THE RELATIONSHIP BETWEEN OBJECTIVE MEASUREMENTS AND THE PRICE PAID FOR BEEF BULLS

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SUMMARY

Relationships between the price paid for a bull and objective information such as weight at sale, weight adjusted for age, 600, 400 and 200 day weight EBVs, milk EBV and muscle score were investigated using 1149 bull prices from 21 auctions at 7 beef cattle studs between 1986-92. Weight and probably visual appearance are important, but EBVs also influence price.

INTRODUCTION

Beef producers have been encouraged for many years by those servicing the industry to take more notice of performance information when selecting bulls. Initially emphasis was placed on weight ratios and, since the introduction of BREEDPLAN in 1985, estimated breeding values (EBVs). Tier et al. (1984) calculated the value to the producer of using higher growth EBV sires. However, the amount of performance data provided to bull buyers is often large and may be confusing. This paper describes an investigation into the impact of this performance information on the price beef cattle producers paid for bulls.

DATA

The analysis included data from 21 auctions at 7 beef cattle studs between 1986 and 1992. The studs provided a range of performance information in their sale catalogues, including BREEDPLAN EBVs for 600, 400 and 200 day weight, and 200 day milk EBV. A number of studs also provided birth weight EBVs. Muscle scores (McKiernan 1990) were available for some herds in some years. With the exception of one stud, weights of the bulls were not generally listed in the catalogue, but were often available on supplementary data sheets provided at the sale. Most bulls were aged between 450 and 800 days at the time of the sale, so the analysis was restricted to this age range to ensure the dataset was as uniform as possible. This resulted in a total of 1149 bull prices. Numbers sold by stud and year are given in Table 1.

ANALYSIS

Weight, as an indicator of physical appearance, was expected to influence price. To see if buyers make allowance for age in their judgements, weight was also adjusted for age, creating a new variate, **wtadj**. As a simple demonstration of effect on price, data from each of the 21 auctions was ranked according to each of the traits listed above, and differences in price, wtadj and the trait used for ranking, calculated between the 'above average bulls' for the trait - i.e. the top 50% - and the rest. Price, trait and wtadj differences over all auctions were then averaged, weighted by numbers of bulls sold (Table 2). Results show that the largest price differentials were commanded by weight, either with or without adjustment for age. By dividing the price difference by the weight difference, Table 2 shows that buyers paid around $25 more for each extra

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Table 1. Number of animals auctioned at ages 450-800 days by stud and year

stud/breed	1986	1987	1988	1989	1990	1991	1992	Total
1 Angus	0	0	0	19	0	0	0	19
2 P.Hereford	0	0	0	0	23	0	0	23
3 Hereford	28	34	38	39	46	0	0	185
4 Angus	26	28	36	44	47	0	0	181
5 Hereford	0	0	112	128	148	0	0	388
6 Hereford	0	0	0	66	99	0	0	165
7 Angus	0	0	0	0	60	68	60	188
Total	54	62	186	296	423	68	60	1149

kilogram of weight. EBVs commanded approximately 70% of the price differential for weight. For 400 day EBV, this represented approximately $80 more for each additional kilogram of EBV.

Because of the strength of the association between price and weight, and because the above average bulls for any particular trait were also heavier, expected price differences between above and below average bulls, based purely on the observed wtadj differences were calculated to see how much of the price differentials could be explained by weight. For example, since buyers paid, on average, $25.9 for each additional kg of wtadj, we might expect the above-average bulls for 600 day EBV, which also averaged 49 kg greater wtadj, to command an increased price of $25.9 x 49 = $1170. Price differentials based solely on wtadj differences were, with one exception, less than the actual price differentials, indicating some variation was due to other information. The exception was birthweight EBV where, of course, low values are generally desirable. Here, the actual price differential was lower than predicted from the wtadj differences, because of a negative impact of high birthweight EBVs on price.

A more formal analysis was carried out using a logarithmic transformation of price and applying regression techniques. Wtadj accounted for more variation in price than any other single factor, including stud and year effects, or auctions within studs and years. These factors were highly significant, as might be expected. Consequently, subsequent analyses were carried out within auctions. Table 3 gives the

Table 2. Differences in price, trait and weight adjusted for age (wtadj) between above and below average bulls when ranked in turn by weight, wtadj, 600, 400, 200 day, milk and birthwt EBVs and muscle score

Trait on which ranked	(a) Price diff ($)	(b) Trait diff	Ratio (a)/(b)	No of cases	Wtadj diff (kg)	Wtadj only price diff ($)
Wtadj	2059	79 kg	25.9	911		
Wt at sale	2061	85 kg	24.3	911		
600 day EBV	1423	22 kg	63.8	1038	49	1276
400 day EBV	1364	17 kg	79.4	1089	46	1181
200 day EBV	1076	7 kg	155.5	999	38	976
Milk EBV	617	4 kg	147.9	1087	11	301
Birth wt EBV	650	2 kg	328.3	731	29	742
Muscle score	654	1.47 cat	445.0	251	16	412

Table 3. Variability of traits analysed, % variation explained in log(price) after fitting auction and auction + wtadj (= weight adjusted for age), regression coefficients for price from fitting the stepwise regression model and from fitting auction+trait and the relationships between wtadj and other traits

Trait	SD within auctions	%Extra variation explained in log(price) after fitting auction	auction+wtadj	Regression coeffs - model auction + trait	stepwise model	Relationship with wtadj Correlation (%) within auctions	Change (kg) per unit increase
Wtadj	51.7	45		25.3	14.9		
Wt at sale	55.1	48	0.6	22.9	8.5	94	0.88± .01
600 day EBV	14.5	22	0.6	58.4	-	61	2.04± .09
400 day EBV	11.2	20	1.0	73.5	16.5	56	2.49± .13
200 day EBV	4.4	12	0.0	148.8	-	46	5.47± .40
Milk EBV	2.8	3	2.1	118.2	69.1	11	2.02± .63
Birthwt EBV	1.3	9	0.1	315.0	-	38	14.4± 1.46
Muscle score	1.0	1	0.0	223.4	-	16	6.66± 2.93

percentage of variation in log(price) within auctions explained by each trait, both by itself and in addition to fitting wtadj. Regression coefficients for each trait from the analysis of the non-transformed price data using the model *auction + trait* are also given and coefficients from a stepwise regression analysis to find the model explaining as much of the variation in price as possible. The latter resulted in quite a good fit, with a correlation of 76% between actual and fitted values. Muscle score and birthweight EBV were not included in this analysis because fewer measurements were available for these traits.

While the coefficients from the stepwise analysis represent the best fit, they cannot reveal what was in the minds of buyers at the sale. Because the EBVs are fairly highly correlated with each other and with weight, buyers may bid for an animal both because of its high EBVs and its physical appearance. Auction sales, with the constant pressure of bidding and counter bidding, are not always the ideal place for calm and considered reasoning about the relative importance of a number of related traits. Nor would it be too surprising, if many a final bid is unduly influenced by urging from the auctioneer and the physical appearance of the animal at the centre of attention.

The EBV for milk presents a simpler picture, as it is largely independent of growth. Here the effect of the EBV on price is clearly significant ($P < 0.001$). When offered the choice between two bulls with similar growth EBVs, buyers can make a positive decision about how much extra they are prepared to pay for a good milk EBV. The results suggest the industry does understand EBVs and paid, on average, around $70 per additional kilogram of milk EBV.

There is often a large step for a commercial producer between having access to EBVs and putting them to best use. Some of these sales were in the early years of BREEDPLAN. Because of the incompleteness of the stud x year table, it would be difficult to distinguish between changes over time and differences between studs. However, a separate analysis was performed on stud 7, which had the latest available data. Results are given in Table 4. The final model again had a correlation of 76% between fitted and actual values. As with the complete dataset, weight was still the biggest single factor determining price. However, the relative importance of EBVs has increased. Within years, the EBV for 400 day weight explained nearly as much variation as weight (37% compared with 45%) and more than 10% extra variation once weight had been fitted. This compares with 22% extra variation explained by weight in

Table 4. Results for stud 7 1990-92, including SD within year, %extra variation in log(price) explained by each trait after fitting year and year + wtadj, regression coefficients for price when fitting year + trait and from the stepwise model.

Trait	SD within year	%Extra variation explained in log(price) after fitting		Regression coeffs in model	
		year	year+wtadj	year + trait	stepwise model
Wt adj age	42.2	44		33.9	.
Wt at sale	46.2	46	2.7	31.2	21.5
600 day EBV	11.0	33	8.7	109.6	.
400 day EBV	10.3	37	10.1	127.0	102.6
200 day EBV	4.3	15	0.8	192.2	.
Milk EBV	2.3	0	4.0	62.0	173.5
Birthwt EBV	1.4	3	0.0	213.6.	-310.
Muscle score	1.1	0	0.0	.	.

addition to 400 day EBV. The fact that weight still comes out as the most important term is interesting, and suggests that most buyers, while aware of the meaning and importance of EBVs, also prefer an animal which is phenotypically larger. However, there could also be some buyers who pay less attention to EBVs and inflate the price of low EBV bulls.

Even though wtadj accounted for more variation in price than any other single factor, EBVs are still of paramount importance to the bull seller, who benefits from having superior genetic material, both in terms of the reputation of the stud, and the fact that the superior genetics leads, with suitable preparation, to superior phenotypes which command better prices. Buyers who look first at the EBVs and then at the bull to assess important characteristics not described by EBVs, such as soundness and suitability for work, may be able to obtain good genetics at relatively good prices. While weight and probably visual appearance play an important role in the price paid for bulls at auction sales, EBVs are also influencing price. As confidence grows in the ability of EBVs to describe an animal's genotype, it is likely that less emphasis will be placed on visual appearance.

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