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# The Economics of Carcass Weight:

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March 20, 2002

# Cornhusker Economics

Cooperative Extension

Institute of Agriculture & Natural Resources
Department of Agricultural Economics
University of Nebraska – Lincoln

## The Economics of Carcass Weight: A Classic Micro-Macro Paradox in Agriculture

| Market Report | Yr Ago | 4 Wks Ago | 3/15/02 |
|---|---|---|---|
| ***Livestock and Products, Average Prices for Week Ending*** | | | |
| Slaughter Steers, Ch. 204, 1100-1300 lb Omaha, cwt | $79.88 | $72.16 | $74.30 |
| Feeder Steers, Med. Frame, 600-650 lb Dodge City, KS, cwt | 97.02 | 90.14 | 89.83 |
| Feeder Steers, Med. Frame 600-650 lb, Nebraska Auction Wght. Avg | 98.94 | 95.52 | 93.86 |
| Carcass Price, Ch. 1-3, 550-700 lb Cent. US, Equiv. Index Value, cwt | 121.19 | 113.20 | 115.59 |
| Hogs, US 1-2, 220-230 lb Sioux Falls, SD, cwt | 47.37 | 39.00 | 36.50 |
| Feeder Pigs, US 1-2, 40-45 lb Sioux Falls, SD, hd | 58.50 | * | 40.00 |
| Vacuum Packed Pork Loins, Wholesale, 13-19 lb, 1/4" Trim, Cent. US, cwt | 131.80 | 105.60 | 103.00 |
| Slaughter Lambs, Ch. & Pr., 115-125 lb Sioux Falls, SD, cwt | * | 64.72 | 60.30 |
| Carcass Lambs, Ch. & Pr., 1-4, 55-65 lb FOB Midwest, cwt | 171.00 | 137.56 | 142.66 |
| ***Crops, Cash Truck Prices for Date Shown*** | | | |
| Wheat, No. 1, H.W. Omaha, bu | 3.17 | 2.97 | 2.91 |
| Corn, No. 2, Yellow Omaha, bu | 1.85 | 1.88 | 1.87 |
| Soybeans, No. 1, Yellow Omaha, bu | 4.23 | 4.19 | 4.43 |
| Grain Sorghum, No. 2, Yellow Kansas City, cwt | 3.45 | 3.55 | 3.57 |
| Oats, No. 2, Heavy Minneapolis, MN , bu | 1.36 | 2.32 | 2.43 |
| ***Hay, First Day of Week Pile Prices*** | | | |
| Alfalfa, Sm. Square, RFV 150 or better Platte Valley, ton | 115.00 | 105.00 | 110.00 |
| Alfalfa, Lg. Round, Good Northeast Nebraska, ton | 70.00 | 65.00 | 65.00 |
| Prairie, Sm. Square, Good Northeast Nebraska, ton | 117.50 | 105.00 | 92.50 |

* No market.

Economists like to use production agriculture as an example of a perfectly competitive industry. The assumption is made that the decisions of an individual firm will not impact the general market price level. However, if a large number of individual firms all have similar cost structures and all make the same economically justified decision to alter production, then collectively this decision will impact the market price level. The result is that the individually correct production decision that was made to increase profits is collectively the incorrect decision, and profits are decreased rather than increased. This is the micro-macro paradox in agriculture.

Carcass weights for fed cattle have been trending upward for the last 30 years. In 1970 the average fed steer had a dressed weight of about 650 pounds. Today, fed steers average dressed weights are about 800 pounds. Since 1986, the average annual increase in carcass weights has been 5.25 pounds.

There are a number of factors that have influenced this trend over the years: cattle genetics, growth promotents, marketing practices and packers accepting heavier cattle are just some of the factors. The price of feed, environmental conditions and seasonal placements of calves and yearlings influence carcass weights in the short-run, but probably have had limited impact on the long-term trend. Ultimately, the real driving factor influencing weight may have been that feedlot managers have found it profitable to feed cattle to heavier weights.

If feedlot managers do find it profitable to feed cattle to heavier and heavier weights, and if collectively all feedlots do feed cattle to heavier weights, what impact does this have on the overall market price level as more beef is pushed onto the market? The objective of this article is to evaluate the individual decision to add more weight to a pen of cattle and then to evaluate this decision from an industry perspective.

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A simple budget approach will be used to evaluate the decision to feed cattle to heavier weights and sell them on the cash market. To evaluate the industry level impact of increasing carcass weights, the fundamental principles of supply and demand in a market will be reviewed. The elasticity of demand with respect to price ($E_d$ = Percentage Change in Quantity / Percentage Change in Price) measures how responsive quantity demanded is to a change in price. However, the inverse of this relationship is known as the Price Flexibility (PF = Percentage Change in Price/Percentage Change in Quantity) and it measures how responsive price is to changes in supply. Past estimates of the price flexibility at the fed cattle level will be used to evaluate the change in price from an increase in carcass weight and to determine if profits to feedlots are increased or decreased when cattle are fed to higher weights.

## Results

### Firm Level

If cattle are sold in the spot market on a live weight basis, and if there are no discounts that will be applied, then the economic decision rule on how long to feed cattle is fairly simple. If the cost of gain is less than the market price, then you should continue to feed the cattle. This is obviously an over simplification, but it is a good place to start the discussion. For example, if your current cost of gain is $0.50 per pound of gain, and if the current market price is $0.70 per pound, then it is profitable to feed cattle longer. Specifically, a 1,250 lb. steer @ $0.70 = $875. Two weeks later, that steer weighing 1,300 lbs. @ $0.70 = $910. The added revenue is $35 and the added cost is only $25 (50 lbs. gain X $0.50/lb of gain) so the added return is $10 per head. So, as long as the market is constant, and gains are constant, the added return from additional weight is equal to the (market price - the cost of gain) times the weight gain. In the example here: [($0.70 -$0.50) X 50 lbs] = $10 per head.

Recent research in Nebraska (Vieselmeyer et al.) and Oklahoma (Wagner et al.) has shown that average daily gain and feed efficiency is not affected by days on feed, and that live slaughter weight is linearly related to days on feed. Both of these studies also concluded it was economically profitable to feed cattle to heavier slaughter weights. It appears from these studies and from current marketing practices that cattle should be fed and are being fed, up to a weight where they are just at a point where additional days would result in price discounts for either heavy weight carcasses or yield grade 4 carcasses.

### Industry Level

What is the overall market impact as more total tons of beef are placed onto the market? A supply and demand diagram is displayed in Figure 1. Increased carcass weights have the effect of increasing the total supply of beef from S1 to S2. If demand remains constant, then the price would fall from p1 to p2. The crucial question here is the relative change of p1 to p2 compared to the change from q1 to q2. If price decreases a greater percentage than quantity increased, then the resulting total dollars spent on beef will decrease.

Previous economic studies have estimated the Elasticity of Demand for fed cattle to be between -0.4 and -0.7. Therefore, the price flexibility coefficient would be between -2.5 and -1.4. So, if quantity increased one percent from q1 to q2, and if demand remained constant, then price would be expected to decrease 1.4 to 2.5 percent.

The industry impact of many feedlots feeding cattle to 1,300 pounds rather than 1,250 pounds would be that carcass weights would increase from 795 to 830 pounds. If three pounds of the additional 35 pounds is fat that is trimmed off, there is a four percent increase in beef. If demand remained constant, the average price of fed cattle would decrease between 5.6 to 10 percent. On a $70 per cwt fed cattle market, that would be a decrease in price of $3.92 to $7.00 per cwt.

Let's re-analyze the decision to increase cattle weight from 1,250 to 1,300 pounds. The 1,250 pound steer would still be valued at $875 per head (1,250 X $.70) but the 1,300 pound steer would only be valued at $819 to $859 per head (1,300 X ($.63 to $.6608)). It still cost $25 per head for the added weight, so the net effect is that returns are decreased $41 to $81 per head. Another method to look at this problem is to consider the break-even selling price. The break-even price will be lower with the 1,300 pound steer compared to the 1,250 pound steer. Consider that a 750 pound steer purchased for $80 per cwt. for a cost of $600, and fed to gain 500 pounds at a cost of $250, would have a break-even price at $68 per cwt ($850/1,250 lbs.). If that steer were sold for $70 per cwt., then the net return per head would be $25. If that same 750 pound steer was fed 550 pounds at a cost of $275, then the break-even price would be $67.30 per cwt. ($875/1,300 lbs). However, if the market price has declined to between $63 and $66.08 from the added beef tonnage on the market, then the net return per head would be between -$55.90 and -$15.86; a reduction of $40.86 to $80.90 per head.

## Implications

From an individual feedlot perspective there currently is an economic incentive to feed cattle up to the point where either there is a risk of substantial discounts for yield grade 4 or heavy weight carcasses. By topping pens, marketing potential yield grade 4 or heavy carcass cattle, feedlots are able to feed the remainder of the pen additional days and sell more total pounds. So long as the cost of gain is less than the market price, this is a profitable practice for a feedlot when the decision is assumed not to impact the

market price. However, it would appear that the negative impact on overall market price from many feedlots feeding cattle to heavier weights outweighs the individual gains. In other words, the feeding industry is worse off feeding cattle to heavier weight.

What is the optimal solution? If one feedlot markets cattle at lighter weights they will give up the individual advantage of feeding cattle to heavier weights, and will still likely receive the same price. If a large group of feeders could collectively agree to market cattle at lighter weights, they most likely could positively influence market price. However, there would be an incentive for other feeders to feed cattle to heavier weights and still get the higher market price. Could feedlot producers police themselves?

Another issue that has not been addressed in the article, but is very relevant to the topic is the bargaining power of feedlots vis-a-vis the packers when cattle are getting too heavy or too fat compared to their bargaining power when cattle are lighter. This shift in the psychology of the market may be worth $2-4 per cwt.

Like many issues in the beef industry, there is not an easy solution to the decision of the optimal end weight for a pen of cattle. However, I think the industry needs to consider that the trade-off may be between selling more beef and selling less beef more profitably.

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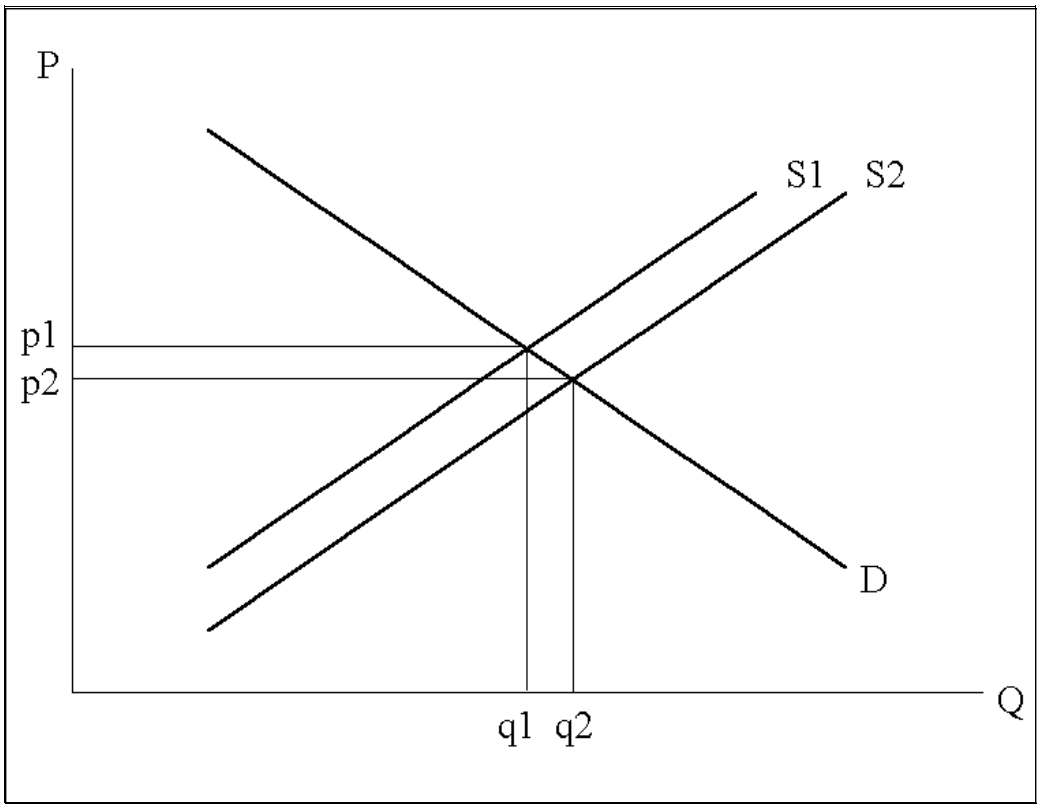


Figure 1. Supply and Demand Diagram.




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