Effects of Brahman Influence on Breeding Female Prices in South Texas

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Introduction

From 2010 to 2014, a severe drought and sharply higher production costs dramatically reduced the cowherd in South Texas; cow inventory in the region declined 22.5% from 2010 to 2013. Favorable projections for calf prices and the potential for continued relatively low feed prices (compared to highs in 2012) indicate that herd rebuilding is likely to remain profitable over the next several years. This assumes that forage availability will improve with drought recovery. Given these circumstances, producers should consider the genetic, managerial, and market factors that increase the value of breeding cattle at auction. This study examines the effects of Brahman influence and other genetic, managerial, and market factors on the price paid for breeding cattle in South Texas.

Cattle with Brahman influence are of special interest in South Texas because crossbreeding them with British and European breed types typically produces offspring that tolerate heat better and are more resistant to insects and disease than their non-Brahman parents. Brahman influence also contributes to reproductive efficiency, longevity, maternal ability, and maternal calving ease. Brahman cattle can be used as straightbreds, but are generally used as crosses to take advantage of the increased hybrid vigor they exhibit (heterosis), especially in the female.

Many studies examine Brahman influence as a binary effect and most are based on feeder cattle or calf prices (Barham and Troxel, 2007; Mathews et al., 2007; Schroeder et al., 1988; Schulz et al., 2009; Williams et al., 2012). However, it is possible to approximate the level of Brahman influence to a much finer degree and the benefits of heterosis are dependent on the degree of Brahman influence. This study defines five levels of Brahman influence: 0% Brahman influence, approximately 25%, 50%, approximately 75%, and 100% or pure-blood Brahman. The

authors are not aware of other work determining the value of different levels of Brahman influence in breeding stock. Thus, this paper contributes to the livestock marketing literature by providing 1) a model of breeding female prices and 2) an empirical analysis of a south Texas special female sale during a time of herd rebuilding.

Data

The data used in this paper were collected at a commercial breeding female sale in Beeville, Texas on April 4, 2014. The cattle sold in this auction were not pre-certified, but the auction staff prescreened ranchers selling livestock at the sale. Because this was a special sale and only represented 121 lots, the authors do not claim that this study represents the overall breeding stock in South Texas. However, special sales in the region are likely to have similar characteristics.

The following information was collected on each lot: number of head, coat color, frame size, condition, Brahman influence, breeding stage (open, bred, exposed, pairs), presence of horns, price per head (female), and weight. Four key variables are discussed below and summary statistics are presented in Tables 1 and 2.

A breakdown of coat color in Table 1 indicates that the influence of black-hided breeds dominate in the breeding stock, followed by red-with-white-face breeds. Of the 121 lots, 26.1% were black and 17.6% were black-with-white-face crosses. This indicates large influence of Angus, Brangus, and their crosses in the breeding stock. Hereford also has a large influence in the breeding stock. Of the cattle sold, 16.8% were red brindle or tiger-stripe and 10.9% were red with a white face. The gray-coated cattle were all purebred Brahman representing 12.6% of the lots. Cattle with solid red coats were 6.6% of the lots while dun coated cattle made up 5.8% of the lots. The remainder was brown, white, smoky, or mottle-faced. Just over 70% of the cattle

had coat colors consistent with crosses that are popular in South Texas. It is likely that those cattle will command a premium over other breed types.

As noted above, many studies examine Brahman influence as either all or none and most are based on feeder cattle or calf prices. This study focuses on breeding stock and collects more detailed data about the effect of Brahman characteristics on their price. Brahman influence includes larger ears, a larger dewlap, and a larger hump on the shoulders. These attributes decrease in size as the percent Brahman decreases. Our evaluators were trained to estimate the percent Brahman based on the size of those physical characteristics. These characteristics were evident to some degree in nearly 96% of the lots (Table 1). Cattle approximately 25% Brahman influence made up 32.5% of the lots. Cattle with an estimated 50% Brahman influence made up 33.3%. Cattle with approximately 75% Brahman influence made up only 16.7%. Finally, 13.3% of the lots were purebred Brahman cattle.

Breeding status of cattle is highly relevant to a buyer who is restocking and breeding status at this sale was confirmed by a veterinarian. Bred cattle and pairs dominated the status of females in the special sale at 33.9% and 34.7%, respectively. Twenty-two percent of the lots were designated as exposed, meaning that the females have been exposed to a bull but does not confirm that they are bred. Just over 9% were open females. Because the buyer does not know whether the seller actually exposed the cow to a bull or if the cow bred, one would expect to see only a slight premium for exposed over open females. One might expect a significant premium for bred cows and pairs over open cows since the calf and/or the potential for a calf both have value. However, bred cows are likely to have a smaller premium than pairs because of the risk of loss of the calf and the time discount associated with waiting for a calf.

Prices and weights from the sale show high variability given the relatively small sample (Table 2). Per-head price ranged from $910 to $2,500 (avg. $1,479). Per-female lot weight ranged from 487.5 to 2270 lb (avg. 1,025.7 lb). Unlike studies conducted on feeder cattle, there does not seem to be a clear relationship between price and weight for females. Figure 1 shows a plot of price per female and average lot weight per female. This may be a result of the fact that lot weight is strongly correlated with breeding status. The statistical analysis explained below will determine to a greater degree of certainty whether weight has a significant impact on price.

Model

Market valuation of breeding females is dependent on supply of and demand for breeding females in a given region. Specifically, the price of a given lot will be determined by the demand for that lot at a particular auction given the supply of breeding females at that location. The physical attributes of the cattle in a lot will have an impact on the demand for the lot. Thus, the price of a lot of breeding females is dependent on physical characteristics (P) of the cattle in the log and changes in market forces (M) reflecting changes in the aggregate supply and demand for breeding females over the period observed. This relationship can be represented as:

$$Price = f(P, M). \quad (1)$$

Since the data in this paper were collected in one location on a single day, fundamental market forces are held constant and are not included in the empirical specification of the model. Thus, the empirical model focuses on the physical characteristics of the cattle in each lot.

A standard hedonic pricing model is used to determine the effects of the factors listed in the previous section on breeding female prices. The model is specified as follows:

(2)

$$Price_i = \beta_a + \beta_b LotSize_i + \sum_{c=1}^{5} \beta_c\, CoatColor_{ic} + \sum_{d=1}^{2} \beta_d\, Frame_{id} + \sum_{e=1}^{2} \beta_e\, Condition_{ie} + \sum_{f=1}^{4} \beta_f\, Brahman_{if} + \sum_{g=1}^{3} \beta_g\, BreedingStatus_{ig} + \beta_h Horns_i + \beta_j Weight_i + \beta_h Weight_i^2$$

where $Price$ is the natural log of the per-head price of the lot, $LotSize$ is the natural log of the number of head in the lot, $CoatColor$ is a set of dummy variables for the dominant coat color in the lot, $Frame$ is a set of dummy variables for the dominant frame size in the lot, $Condition$ is a set of dummy variables for the dominant condition or fat cover in the lot, $Brahman$ is a set of dummy variables for the dominant visually observed percentage of Brahman genetic influence, $BreedingStatus$ is a set of dummy variables indicating the breeding status of the female, $Horns$ is a dummy variable indicating whether the majority of head in the lot had horns, and $Weight$ is the average lot weight per female (total lot weight divided by the number of females in the lot).

The focus of this paper is the effect of Brahman influence on breeding female prices. In contrast to other studies on feeder cattle, this study breaks down Brahman influence into five levels: 0% Brahman influence, approximately 25%, 50%, approximately 75%, and 100% or pure blood Brahman. This allows us to determine the degree to which market participants value different levels of Brahman influence in breeding females. Brahman influence positively impacts the ability of cattle to resist certain diseases, handle heat stress, and increases breeding productivity in females. Thus, we expect the signs on β_f to be positive and to be larger in magnitude for higher levels of Brahman influence.

We expect large and small frame cattle and thin and fat condition cattle to be discounted relative to medium frame and average condition cattle. Horned cattle are likely to be discounted

relative to polled or dehorned cattle. Larger lots will likely command a premium. These predictions are based on previous work in calf markets.

Average lot weight per female is not likely to increase the lot price per head (Figure 1). This is because breeding females are not sold by the pound and because weight itself is not an important factor in determining the productivity of the female. Further, breeding status is likely to be highly correlated with lot weight per female.

We expect breeding females exposed to a bull, confirmed bred, and pairs will be priced significantly higher than open cows. Since this is a special sale, concerns of infertility are unlikely to discount open cow prices. This means that the expected premiums associated with exposed and confirmed bred females and pairs will not likely be influenced by uncertainty regarding the quality of the open cows in the sale.

Coat color is an indicator of breed type, which is an important factor for commercial cow-calf producers. One breed type which can be discerned by coat color is the Hereford-Brahman cross. Since this breed type can be determined by coat color, we explicitly include it as a binary variable in the model (red brindle). We expect that this coat color will carry a premium over some other coat colors due to its popularity in the breeding stock of the region.

Though most cattle in the U.S. are black in color, cattle in the southern region of Texas are more likely to have red, white, or gray coats. This is because black-hided cattle in this region are more likely to suffer from heat stress during the long, hot summers. We expect that black coat color will be discounted relative to other coat colors.

Results

The results in Table 3 indicate that Brahman influence, breeding status, and lot size have the most statistically-significant impact on price. Except in the case of red brindle cattle,

different coat colors do not generate statistically significant premiums or discounts. The presence of horns, average weight per female, and body condition did not have a statistically significant effect on price. Small-framed cattle had a statistically significant discount relative to average and large-framed cattle.

The primary results of interest indicate that Brahman influence is an important determinant of breeding female prices in the region. Cattle with less than 25% observed Brahman influence had a premium of 17.7% while cattle with roughly 75% Brahman influence had a premium of 27.13%. The premium for 50% Brahman influence was not statistically significant. This is due to the fact that nearly all 50% Brahman cattle in the study were either red-brindle- or black-coat cattle. If all Brahman influence effects are dropped from the model, black coat color has statistically significant discount while the red brindle coat color has a positive and statistically significant premium. Purebred Brahman cattle had a net premium of 44.21%, calculated by subtracting the 18.05% discount for gray coat color from the premium of 62.26% for purebred Brahman. This calculation is necessary since all gray-coat cattle in the study were purebred Brahman.

Coat color is important to the price of breeding cattle because it represents the breed, breeding, or some notion of genetics. Premiums and discounts are calculated for the five most prevalent coat colors in the sale—solid black, solid gray, red brindle, black-with-white-face, and red-with-white-face. These calculations are relative to all other coat colors in the sale—red, dun, white, brown, and smoky. Red brindle was the only color to show a statistically significant premium (14% per head) over red, dun, white, brown, and smoky coated cattle. This is likely due to buyers' perception that Hereford-Brahman cross cattle are of higher quality than other breed

types in the region. This perception is likely founded on the success of other Brahman-British cross cattle such as Santa Gertrudis and Beefmaster breeds.

The breeding status of the cows in this sale contributed significantly to price differences when compared to open cows. Some of the cattle were designated as exposed, indicating that they had been exposed to a bull but were not confirmed as bred. The 13.2% premium for exposed females over open cows was statistically significant. This indicates that, though buyers are not certain whether the female is bred, they are willing to pay a premium based on the claim of the buyer. It is also possible that since the data used in this study were collected at a special sale, buyers are more confident about the sellers' claims about exposed females. Bred females brought 28.27% per head more than open females. This premium represents not only the value of breeding a cow prior to sale, but the veterinarian's confirmation of the breeding status of the female. Pairs also showed a statistically significant premium of 46.23% per head over open females. This premium ($525.43 at the average open cow price) represents the market value of an un-weaned calf. The difference between this premium and the price of a 500 lbs. weaned calf is likely due to time discount and risk factors such as forage availability and potential death of the calf.

Management and marketing factors also contribute to the value of breeding stock. Frame size had a significant impact only in the case of small-framed cattle. Medium-framed breeding cattle were more desirable than large- and small- framed cattle, which had statistically-significant discounts of 7.4% and 10.42% per head relative to medium framed cattle, respectively. Condition or level of fatness did not have a significant impact on the prices of breeding stock in this auction. Neither the presence of horns nor average lot weight per female had a significant impact on per-head prices. The insignificance of the horn discount may indicate

that many of the cattle were of high enough quality that the discount for horns was not consistent in this sale. As previously discussed, the lack of significance of lot weight per female is likely due to effects such as breeding stage and breed type dominating.

The cattle lots ranged from 1 to 6 head, with an average of 2 head per lot. Larger lots had a significant premium over smaller ones. The model calculates the effect of lot size as an elasticity. For a 100% increase in lot size, there is a 15.49% increase in the price per head. Because lots in the sample did not exceed 6, this premium may not extend to lots of 7 or more.

Conclusion

This paper presents the results of a unique study of breeding female prices at a special sale in south Texas. Though Brahman influence typically results in a discount in feeder cattle in other areas of the country, the influence of this breed increases the value of breeding stock in the hot climate of south Texas. This study quantifies the effect of Brahman influence. Pure-bred Brahman females were worth, on average, 44% more than females with no Brahman influence. Females with roughly 75% Brahman influence were worth 27.13% more than non-Brahman females and females with roughly 25% Brahman influence were worth 17.7% more than non-Brahman females. There is also evidence that a half-blood Brahman cross with Hereford cattle generates a 14% premium.

Another interesting set of results of the study were premiums for different breeding stages. Four breeding stages were represented in the study: open, exposed, bred cows, and pairs. No information was collected on the gestation of the calf in bred cows or the age of the calf at side in pairs, so the results represent premiums for typical gestation lengths and calf ages at sale. Exposed females, bred females, and pairs had premiums of 13.2%, 28.3%, and 46.23% over open cows, respectively. These premiums have implications for breeding cattle market

participants in terms of valuing each breeding stage relative to the costs and risk associated with producing a similar female. Future work will examine the risk implications in more detail.

Several other factors in the study can be related to the existing literature on market calves. First, lot size is a significant driver of the per-head price sellers receive. The effect of lot size was modeled as an elasticity. Similar to other studies on feeder cattle, lot size was positively correlated with price. Second, both large- and small-framed females received discounts relative to medium-framed cattle. Frame size is also an important determinant of feeder cattle prices and has an effect on the productivity of breeding females. Finally, two effects that were clearly different from the market calf literature were average lot weight per head and the presence of horns. The results of this study found no discount for horned cattle and no clear relationship between average weight per head and price. In studies on market calves, horns were discounted due to the increased ability of feeder cattle to cause productivity issues at the feedlot. Additionally, in feeder cattle, the weight per head is the key driver of value.

More research is required in this area to determine the effects of different market, genetic, and managerial factors on breeding female prices over a broader geographic area. This paper provides a model that can be used to carry out further research. As the US beef cattle industry recovers from massive herd depletion due to drought, research on breeding females will be of great importance.

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Table 1. Tabulation of Genetic, Managerial, and Marketing Characteristics

	Freq.	Percent
Coat color (n=119)		
Solid black	31	26.1%
Gray	15	12.6%
Red brindle	20	16.8%
Black with white face	21	17.6%
Red with white face	13	10.9%
Other colors	19	16.0%
Brahman influence by lot (n=120)		
0%	5	4.2%
~25%	39	32.5%
50%	40	33.3%
~75%	20	16.7%
100%	16	13.3%
Breeding status by lot (n=121)		
Open	11	9.1%
Exposed	27	22.3%
Bred	41	33.9%
Pair	42	34.7%
Frame size (n = 121)		
Large	34	28.1%
Medium	70	57.9%
Small	17	14.0%
Body Condition (n=120)		
Fat	40	33.3%
Medium	64	53.3%
Thin	16	13.3%
Lot Size (n=121)		
1	59	48.8%
2	24	19.8%
3	18	14.9%
4	9	7.4%
5	9	7.4%
6	2	1.7%
Horns (n =121)	20	16.5%

Table 2. Summary of Price and Weight (n=121)

	Average	St. Dev.	Minimum	Maximum
Price (dollars per head)	$1,479	$339	$910.00	$2,500.00
Average lot weight (lbs. per head)	1025.7	268.21	487.5	2270

Total number of lots: 123

Table 3. Regression Results*

		Coefficient	St. Error	t-value
Coat color				
(base is all other colors)	Solid black	-0.084	0.063	-1.32
	Solid gray	-0.199	0.171	-1.16
	Red brindle	0.131	0.067	1.94
	Black with white face	0.002	0.063	0.04
	Red with white face	0.053	0.066	0.81
Brahman Influence				
(base is 0% Brahman)	Up to 25 % Brahman	0.163	0.080	2.03
	50% Brahman	0.111	0.087	1.27
	More than 50% Brahman	0.240	0.099	2.41
	Purebred Brahman	0.484	0.184	2.63
Breeding status				
(base is open)	Exposed	0.124	0.067	1.84
	Bred	0.249	0.070	3.53
	Pair	0.380	0.077	4.96
Frame				
(base is medium frame)	Large frame	-0.077	0.046	-1.68
	Small frame	-0.110	0.051	-2.17
Condition				
(Base is average)	Fat/fleshy	0.026	0.041	0.64
	Thin/very thin	-0.043	0.050	-0.86
Other Variables				
	ln(Lot size)	0.144	0.038	3.83
	Horns	-0.043	0.046	-0.93
	Average lot weight per female	0.000	0.000	1.20
	Average lot weight per female squared	-1.31E-07	1.42E-07	-0.92
Constant		6.484	0.257	25.22

*Dependent variable is natural log of price per female.

Figure 1. Price Per Head vs Average Lot Weight Per Female