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Kevin C. Dhuyvetter

R. Jones

T. Turner

See next page for additional authors

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Economic values associated with expected progeny differences (EPD) for angus bulls at auction (2005)

Authors

Kevin C. Dhuyvetter, R. Jones, T. Turner, and T. Marsh

ECONOMIC VALUES ASSOCIATED WITH EXPECTED PROGENY DIFFERENCES (EPD) FOR ANGUS BULLS AT AUCTION

K. Dhuyvetter[1], R. Jones[1], T. Turner[1], and T. Marsh[1]

Summary

The two primary objectives of this study were to re-examine the economic values of production expected progeny differences (EPD) and how they relate to the values assigned to actual weights, and to assess the impact that ultrasound EPD have on Angus bull prices. Buyers consider the EPD birth weight to be more important than actual birth weight when selecting bulls. For the remaining production EPD, however, the actual measures were considered more important than the EPD. All four ultrasound EPD were significantly related to price, with three out of the four exhibiting the expected response. Comparisons among premiums/discounts associated with ultrasound EPD, production EPD, and actual weights showed that EPD for ultrasound ribeye area had significantly larger price responses than did either the EPD for birth weight or the actual adjusted yearling weight. This finding suggests that breeders who currently fail to report this data should consider its inclusion in future production sales.

Introduction

The purebred cattle industry has undergone a period of significant informational change in the last 20 years. The development and use of expected progeny differences (EPD), which are statistical estimates of performance for a given animal's progeny, has been a primary component of this change. Since their introduction, EPD have been increasingly accepted and used by purebred producers selling breeding stock, but the impact EPD have had in the market place and on commercial cattle producers is less clear. Previous research has demonstrated that some EPD, specifically birth weight, are valued by producers when they purchase bulls, but the magnitudes of the economic values of EPD relative to the corresponding actual underlying phenotypic measures have been surprisingly small.

In this study we re-examine the role of performance EPD in determining value for purebred Angus bulls. Specific consideration was given to carcass and ultrasound EPD, in an attempt to define their role in breeding stock selection. Other measures, such as actual weights, ultrasound scores, regional issues, and marketing factors, also were examined as they pertain to the value of purebred Angus bulls.

Procedures

Data for this study were collected from purebred Angus producers across the Midwest, Rocky Mountain, and Northwest regions of the United States. Producers were contacted by phone, written correspondence, and email, requesting sale catalogs and price data from their most recent production sale. Data were collected on 8285 bulls from 60 sales in

[1]Department of Agricultural Economics.

an 11-state region. Variables gathered from this process included prices, registration numbers, and various marketing factors specific to each sale. Data relating to actual weights and EPD were not recorded at this time, although animals found to have incomplete production records were noted for each sale.

The collection of all actual weights, EPD, and pedigrees was done in cooperation with the American Angus Association. Registration numbers for each bull were given to the American Angus Association, which then generated a database with all relevant genetic information for each bull. This database was then combined with the existing record of prices and marketing factors to create a complete summary of variables for each observation. Summary statistics for price, actual weights, EPD, and marketing factors are presented in Table 1.

No two sales in this study reported exactly the same number or types of variables in their sale catalogs. These discrepancies were noted and are accounted for in that models were specified using only data that were available to buyers at the time of the sale (i.e., data reported in the sale catalog).

Actual production measures, EPD, and marketing factors formed the basis for a conceptual model of bull prices that was specified as:

Bull Price = function of:
(Actual production measures,
Production EPD, Ultrasound EPD,
Marketing factors, Sire, Sales).

Actual production measures included age, birth weight, adjusted weaning weights, and yearling weights; ultrasound scans included adjusted intramuscular fat, ribeye area, and 12^{th}-rib fat thickness. Production EPD included birth, weaning, milk, and yearling weights. Ultrasound EPD include intramuscular fat, ribeye area, fat thickness, and percentage of retail product. The marketing factors recorded from each sale are sale order, semen retention, season of the sale (fall versus spring), picture, embryo transfer, pathfinder dam, and the inclusion of full brothers and females in the sale. Sire was a series of dummy variables used to capture bulls who are the progeny of highly ranked Angus sires. Sales identified bulls sold in a particular state or sale. A hedonic modeling approach, using OLS regression, was applied to the data to obtain estimates for each of the variables presented in the conceptual model. In accord with previous work, the dependent variable, price, was transformed to log form.

Results and Discussion

Specific regression results from the first specification of this model are available from the authors. The three actual performance measures were all significant and exhibited the expected sign relationships to price: birth weight was negatively related to price, whereas weaning and yearling weights were positively related to price. Buyers are likely to pay less for heavier birth weights due to expected increases in calving difficulty. Adjusted weaning and yearling weights provide buyers with a measure of a bull's ability to add additional pounds of gain. This is desirable because it provides a picture of the expected performance of a bull's progeny.

Comparing the coefficients for the EPD and actual weights revealed larger values for the EPD relative to the related actual weights, but this comparison is not appropriate because of differing units involved. Elasticities provide a unit-less comparison between the two genetic measures and offer a measurement that is readily comparable across variables. The elasticities for the actual weights are greater than the elasticities for the EPD.

A problem with the elasticities is that they only show the effect of the variable at a certain point, however, here being the mean. This

technique ignores the true behavior of most variables by assuming that a 1% change in all variables occurs with equal likelihood. It is best to examine the effect a variable has on price across a standardized range of likely changes. This allows the effects of a variable to be evaluated at many points while still providing comparisons between variables of differing units. To compare the relative value of EPD versus actual weights, standardized premiums were calculated based on standard deviation incremental changes in the variable of interest. Figure 1 depicts the comparison of the standardized (equally likely) premiums for actual birth weight and EPD for birth weight. Here it is seen that the EPD for birth weight has slightly larger standardized premiums associated with it than does the actual birth weight. From this result, it can be argued that EPD for birth weight is the more significant genetic measure, despite the higher elasticity of birth weight.

Figure 2 shows that adjusted yearling weight has larger standardized premiums than EPD for yearling weight does when the relationship between these two variables was accounted for. Thus, although buyers may pay greater premiums for the genetic information in EPD for birth weight relative to actual birth weight, it seems that they are unwilling to do so for EPD for yearling weight.

Reasons for the difference between birth weight and yearling weight are not entirely clear. A possible explanation may lie in the accuracy of the EPD at the time of sale. Bulls are typically sold at one year of age or older. Buyers may believe that the EPD for yearling weight are, in fact, unreliable for yearling bulls. Because EPD for yearling weight is based solely on records of related animals (parents, grandparents, and siblings), they may believe that the possible variation in the EPD is quite large and, thus, they place more confidence in the actual yearling weight.

A second model including carcass ultrasound EPD was developed to examine the value that buyers place on carcass quality. Each of the ultrasound EPD in this model were significant, indicating that buyers value the information they provide. The EPD for intramuscular fat and for ribeye area variables were positively related to price, indicating that additional units of intramuscular fat and ribeye increased the price paid for a bull. The coefficient for relating price to EPD for backfat thickness was negative, implying that increases in fat thickness decreased value. The EPD for percentage of retail product was expected to be positively related to price, given that a bull's ability to sire progeny that yield greater quantities of retail product would be desirable to a buyer, but the estimated coefficient was negative. Reasoning for the negative relationship of this variable to price is unknown. On the basis of elasticities, the EPD for ribeye area had the greatest effect on price among the ultrasound EPD, although its effects were much smaller than the effects of any of the actual production measures or production EPD. This indicates that the ultrasound EPD provide additional information to buyers, but do not seem to be as important as other factors used in making purchasing decisions.

Figure 3 compares the standardized premiums received for EPD for ribeye area, EPD for birth weight, and actual adjusted yearling weight. The premiums received for EPD for ribeye area are considerably greater than those received for EPD for birth weight or for actual adjusted yearling weight at sales that report all three measures. This contradicts the earlier conclusion, derived from the elasticities, but again provides a reasonable examination of the effects of the variables (because of the "likelihood" of change in the value). The findings in Figure 3 suggest that the inclusion of ultrasound EPD should be considered by sales, given the high premiums received for bulls possessing large ultrasound ribeye EPD.

Variables pertaining to various market factors were also included in the models. These factors were shown to be as significant in determining value as genetic measures were, and indicate that bulls that are aggressively marketed will likely bring premiums relative to bulls not benefiting from marketing. Additional variables used to describe the sire of the bull and the sale at which he was sold, showed various levels of significance as well. The significance of the sire variables indicates that buyers believe additional information, not contained in the bull's genetic record, is captured by the bull's sire. Significance of several sale variables suggests that buyers recognize the reputations of breeders and are willing to pay premiums or discounts for comparable animals sold at different sales.

Purebred bull purchasers are using information from both actual physical characteristics and EPD when making bull purchasing decisions. Buyers seem to pay particular attention to birth weight EPD, adjusted yearling weights, and ultrasound ribeye EPD.

Table 1. Summary Statistics for Bull Price and for Variables Included in the Model to Explain Differences in Purebred Bull Prices

Variable	n	Mean	Std Dev	Minimum	Maximum
Price	8285	2565	1908	875	51,500
Production Measures					
Age, days	8285	447	125	98	1829
Birth weight, lb	7986	83.5	9.9	40	124
Adjusted weaning weight, lb	8063	660	72	378	988
Adjusted yearling weight, lb	7380	1168	114	636	1742
Adjusted intramuscular fat, %	7255	3.7	0.9	0.8	10.5
Adjusted ribeye area, square inches	7243	12.4	1.6	6.5	18.8
Adjusted rib fat, inches	7259	0.3	0.1	0.0	0.8
EPD for:					
Birth weight	8227	2.6	1.6	-3.8	9.6
Weaning weight	8253	38.3	6.7	11.0	71.0
Milk	8253	20.3	4.6	0.0	36.0
Yearling weight	8252	72.6	11.4	19.0	125.0
Carcass weight	4575	5.2	6.3	-16.0	30.0
Marbling	4575	0.18	0.12	-0.13	0.75
Ribeye area	4575	0.13	0.13	-0.35	0.59
Fat thickness	4575	0.00	0.02	-0.05	0.05
Percentage retail product	4575	0.06	0.24	-0.87	0.77
Ultrasound intramuscular fat	7814	0.07	0.14	-0.40	0.74
Ultrasound ribeye area	7814	0.12	0.21	-0.62	1.00
Ultrasound fat	7814	0.00	0.02	-0.06	0.06
Ultrasound retail product	7814	0.02	0.28	-0.96	1.20
Marketing Factors[1]					
Sale order	8285	0.50	0.29	0	1
Semen third	8285	0.20	0.40	0	1
Semen half	8285	0.08	0.27	0	1
Season of sale	8285	0.77	0.42	0	1
Picture	8285	0.11	0.31	0	1
ET	8285	0.21	0.41	0	1
Full brother	8285	0.10	0.30	0	1
Pathfinder	8285	0.06	0.23	0	1
Female in sale	8285	0.46	0.50	0	1

[1]Sale order = order of sale that bull was sold (in percentile); Semen third = one third of semen rights retained by the seller; Semen half = one half of semen rights retained by the seller; Season of sale = the season that the sale was held; Picture = bulls whose picture appeared in the sale catalog; ET = bulls who are listed as embryo transfers; Full brother = bulls who have a full brother in the sale; Pathfinder = bulls whose dam is a pathfinder; Female in sale = sale selling females as well as bulls.

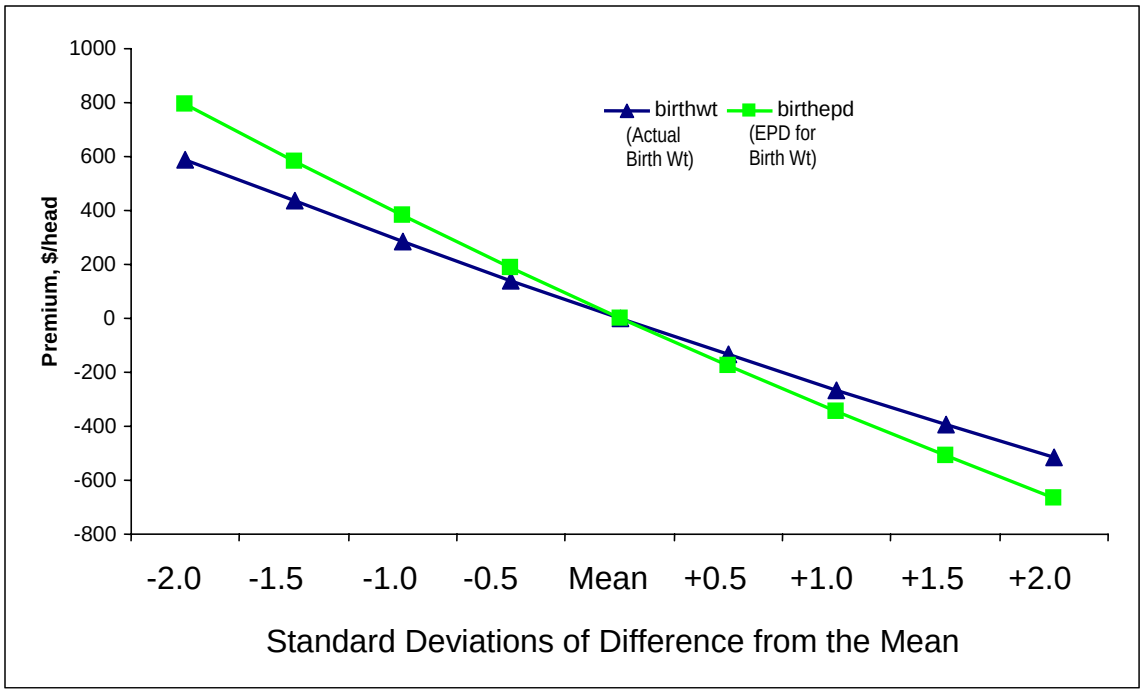

Figure 1. Predicted Premiums for Birth Weight and Birth Weight EPD.

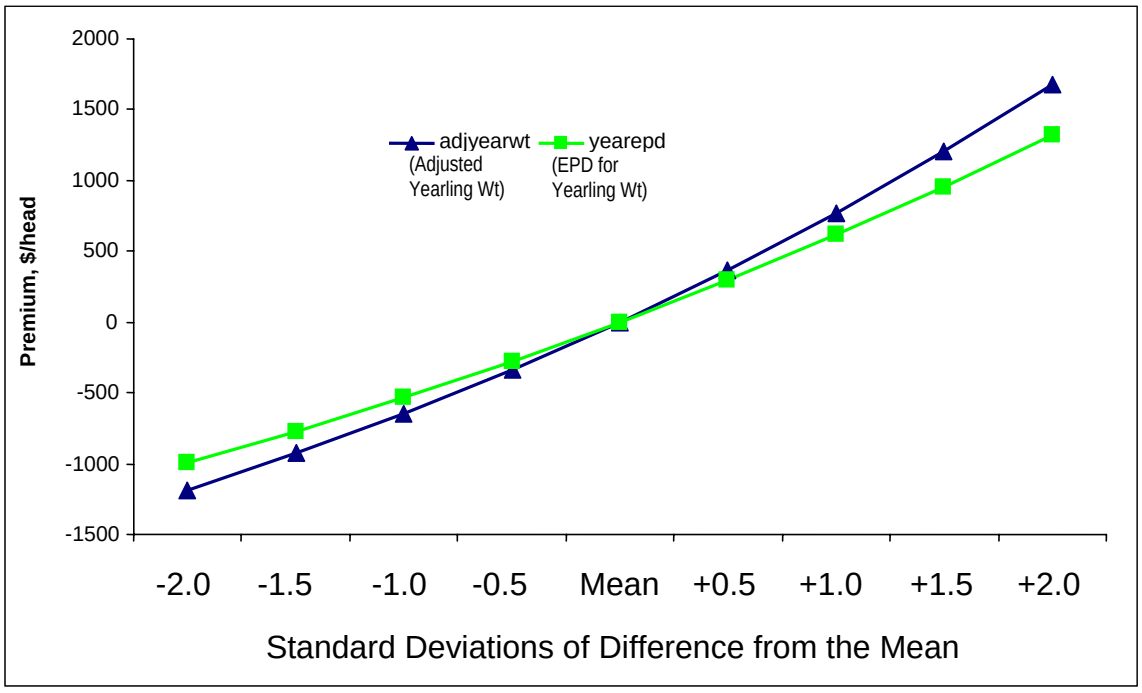

Figure 2. Predicted Premiums for Adjusted Yearling Weight and Yearling Weight EPD.

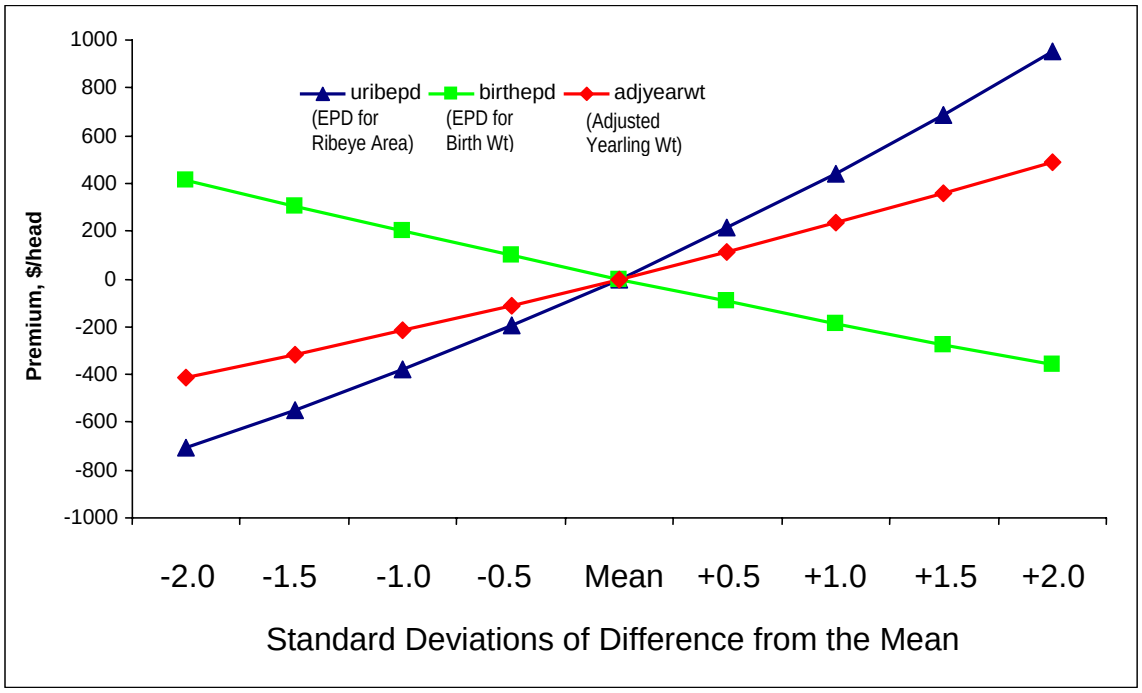

Figure 3. Predicted Premiums for Ultrasound Ribeye EPD, Birth Weight EPD, and Adjusted Yearling Weight.