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Introduction

In recent years, the sale prices of beef calves have increased on average, in part due to tighter supply of beef calves and generally strong demand for beef products by consumers. Historically, research has demonstrated beef calf sale price to be influenced by a variety of calf management factors and characteristics. The opportunity to comprehensively evaluate some of these factors amidst recent dynamic changes in the beef industry has been available through analysis of sale prices of beef calves sold as lots via a livestock video auction service. The objective of this study was to quantify the effects of breed, gender, and their potential interaction on sale price of beef calves marketed through video auctions, while adjusting for other factors that significantly influenced price.

Key words: breed, market, price

Experimental Procedures

Information describing factors that could potentially affect sale prices of lots of beef calves that were marketed through a livestock video auction service (Superior Livestock Auction, Fort Worth, TX) was obtained from the auction service in an electronic format. These data were collected for lots offered for sale from 2010 through 2014.

Descriptive information available for each lot of calves were date of the video auction, number of calves, sex of the calves (steers, heifers, or both steers and heifers), base weight, whether calves had been weaned before shipment from the farm or ranch of the current owner, geographical region of the United States where the lot was located before the auction, breed description of the cattle, frame score of the calves, flesh score of the calves, the vaccination history, a subjective classification indicating the amount of the base weight variation within the lot, whether the calves had horns, whether the calves had been implanted with a growth-promoting compound, whether the lot qualified for a United States Department of Agriculture approved Age and Source Verification program, the number of days between the date of the auction and the planned date

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of delivery, whether the lot qualified for one or more of the video auction service's special programs:

- Value Added Calf,
- Certified Natural,
- Non-Hormone Treated Cattle,
- Superior Progressive Genetics,
- Bovine Viral Diarrhea-Persistently Infected Free,
- Verified Natural Beef or Never Ever 3,
- Certified Natural Plus,
- Global Animal Partnership,
- Superior RightSlide,
- Reputation Feeder Cattle, or
- Top Dollar Angus, and
- The sale price of the lot (\$/cwt).

The specific and current requirements of each of the video auction service's special health and management programs are available at www.SuperiorLivestock.com.

Breed description of the calves in the lots was 1 of 19 factors included in the original model and was characterized into five groups: English and English crosses, English–Continental crosses, Black Angus sired out of dams with no Brahman influence, Red Angus sired out of dams with no Brahman influence, and Brahman influenced.

Factors describing the lots of beef calves that were non-numeric in the original file received from the video auction service were classified into well-defined groups, and each group within a factor was assigned a numeric code. A multiple-regression model was developed using a backwards selection procedure to quantify effects of factors on sale prices of beef calves.

The fixed effects included in the original models were year of sale, calf sex, whether the lot was a mixed-gender or single-sex lot, geographical location, breed description, health protocol, base weight variation within the lot, frame score, flesh score, presence of horns, Certified Natural program nested within implant status, Non-Hormone Treated Cattle program nested within implant status, age and source verified, whether the lot qualified for Superior Progressive Genetics program, size of the lot (linear and quadratic terms), base weight (linear and quadratic terms), whether the lot qualified for Bovine Viral Diarrhea-Persistently Infected Free program, number of the days between auction and planned delivery, and the implant status. At each step of the backwards selection procedure, the variable with the largest P -value was eliminated from the model. A value of $P < 0.05$ was used to include a fixed effect in the model. Of the 19 fixed effects, 16 were significant and included in the final model.

Results and Discussion

Data analyzed were collected from 116 livestock video auctions from 2010 to 2014. There were 2,106,181 total steer calves and 1,239,645 total heifer calves used in the analyses (Table 1). Breed and gender of the lot interacted to affect sale price of calves ($P < 0.0001$). Implant status, number of days between auction and planned delivery, and

calves that qualified for Bovine Viral Diarrhea-Persistently Infected Free program did not significantly affect the sale price of beef calves and thus were excluded from the final model.

Red Angus and Black Angus sired steer calves had similar sale prices ($P=0.954$; \$171.95/cwt and \$171.52/cwt, respectively) and sold for greater ($P<0.05$) sale prices as compared with steers in all other breed categories. English/English crossed (\$170.66/cwt) and English-Continental crossed (\$170.06/cwt) steer calves had similar ($P=.258$) sale prices but were greater ($P<0.05$) than those of Brahman influenced steer calves (\$165.84/cwt).

Among heifer lots, Red Angus-sired heifer calves had the greatest ($P<0.05$) sale price compared to heifers in all other breed descriptions at \$161.49/cwt. Black Angus-sired heifer calves (\$156.92/cwt) had a greater ($P<0.05$) sale price than heifers in the remaining breed categories. English-Continental crossed (\$154.90/cwt) and English/English crossed (\$154.74/cwt) heifer calves had similar sale prices but that were greater ($P<0.05$) than Brahman influenced heifer calves that had the lowest ($P<0.05$) sale price at \$151.79/cwt.

Implications

Value of specific breed composition of beef calves is influenced by gender and may be related to the buyer's purchasing certain breeds of heifer calves as replacements for the breeding herd.

Table 1. Breed and gender interact to affect the sale price of beef calves sold through video auctions from 2010 through 2014

Breed description	No. lots	No. calves	Sale price least squares mean (\$/cwt)	Price difference (\$/cwt) ^a	P-value
Gender by breed description interaction	33,811	3,345,826			<.0001
Steer calves					
English, English crosses	2,114	219,762	170.66 ^d	4.82	
English-Continental crosses	5,252	543,043	170.06 ^d	4.22	
Black Angus sired ^b	6,620	759,975	171.52 ^e	5.68	
Red Angus sired ^c	879	88,532	171.95 ^e	6.11	
Brahman influenced	5,142	494,869	165.84 ^f	0.00	
Heifer calves					
English, English crosses	1,407	123,356	154.74 ^d	2.95	
English-Continental crosses	3,770	348,627	154.90 ^d	3.11	
Black Angus sired ^b	4,124	388,294	156.92 ^e	5.13	
Red Angus sired ^c	494	38,737	161.49 ^f	9.70	
Brahman influenced	4,009	340,631	151.79 ^g	0.00	

^aThe price differences were the regression coefficients of the model.

^bLots of calves in this breed group were sired by Black Angus bulls and out of dams with no Brahman influence.

^cLots of calves in this breed group were sired by Red Angus bulls and out of dams with no Brahman influence.

^{d,e,f,g}Values within a gender without a common superscript differ (P<0.05).

The model was adjusted for all other factors that significantly affected the sale price of beef calves and for the random effect of auction date nested within year.