1989 followed a distinct pattern. Although the Central Plains started with feeder cattle averaging 35 pounds heavier than those placed in the Southern Plains, the finished steers were within four pounds of each other. Ending weights in the Plains became increasingly heavier when moving from south to north, and those in the Corn Belt increased when moving from east to west. The heaviest ending weights were in the Northern Plains.

Figure 1.
Average Total Initial Cost and Initial Weight per Head, by Region

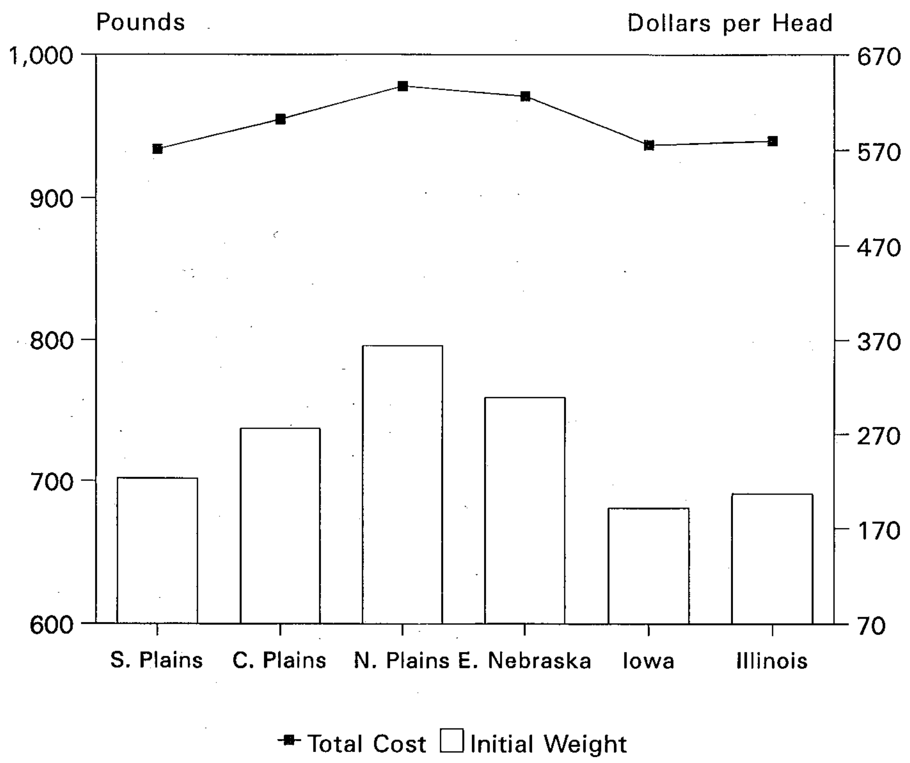
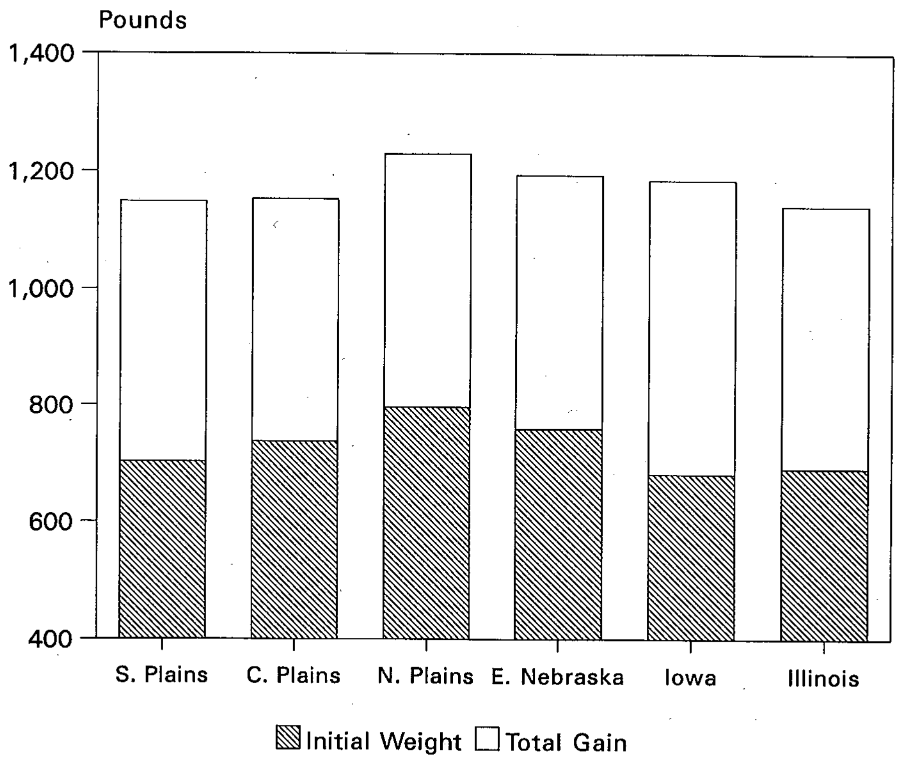


Figure 2.
Average Initial Weight, Ending Weight, and Total Weight Gain per Head, by Region



The greatest liveweight gain seemed to occur in the regions that started with the lightest steers, i.e., Iowa, Illinois and the Southern Plains. Although average ending weights in the Northern Plains were 36 pounds heavier than those in eastern Nebraska, total liveweight gain was almost identical. Iowa feedlots produced almost 43 percent of their ending weights in the form of liveweight gain, Illinois and the Southern Plains produced approximately 40 percent and 39 percent, and eastern Nebraska and the Central Plains each produced approximately 36 percent. The heaviest ending weight occurred in the Northern Plains, where only 35 percent of liveweight gain was put on in the feedlots.

Average Days on Feed and Average Daily Gain. Average days on feed, or the number of days a steer within a given population is in the feedlot, is calculated by dividing the total number of days every steer within that population is on feed (total head days, or THD) by the number of steers closed out. Average daily gain (ADG) is an average of total weight gained (in pounds) on a daily basis while the steer is in the feedlot: ADG = TWG/THD.

When average days on feed was compared with average daily gain, a grouping became apparent (see Figure 3). Based on the 1989 records, the results show that the Central and Northern Plains and eastern Nebraska had cattle on feed for the fewest days but achieved a greater average daily gain. In contrast, feeders in Iowa, Illinois and the Southern Plains, placed lighter cattle, fed the cattle longer and achieved smaller average daily gains.

Cost of Gain per Ton of Feed. The 1989 survey of the three Plains regions revealed that per-ton finished ration costs tended to decrease when moving from the Southern Plains to the Northern Plains. Costs were $156.21 per ton in the Southern Plains, $151.56 per ton in the Central Plains and $141.13 per ton in the Northern Plains.

Although finished ration costs were available only for the Plains, markups were reported for all regions estimated except for eastern Nebraska. Markups generally encompass the feedlot cost of operation and profit and may be included in the total bill as markup per ton of feed, the daily yardage fee, or a combination of both. In this analysis, markups were calculated based on per ton of feed. Markups declined in the Plains when moving from south to north.

Feed-Conversion Rates. Feed conversion is the ability to convert feed rations into pounds of liveweight. The feed-conversion rate is calculated as pounds of feed consumed per weight gain, for which all feed is calculated on a 100 percent dry-matter basis. The greater the feed-conversion rate, the more pounds of feed needed to produce one pound of liveweight and the less efficient the weight gain.

Figure 3.
Average Days on Feed Versus Average Daily Gain per Head, by Region

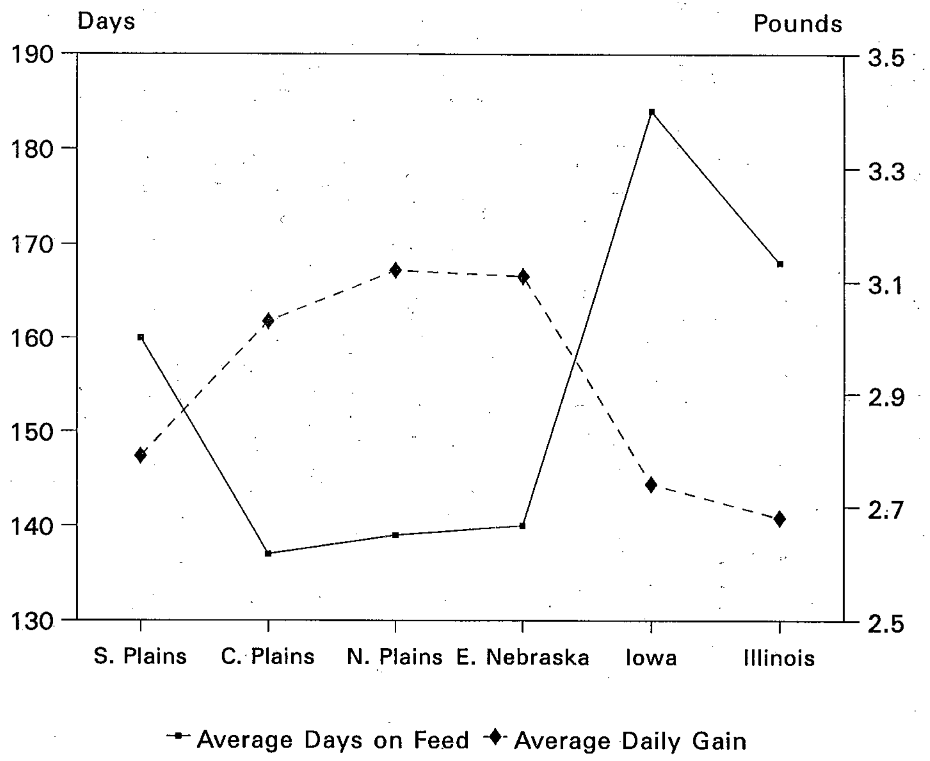


Figure 4 compares average regional cost of gain per ton of feed to corresponding feed-conversion rates. The Plains areas, although registering the greatest cost of gain per ton of feed, generally enjoy a distinct advantage in feed-conversion rates. The Corn Belt, with a lower cost of gain per ton of feed, is at a distinct disadvantage. It is not surprising to find that steers in Iowa and Illinois, with the least cost of gain per ton of feed, greatest feed-conversion rate and most total weight gain, consumed the most total feed per head, at 1.89 tons per head and 1.65 tons per head, respectively. Steers in the Central Plains, with the greatest cost of gain per ton of feed, least feed-conversion rate and least total weight gain, consumed the least total feed per head, at 1.32 tons.

Cost per Pound of Gain. The cost to produce one pound of liveweight, although dependent on production cost per ton of feed, can be influenced by how efficiently the feed is converted into liveweight. If the combination of feed and nonfeed costs are low enough, yet still effective in producing the desired product, poor feed-conversion rates may not be as damaging. Conversely, if the combination of feed and nonfeed costs yields a greater production cost per ton of feed, it is possible to generate a competitive cost of liveweight gain with good feed efficiencies.

Figure 5 illustrates regional costs per pound of gain in 1989. The Corn Belt had the least cost per pound of gain, despite poorer feeding efficiencies. Iowa had the least cost per pound of gain, whereas the Southern Plains had the greatest. Cost of gain became progressively less when moving south to north through the Plains.

Total Cost of Production per Steer and Estimated Break-even Point. Although cost per pound of gain is the measure of feeding performance most often referred to, it is the combination of initial cost, total cost of weight gain and interest that makes up the total cost of production (TCOP). For the purpose of this study, interest was calculated at a simple rate of 12 percent on the total value of the feeder steer plus half of the cost of gain per ton of feed. This rate assumes away any possible financing advantages of one region over another with regard to the cost of borrowing money, yet it accounts for interest cost differences related to regional cattle-feeding trends as they affect initial investments, cost of gain per ton of feed, and time.

Table 1 presents the average of all the cost components of all the pens closed out in each feedlot for the 1988-1989 feeding period. The data are a gross estimate of the total costs incurred in producing steers for slaughter. The estimated break-even point for each region is calculated by dividing total cost of production over ending weight and is the cost of production per hundred pounds of ending liveweight: (TCOP/EW) • 100. The greatest total dollar cost of production per steer occurred in the Northern Plains,

Figure 4.
Feed-Conversion Rate Versus Total Gain Cost per Ton of Feed per Head, by Region

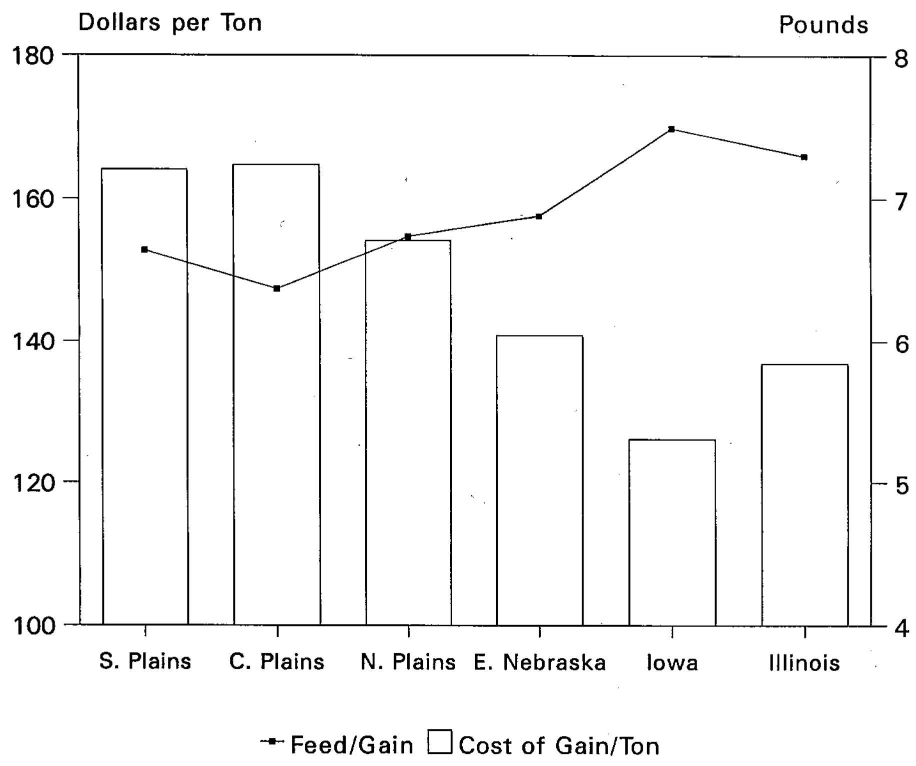
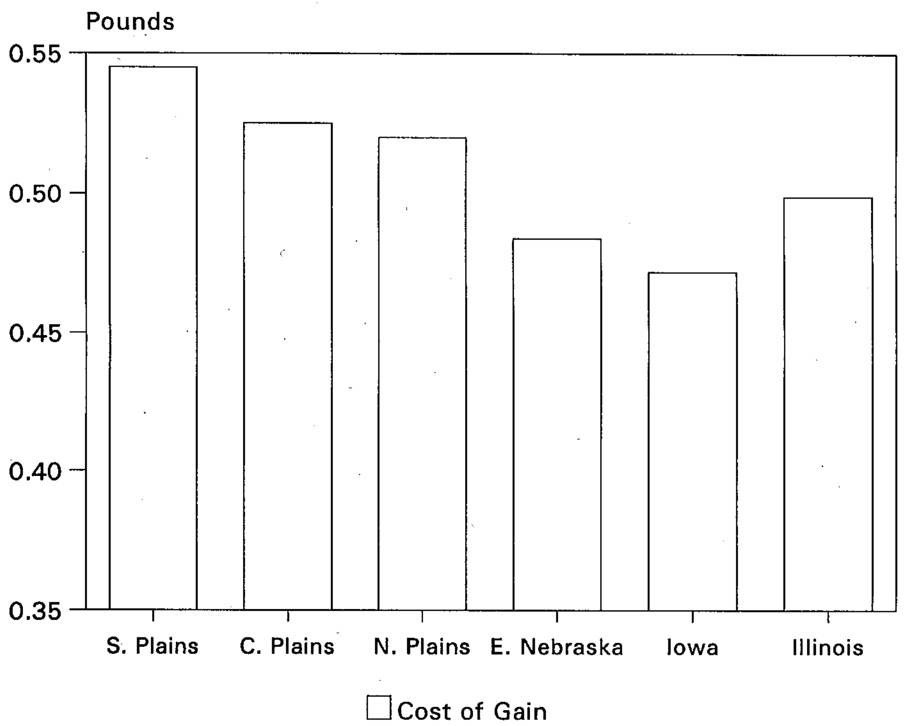


Figure 5.
Cost per Pound of Gain, Less Interest and Including Mortality Costs, by Region



Note: Iowa data include an additional $5/ton markup.

which produces steers with the heaviest ending weights. The least total dollar cost of production per steer was in Illinois, which produces steers with the lightest ending weights. As shown in Table 1, however, the final cost-of-production indicator (break-even point) favored Iowa.

Effect of Ending Weight on Break-even Point. Figure 6 was derived by holding costs and performances constant while varying ending weights for both the Southern Plains and Iowa. Average daily gain and feed-conversion rates will vary, however, depending on the level of technology employed and the age, sex and fat composition of the cattle. In both Iowa and the Southern Plains, break-even costs declined as cattle are fed to heavier ending weights, declining at a decreasing rate as cattle reach these heavier weights. Although break-even costs were fairly close at lighter weights, Iowa's advantage was greater at greater weights than was that for the Southern Plains. This trend may help explain why the average ending weight in the 1989 data was lighter in the Southern Plains (1,149 pounds) than in Iowa (1,185 pounds).

The price received for producing additional pounds beyond the 1,150-pound ending weight has not been cost effective over time in the Southern Plains, whereas expenses incurred in Iowa have been cost effective as the steers approach 1,200 pounds. Beyond 1,200 pounds, price discounts for excessively fat or heavy steers may be too great to continue feeding when cattle are targeted for the domestic market. If a region can produce to heavier ending weights without price discounts for excess fat or weight, the low-ration-cost regions may have incentive to produce steers with heavier ending weights that yield a greater percentage of U.S. Department of Agriculture (USDA) Choice and Prime beef. In regions in which greater feed efficiencies and greater ration costs are more competitive at lighter ending weights, producers may target a lower USDA Choice or higher USDA Select product, whereas low-ration-cost regions will target a greater percentage of the USDA Choice market.

Because of the expense involved in visiting feedlots and transcribing data, only one year ofthe feedlot records was collected for the cost analysis. However, it is interesting to compare the cross-sectional results for the 1988-1989 feeding period with the more aggregate time-series data that are available for other years. Table 2 compares corn prices and prices of both heavy and light feeder cattle, averaged over the period 1980-1989.

Although these numbers are not directly comparable with those used elsewhere in this study, they seem to support the basic points made earlier. The Corn Belt—Iowa in particular—has an important cost advantage over Texas. On average, Iowa cattle producers paid 36¢ per bushel less for corn than did producers in Texas.

Table 1.
Production Costs, 1989

	Plains			Corn Belt		
	Southern[a]	Central[b]	Eastern Northern[c]	Nebraska[d]	Iowa[e]	Northern Illinois[f]
Delivered in-cost per hundredweight	$81.28	$81.74	$80.04	$82.57[g]	$84.53	$83.93
In-weight per head (lb)	702	737	796	759	681	691
End-weight per head (lb)	1,149	1,153	1,230	1,194	1,185	1,142
Gain per head (lb)	447	416	434	435	504	451
Average days on feed	160	137	139	140	184	168
Average daily gain (lb)	2.79	3.03	3.12	3.11	2.74	2.68
Feed (dm) per gain (lb)	6.64	6.37	6.74	6.88	7.49	7.30
Tons of feed per head	1.48	1.33	1.46	1.50	1.89	1.65
Finishing ration ($/ton)	156.21	151.56	141.13	NA	NA	NA
Markup ($/ton)	27.50	26.25	24.25	21.00[h]	25.00[i]	24.00
Gain cost[j] ($/ton)	164.06	164.71	154.21	140.84	126.07[k]	136.79
Cost of gain[l] ($/lb)	0.5447	0.5246	0.5197	0.4845	0.4721	0.4993

Table 1. *(continued)*

Total gain cost	$243.48	$218.23	$225.55	$210.76	$237.94	$225.18
Total in-cost	$570.59	$602.42	$637.12	$626.71	$575.65	$579.96
Projected interest[m]	$36.42	$32.05	$34.26	$33.70	$42.02	$38.25
Total cost	$850.48	$852.71	$896.94	$871.16	$855.61	$843.39
Estimated break-even cost per hundredweight	$74.02	$73.96	$72.92	$72.96	$72.20	$73.85

[a]Data summarized from feedlot closeouts on more than 212,000 steers.

[b]Data summarized from feedlot closeouts on more than 1.474 million steers.

[c]Data summarized from feedlot closeouts on more than 399,600 steers.

[d]Data summarized from feedlot closeouts on 30,968 steers and provided by Farr Nutritional Services, Duncan, Nebraska.

[e]Data summarized from the *State of Iowa Feedlot Summary* on 76,895 steers, provided by the Iowa State University Extension Service (Iowa State University).

[f]Data provided by DeKalb Feeders, Inc., representing 35,963 steers (DeKalb Feeds).

[g]1989 Data not available; substituted September 1988-August 1989 average, Sioux Falls, 700- to 800-pound USDA #1, medium-frame steers + $0.35 freight.

[h]Estimated.

[i]Original data indicated at $20 per ton nonfeed cost; additional $5 per ton markup was added.

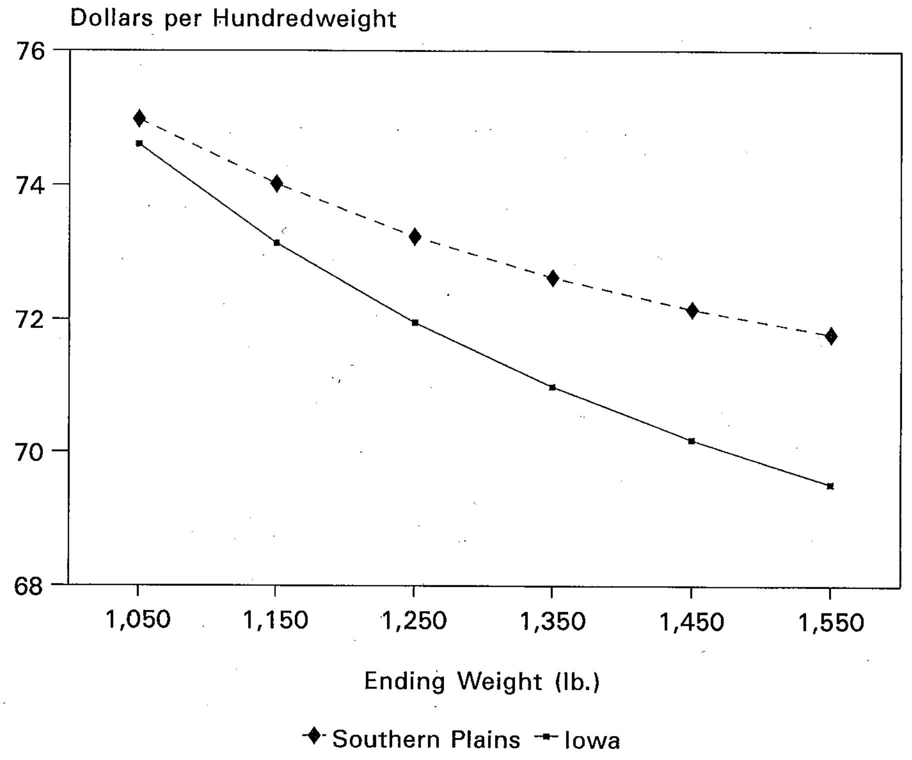
[j]Includes all costs incurred while on feed, less interest.

[k]Original data indicated cost of gain per ton of feed at $121.01; $126.07 includes additional $5 per ton markup.

[l]Includes deads, less interest.

[m]Projected at 12 percent simple interest on full value of feeder plus one-half of gain cost.

Figure 6.
Cost-of-Production Comparisons, Estimated Break-even Costs, Iowa and the Southern Plains



Feeder cattle prices were relatively similar across regions, although prices of heavier feeder steers were lower in Iowa, Missouri and Colorado and prices of lighter animals were lowest in Texas and Nebraska. The relatively large differences in corn prices explain much of the behavior observed from the 1989 data, even though actual ration costs were used instead of corn prices. While regional ration formulations vary widely, this analysis suggests that corn prices were an excellent proxy for ration prices. In hindsight, this result makes sense. Spatial arbitrage will ensure that ration costs—expressed in corn equivalents—are approximately equal to corn transportation costs. Otherwise, additional corn would be shipped into the Southwest.

Table 2.
Comparison of Corn Prices Averaged from 1975-89 and Feeder Cattle Prices, Averaged from 1980-1989

State	Corn Price (¢/lb)	Price of 700-800 lb Feeder Steers ($/cwt)	Price of 500-600 lb Feeder Steers ($/cwt)
Colorado	2.77	73.74	81.57
Illinois	2.76	74.66	80.17
Iowa	2.63	73.83	79.34
Kansas	2.79	75.41	81.17
Missouri	2.78	72.85	79.43
Nebraska	2.67	73.97	78.36
Texas	2.99	74.14	79.34

Source: Loy *et al.*

Feeding Cattle for the Japanese and U.S. Markets

An advantage of using the accounting method to compare feeding costs is the ability to analyze how total production costs would evolve under different feeding regimes. Based on the cost analysis, two scenarios were developed for feeding cattle for the Japanese and U.S. markets. The Japanese market has recently been liberalized. This market rewards the producer for adding intramuscular fat, or marbling, to animals, which necessitates additional days on feed. To show how regional beef producers will compete for this market, the first scenario considers how additional days on feed will influence feed-conversion efficiencies and optimal purchase and sales weights. We expected that as the market requires a more marbled (corn-intensive) animal, the Corn Belt should become a more important supplier of fed beef for this market due to its lower feed-grain costs.

A second scenario worth examining is the likely regional impact of a continuing trend toward leaner (Select) beef in the U.S. market. The regions that do best under this regime are those that do worst under the Japanese scenario. This situation raises the interesting possibility that the grain-surplus regions of the United States will prosper only so long as U.S. exports of high-quality beef expand. These new markets may in fact "save" the industry in these regions if the U.S. market follows California's lead toward leaner beef.

Scenario A: Producing Beef for Japan

If all feeding regions were to continue to feed steers to 1,500 pounds to achieve a greater degree of marbling for the Japanese market, several changes may occur. Cattle must remain on feed longer; therefore, each animal will continue to mature and approach the end of its growth curve. As cattle mature, a higher proportion of weight gain will be in the form of external, internal and intramuscular fat, or marbling. Each animal will require more feed to produce an additional pound of gain, which raises the cost of gain. Regions with the advantage of feeding efficiency will begin to lose ground because of inefficient weight gains attributed solely to fat deposition. Feedlots or feeding regions with greater initial feed costs might find it difficult to compete as feeding efficiencies deteriorate.

The data presented in Table 1 provide the basis for the projected cost performances presented in Table 3. Projected cost of gain, shown in Table 3, is the least in the Corn Belt, with the least increase in Iowa. As Table 3 shows, estimated break-even points gradually decrease when moving eastward toward the western Corn Belt.

Once cattle reach slaughter weight, packinghouse location may be important when considering the cost of transporting the meat to the West Coast for export. Cost-of-production disadvantages could be offset by meat transportation costs. A 1,500-pound live steer, when slaughtered and the carcass is trimmed for export to Japan, will yield approximately 58 percent hot weight, or 870 pounds. Approximately 46 carcasses would fill one 40,000-pound ocean container. As shown in Table 3, Iowa had the lowest total export costs among all the regions in 1989. However, the estimated break-even costs to export were similar in Iowa, eastern Nebraska and the Northern Plains.

Two important assumptions were made in the above analysis of the regional competitiveness for the Japanese market. First, the decreases in feeding efficiencies were assumed to be the same for each region. If a region accustomed to better feeding efficiencies can minimize efficiency loss more effectively than can regions not accustomed to that advantage, the increased total cost of production will be less.

Second, the per-ton production costs were assumed constant among the producing regions. Any change, if not proportional among regions, will change the competitive position of the region. If, for example, a region's production cost includes feeding an animal with a less expensive ration to avoid an expensive finishing ration until necessary, the loss of feeding efficiencies plus a disproportionately greater finished-ration usage will amplify the cost. If a region has a disproportionately less expensive high-concentrate finishing ration, the cost of production for the additional weight gain may be almost unnoticed when comparing original break-even points with break-even points at heavier ending weights.

In most instances, the analysis shows that additional days on feed required to produce highly marbled beef almost equaled the original days on feed (Table 3). In the Southern and Central Plains, feed use per head doubled. These factors are important when comparing regions, especially in the Northern Plains, eastern Nebraska and Iowa, where delivered-to-export break-even estimates are within $9 per head. When shipping fabricated beef to eliminate fat, bone and unwanted cuts, however, a larger number of cattle equivalent units can be shipped at a set rate. This per-head freight reduction provides an advantage to the more distant cattle-feeding regions and, thus, would slightly increase Iowa's advantage.

Scenario B: A Trend Toward Leaner Beef for the U.S. Market

The preceding analysis lends support to the contention that regions with lower relative feed costs would have an advantage in producing highly marbled beef. This section examines the scenario that a changing demand for leaner beef in the U.S. market would make regions with lower feed costs and lower feeding efficiencies become less competitive.

Figure 7 compares break-even points for the two extremes (Iowa and the Southern Plains) at different ending weights. These results show how Iowa's feed cost advantage depends on continuing domestic and international demand for heavy animals. In feeding cattle to weights of less than 1,000 pounds, Iowa loses its advantage to regions with cheaper feeder cattle supplies or better feed efficiencies.

Table 3.

Estimated Regional Production-Cost Differences for the Japanese Market

	Plains			Corn Belt		
	Southern[a]	Central[b]	Eastern Northern[c]	Nebraska[d]	Iowa[e]	Northern Illinois[f]
In-cost per hundredweight	$81.28	$81.74	$80.04	$82.72	$84.53	$83.93
Pay weight, in (lb)	702	737	796	759	681	691
Pay weight, out (lb)	1,500	1,500	1,500	1,500	1,500	1,500
Total gain per head (lb)	798	763	704	741	819	809
Additional gain (lb)	351	347	270	306	315	358
Additional days on feed	153	137	103	118	141	164
Total days on feed	313	274	242	258	325	332
Average daily gain[a] (lb)	2.55	2.78	2.91	2.87	2.52	2.44
Feed (dm) per gain[b] (lb)	7.51	7.28	7.51	8.10	8.36	8.39
Tons of feed per head	3.00	2.78	2.64	2.86	3.38	3.31
Gain cost per ton of feed	$164.06	$164.71	$154.21	$140.84	$126.07	$136.79
Cost of gain (less interest)	$0.6169	$0.5995	$0.5788	$0.5426	$0.5205	$0.5598
Total gain cost	$492.26	$457.42	$407.51	$402.11	$426.36	$452.91
Total in-cost	$570.58	$602.42	$637.12	$626.71	$575.65	$579.96

Table 3. *(continued)*

Projected interest[c]	$84.12	$74.91	$66.92	$70.00	$84.19	$88.08
Total production cost	$1,146.96	$1,134.76	$1,111.54	$1,098.82	$1,086.20	$1,120.94
Break-even cost per hundredweight	$76.46	$75.65	$74.11	$73.25	$72.41	$74.73
Export freight cost per head	$26.10	$30.45	$27.18	$39.15	$43.50	$47.80
Total cost to export	$1,173.06	$1,165.11	$1,138.72	$1,137.97	$1,129.70	$1,168.74
Estimated break-even cost to export	$78.20	$77.68	$75.91	$75.86	$75.31	$77.92

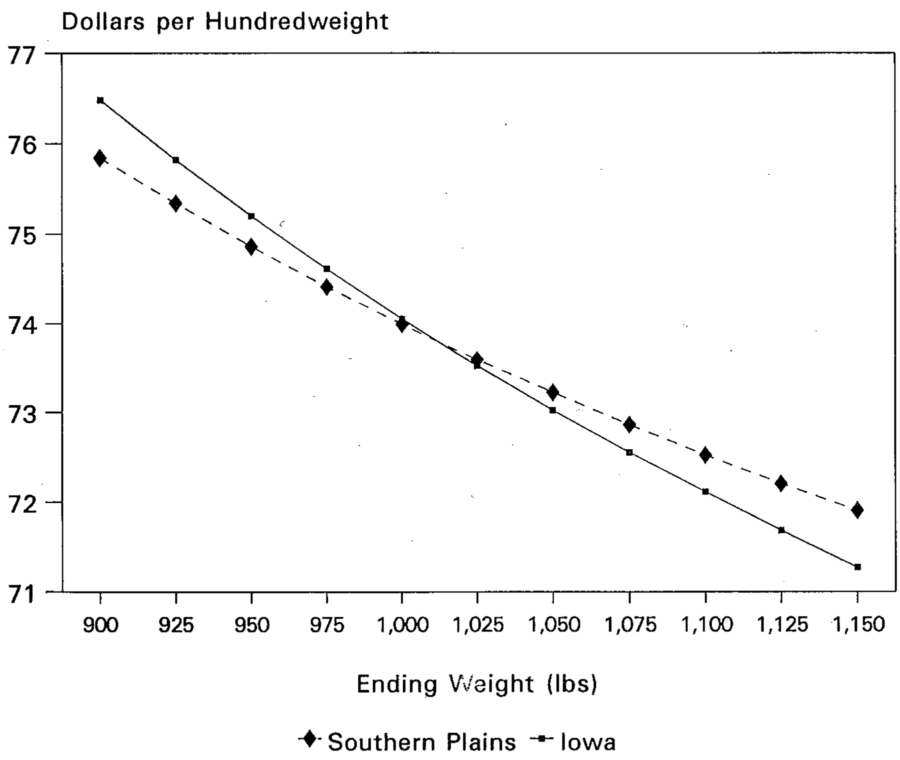
[a]Projected average daily gains reduced by 0.5 pound per day for additional time period.

[b]Two pounds of feed per pound of gain was added when calculating additional weight gain.

[c]Projected at 12 percent simple interest on full value of in-cost plus one-half of feed bill.

Note: The following assumptions have been made: average daily gain for the added weight gain required will be 0.5 pound less than that required for the earlier fattening period and feed conversion for the added weight gain required will add 2.0 pounds of feed per pound of liveweight gained. Assumptions were drawn from research conducted at Iowa State University (Reiling *et al.*).

Figure 7.
Estimated Break-even Points for Lighter End Weights, Iowa Versus the Southern Plains



These results are based on 1989 prices and performance ratios. Had 1990 or 1991 prices been used, slight differences would occur. For example, the point at which Iowa loses its comparative advantage would probably lie within the range from 1,000 to 1,100 pounds and not exactly at the 1,012-pound point indicated by Figure 7. Regardless of the year used for this comparison, it is obvious that grain-surplus regions will continue to have an advantage in producing animals at heavier weights. Evidence exists indicating consumers in California and Canada are demanding a lighter and leaner product. Should this change in demand occur throughout the United States, beef producers in grain-surplus regions may stand to lose their market shares to producers in Texas and the Southern Plains, provided that the differences in regional feed efficiencies remain constant. If less efficient regions such as Iowa were to improve feed efficiencies relative to the more efficient regions while maintaining their feed cost advantage, this loss could be reduced or eliminated.

Conclusions

This study argued that slow regional shifts in the U.S. cattle-feeding industry are likely to be caused by relatively small differences in regional production costs. Using the actual cost-of-production data for selected feedlots in 1989, the study shows that break-even values per hundredweight varied from $72.20 in Iowa to $74.02 in the Southern Plains. Regional costs differ in large part because of differences in feed costs and feed-conversion efficiencies. Iowa represents one extreme in this tradeoff and Texas represents the other.

Two scenarios were examined based on the comparative analysis of costs of production. The first scenario compared the costs of production to determine which region is most promising as a source of heavily marbled beef for export to Japan. The results showed that, even when transportation costs are included, Iowa holds an advantage in this market. The second scenario suggested that Texas (the Southern Plains) has an advantage in producing lighter animals provided the trend toward leaner beef continues in the U.S. market.

We emphasize that the analysis is based on one year observation of the selected feedlot records. Cautions should be exercised when making regional comparisons because the results may be biased and sensitive to the annual variations and samples selected. A worthwhile project would be to extend this analysis for several more years. Nevertheless, under most circumstances, it can be argued that regions such as Iowa that have a surplus of grain will have a comparative advantage in producing heavily marbled beef, while regions such as Texas that have good feed-conversion efficiencies will have a comparative advantage in producing leaner animals. Thus, if the markets for highly marbled and leaner beef expand simultaneously, it is conceivable that regional specialization will occur, with marbled beef being produced in areas in which grain is cheap and lean beef being produced in areas in which feed-conversion efficiencies are better. Iowa producers have the potential to compete in both the domestic and export markets if they can improve their feed-conversion efficiencies while maintaining the advantage of feeding cattle to heavier weights.

Notes

Lee Sankey is a Research Assistant, Dermot J. Hayes is Associate Professor, and Roxanne L. Clemens is a Communications Specialist in the Department of Economics, Iowa State University, Ames. *This project was funded by the Iowa Beef Industry Council. Journal paper No. J-14782 of the Iowa Agriculture and Home Economics Experiment Station, Ames, Iowa. Project No. 2994.*

1. See, for example, *Job Creation in Animal Agriculture in Iowa.*
2. In the accounting procedure used throughout this paper, we first calculate averages across pens and then use these averages in the various formulas. A reviewer pointed out that in order to account for the correlation between prices and physical attributes, we should have inserted individual pen data into the formulas and then averaged across pens. The reviewer's analysis shows that the error introduced by the incorrect averaging procedure is about 4¢ per hundredweight. Ideally, one should use individual animals as the basis for comparison and thus the issue is one of data collection costs versus the accuracy of the averaging procedure.

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