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Determinants of Cow-Calf Pair Prices

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Cow-calf prices are determined by interaction of many factors. At a particular auction, cow-calf pair prices often had a range of 75% of the mean price. This variability suggests that producers need to be informed regarding cow-calf price determinants. This study uses auction data during 1993 to estimate price differentials associated with cow-calf pair characteristics using a hedonic model. Cow breed, age, health, condition, horns, frame, and whether the cow had been bred back were significant price determinants. Calf weight, health, and frame had significant price impacts. Highest prices were paid for pens containing 9–12 pairs of young Angus, dehorned, bred back, healthy cows with heavy healthy calves.

Key words: cattle marketing, cow-calf prices, hedonic models

Introduction

Consumers have become progressively more discriminating food buyers (Barkema). This has resulted in producers having increased price incentives to supply products possessing specific attributes. Producers need to understand price determinants of heterogenous products they produce and use as production inputs so they can respond efficiently to pricing signals. Together these issues have motivated considerable research investigating hedonic pricing of numerous agricultural commodities. This study uses hedonic modeling to analyze cow-calf pair values.

Cow-calf pair prices vary considerably across pens. Typical price range on any given day at a local auction during 1993 was $700/pair (78% of the average price and a coefficient of variation in price of approximately 20%). This wide price variation suggests buyers place substantial value differentials on different animal qualities and significant price incentives are present for producers to supply animals having desired traits. Determining market values of factors affecting cow-calf pair prices is complex because the two commodities are sold as a single product, yet each animal in the pair possesses different traits and each is intended for different uses in an overall goal of beef production.[1] This suggests that buyers need to assess the values of each animal in the pair and aggregate these to determine their reservation price for the pair.

The purpose of this study is to determine implicit values of characteristics of individual cow-calf pairs. Producers selling cow-calf pairs need this information to make informed marketing and production decisions.[2] Likewise, buyers of cow-calf pairs need to understand value differences as they make purchasing decisions. This study uses transaction price and

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[1]Indicative of this complexity, sources reporting cow-calf pair prices use vague categories such as "cows with small calves; cows with large calves; or small or aged cows with calf" (*Drovers Journal* 1994, p. 35). Obviously, these fairly vague categories leave considerable room for interpretation.

[2]Marketing decisions include number of pairs to market in a lot, health of the cattle, calf age and weight, and cow age and condition. Production decisions include breed, frame, muscling, etc. which are affected by breeding and management decisions.

animal characteristic data from a Kansas cow-calf auction market during 1993 to estimate market values of specific animal traits.

Numerous previous studies have investigated price determinants in the cattle industry. Many of these studies have analyzed feeder cattle price differentials (e.g., Bailey, Peterson, and Brorsen; Bailey and Peterson; Faminow and Gum; Schroeder et al.; Sullivan and Linton; Turner, Dykes, and McKissick; Turner, McKissick, and Dykes). Jones et al. and Ward estimated hedonic models for fed cattle. Mintert et al. examined cull cow price differentials. Each of these studies provide important information on values of cattle characteristics at various stages of production. They also provide information on relevant characteristics to consider in valuing cow-calf pairs since demand for cow-calf pairs is essentially derived from all three of these other markets (fed, feeder, and cull cattle). However, no previous studies have explicitly examined cow-calf pair price differentials. Given the large variation in prices across cow-calf pairs at a given auction and the complex nature of these prices, producers and analysts need information regarding cow-calf pair price differentials.

Pricing Model

Cow-calf pairs are inputs into beef production. The pairs are sold together because the calf is not of weaning age. Therefore, they are presumably worth more when sold together than when separated. The total contribution of this input into beef production depends upon the characteristics of the cow-calf pair. Following Ladd and Martin, assuming cow-calf pair purchasers maximize profit, the price of a cow-calf pair ($/pair) used as an input in beef production can be specified as:[3]

$$r_i = \sum_j T_j(\partial x_{j.} / \partial v_i), \tag{1}$$

where i refers to an input in beef production (here i is a particular cow-calf pair),[4] j refers to characteristics of the input, T_j is the marginal implicit price paid for the jth characteristic used in beef production, $x_{j.}$ is the total quantity of characteristic j that enters into beef production, and v_i is the quantity of the ith input used in beef production. For example, $x_{j.}$ is the total pounds of calf used to produce beef. Thus, $\partial x_{j.} / \partial v_i$ is the marginal yield of characteristic j in beef production from the ith input. This represents for example, the marginal change in total calf pounds used in beef production as a result of an additional cow-calf pair.

Equation (1) indicates the price for each cow-calf pair equals the sum of the values of the marginal yields of the pair's characteristics in beef production ($T_j(\partial x_{j.} / \partial v_i)$). Assume $\partial x_{j.} / \partial v_i = x_{ji}$ is a constant, that is, marginal yields of cow-calf pair characteristics in beef production are constant. Using the calf weight example, this assumption implies that increasing the number of cow-calf pairs used in beef production by one pair results in an increase in total calf pounds used in beef production equal to the calf's weight. Note, this

[3]The price of a specific input is also related to transaction costs. For example, the number of pairs in a pen provides a measure of transportation efficiency. To reduce notation in the conceptual model, variables affecting transaction costs are included exclusively in the empirical model.

[4]Both the cow and the calf are used directly or indirectly to produce beef. The calf generally goes directly to production (although it could be retained for breeding) and the cow is generally placed in the breeding herd to calve and possibly continue production of calves in the future (or culled).

does not necessarily imply the values of the marginal yields (T_j) are constant. This suggests (1) can be written as:

$$r_i = \sum_j T_j x_{ji}. \tag{2}$$

If the values of the marginal products of the jth characteristic used in beef production, T_j, were constant, linear regression could be used to estimate these implicit values by regressing prices paid upon input characteristics. However, with cow-calf pairs, some T_j are expected to vary with the level of characteristic present. For example, as calf weight changes, the marginal implicit value of an additional pound changes (that is, the marginal implicit price is a function of weight).[5] In such cases, nonlinear terms of x_{ji} are included in the empirical model. Such models have been used extensively in estimating marginal implicit values of other inputs in beef production (Bailey, Peterson, and Brorsen; Bailey and Peterson; Faminow and Gum; Jones et al.; Schroeder et al.; Turner, Dykes, and McKissick; Turner, McKissick, and Dykes).

Each T_j could be used as a dependent variable to estimate structural supply and demand equations (marginal implicit value schedule) for each cow-calf pair characteristic as introduced by Rosen and refined by Mendelsohn and Epple. Equation (2) represents the equilibrium of numerous supply and demand equations, whereas Rosen's approach seeks to determine the supply and demand for individual characteristics. Data constraints for this analysis preclude estimating structural supply and demand equations.[6]

Equation (2) can be estimated to determine the marginal implicit prices associated with cow-calf pair characteristics given cow-calf pair characteristic data and associated prices paid for the pairs. The empirical model is

$$\begin{aligned} Price_{it} = {} & \alpha + \beta_1 CoB_{it2} + \beta_2 CoB_{it3} + \beta_3 CoB_{it4} + \beta_4 CoC_{it1} + \beta_5 CoC_{it2} + \beta_6 CoC_{it4} \\ & + \beta_7 CoA_{it} + \beta_8 CoASQ_{it} + \beta_9 CoH_{it} + \beta_{10} CoHOR_{it} + \beta_{11} CoF_{it1} + \beta_{12} CoF_{it3} \\ & + \beta_{13} CoR_{it} + \beta_{14} CoBB_{it} + \beta_{15} CaT_{it} + \beta_{16} CaA_{it} + \beta_{17} CaW_{it} + \beta_{18} CaWSQ_{it} \\ & + \beta_{19} CaH_{it} + \beta_{20} CaF_{it1} + \beta_{21} CaF_{it3} + \beta_{22} CaM_{it1} + \beta_{23} CaM_{it3} + \beta_{24} PPP_{it} \\ & + \beta_{25} PPPSQ_{it} + \beta_{26} ORD_{it} + \beta_{27} MON_{it1} + \beta_{28} MON_{it2} + \beta_{29} MON_{it3} \\ & + \beta_{30} MON_{it4} + \beta_{31} MON_{it6} + \beta_{32} MON_{it7} + \varepsilon_{it}. \end{aligned} \tag{3}$$

Variable definitions are presented in table 1. To simplify notation, variable subscripts are dropped for the remainder of this section. The price per cow-calf pair is the dependent variable ($/pair). Monthly dummy variables (*MON*) were used to capture changing market fundamentals over time. The number of pairs per pen (*PPP*) and pairs per pen squared (*PPPSQ*) were included to detect buyer preference for the number of cattle in each pen.

[5] If for example, cow-calf pair price only depended upon calf weight, and the marginal implicit value of weight was a linear function of weight, the input pricing model could be specified as:

$$r_i = \beta_1 x_i + \beta_2 (x_i)^2 = x_i(\beta_1 + \beta_2 x_i),$$

where the term $(\beta_1 + \beta_2 x_i)$ is the marginal implicit value of weight.

[6] Proper modeling of structural demand equations requires large numbers of observations either across locations and/or over time in order to obtain reliable estimates of T_js as economic conditions change.

Table 1. Definition of Variables Employed in the Hedonic Cow-Calf Pair Regression

Variable	Definition
$Price_{it}$	Average cow-calf pair price of the ith pen in month t (\$/pair)
CoB_{itm}	Cow breed Separate binary (0 or 1) value: m=1, 2, 3, 4 1=Angus 2=Hereford 3=other English (non-Angus) 4=Continental default = Angus
CoC_{itm}	Cow condition Separate binary (0 or 1) value: m=1, 2, 3, 4 1=very thin 2=thin 3=average 4=fat default=average
CoA_{it}	Cow age in years
$CoASQ_{it}$	Cow age in years squared
CoH_{it}	Cow health 0=healthy 1=unhealthy
$CoHOR_{it}$	Cow horns 0=no horns 1=horns
CoF_{itm}	Cow frame Separate binary (0 or 1) value: m=1, 2, 3 1=small 2=medium 3=large default=medium
CoR_{it}	Registered cow 0=unregistered 1=registered
$CoBB_{it}$	Cow bred back 0= not bred back 1=bred back
CaT_{it}	Calf twins 0=no twins 1=twins
CaA_{it}	Calf age in months
CaW_{it}	Calf weight in pounds
$CaWSQ_{it}$	Calf weight in pounds squared
CaH_{itm}	Calf health 0=healthy 1= unhealthy
CaF_{itm}	Calf frame Separate binary (0 or 1) value: m=1, 2, 3 1=light 2=medium 3=heavy default=medium
CaM_{itm}	Calf muscling Separate binary (0 or 1) value: m=1, 2, 3 1=light 2=medium 3=heavy default=medium
PPP_{it}	Pairs per pen
$PPPSQ_{it}$	Pairs per pen squared
ORD_{it}	Order in which pen appeared for sale
MON_{itm}	Sale month Separate binary (0 or 1) value: m=1, . . . , 7 1=January 2=February 3=March 4=April 5=October 6=November 7=December default=October

Presumably there is an optimal pairs per pen which buyers seek to fill trucks. Numerous studies have found a quadratic lot size-price relation in cattle (Bailey, Peterson, and Brorsen; Faminow and Gum; Jones et al.; Schroeder et al.; Turner, Dykes, and McKissick; Turner, McKissick, and Dykes; Ward). Earlier pens are expected to receive a premium as risk-averse buyers compete to assure they fill their needs. Therefore, order in which pens were sold (*ORD*) is expected to have a negative coefficient. Turner, Dykes, and McKissick found that feeder cattle sold later in an auction received discounts. Similarly, Schroeder et al. and Bailey, Brorsen, and Thompson found that feeder cattle sold in the later half of sales received lower prices than cattle sold in the second quarter. Cow and calf frames (*CoF* and *CaF*) were each assigned separate binary (0 or 1) values for small, medium, or large frames. Small frame cows and calves are expected to receive discounts due to difficulty in calving and lighter finishing weights, respectively. Similarly, calf muscling was separated into dummy variables for light, medium, or heavy. A premium is expected for heavier muscled calves.

Calf weight was included in the model in both linear (*CaW*) and quadratic (*CaWSQ*) forms. As calf weight increases, price paid per pair is expected to increase at an increasing rate. Early in a calf's life uncertain viability makes its total value relatively low. As the calf grows and certainty regarding its growth potential becomes more evident, its value increases at an increasing rate.[7] Cow age in years (*CoA*) and calf age in months (*CaA*) were included with premiums expected for younger cows that can expect to be retained for breeding and for older calves. Cow age was included in both linear and quadratic form. Cows that calved for the first time could receive a discount because of their lower milking productivity, with premiums awarded to cows having second and third calves. Subsequent years of cow age would be expected to be discounted at an increasing rate as the remaining productive life of the cow becomes more uncertain. Older calves are expected to receive premiums as older calves have less viability uncertainty.

Cow breed (*CoB*) was categorized into Angus, Hereford, other English, and Continental. Other English breed includes English crosses and English-Continental crosses. Calf breed was not included separately because of high correlation with cow breed. Cow and calf health (*CoH* and *CaH*) were each included in the model with a 0 value indicating a healthy cow or calf and a 1 value indicating an unhealthy cow or calf. Health problems relate to bad eye, lameness, and bad udder with the cow and bad eye, lameness, and other health problems with the calf.[8] A discount is expected for health problems associated with either the calf or the cow. Horns on cows (*CoHOR*) were included with a 1 value indicating horns and a 0 value indicating no horns. A negative relationship is anticipated for cows with horns since this increases potential for cow, calf, or handler injury and makes routine handling of the cow more difficult.

Cow condition (*CoC*) was categorized into dummy variables represented by very thin, thin, average, or fat. Buyers were expected to discount thinner-than-average cows. Thin cows may have health problems, often provide less milk, and require considerable care to get into condition for the next calving. The variable bred back (*CoBB*) was assigned a value of 1 to a pen of cows that had been bred back and a value of 0 to a pen not bred back. Bred back cows should retain a premium since breeding costs are bid into the price and the cow

[7] After the trauma of weaning is complete, information regarding expected productive performance of the calf is more certain and per-head calf value increases at a declining rate. This suggests that an inflection point occurs in the per-head value of calves after weaning. Buccola provides an analysis of feeder cattle weight-price relationships after weaning.

[8] These health problems were grouped together because of low numbers of pairs having each individual health problem in the data analyzed.

will calve again sooner. Generally pregnancy is checked by a veterinarian and announced by the auctioneer prior to sale. Registered cows (*CoR*) could have a higher value if being retained for breeding. Pairs with twin calves (*CaT*) were expected to garner a premium because of the two calves and presence of the genetic trait.

To avoid perfect collinearity in estimation a default variable was chosen for any characteristic represented by multiple binary variables. Angus was chosen as the default breed. Medium cow and calf frames were the default variables. Similarly, a cow condition default of average grade was used. Medium calf muscling was chosen as a default variable. Parameter estimates represent average implicit price differentials from this base lot.

When using time-series data of this nature residual autocorrelation is a concern. Autocorrelation could be present across pens or across auctions. The most likely source of autocorrelation would be across subsequent pens on a particular auction date. Autocorrelation was tested for at each auction date allowing the autocorrelation coefficient ρ to vary by date. No statistically significant autocorrelation was present within any auction date at the 0.05 level. Heteroskedasticity was adjusted for using White's procedure in SAS. White's procedure produces consistent estimates of the parameters and their standard errors, but it is not as asymptotically efficient as a correctly specified maximum likelihood. Residual normality was tested for using the Shapiro-Wilk test. Normality of the residuals was not rejected at standard significance levels.[9]

Data

Sale price and physical characteristic data of cow-calf pairs were collected from seven monthly cattle auctions held at the Manhattan Kansas Commission Company, Inc., Manhattan, Kansas. Data were evaluated by viewing video tapes of cow-calf pens sold during each particular sale date of 1993. The date, price, cow-calf pairs per pen, cow breed, cow condition, cow age, cow health, existence of horns on cows, cow frame, registered cow, whether a cow had been bred back, order of pens sold, twin calves, calf age, calf weight, calf breed, calf health, calf frame, and calf muscling were collected for each cow-calf pen. Data were collected during the spring cow-calf sales conducted in the months of January, February, March, and April, and fall data were collected at sales held during October, November, and December 1993. No cow-calf pair sales occurred during May, June, July, August, and September at this auction site.

The data included 490 pens of cow-calf pairs comprising 2,086 pairs of cattle. Two sets of twins were recorded. Averages and standard deviations of selected data are reported in table 2. Average price per cow-calf pair was \$949.96/pair. For lots containing two or more cow-calf pairs individual cow-calf pair prices were unobtainable because the pairs were sold together. Average price is the amount paid for a cow-calf pen divided by the number of cow-calf pairs in the pen. Price paid for a cow-calf pair ranged in value from \$575/pair to \$1,350/pair. Cow-calf pens ranged in size from one pair to eighteen pair, with an average of 4.26 pairs.

For any pen containing more than one pair, the average characteristic for each cow-calf pair in the pen was recorded. Cow-calf pairs were generally sorted into homogeneous lots prior to auctioning. Individual pairs with undesirable traits were sorted off by the buyer during the sale and sold separately. Because each pen is from a single producer, and buyers

[9]The significance level of the Shapiro-Wilk normality test was 0.63.

Table 2. Summary Statistics of Selected Cow-Calf Pair Characteristics for Manhattan, Kansas, Auction during 1993

Characteristic	Average	SD	Minimum	Maximum
Price ($/pair)	949.96	173.85	575.00	1,350.00
Head (pairs/pen)	4.26	4.05	1.00	18.00
Cow age (yrs.)	5.95	2.59	2.00	9.00
Cow condition[a]	2.51	0.65	1.00	4.00
Cow frame[b]	2.14	0.64	1.00	3.00
Calf frame[b]	1.84	0.64	1.00	3.00
Calf age (months)	2.38	1.45	0.07	6.00
Calf weight (lbs.)	157.19	97.27	50.00	450.00
Calf muscling[c]	1.74	0.61	1.00	3.00

[a]Cow condition graded as very thin=1, thin=2, average=3, fat=4.
[b]Cow and calf frame graded as small=1, medium=2, large=3.
[c]Calf muscling graded as light=1, medium=2, heavy=3.

can cut out undesirable pairs from the pen, the degree of homogeneity of physical characteristics of pairs in a pen is usually high.

Although the average price was relatively stable over the year, cow-calf pair prices typically had ranges of around $700/pair on a given auction date. This large price variation is associated with diverse characteristics among the pairs offered for sale.

Results and Discussion

The estimated parameters of equation (3) are reported in table 3. The model explained 74% of the variation in cow-calf pair prices across pens. Most coefficients were statistically significant at the 0.10 level, with the majority of these coefficients significant at the 0.05 level. Positive parameter estimates indicate a premium and negative parameter estimates indicate a discount relative to a base cow-calf pair.

The model was estimated using monthly dummy variables for sale months to capture exogenous shocks to the market that may have made aggregate cow-calf pair prices change. Cow-calf pairs sold during January and February received discounts relative to October cow-calf pairs. Alternatively, cow-calf pairs sold during March received premiums relative to pairs sold in October. Coefficients for order sold, whether a cow was registered, calf age, calf muscling, and twins were not significant. Calf weight is likely a more important factor than calf age, since weight is observable. Order in which pens were sold was insignificant suggesting buyers were present in adequate number throughout the sales. Cow-calf pens may have been viewed prior to the auction, or advertisement of certain cow-calf pens may have convinced buyers to attend the entire sale.

Buyers often prefer cows that have been bred back if they intend to keep the cow. Cows that were bred back received an average premium of $67.04/pair. This implicit value represents the cost associated with impregnating the cow. Breeding costs are typically around

Table 3. Cow-Calf Pair Hedonic Price Model Parameter Estimates

Cow Characteristic	Parameter Estimate[a]	*t*-Statistic
Head (*PPP*)	29.203**	8.804
Head squared (*PPPSQ*)	− 1.356**	− 6.037
Health (*CoH*)		
Unhealthy	− 69.688**	− 3.757
Frame (*CoF*) (Default = medium)		
Small	− 1.339	− 0.091
Large	59.610**	4.468
Condition (*CoC*) (Default = average)		
Very thin	− 37.808*	− 1.623
Thin	− 51.945**	− 4.438
Fat	5.702	0.270
Breed (*CoB*) (Default = Angus)		
Hereford	− 68.577**	− 4.483
Other English[b]	− 46.172**	− 3.875
Continental	− 45.325**	− 2.430
Order (*ORD*)	0.113	0.635
Cow age (*CoA*)	22.644**	2.310
Cow age squared (*CoASQ*)	− 5.259**	− 6.115
Horn (*CoHOR*)	− 66.501**	− 3.061
Bred back (*CoBB*)	67.044**	3.839
Registered (*CoR*)	12.322	0.373
Month (*MON*) (Default = October)		
January	− 46.082*	− 1.772
February	− 49.967**	− 2.718
March	23.066*	1.830
April	− 1.821	− 0.108
November	17.023	1.099
December	5.027	0.223

Calf Characteristic	Parameter Estimate[a]	*t*-Statistic
Weight (*CaW*)	− 0.647**	− 2.167
Weight squared (*CaWSQ*)	0.002**	3.167
Health (*CaH*)		
Unhealthy	− 132.285*	− 1.805
Frame (*CaF*) (Default = medium)		
Small	− 45.695**	− 4.224
Large	0.378	0.027
Muscling (*CaM*) (Default = medium)		
Light	− 2.337	− 0.027
Heavy	3.690	0.247
Calf age (*CaA*)	8.147	0.836
Twin (*CaT*)	− 3.495	− 0.160
Intercept	1,029.979**	24.310
Adjusted *R* squared	0.737	
RMSE	92.105	
F-statistic	40.161**	
Observations	490 pens	2086 pairs
Dependent variable mean		$949.96/pair

Note: Two asterisks denote coefficients which are significantly different from zero at the 0.05 level and a single asterisk denotes coefficients which are significantly different from zero at the 0.10 level.

[a]Represents the $/pair price effect a characteristic has on the price of the cow-calf pair.

[b]Other English includes Other English Cross, English-Continental Cross.

$20 to $30 per breeding (*Drovers Journal* 1995, p.28). This suggests cow-calf buyers were willing to pay roughly $40 more per pair for a cow that was impregnated (and tested by a licensed veterinarian at the auction). This premium reflects the implied guarantee of pregnancy and reduced time cost associated with calving sooner than if the cow were open.

A discount of $66.50/pair was realized for cows having horns. The cost of dehorning cattle at an early age is inexpensive. However, after one year of age, the risk of inducing health problems during dehorning is high (Simms). The discount for horned cows reflects problems with the cow's potential to injure others and the difficulty encountered during vaccinating, tagging, and other handling of the cow.

Effect of Calf Weight

Calf weight had a nonlinear impact on cow-calf pair price as anticipated. Calf weight ranged from 50 lbs. to 450 lbs., with an average calf weight of 157 lbs. (table 2). Figure 1 illustrates how price per pair increased at an increasing rate for calves weighing 200 lbs. or more. A differential of $90/pair for calves weighing 350 lbs. relative to those weighing 450 lbs. can be observed in figure 1. This price differential is similar to the weight-price differential observed during this time period for Kansas feeder cattle.[10] Cow-calf buyers are willing to pay more for calves that have shown good performance as evident by weight. Lighter-weight calves are riskier to buyers, since growth potential and health conditions are less apparent at lighter weights. As noted earlier, after weaning, price per head for feeder cattle generally continues to increase but at a declining rate.

Effect of Head per Pen

Head per pen refers to the number of cow-calf pairs per pen. One might expect an optimal number of cow-calf pairs to suit transportation modes. Faminow and Gum, Jones et al., and Schroeder et al. found that maximum prices were paid for truckloads of cattle. The combined head and head-squared terms indicate that a maximum price occurs at a pen size of 9–12 pairs. This relationship may be viewed in figure 2, which shows that buyers realize the opportunity cost of not filling a load or bringing in additional modes of transportation. Typical hauling modes at this auction site are straight truck and stock trailers which account for the maximum price paid at the optimal pen size number. Producers should realize that costs associated with obtaining optimal pen sizes may exceed the gains from selling in larger pen sizes (Mintert et al.).

Cow Age

Cow age had a nonlinear impact on cow-calf pair prices. However, this impact was not exactly as expected. Figure 3 indicates that cows were discounted from two years of age up through the maximum age of cows in this study, nine. It was hypothesized that cows of age three years and four years would receive premiums relative to two-year-old cows because two-year-old (first-calf) cows often produce less milk. Older cows are discounted heavily as their useful breeding life is limited.

Effect of Frame, Condition, and Health

A premium was paid for large-frame cows (table 4). Whereas, prices of pens containing large-frame calves were not significantly different from those with medium frames. A discount was present for small-frame calves relative to medium-frame calves. Small-frame calves generally finish at lighter weights making them less desirable to producers. Very thin and thin condition cows received $37.81/pair and $51.95/pair discounts relative to average condition cows. Depending upon the costs of improving a cow's condition (including feed

[10]The average Kansas price for 350 lbs. calves was $379.19/head and the average price for calves weighing 450 lbs. was $468.41/head during 1993 (U.S. Department of Agriculture). This price difference of $89.19/head is similar to the $90/head-differential estimated in figure 1.

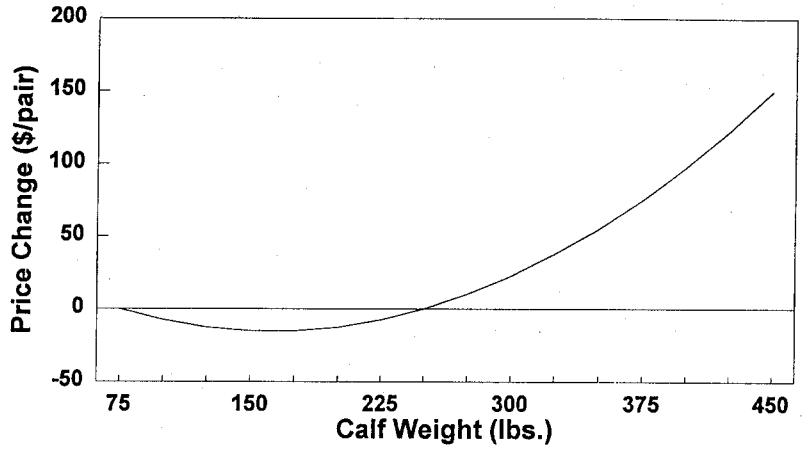

Figure 1. Effect of calf weight on price per cow-calf pair

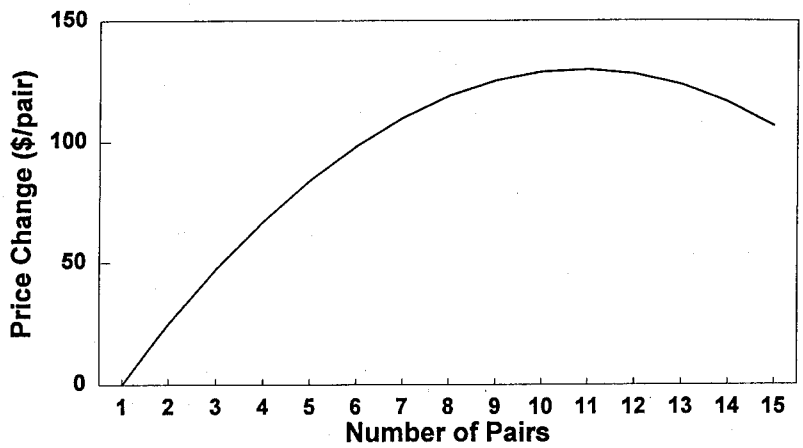

Figure 2. Effect of number of cow-calf pairs per pen on price per cow-calf pair

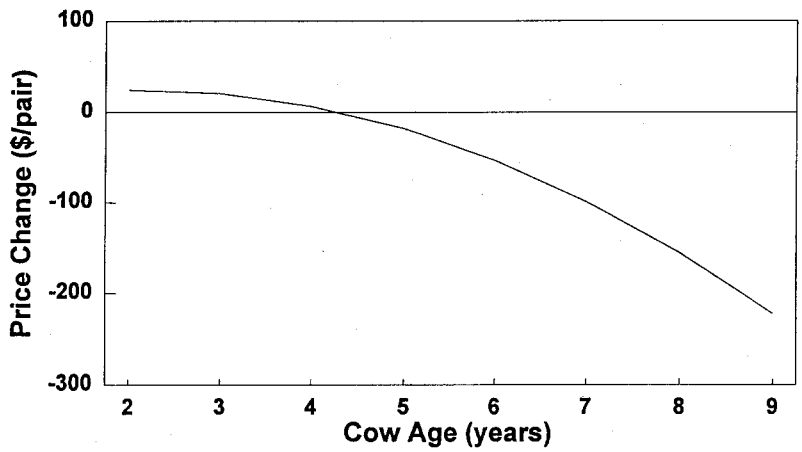

Figure 3. Effect of cow age on price per cow-calf pair

Table 4. Effect of Frame, Condition, and Health on Cow-Calf Pair Price

Characteristic	Percent of Pens	Price Change ($/pair)
Cow frame (*CoF*)		
Small	13.6	– 1.34
Medium	58.2	Default
Large	28.2	59.61**
Cow condition (*CoC*)		
Very thin	5.5	– 37.81*
Thin	41.4	– 51.95**
Average	49.8	Default
Fat	3.3	5.70
Cow health (*CoH*)		
Unhealthy	1.2	– 69.69**
Calf frame (*CaF*)		
Small	29.8	– 45.70**
Medium	56.5	Default
Large	13.7	0.38
Calf health (*CaH*)		
Unhealthy	3.5	– 132.29*

Note: Two asterisks denote price changes which are significantly different from zero at the 0.05 level and a single asterisk denotes price changes which are significantly different from zero at the 0.10 level.

costs and cow feeding response), it may be profitable for sellers of cow-calf pairs to upgrade a cow to average condition prior to selling.

Discounts were realized for unhealthy cows and calves. Unhealthy cows received a discount of $69.69/pair relative to healthy cows. This discount reflects costs of care and risks of chronic problems for cows. Unhealthy calves received a discount of $132.29/pair relative to healthy calves. This discount suggests an unhealthy calf has no value and may translate to a lesser value for the cow because of the risk of producing unhealthy calves. The obvious problem is the seller has incentive to nurse the calf back to a healthy status, but risk-of-death loss and associated health care costs may balance the price discount.

Effect of Breed

Discounts, ranging from $45/pair to $68/pair were realized for cows of Hereford, other English, and Continental breeds, relative to Angus (table 5). These premiums for Angus cattle may reflect the ability of Angus cattle to grade choice with less external fat than other breeds.

Table 5. Effect of Breed on Cow-Calf Pair Price

Breed	Percent of Pens	Price Change ($/pair)
Angus	15.3	Default
Hereford	13.1	−68.58**
Other English	59.2	−46.17**
Continental	12.4	−45.33**

Note: Two asterisks denote price changes which are significantly different from zero at the 0.05 level.

Conclusions

No previous research has estimated price differentials associated with cow-calf pair characteristics. Numerous studies in the cattle industry have found premiums and discounts awarded based on physical characteristics. This study showed that several physical characteristics are important cow-calf pair price determinants. A young, quality, healthy cow and a healthy large calf that have breeding and growing value, received significant premiums. Oppositely, pens containing low quality or old unhealthy cows and pens containing unhealthy calves have considerably reduced value.

Physical characteristics are important in determining cow-calf pair values. Cow breed, age, health, condition, horns, frame, and whether the cow had been bred back influenced cow-calf pair values. Calf weight, weight squared, health, and frame were significant in valuing cow-calf pairs. Pairs per pen and pairs per pen squared were significant, indicating a maximum price is obtained for an optimal number of pairs per pen.

Price incentives are present for producers to market cow-calf pairs in 9–12 pair lots. A higher price is obtained for pregnant cows. In addition, holding pairs until calves are near weaning weight will result in higher per pair prices as uncertainty regarding growth potential is reduced. Decisions to alter characteristics must be made relative to the costs and risks associated with these activities.

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