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Factors Affecting Feeder Cattle Price Differentials

Ted Schroeder, James Mintert, Frank Brazle, and Orlen Grunewald

Feeder cattle prices are determined by the interaction of many factors. This study uses 1986 and 1987 Kansas feeder cattle auction data to investigate the impact of a wide variety of physical characteristics, many of which have not been used in previous studies on feeder cattle prices. Unlike previous studies, this analysis explicitly incorporates changes in feeder cattle market fundamentals during the data collection period and also allows price differentials to vary by sex and weight. Weight, weight-squared, lot size, lot size-squared, health, muscling, frame size, condition, fill, breed, presence of horns, and time of sale are significant factors affecting feeder cattle prices on any given day. Several physical traits also exhibit different seasonal price impacts.

Key words: cattle marketing, price analysis, price differentials.

The discovery of feeder cattle prices involves the interaction of many factors. Price differentials among lots of feeder cattle should reflect differences in supply and demand of the cattle in various weight and grade categories (Marsh). Moreover, price should reflect the demand for and value of the product's characteristics (Ladd and Martin). Kerr demonstrated that the value of breeding bulls corresponded to the implicit values of the bull's characteristics. Similarly, the relative price premiums and discounts among lots of feeder cattle at a given location should reflect the demand for specific traits of a lot such as sex, weight, number of head, breed, health, grade, and condition.

Several studies have investigated the price premiums and discounts attributable to the characteristics of feeder cattle. Marsh demonstrated that long-run equilibrium price differentials between steer calves and yearlings

were a function of the expected cost of gain and expected fed cattle prices. Buccola and Jessee found that price differentials for feeder steers and heifers were related to backgrounding and finishing costs; expected future feeder cattle prices; price differentials between slaughter steers and heifers; and inventories of steers and heifers. Buccola (1980), using break-even analysis to investigate the long-run interactions in price differentials between heifers and steers, concluded that the relative premiums and discounts depended upon trends in corn prices, expected slaughter cattle prices, soil moisture conditions, and rates of cattle inventory changes. A similar analysis of long-run steer and heifer price differentials was performed by Schultz and Marsh. These findings help explain the long-run equilibrium relative prices of various types of feeder cattle. However, they do not help quantify the short-run price premiums and discounts apparent in the feeder cattle auction markets.

Physical traits of individual lots of feeder cattle are expected to influence short-run feeder cattle price differentials. Menzie, Gum, and Cable determined that Arizona feeder cattle prices were significantly influenced by the weight, sex, number of head, breed, and grade of the cattle in the lot, and fat cattle prices. Sullivan and Linton concluded that finish, weight, and sex significantly affected Alabama feeder cattle prices but muscling, body size,

Ted Schroeder is an assistant professor, and James Mintert is an extension agricultural economist, Department of Agricultural Economics; Frank Brazle is an extension specialist, livestock production, Department of Animal Sciences and Industry, and Orlen Grunewald is a visiting associate professor, Department of Agricultural Economics, University of Arizona.

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physical defects, breed, and grade were not significant. Kuehn found that the sale size and type and number of buyers affected prices of West Virginia feeder cattle. Davis, Bobst, and Steele found that weight and lot size were not linearly related to price. Faminow and Gum, using nonlinear lot size and weight variables, determined that feeder cattle prices at Arizona auction markets were related to weight, lot size, sex, breed, auction location, and sex-weight interactions.

Although previous research has identified many of the physical characteristics likely to influence feeder cattle prices, several potentially important factors have been ignored. Characteristics investigated in earlier studies include weight, sex, breed, head per lot, market location (Schwab; Schwab and Rister; Schwab, Rister, and Ritchie); weight-squared, head-squared (Menzie, Gum, and Cable; Faminow and Gum; Davis, Bobst, and Steele); muscling, finish, body size, defects, lot uniformity (Sullivan and Linton); animal appearance (fleshy, full, and gaunt) (Folwell and Rehberg); seasonal factors (Madsen and Liu); and time of sale (Buccola 1982). Factors most frequently omitted in previous research which deserve investigation include health, presence of horns, fill, lot uniformity, time of sale during the auction, and seasonal differences among these factors. No studies have incorporated all of these potentially important factors, and in several instances, the factors investigated were not statistically significant, suggesting one of three possibilities: (a) these factors were not measured consistently; (b) they had little influence on price; or (c) model misspecification made precise parameter estimation impossible.

The purpose of this study was to examine the impact of a wide variety of physical characteristics on Kansas feeder cattle prices. It incorporated all of the characteristics mentioned above in a comprehensive model explaining short-term variation in prices. The analysis was performed on four different categories of cattle separated by sex and weight. This allowed for the evaluation of a more homogenous data set in terms of cattle weight, sex, and potential buyers bidding on each lot than the aggregated data series used in previous research. The analysis also explicitly incorporated changes in feeder cattle market fundamentals during the data collection period (a 12-week period during fall 1986 and spring 1987), a factor that has been ignored in pre-

vious research. Additional knowledge of the price premiums and discounts associated with feeder cattle traits and characteristics is necessary to help facilitate improved production, management, and marketing decisions by feeder cattle producers and buyers.¹

Pricing Model

Feeder cattle prices at a given market should reflect local market supply and demand conditions. Feeder cattle prices will be determined by the demand for an individual lot of cattle at a particular market given the supply of cattle at that auction (Faminow and Gum). The demand for any lot of cattle will be influenced by the physical attributes of the cattle in that lot. This suggests that feeder cattle price should be a function of the physical characteristics (C) of the cattle in the lot and fundamental market forces (M) reflecting aggregate feeder cattle supply and demand changes over the observed time period (Buccola 1980). This relationship can be formulated as

$$(1) \quad Price_{it} = \sum_k V_{ikt} C_{ikt} + \sum_h R_{ht} M_{ht},$$

where i refers to lot of cattle, k refers to specific animal trait, h refers to market influence, and t represents the auction date. The value of each specific trait is represented by V , and R is the price effect of the fundamental market forces. Equation (1) states that the price per hundred-weight of each lot of feeder cattle will be the sum of the marginal implicit values of each lot's characteristics (Ladd and Martin) and the sum of the market forces.² Factors in the market forces category might include expectations about input prices, output prices, and exogenous variables such as interest rates. Alternatively, it can be argued that an intermediate product price could serve as a proxy variable that would reflect these fundamental market conditions. The deferred feeder cattle futures price was chosen as the proxy variable for an

¹ Throughout this paper the term feeder cattle is used in a general sense with reference to calves, yearlings, and replacement heifers.

² An alternative approach to estimating the value of characteristics is that of Ladd and Martin, who investigated a similar problem from a linear programming (L-P) formulation. The L-P formulation would involve minimizing the cost (and maximizing profitability) of feeding cattle subject to limits in the quality of inputs (feeder cattle), where the quality of the inputs are determined by the characteristics of the feeder cattle.

Table 1. Correlation Coefficients of Feeder Cattle Characteristics

	Price	Sex ^a	Head	Weight	Fill ^b	Condition ^c	Frame Size ^d	Muscling ^e	Health ^f
Price	1.000	-.289* ^g	.144*	-.254*	-.126*	-.096*	-.035*	-.217*	-.209*
Sex		1.000	-.037*	-.198*	-.024*	-.023*	.081*	-.108*	-.013
Head			1.000	.158*	.106*	.087*	-.030*	-.056*	-.069*
Weight				1.000	.161*	.271*	-.273*	.090*	-.075*
Fill					1.000	.425*	.232*	-.058*	-.001
Condition						1.000	.205*	-.157*	-.116*
Frame size							1.000	-.192*	.075*
Muscling								1.000	.032*
Health									1.000

^a Sex is coded as steer = 1, heifer = 2.

^b Fill is coded as gaunt = 1, shrunk = 2, average = 3, full = 4, tanked = 5.

^c Condition is coded as very thin = 1, thin = 2, average = 3, fleshy = 4, fat = 5.

^d Frame size is coded as large = 1, medium upper 1/2 = 2, medium lower 1/2 = 3, small = 4.

^e Muscling is coded as heavy = 1, medium = 2, light = 3.

^f Health is coded as healthy = 1, dead hair or mud = 2, stale = 3, sick = 4, bad eye = 5, lame or lumps = 6.

^g Asterisk indicates significantly different from zero at the .05 level.

intermediate product price in this study to represent changes in the fundamental market forces during the period investigated.³

The model formulated in equation (1) is adaptable and relatively easy to estimate. Non-linearities and interactions of attributes were incorporated into this formulation by including them as separate characteristics. Monetary values were assigned to the characteristics and market forces by estimating equation (1) via multiple regression (Ladd and Martin). This model formulation assumes that all independent variables are measured without error, and all relevant factors affecting feeder cattle price differentials have been included. Measurement error of the independent variables is a serious problem only to the extent that feeder cattle buyers identify the various physical characteristics differently than the evaluators (Johnston). Previous studies omitted relevant feeder cattle characteristics which have been included in this study. Thus, the likelihood of model misspecification in this study is lower than in previous research.

Data

Data on prices and physical traits of feeder cattle were collected from seven weekly Kansas feeder cattle auction markets.⁴ The date,

location, time of sale, price, average weight per head, health, muscling, condition, fill, frame size, sex, breed, presence of horns, and lot uniformity were recorded as each lot of cattle was sold. The fall data were collected from 31 October 1986 through 13 December 1986, and the spring data were collected from 19 March 1987 through 15 April 1987. Only data for lots containing steers and heifers weighing between 300 and 899 pounds were retained for this analysis. The data set included 17,121 lots of cattle consisting of 138,027 head. Fifty-eight percent of the cattle were steers, 42% were heifers. Fifty-seven percent of the cattle were sold in the fall, 43% were sold during the spring.

A concern in collecting data on traits that may appear similar is that the different characteristics could be highly cross-correlated, creating multicollinearity problems in model estimation. Such problems did not appear to occur in this data set. Table 1 contains the correlation coefficients of the coded feeder cattle characteristics. The highest correlation (coefficient of .425) occurred between fill and condition. The relatively low levels of correlation between physical characteristics, which would seem similar to an untrained evaluator, provide support that the data collectors were able to discern among animal traits.

Procedure

The values of the various feeder cattle characteristics were estimated using equation (1). The specific feeder cattle characteristics and

³ It is assumed that the feeder cattle futures market is efficient.

⁴ The seven markets from which data were collected were Dodge City, Fort Scott, Manhattan, Parsons, Pratt, Russell, and Salina. Data collectors were trained to evaluate feeder cattle characteristics in a systematic manner by the Department of Animal Sciences and Industry, Kansas State University.

Table 2. Feeder Cattle Characteristics and Market Forces Examined

Dependent Variable = Price (\$/cwt)

Feeder Cattle Characteristics (C)*Weight = average weight of animals in a lot (lbs.).^a

*Weight-squared = average weight squared (lbs.-squared).

Lot size = number of head in the lot (head).

Lot size-squared = number of head squared (head-squared).

Uniformity = overall assessment of all attributes of cattle in the lot, uniformity = 0 if uniform and = 1 otherwise.

Health: consists of six binary (0,1) variables assigned a 1 if the cattle, (i) had dead hair or mud, (ii) were stale, (iii) were sick, (iv) had bad eyes, (v) were lame or had lumps, or (vi) were healthy, and each variable was assigned 0 otherwise.

Horns: consists of three binary variables, lots were assigned a 1 if the cattle (i) had horns, (ii) were mixed horned and dehorned, or (iii) had no horns, and each variable was assigned 0 otherwise.

*Condition: consists of five binary variables, lots were assigned a 1 if the cattle were (i) very thin, (ii) thin, (iii) average condition, (iv) fleshy, or (v) fat, and each variable was assigned a 0 otherwise.

*Fill: consists of five binary variables, each lot was assigned a 1 if the cattle were (i) gaunt, (ii) shrunk, (iii) average fill, (iv) full, or (v) tanked, and each variable = 0 otherwise.

Muscling: consists of three binary variables and lots were assigned a 1 if the cattle were (i) heavily muscled, (ii) medium muscled, or (iii) light muscled, and each variable was assigned a 0 otherwise.

Frame size: consists of four binary variables assigned a 1 if the cattle had (i) large frame, (ii) medium upper ½, (iii) medium lower ½, or (iv) small frame, and each variable = 0 otherwise.

Breed: consists of ten binary variables assigned a 1 if the cattle in the lot were (i) Hereford, (ii) Angus, (iii) white-face (black or red), (iv) other English crosses, (v) exotic crosses, (vi) less than ¼ Brahman, (vii) ¼ or more Brahman, (viii) dairy, (ix) Longhorn, or (x) mixed breeds, and = 0 otherwise.

Market Influences (M)

Time of sale was split into four periods and lots were assigned a 1 if sold between (i) auction open and 12:00 noon, (ii) 12:01 p.m. and 4:00 p.m., (iii) 4:01 p.m. and 8:00 p.m., or (iv) 8:01 p.m. and auction close, and = 0 otherwise.

*Futures prices = the closing feeder cattle futures price for the most recent trading day prior to the auction date (\$/cwt).

Market location = 1 for cattle sold at market, for $i = 1, 2, 3, 4, 5, 6, 7$ and = 0 otherwise.^a Asterisk indicates the influence of the factor was allowed to differ between the fall and the spring.

fundamental market forces examined in this study are reported in table 2.

The explanatory model used in this study differs from models used by other researchers because it explicitly incorporates market ex-

pectations in an attempt to explain price variation during the data collection period. The feeder cattle futures price used as a proxy for current market expectations was the closing price from the most recent trading day before the day of the auction. The January 1987 feeder cattle futures contract price was used for fall cattle weighing more than 599 pounds. The April 1987 contract price was used for fall cattle weighing less than 600 pounds. For yearling (greater than 599 pounds) spring cattle, the May 1987 contract price was used, and for lighter weight spring cattle, the August 1987 contract price was used. These contract months were chosen to match most closely the time frame when the feeder cattle in each category would meet the feeder cattle futures contract weight specifications (600–800 pounds). The futures price effect was allowed to differ seasonally, thereby adjusting to seasonal patterns in feeder cattle basis.

Seasonal interactions between weight and weight-squared were included in the model to detect seasonal preferences for different weights of cattle. It was hypothesized that heavier cattle would receive a premium in the fall relative to the spring. Similarly, it was expected that condition would have a seasonal impact on price and that thin (fleshy) cattle would receive a discount (premium) in the fall relative to the spring. Likewise, fill was also expected to have a seasonal impact on price. The model used in this study was designed to test these hypotheses.

The seasonal interaction variable was assigned a value of 1 in the fall and 0 in the spring. The prices were also adjusted for market location with binary dummy variables for each market. The data were separated into four categories: (a) steers weighing 300 to 599 pounds, (b) steers weighing 600 to 899 pounds, (c) heifers weighing 300 to 599 pounds, and (d) heifers weighing 600 to 899 pounds. The model was estimated for each category separately.⁵

⁵ Initially, the data were split only between steers and heifers, and the models were estimated over the entire weight ranges (300 to 899 lbs.). Subsequently, the data were split into the separate weight categories because it was reasoned that the different cattle weight groups were likely demanded by different buyers. Thus, it was expected that the values of the feeder cattle characteristics would differ across weight ranges. *F*-tests comparing the combined models, including all weights, to the models separated by weight, were significant at the .01 level for both heifers and steers. The *F*-test results indicated that separate models estimated for the two weight categories were statistically superior to the combined models.

Selecting a reference lot was necessary to obtain a regressor matrix of full rank in order to be able to calculate the relative discounts and premiums in the model. An arbitrarily chosen, uniform lot of Hereford cattle, in good health, average condition and fill, large framed, heavy muscled, without horns, and sold during the first quarter of the sale at auction market 1 was used as a reference lot. The results are invariant to the reference choice.

Results and Discussion

The estimated parameters are reported in table 3. All of the models explained more than 70% of the variation in feeder cattle prices. No significant degree of heteroscedasticity was detected among the residuals. Although residual autocorrelation at a given market location on a given day could be present, it is likely that this autocorrelation diminished across days and market locations. The data analyzed were collected during the fall (7 weeks) and the spring (5 weeks), at seven different auction markets; thus, it is unlikely that autocorrelation at any given auction market on a given day resulted in inconsistent parameter estimates.

The majority of the models' coefficients were significant at the .01 level. The estimated coefficients are the marginal implicit dollar per hundredweight values of the respective feeder cattle characteristics. For reference purposes, the averages and standard deviations of the feeder cattle prices over several weight ranges are reported in table 4.

Effects of Weight

As expected, weight had a nonlinear impact on the feeder cattle price (\$/cwt). In general, the price declined as weight increased. This is consistent with the price-weight relationships reported in previous studies (Faminow and Gum; Menzie, Gum, and Cable). Yearling heifer prices, however, increased as weight increased. The yearling heifers included lots of cattle intended for entry into breeding herds as well as cattle destined for fattening. Heavier, more mature heifers are likely to receive a premium, if they are purchased for breeding purposes. Although it was not possible to separate the heifers going to these different destinations, the results suggest that breeding heifers dominated the heavier weight group.

Figure 1 illustrates the relative price patterns for different weights of steers in the spring versus the fall. The relative rates of change in price differ from the spring to the fall. As weight increases, the spring price for steer calves decreases at a much faster rate than the fall price. These results imply that the discount for added weight is less in the fall than in the spring.

This seasonal difference in weight discounts might be accounted for by several factors. Relatively larger weight discounts in the spring might be caused by strong demand for lighter weight cattle that are more suitable for placement on spring pastures. During the fall, however, demand is often stronger for feedlot cattle; so somewhat heavier animals are preferred. Additionally, seasonal variations in feeder cattle supply could contribute to the differing weight discounts. The data collected in this study indicated that only about 40% of the fall cattle sold weighed at least 600 pounds, whereas more than 50% of the spring cattle weighed 600 pounds or more. The relatively smaller supply of heavier weight cattle in the fall likely results in reduced fall weight discounts. Similarly, greater supplies of heavy weight cattle in the spring lead to larger spring weight discounts.

Effects of Lot Size and Lot Uniformity

Lot size also had a significant impact on price, with buyers preferring large, uniform lots of cattle. The maximum premium for lightweight cattle was for lots of forty-five to fifty head, with premiums of \$6.50 per hundredweight for steers and \$6.15 per hundredweight for heifers, relative to single-head lots. The highest prices for heavier cattle were for fifty-five to sixty-five-head lot sizes, with premiums of around \$4.25 per hundredweight for steers and \$5.24 per hundredweight for heifers, relative to single-head lots. These lot sizes reflect common truckloads. This is consistent with Faminow and Gum's finding that maximum prices were received for sixty-two-head lots of feeder cattle in Arizona.

Effects of Health, Horns, Condition, and Fill

Of the characteristics examined, health had the most profound influence on price. Cattle that were not in good health, had physical impairments, or were muddy received large dis-

Table 3. Estimated Premiums and Discounts Associated with Feeder Cattle Characteristics, Fall 1986 and Spring 1987 Data Combined^a

Characteristic	Steers 300-599 lbs.	Heifers 300-599 lbs.	Steers 600-899 lbs.	Heifers 600-899 lbs.
Weight				
Weight	-.0716** (4.08) ^b	-.0412** (3.01)	-.05437** (3.17)	.0577* (2.08)
Weight, fall	.0193 (.90)	-.00474 (.27)	.1034** (4.84)	.0608 (1.80)
Weight-squared	.00002 (1.32)	.000007 (.45)	.000026* (2.20)	-.00005** (2.58)
Weight-squared, fall	-.000003 (.13)	.00003 (1.47)	-.000068** (4.62)	-.00004 (1.77)
Lot Size and Uniformity				
Head	.282** (16.07)	.261** (18.27)	.131** (16.14)	.187** (13.39)
Head-squared	-.00305** (10.10)	-.00276** (11.84)	-.00101** (10.35)	-.00166** (9.63)
Nonuniform lot	-.583** (3.22)	-.154 (.91)	-.328* (2.40)	-.018 (.10)
Health				
Dead hair or mud	-1.307** (6.42)	-1.332** (7.86)	-.971** (6.71)	-1.180** (5.38)
Stale	-4.646** (10.57)	-5.346** (13.76)	-5.386** (11.33)	-4.775** (5.60)
Sick	-19.523** (25.90)	-21.345** (30.23)	-18.207** (24.23)	-11.469** (6.27)
Bad eye	-10.033** (18.54)	-8.685** (18.15)	-4.348** (7.19)	-4.271** (5.96)
Lame or lumps	-19.141** (28.00)	-15.822** (24.80)	-10.514** (23.76)	-10.973** (14.97)
Horns	-.494* (1.98)	-.418 (1.84)	-.535** (2.82)	-.840** (2.95)
Mixed horns	.150 (.55)	.445 (1.89)	.166 (1.03)	-.285 (1.11)
Condition				
Very thin	.464 (.31)	-2.872* (2.04)	.793 (.82)	-.670 (.61)
Very thin, fall	-6.613** (2.95)	-2.940* (1.98)	-3.241 (1.25)	
Thin	-.215 (.64)	-.706** (2.62)	-.594 (1.82)	-.517 (1.02)
Thin, fall	-1.131** (2.61)	-.277 (.77)	-1.013* (2.47)	-.593 (.93)
Fleshy	-2.051** (3.22)	-.973* (2.26)	-.827** (3.91)	-.939** (2.87)
Fleshy, fall	1.738* (2.46)	-.036 (.07)	.644* (2.30)	.931* (2.24)
Fat	-2.994 (.57)	3.009 (.68)	-1.827 (1.41)	1.615 (.76)
Fat, fall		-3.149 (.58)	.439 (.23)	-2.447 (.98)
Fill				
Gaunt	.889 (1.29)	1.504** (2.80)	.313 (.53)	-.935 (.93)
Gaunt, fall	-.538 (.57)	-2.290** (2.63)	-.563 (.69)	1.974 (1.42)

Table 3. Continued

Characteristic	Steers 300-599 lbs.	Heifers 300-599 lbs.	Steers 600-899 lbs.	Heifers 600-899 lbs.
Shrunk	.575 (1.68)	1.430** (5.14)	-.103 (.38)	-.171 (.40)
Shrunk, fall	-.597 (1.49)	-1.242** (3.81)	-.265 (.80)	.316 (.62)
Full	-4.062** (7.13)	-3.649** (7.62)	-1.542** (4.38)	-2.547** (5.62)
Full, fall	3.357** (5.24)	2.444** (4.46)	.872* (2.15)	1.351* (2.53)
Tanked	-11.512** (4.93)	-12.999** (7.73)	-.677 (.29)	-9.164** (7.03)
Tanked, fall	-1.304 (.46)	5.173** (2.60)	-5.767* (2.27)	.429 (.24)
<u>Muscling</u>				
Medium muscling	-4.278** (6.99)	-2.398** (4.08)	-3.272** (6.97)	-3.503** (3.86)
Light muscling	-14.792** (8.64)	-6.719** (3.84)	-4.388** (4.43)	-6.428** (3.53)
<u>Frame Size</u>				
Medium upper ½	.552* (2.28)	-.748** (3.30)	-.0360 (.23)	-.173 (.69)
Medium lower ½	-1.377** (4.51)	-1.976** (7.16)	-1.705** (7.12)	-2.519** (6.97)
Small	-9.101** (14.14)	-9.808** (18.17)	-4.109** (6.35)	-7.750** (8.50)
<u>Breed</u>				
Angus	-1.744** (5.92)	-1.568** (6.78)	-.946** (3.78)	-1.292** (3.66)
Whiteface (black and red)	.605* (2.35)	.584** (2.85)	.325 (1.56)	-.188 (.65)
Other English crosses	-2.571** (4.74)	-.491 (1.09)	-1.732** (4.07)	-1.816** (2.72)
Exotic crosses	.886** (3.34)	1.045** (4.85)	.0605 (.29)	.312 (1.05)
Brahman less than ¼	-1.758** (4.69)	-1.092** (3.32)	-1.521** (5.82)	-.612 (1.56)
Brahman greater than ¼	-7.058** (4.69)	-5.106** (10.73)	-3.880** (8.41)	-3.287** (4.56)
Dairy	-8.589** (11.93)	-7.708** (8.30)	-7.319** (14.23)	-10.100** (9.27)
Longhorn	-6.975** (11.08)	-6.318** (12.74)	-5.237** (9.72)	-4.561** (5.76)
Mixed	-.0947 (.33)	.110 (.48)	-.478* (2.25)	-.358 (1.19)
<u>Time of Sale</u>				
2nd quarter	2.470** (10.81)	1.434** (7.68)	1.466** (8.63)	1.858** (7.67)
3rd quarter	1.618** (6.05)	.857** (3.81)	1.028** (5.55)	1.463** (5.29)
4th quarter	1.213* (2.38)	.838* (2.08)	1.042** (2.99)	.788 (1.21)
<u>Futures Price</u>				
Futures price, fall	.174 (1.39)	.522** (5.03)	.314* (2.57)	.436* (2.48)
Futures price, spring	.465** (4.05)	.719** (7.62)	.983** (7.84)	.845** (4.36)

Table 3. Continued

Characteristic	Steers 300-599 lbs.	Heifers 300-599 lbs.	Steers 600-899 lbs.	Heifers 600-899 lbs.
<u>Market Location^c</u>				
Market 2	-.668 (1.64)	-.758* (2.17)	-.988** (3.30)	-.035 (.08)
Market 3	-1.888** (4.92)	-.647* (2.02)	-1.527** (4.63)	-.658 (1.33)
Market 4	-4.224** (11.68)	-3.260** (10.80)	-2.130** (7.76)	-1.960** (4.90)
Market 5	-3.341** (8.51)	-1.885** (5.75)	-1.482** (5.32)	-.795 (1.89)
Market 6	-3.437** (9.27)	-2.257** (7.55)	-1.714** (5.93)	-1.037* (2.45)
Market 7	-3.271** (8.97)	-3.270** (10.73)	-1.837** (6.69)	-1.450** (3.42)
Intercept	75.207** (9.81)	40.853** (6.40)	28.031** (3.34)	-9.433 (.74)
Adjusted R ²	.71	.74	.74	.72
RMSE	5.14	4.37	3.31	3.55
Observations	5,305	5,574	4,070	2,172

Note: Single asterisk indicates significantly different from zero at the .05 level; double asterisk indicates significantly different from zero at the .01 level.

* All premiums and discounts are relative to the reference lot of Hereford cattle in healthy condition, heavy muscled, average condition, average fill, large frame size, without horns, in a uniform lot, and sold during the first quarter of the auction. To obtain the value of characteristics in the fall the trait labeled "fall" must be added to the parameter estimate not identified by season. Traits labeled "fall" represent differences in the parameters in the fall relative to the spring. For example, the fall weight impact is "weight" plus "weight fall." This does not apply to the futures price variable.

^b Absolute *t*-statistics are in parentheses beneath the respective coefficients.

^c Markets are listed in random order to maintain anonymity.

counts. Stale animals typically received discounts of about 5% to 8%, whereas sick animals generally received discounts exceeding 20% of the average price for healthy cattle. The presence of horns also reduced the price for a lot of cattle, especially for heavier weight animals.

Fleshy and fat cattle were discounted, whereas prices for very thin and thin cattle

were not significantly different from those for cattle in average condition (with the exception of lightweight heifers). During the fall, the discounts received for fleshy cattle declined, and significant discounts were received for thin and very thin steers relative to the spring. There are clear-cut financial incentives for producers to market feeder cattle in average or heavier

Table 4. Summary of Price Averages and Standard Deviations for Spring and Fall Steers and Heifers, Fall 1986 and Spring 1987

Weight Range (lbs.)	Steers				Heifers			
	Spring		Fall		Spring		Fall	
	Avg. ^a	SD ^b	Avg.	SD	Avg.	SD	Avg.	SD
	(\$/cwt)							
300-399	80.45	9.61	67.17	8.92	71.80	7.64	57.94	6.56
400-499	76.77	8.75	65.35	6.98	69.18	7.02	57.26	5.78
500-599	71.61	7.92	62.41	6.16	65.97	6.63	56.16	5.22
600-699	68.26	5.45	60.26	5.89	63.95	5.42	55.52	5.06
700-799	67.31	4.44	59.64	4.94	63.69	4.26	55.02	4.79
800-899	65.47	4.48	58.19	4.65	60.42	4.53	51.99	5.68

^a Average price within each weight range.

^b Standard deviation of prices within each weight range.

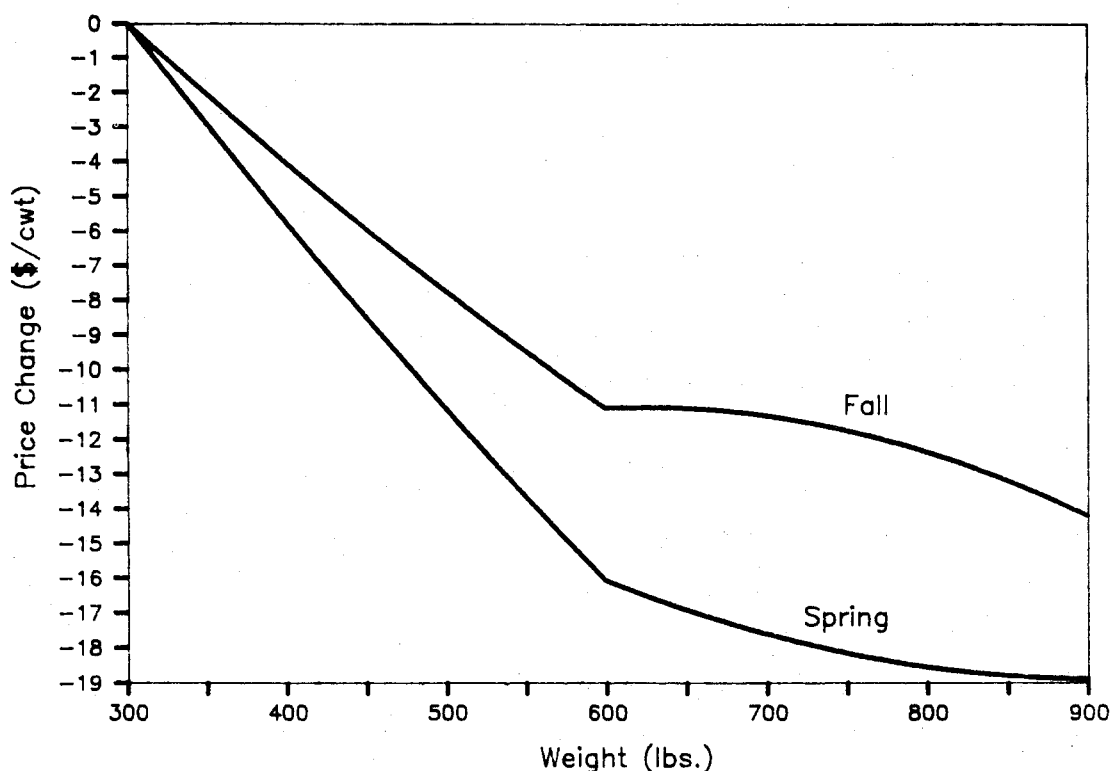


Figure 1. Effects of weight on steer price in the spring versus the fall

condition if they are being sold in the fall, whereas during spring sales heavier conditioning is not as important. These findings differ from Folwell and Rehberg's conclusion that fleshy or gaunt appearance did not significantly affect the pricing of stocker-feeder cattle in Washington.

Full and tanked cattle also received discounts relative to cattle with average fill. Seasonal differences were prevalent once again. Full cattle sold in the fall received smaller discounts (\$.85/cwt to \$3.35/cwt smaller) than full cattle sold in the spring. A note is warranted on the interpretation of the discount that is reported for tanked heavyweight steers. Because only three such steers were sold in the spring, this spring discount is not necessarily typical.

Effects of Muscling, Frame Size, and Breed

Feeder cattle buyers exhibited a strong preference for large framed, heavy muscled cattle. Discounts for medium and light muscled cattle ranged from approximately 5% to 9% of the

average price for heavy muscled cattle. Discounts for small framed and the lower half of the medium framed cattle were also significant. Discounts for small frames appeared to be a more important factor for heifers than for steers, whereas light muscled steers were discounted more heavily than heifers. The different frame size and muscling discounts for steers and heifers reflect the fact that some heifers are being purchased for breeding. Large frames are a desirable trait for breeding stock, whereas heavy muscling is more desirable for slaughter animals.

Breed type also influenced the prices buyers were willing to offer for feeder cattle. Significant discounts were received for Angus, other English crosses, Brahman, dairy, and Longhorn cattle relative to Herefords. Small premiums were realized for the exotic crosses and whitefaced crosses relative to Herefords. This is consistent with findings in other studies, in which Hereford cattle received premiums relative to other nonexotic breeds (Schwab, Rister, and Ritchie; Lambert, Corah, and Grunewald).

Effects of Time of Sale and Auction Location

Time of sale had an impact on the prices received. Cattle sold in the second and third quarters of the sale received \$1 per hundredweight to \$2 per hundredweight premiums versus cattle sold in the first quarter. The premiums present during the second and third quarters could reflect a greater presence of buyers during these periods. Prices also differed across market locations, reflecting regional differences in the demand and supply of feeder cattle during the data collection period.

Conclusions

Feeder cattle prices are determined by the interaction of many factors. Physical characteristics of the feeder cattle are important components in the short-run price discovery process. Weight, weight-squared, lot size, lot size-squared, health, muscling, frame size, condition, fill, breed, presence of horns, and time of sale were all significant factors affecting feeder cattle prices. Omissions of several of these important factors in previous research may have resulted in model misspecification bias. Furthermore, the price impacts of several physical traits were dependent on the season. During the fall, buyers bid up the prices of heavier and bulkier animals and bid down the prices of lighter and thinner cattle. During the spring, the opposite trend prevails.

Changing market expectations during the period of data collection were also found to be reflected in the feeder cattle cash markets. As the feeder cattle futures market reacted to new information, the cash market appeared to adjust to this information as well. Several studies have ignored the impacts of changes in market fundamentals over the period of data collection, and this omission may have biased their results.

Previous studies investigating the factors affecting feeder cattle prices have aggregated the data into one series. This study stratified the data by sex and weight into four different categories, yielding a more homogenous set of feeder cattle prices and characteristics for analysis. This is a preferred manner in which to analyze this type of data because the cattle in these separate sex and weight categories generally are destined for different phases of grow-

ing or finishing. As a result, disparate buyers facing dissimilar production and marketing prospects are likely bidding on separate feeder cattle weight groups. Splitting the data into more homogenous weight ranges should help capture the differences in the preferences of these various buyers.

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