Abstract

Data are pooled and analyzed to differentiate the value between "packer" and "feeder" type cattle. Results indicate that the value of animals entering the stocker and feeding stages of the industry are sensitive to gender, color, breedtype, body condition, and the presence or absence of brands and/or horns.

Packer versus Feeder Cattle Live Animal Value Based on Phenotypic Characteristics

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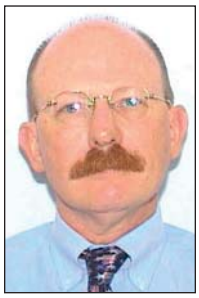

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Introduction

The influence that cow-calf producers have over the price of cattle in the market is perceived by producers as being limited to producing the animal most demanded by the market. "The animal most demanded by the market" is thought by some to be defined by breed type, color, absence of horns, gender, pre-conditioning, and/or absence of the use of implants. Commercial cow-calf producers have traditionally offset the cost of production by increasing the pounds of calves sold.[1] However, cow-calf producers deliver two products to the market: calves and culled breeding stock or cull/packer cattle. In the process of producing calves, producers utilize breeding stock until the productive life of the animal has been economically exhausted. Many industry groups have suggested that market condition could be enhanced with the improvement of total product quality.[2]

Many cow-calf producers have expressed the concern that premiums are not being paid for superior quality characteristics that produce improved harvest values. Researchers have conducted analyses of feeder calf markets to determine market pressures for some phenotypic characteristics and the associated values for these characteristics. However, a detailed study has not been conducted in the Eastern New Mexico and West Texas cattle market region nor have several characteristics been considered. Furthermore, past research has shown that structural changes have occurred in the cattle markets over time, making it necessary to identify the changes in market structure.[3]

Understanding the relationship between product quality and market price of cull/packer cattle and feeder calves can be difficult. The use of hedonic price analysis allows for comparisons of various quality levels and factors that influence the price of products having such a multitude of characteristics. However, understanding the price-quality relationship is only as accurate as the model developed. Prior conceptual knowledge in conjunction with thorough empirical analysis can provide objectivity to the discovery process required to identify the accurate economic values of varied phenotypic characteristics. The objective of this research was to determine the current market value of the phenotypic characteristics of cull/packer animals and feeder cattle as distinctly separate groups in the Eastern New Mexico and West Texas livestock markets. This pooling of the two groups (cull/packer and feeder) is made to determine whether different pricing strategies are used for the two groups of animals.

Materials and Methods

Random pens of both cull/packer and feeder cattle were sampled at four livestock auction facilities located at Roswell and Clovis, New Mexico, and Amarillo and San Angelo, Texas. A total of 1,449 pens, representing 2,482 head of packer animals, and 4,067 pens, representing 16,277 feeder calves were evaluated at the time of sale from the buyer stadium. Evaluation occurred at the buyer stadium to ensure the data were collected in a "real world" setting consistent with the evaluation conducted by the actual bidders. Samples were collected for two eight-week periods, consistent with the regional cattle industry's traditional Fall and Spring marketing seasons. The Fall sampling period began September 27, 1999 and ended on November 18, 1999. The spring sampling period began February 14, 2000 and ended on April 20, 2000, including a two-week break in data collection. Data were collected at each facility for a period of four hours, one day a week during the sampling periods. The data recorded were auction location, date, gender of animals, breed type, weight of animals, hide color, hide color pattern, presence or absence of horns, body condition score, frame size, fill (visual sign of recent foraging), muscle score, brand size, and number of brands.

Model Development

Collected data from each auction facility were encoded into spreadsheet format and analyzed using the GLM Procedure in SAS software version 7.0.[4] To determine factors that influence cattle prices (dependent variable) at regional livestock markets, a theoretical model was developed using qualitative factors as independent variables. Factors considered to influence cattle prices were: (1) specific auction facility; (2) week of study; (3) gender of animals in pen; (4) number of animals in pen; (5) weight class of animals; (6) breed type of animals; (7) color of hide; (8) hide color pattern; (9) presence or absence of horns; (10) body condition score of animals; (11) frame size of animals; (12) gut fill of animals; (13) muscle score of animals; (14) size of brand damage to hides; (15) number of locations of brands on animals; and (16) general health of animals.

The theoretical model was developed to reflect those factors that have been suggested to affect the value of the animals. Some factors were included to reflect price-quality relationships based on prior research and knowledge of the characteristics and market of feeder calves and cull/packer cattle. Reasons for the inclusion of individual quality factors in the model are reported in the following paragraphs of this section:

Auction facility (A) was perceived as affecting price because of differences in management strategies and distance from the feedlots and seasonal forages. These factors influence the type and number of buyers, creating fluctuation in demand at individual auctions. Cattle prices at a given auction for a specific date should reflect supply and demand conditions related to that particular auction facility on that day.

The dynamics of the cattle markets are also affected by external factors, such as the futures market, weather patterns, and crop production; these factors change continuously and impact buyer attitudes and profitability projections. To account for these influences, the study period was divided into sixteen weeks (W). Eight weeks in the Fall sampling period and eight weeks in the Spring sampling period. These periods represent traditional feeder calf marketing seasons in the studied geographical region.

Gender (G) of the cattle in each pen has an effect on final production expectations. Gender reflects expected relations to feeding efficiencies and production costs (i.e., the cost of castrating bull calves or feed conversion rates of heifers vs. steers, etc.).

Recent interest in decreasing variation in marketed cattle, and marketing animals that have similar performance in the feedlot and packing houses, makes number of animals (Na) in a marketed lot a factor to consider that affects cattle price. Larger lots may indicate a single point of origin, leading to less stress and fewer health problems than are sometimes associated with cattle from multiple origins. Buyers of cattle vary in number of animals needed to meet their demands, causing variation in the lot size that provides the greatest convenience.[3] Number of animals per lot (Na) was evaluated in categories.

Generally, as cattle weight increases, value in dollars per hundred weight ($/cwt) decreases. The United States Department of Agriculture (USDA) reports market prices of beef cattle in terms of weight classes; therefore weight class (Wt) was adopted in the theoretical hedonic model, consistent with present industry systems.

The U.S. cattle population is composed of many breed and breed types. Breeds have been developed to obtain desirable production goals in varied environmental settings. To account for breed variation in the feeder calf market population, apparent breed type (B) was visually determined according to the guidelines set forth in the Texas Beef Cattle Management Handbook.[5]

Branded beef or breed type marketing programs (e.g., Certified Angus Beef) have incorporated guidelines on hide color, inducing some producers to emphasis hide color (C) in breeding objectives. With this in mind, hide color was theorized as having an effect on feeder calf value and included in the theoretical model.

Hide color pattern (P) can give buyers evidence of breeding background. Some patterns of hide coloring are also considered negative traits for specific breeds (i.e., rat-tailed animals with certain breeding are considered by some to be inefficient converters of feed to muscle). For these reasons, a variable for hide color pattern was included in the theoretical model.

The presence of horns on cattle is recognized as a source of lost income to the beef industry. The presence of horns also indicate a higher percentage of the animal that will not be used in consumer products. The horns on animals can cause carcass bruising and damage to hides of other animals. This damage often occurs during the transportation and handling of animals. This trait is easily managed at the cow-calf producer level by breeding decisions or physical dehorning procedures. Given that horn presence is a trait that could possibly lead to decreased end value, the presence or absence of horns (Hp) were included in the model.

General animal health and condition are of concern to buyers. If an animal has been malnourished, animal health may be compromised. If an animal is overly conditioned, the efficient

utilization of feed or forage may be decreased. With these considerations, body condition (Bc) was included in the preliminary model. Body condition was evaluated on a scale from one to nine as outlined in the Texas Beef Cattle Management Handbook.[5]

Frame size (F) is important in the prediction of final harvest size and weight. The USDA estimates that large frame cattle reach a final finish weight above 1,200 pounds, medium framed cattle reach a final finish weight between 1,000 and 1,200 pounds, and small frame cattle reach a finished weight of less than 1,000 pounds. Discounts occur at the packer level for those carcasses that are considered too large (above 950 pounds) and carcasses that are too small (below 550 pounds).[6] To determine if frame size (F) has a significant effect on feeder calf value, frame score was considered in the model.

Gut fill is important to the cattle buyers. Gut fill is used as an indication of recent foraging and watering. Animals that have been restricted from forage or water may have a gaunt look to them, while animals that have been overly fed and watered my have a tanked look to them. Water and feed can be purchased at a lower cost relative to feeder calves. Cattle overly filled are discounted accordingly. Cattle overly thin or gaunt may be indicative of the potential for heath problems. Gut fill (Fi) was considered to have a potential effect on cattle prices and was adopted into the model.

Muscling is a prediction of expected final yield of lean red meat at time of harvest. Light muscled cattle may show signs of malnourishment and decreased health. Carcass yield is important at the packer level and significant discounts occur when carcasses have low yield. With this in mind, muscling (M) was considered in the model to determine if it affects the value of feeder calves.

The hides of slaughter cattle represent the largest percentage of income from by-products to the industry.[2] Given that brands on the hide represent the greatest percentage loss in hide value, the theoretical model included the "size" of damage from brands (Bs) and the "number" of brands (Bn) on the animal to determine if they are considered in determining feeder calf value. Additional binary variable (Bd) was considered when combining the size and number of brands, representing the presence or absence of brand damage to the hide.

Statistical Analysis of the Final Theoretical Model for Feeder Cattle

The final theoretical model developed for feeder cattle was:

$$P = f(A, W, G, Na, Wt, B, C, Hp, Bc, F, Fi, Bd) + e$$

This model was tested on 4,221 lots of animals using the GLM procedure in SAS version 7.0.[4] This model included fifty-three degrees of freedom, 4,013 degrees of freedom in the error for a corrected total of 4,066 degrees of freedom due to missing data points for variables analyzed. The value for the coefficient of determination was .6274 with a mean price of $81.73 per hundred weight. Analysis of the model indicated that all independent variables considered were significantly different from zero ($P<.05$).

The price (P) per hundredweight of a pen of feeder cattle was used as the dependent variable. The following general regression model was ultimately developed to estimate the influence of auction(A_i), week(W_j), gender(G_k), number of animals in lot(Na_l), weight class(Wt_m), breed type(B_n), color(C_o), horns(Hp_p), body condition(Bc_q), frame size(F_r), gut fill(Fi_s), and whether or not the hide has been branded(Bd_t).

$$\text{Price (\$/cwt.)} = 81.73 + \hat{a}_1A_i + \hat{a}_2Wj + \hat{a}_3G_k + \hat{a}_4Na_1 + \hat{a}_5Wt_m + \hat{a}_6B_n + \hat{a}_7C_o + \hat{a}_8Hp_p + \hat{a}_9Bc_q + \hat{a}_{10}F_r + \hat{a}_{11}Fi_s, + \hat{a}_{12}Bd_t$$

($R^2 = 0.8173$, n = 4067, df = 4013, F = 127.54, $P<0.0001$ for the intercept coefficient)

Results indicate that animals received the highest value at auction Z, while those selling at auction W received on the average $5.56 per hundredweight less. Analysis of weeks in which animals are marketed indicate that Fall marketed animals brought $18.87 to $20.50 dollars per hundredweight less than animals marketed on week 16 of the study (Spring marketed animals).

Steer calves received a higher dollar premium than bulls, while heifers received a discount of $8.33/cwt. when compared to steers. The lighter weight calves received the highest premiums when compared to 800 pound animals. Calves weighing 300 pounds received a premium of $29.25/cwt. when compared to 800 pound animals.

When considering the breed type of an animal, the statistical results indicate that the British/Continental breed types generated the highest premium of $2.25/cwt. when compared to the straight-bred British breeds. However, Dairy, Longhorn, *Bos indicus*, and their associated crosses received the largest discounts of $11.05/cwt., $8.06/cwt., and $7.31/cwt., respectively, when compared to the straight-bred British breeds. The results of analyzing the value of hide color indicate that the market prefers black and black baldy animals.

Statistical results indicate that cattle buyers prefer higher body condition scores as opposed to scores of 3 and 4. When compared to body condition score 5, animals having a score of 3 received a discount of $33.95/cwt. while those with score of 6 received a premium of $1.52/cwt.

Large and medium framed animals are preferred to small framed animals. Large and medium framed animals received a premium of $23.41/cwt. and $21.55/cwt., respectively, when compared to small framed animals.

Results indicate that animals with a higher gut Fill score are preferred to those with under-Filled guts. When compared to Fill score 3, animals with a score of 4 received a premium of $1.18/cwt. while those with a score of 2 received a discount of $7.44/cwt.

Horned animals were discounted by $0.92/cwt when compared to polled animals. Those animals exhibiting brands were discounted by $1.46/cwt. when compared to those exhibiting a native hide.

Statistical Analysis of the Final Theoretical Model for Cull/Packer Cattle

The final theoretical model developed for cull cattle was:
P = f(W, G, Wt, Hp, Bc, F, M, Ha) + e

This model was tested on 1,502 lots of cull/packer animals using the GLM procedure in SAS version 7.0. This model included fifty degrees of freedom, 1,385 degrees of freedom in the error for a corrected total of 1,435 degrees of freedom due to missing data points for variables analyzed. The value for the coefficient of determination was .6433 with a mean price of $37.80 per hundred weight. Analysis of the model indicated that all independent variables were significantly different from zero ($P < .005$), except presence or absence of horns (Hp) ($P=.18$).

The price per hundredweight of a pen of cull/packer cattle was used as the dependent variable. The following general regression model was developed to estimate the influence of week (W_i), gender (G_j), weight class (Wt_k), horns (Hp_i), body condition(Bc_m), frame size(F_n), muscle score (M_o), and health (Ha_p):

$$\text{Price (\$/cwt.)} = 37.80 + \hat{a}_1 W_i + \hat{a}_2 G_j + \hat{a}_3 Wt_k + \hat{a}_4 Hp_l + \hat{a}_5 Bc_m, + \hat{a}_6 F_n + \hat{a}_7 M_o + \hat{a}_8 Ha_p$$

$(R^2 = 0.6433, n = 1,502, df = 1,435)$

Analysis of weeks in which animals are marketed indicate that Fall marketed animals tend to bring a larger discount than those selling in week 16 of the study (Spring marketed cattle). Bulls received a higher premium than cows. Weight class does not appear to influence the value of cull/packer cattle. The horn/poll characteristic was not statistically significant.

Cattle buyers give a lower value to animals with lower body condition scores. Thus, animals with body condition scores of 2 received an average of $22.95/cwt. less than those with body condition scores of 8. Large and medium framed animals are preferred to small framed animals. Large and medium framed animals receive a premium of $4.28/cwt. and $2.64/cwt., respectfully, when compared to small framed animals.

Results indicate that animals with heavy muscling are preferred. Heavy muscled cull/packer animals receive a premium of $2.18/cwt. while light muscled animals receive a discount of $3.49/cwt.

Many of the health issues were not statistically significant. Compared to older animals without teeth, animals with bad eyes received a discount of $5.35/cwt. and those with multiple health issues received a discount of $2.74/cwt.

Discussion of Results

As important as it is to define which characteristics determine the value of an animal, it is also important to understand those which do not. Given that feeder cattle differ from cull/packer cattle in the potential for producing consumable goods, it seems

reasonable that each would be valued differently. We will interpret the results of this analysis as a means of estimating the values of the two commodities (i.e., feeder and cull/packer animals) as distinctly different commodities. One approach at making sense of this analysis is to explain the results as they relate to four general categories: 1) primary product quality (i.e., carcass); 2) by-product quality; 3) animal health; and 4) profitability.

Profitability is an assumed requirement for a market to exist for a product. Whether it be a feeder or a cull/packer animal, for a seller to make a profit, the product of purchase price and weight must be lower than the combination of the input costs and product of selling price and weight. The following study characteristics can be placed within this category:

a) The auction location was significant for the feeder cattle, but not for the cull/packer cattle. An explanation for this is that the cull/packer animals are generally processed within days of purchase, whereas the feeder cattle may be placed on wheat or grass, then shipped to a feedlot for approximately 150 days. Thus, the transportation expense for feeder cattle is greater than for cull/packer cattle, thereby causing the auction location to be of importance to those purchasing feeder cattle.
b) The week the animals are sold is important to both feeder and cull/packer animals. This results from the overall cattle market and the availability of feed.
c) The weight class at which the animals are sold is important to the feeder cattle market, while not to the cull/packer cattle market. This is because the cull/packer animals are generally processed in the same condition as purchased. Most purchasers of these animals do not consider it cost effective to increase their investment by feeding these animals too long. However, feeder cattle are fed in an effort to increase profit.
d) Previous research has shown that a feeder animal's feed efficiency is effected by the gender of the animal. For this reason, steers are valued higher than bulls, and bulls are valued higher than heifers. However, the reason that cull/packer bulls receive a premium when compared to cows of the same quality is because bulls are recognized to have a larger percentage of red meat than cows, bulls have a lower percentage of offal than cows because they do not have the large reproductive tract, and bull meat is more lean than cow meat. Bulls receive the premium over cows largely because their lean meat is ground and added to hamburger to increase the leanness of hamburger.

For an animal to be sold for a profit, its health must be sound enough to survive the trip to the packing house. Generally speaking, if a feeder animal is sick or has a health problem, it is assumed that the new owner can economically nurse it back to health. On the other hand, a cull/packer animal in the same state of health might be quickly sold to prevent putting good money after bad. The following study characteristics can be placed within the health category:

a) A low body condition score for either feeder or cull/packer cattle results in a discounted value. This is because these lower scores are reflective of a sickly appearance.
b) For feeder cattle, a low gut fill score results in a discounted value, while this does not affect the value of cull/packer cattle. The reason that this characteristic may not affect the value of cull/packer cattle could be that these animals are being salvaged rather than increased in value.

The most valued by-product of cattle is the hide. Feeder cattle purchasers place a value on the hide as evidenced by the premium for native hides (i.e., hides without brands). However, purchasers of cull/packer animals do not differentiate between the values of animals on the basis of brands on hides. A possible explanation of this is that cattle producers in both states (New Mexico and Texas) generally tend to brand all breeding animals whereas the branding of feeder animals will vary according to the producer's management objectives.

Primary product quality (i.e., carcass) is visually interpreted on the basis of perceived breed type, hide color, frame size, and muscle score. Most of these characteristics can be visually determined with a high level of accuracy by the practiced eye. The muscle score is important in the cull/packer market, while in the feeder market this is not a characteristic which specifies the value of the animal. The reason that the cull/packer market considers muscle score important is that buyers will purchase the animal at the sale barn and quickly sell the animal to the packing house. The animal's muscle is the primary product to be used in producing hamburger. Heavier muscled cull/packer animals will receive the highest prices.

Frame size, hide color, and breed type all tend to indicate the genetic origin of the animal and are also used by the buyer to predict the potential for a profitable investment. Although breed type does not influence the value of cull/packer animals, it does influence the feeder market. Compared to straight-bred British cattle, large price discounts are received for Longhorn, dairy, *Bos indicus*, and their crosses. However, British/Continental crosses receive a premium of $2.25/cwt. Hide color is used by many to identify the breed(s) of the animal. Again, hide color does not influence the value of cull/packer animals. However, black and black baldy cattle are the highest valued colors on feeder animals.

Frame size significantly impacts the value of both feeder and cull/packer animals. The larger the frame size, the higher the premium paid for the animal.

Conclusions

Cattle buyers view feeder and cull/packer cattle as two distinctly different commodities. There is no difference in value for a cull/packer animal whether it has a native or branded hide; buyers do not pay a premium for feeder cattle with native hides; the leather industry's efforts to increase the quality of the hide are best directed to the feeder market where a monetary incentive already exists.

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