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Determinants of Price Differentials in Oklahoma Value-Added Feeder Cattle Auctions

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Many value-added practices cannot be observed by feeder cattle buyers. Third-party verification can decrease market inefficiency associated with this asymmetric information. We evaluate the effectiveness of a verification program, the Oklahoma Quality Beef Network, in increasing received prices. We estimate the value of verification, weaning, vaccinating, certification and phenotypic traits of feeder cattle at Oklahoma auctions. Results indicate that the OQBN program adds \$2.39 to \$5.74/cwt. Vaccinating calves adds \$1.44/cwt, and weaning calves adds \$2.05/cwt. Differential values for lot size, average weight, hide color, frame size, conditioning, Brahman influence, gender and other characteristics are also reported.

Key words: feeder cattle, preconditioning, value-added marketing

Introduction

Cow-calf producers and sellers of feeder cattle have access to privately-held information about on-farm production practices that often cannot be determined by buyers, even after purchase. Feeder calves exhibit various characteristics that fall into one of three categories: search, experience, and credence attributes. Search attributes, such as hide color, can be easily verified prior to sale or consumption (Darby and Karni, 1973). Experience attributes are not readily verified prior to purchase, but can be determined by the buyer after purchase. Credence attributes, however, cannot be readily determined before or after purchase (Darby and Karni, 1973). In the case of feeder calves, a seller could announce that calves are vaccinated against respiratory disease. However, even vaccinated calves can develop respiratory problems and unvaccinated calves can remain healthy. Hence, vaccinations are not readily verifiable. In particular, those attributes generated by on-farm preconditioning management protocols fall into the category of credence attributes.

One method for overcoming market inefficiencies associated with asymmetric information is third-party verification of information provided by the seller to potential buyers (see, e.g., McCluskey, 2000). By utilizing third-party verification of on-farm processes, additional credence is added to the information provided by sellers. Credible information has value (Stigler, 1961). The provision of credible information via third-party verification should add value to calves that possess credence attributes.

Adding value to beef calves at marketing continues to be a major focus of livestock research and extension efforts. The most frequently used valued-added practices include basic management practices of dehorning and castration (Williams et al., 2011). Since potential buyers can visually verify these practices, third-party verification is not required. Other practices, such as adhering to a vaccination protocol and weaning, are credence attributes. Third-party verification is often used to

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credibly relay information and enable producers to capture premiums associated with value-added practices.

Past research has shown that premiums can be obtained through these value-added practices (Avent, Ward, and Lalman, 2004; Blank, Forero, and Nader, 2009; Bulut and Lawrence, 2007; Faminow and Gum, 1986; Lalman and Smith, 2001; Menkhaus and Kearl, 1976; Schroeder et al., 1988; Ward, Ratcliff, and Lalman, 2003; Zimmerman, 2010). Others report that profits can increase due to the adoption of value-added practices (Bulut and Lawrence, 2007; Dhuyvetter, Bryant, and Blasi, 2005; Mitchell, 2007). However, (McKinney, 2009) reports that less than 5% of Oklahoma calves are formally marketed as "value-added." The Oklahoma cattle industry represents approximately 6.3% of the U.S. cow herd and nearly 53% of Oklahoma's agricultural production value (U.S. Department of Agriculture, 2007). Anecdotally, many of Oklahoma's cattlemen believe that access to value-added marketing programs is limited because of small herd size and transportation costs to move cattle to distant sale venues for value-added sales. To encourage increased adoption of value-added practices among the state's 47,000 beef cattle producers, Oklahoma State University and the Oklahoma Cattlemen's Association established the Oklahoma Quality Beef Network (OQBN) in 2001.

OQBN is a preconditioning and health protocol verification program in which participating producers are required to dehorn calves, castrate bull calves, wean calves a minimum of 45 days before sale, and follow one of three brand-neutral vaccination protocols. Deworming and providing grain-based feed for seven days prior to sale (i.e., preconditioning) are recommended. The OQBN program provides third-party verification that protocols have been followed.[1] Research has shown that when cattle have been preconditioned, feedlot and carcass performance increase and medication costs decrease (Schumacher, Schroeder, and Tonsor, 2011). These cost declines translate into added profits for feedlot operators (Roeber et al., 2001) and provide feedlot operators with incentives to pay premiums for verified preconditioned calves. OQBN also offers age and source verification as a stand-alone verification program or as a supplement to preconditioning verification.

Previous studies that examine feeder cattle price differentials focus on physical and market characteristics associated with cattle (Blank, Forero, and Nader, 2009; Buccola, 1980; Menkhaus and Kearl, 1976; Schroeder et al., 1988; Bailey, Peterson, and Brorsen, 1991; Zimmerman, 2010). Physical factors typically include gender, breed, average weight, muscle score, frame size, horn status and health, while market characteristics include lot size, overall sale volume, and time of sale. However, many value-added characteristics are the result of on-ranch management practices implemented prior to marketing that may not generate attributes readily visible to buyers. This is particularly true of preconditioning attributes. While research shows that preconditioning positively impacts calf performance (Bach et al., 2004; Lalman and Smith, 2001; Schumacher, Schroeder, and Tonsor, 2011), asymmetric information still exists in the cattle marketing chain. Buyers do not know with certainty that producers' claims of management practices such as administered vaccinations and weaning time period are true. Other characteristics, including age and age information stipulated by trading partners in response to the bovine spongiform encephalopathy (BSE) occurrences in the early 2000s as credence attributes. The market response to asymmetric information has been the creation of third-party certification programs to verify implementation of health management protocols or appropriate farm records on source and calf age.

As certification programs have grown in prevalence, subsequent research has focused on the value of certification for specific attributes. In the initial years of the OQBN program, (Ward, Ratcliff, and Lalman, 2003) reported OQBN premiums of $1.51/cwt, $3.95/cwt, and $5.89/cwt over non-preconditioned cattle for the years 2001-2003, respectively. Buyers at Joplin, Missouri placed a premium of $3.30/cwt on cattle sold at a certified VAC-45 special sale (Avent, Ward, and Lalman, 2004).[2] More recently, Bulut and Lawrence (2007) found premiums of $6.12/cwt across 105

[1] See Oklahoma Cooperative Extension Service (2011) for more information.

[2] A VAC-45 special sale is a sale in which all cattle offered for sale that day have been vaccinated and weaned a minimum of 45 days prior to the sale.

Iowa sales for calves with certified vaccination and at least thirty days weaned over unvaccinated or unweaned calves. In pre-BSE markets, Lawrence and Yeboah (2002) estimated the premium for source verified cattle at an auction in Bloomfield, Iowa as $1.30/cwt for cattle weighing less than 650 pounds. Premiums for a 600 pound, third-party certified age and source calf were $12.83/cwt for Superior Livestock video auctions in 2007 (Kellom et al., 2008). Zimmerman (2010) reports premiums of $1.32/cwt for one vaccination, $2.18/cwt for two vaccinations, and from $1.70 to $8.99/cwt for various vaccination-weaning protocols combinations.

We build on these previous studies by considering the impact of a brand-neutral preconditioning program that is accessible to producers of all sizes across all regions of Oklahoma.[3] Most recent studies use data from large video auctions where lot sizes are typically large and calves are preconditioned through a company-sponsored program. The OQBN program is not sponsored by a pharmaceutical company and so claims of increased sale prices might be better received by producers. OQBN sales are held at livestock auctions across the state and, as such, increase access to the program. Further, there are no lower limits to lot size when cattle are marketed. These program characteristics have the potential to increase producer participation. Given that price levels have been shown to differ between video auctions and live sale barn auctions (Bailey, Peterson, and Brorsen, 1991), it is also possible that premiums received by producers in those distinct marketing settings differ, highlighting the importance of robust estimates of premiums for producers participating in the OQBN program.

We investigate the factors that affect price differentials at Oklahoma feeder cattle auctions. Specifically, we develop a hedonic pricing model to measure the contribution of various calf and lot characteristics, including OQBN preconditioning certification and age and source verification, to feeder cattle prices in Oklahoma. The objectives of this paper are to measure the value of OQBN preconditioning certification at Oklahoma auctions, determine the marginal value of various cattle traits at auction, and measure the value of OQBN age and source verification at auction.

Market conditions have changed since the inception of OQBN and other third-party-verified precondition programs. In particular, the cost of finishing cattle has increased substantially as prices of corn and other feedstuffs have risen sharply due to increased competition for ethanol feed stocks. Higher finishing costs for cattle lead to higher morbidity and mortality costs. As the cost of adding weight to cattle increases, producers have more invested in cattle that may die. Illnesses increase the time to reach harvest weight, which increases feeding cost, increasing demand for healthy calves that are more likely to survive and perform well in feedlots. Further, growth in the OQBN program means that higher volumes of certified preconditioned calves are offered at auction. Consequently, buyers of preconditioned cattle can more easily justify travel to an OQBN sale where truck loads of similar cattle can be purchased. These catalysts lead to potentially higher preconditioning premiums. However, verification and effective communication regarding credence attributes of the calf management system remain a challenge.

Data

Data were collected at sixteen feeder cattle auctions in seven different locations across the state of Oklahoma. Data were recorded at sales starting October 27, 2010, through December 13, 2010, on 2,973 lots of cattle representing 22,363 head of cattle. OQBN cattle were sold at eight sales and accounted for 818 lots (28%) and 7,251 head (32%) sold. Six OQBN sales were held in conjunction with regular feeder cattle sales, while two sales were conducted with only OQBN certified cattle sold. For each lot, sale price, lot size, phenotype, management practices, and market influences were recorded. Phenotypic information included average weight per calf, hide color, gender, condition (fleshiness), frame score, uniformity, health, horned status, muscle score, and fill.

[3] Dhuyvetter, Bryant, and Blasi (2005) also investigated a preconditioning program that appears to not be tied to an animal pharmaceutical firm.

Management practices included vaccinations, weaning, preconditioning certification, and age and source certification. Market factors included sale location, source (seller name) identification and a reference market price defined as the weekly average price for a 750-pound steer (Medium and Large #1) from the Oklahoma City, Oklahoma market (USDA-AMS, 2010). Feeder cattle weights ranged from 300-799 pounds.

Study personnel shadowed United States Department of Agriculture (USDA) Agriculture Marketing Service (AMS) professionals at AMS data collection sites prior to data collection to improve reporting consistency, given the subjective nature of some cattle characteristics. Data collection was limited to five trained individuals to minimize variation in the collection process. Data collection teams were employed in groups of two or three persons per sale. The data collection group included three livestock extension specialists from the Oklahoma State University Agricultural Economics Department, one Agricultural Economics Master's student, and an Animal Science PhD student.

On OQBN sale days, data were recorded a minimum of one hour before and one hour after OQBN cattle were sold. Data collection times averaged 4.2 hours per sale.[4] For non-OQBN certified sales, data were collected at similar midday times to reduce variability due to differences in the time of day. Average collection time was 3.2 hours per sale.

Hide color is primarily used to distinguish between cattle types (breeds) (Bulut and Lawrence, 2007; Leupp et al., 2009). The exceptions are Hereford and Dairy/Longhorn. These breeds have distinct markings and have traditionally been subject to large discounts in the market. Solid color lots were coded as black, red, or white/grey. Lots are recorded as black mixed or red mixed if lots contain less than 25% of some other hide color. All other lots are deemed as mixed color lots or other.[5] Brahman influence was recorded as a separate variable from hide color. The threshold used was visible Brahman characteristics on at least 25% of the lot.

Summary statistics are presented in table 1 for all lots, OQBN lots, non-OQBN lots at an OQBN sale, and non-OQBN lots at non-OQBN sales. Data characteristics are similar for all subsets, but with some notable differences. At OQBN sales, approximately 25% of non-OQBN calves are vaccinated, while less than 14% of calves at non-OQBN sales are vaccinated. This could be due to auction barn managers scheduling cattle with similar management practices to be sold immediately following the OQBN certified sale. In contrast, more non-OQBN calves at non-OQBN sales are recorded as weaned (58%) than are non-OQBN cattle at certified OQBN sales (52%).

The summary indicates 77% of lots offered by the OQBN program are either black or black mixed hided cattle compared to only 67% at non-OQBN sales. Steers comprised 58% of OQBN calves compared to 52% of non-OQBN calves at non-OQBN sales. Announcing the seller occurred more frequently at OQBN sales, with 36% and 40% of OQBN and non-OQBN lots recorded as seller announced, while less than 23% of lots at non-OQBN sales are seller announced.[6]

Model

The law of one price states that prices across time, form, and space should differ by no more than the transaction costs, represented by:

(1) $$Price = f(time, form, space).$$

In the case of feeder calf price differentials, time and space can be held constant while analyzing how different forms of cattle affect the price received. We use the Input Characteristics Model (ICM) (Ladd and Martin, 1976) as a framework to model feeder calf price differentials as a function

[4] Most OQBN certified sales were held midday with the exception of one, which was held mid-morning.

[5] Other hide colors, for example, include belted (Belted Galloway) and hide colors associated with Shorthorn calves.

[6] Cattle sold at one OQBN location (two separate sale dates) were comingled to achieve larger lots sizes. In this case, no seller names were announced.

Table 1. Summary Statistics

	All Calves		OQBN Calves at OQBN Sales		Non-OQBN Calves at OQBN Sales[a]		Non-OQBN Calves at Non-OQBN Sales[a]	
Lot Characteristic	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Head	7.52	13.43	8.86	11.86	7.17	13.69	6.9	14.14
Weight	529.38	116.59	543.72	115.2	509.29	108.09	534.5	121.44
Price	113.79	16.9	118.39	15.27	110.74	17.31	112.99	17

Lot Characteristic	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Vaccinations								
Vaccinated	1216	40.90	818	100.00	228	25.25	170	13.58
Not vaccinated	1757	59.10	0	0.00	675	75.75	1082	86.42
Weaning								
Weaned	1813	60.98	818	100.00	472	52.27	729	58.23
Not weaned	1160	39.20	0	0.00	431	47.73	523	41.77
Certification								
Not certified	2155	72.49	0	0.00	903	100.00	1252	100.00
Certified OQBN	818	27.51	818	100.00	0	0.00	0	0.00
Color								
Black	1836	61.76	521	63.69	560	62.02	755	60.30
Red	229	7.7	53	6.48	73	8.08	103	8.23
Hereford	52	1.75	11	1.34	15	1.66	26	2.08
White/Grey	261	8.78	46	5.62	96	10.63	119	9.50
Dairy/Longhorn	39	1.31	3	0.37	6	0.66	30	2.40
Black mixed	276	9.28	110	13.45	78	8.64	88	7.03
Red mixed	66	2.22	20	2.44	10	1.11	36	2.88
Mixed	189	6.36	51	6.23	60	6.64	78	6.23
Other	25	0.84	3	0.37	5	0.55	17	1.36
Brahman								
Non-Brahman	2766	93.04	747	91.32	833	92.25	1186	94.73
Brahman Infl.	207	6.96	71	8.68	70	7.75	66	5.27
Gender								
Steer	1542	51.87	477	58.31	418	46.29	647	51.68
Heifer	1298	43.66	341	41.69	412	45.63	545	43.53
Bull/Mixed	133	4.47	0	0.00	73	8.08	60	4.79
Condition								
Thin	67	2.25	7	0.86	9	1	51	4.07
Average	2036	68.48	513	62.71	565	62.57	958	76.52
Fleshy	870	29.26	298	36.43	329	36.43	243	19.41
Muscling								
Thick, all #1	389	13.08	78	9.54	148	16.39	163	13.02
Mixed, #1 & #2	778	26.17	295	36.06	212	23.48	271	21.65
Medium, all #2	1755	59.03	443	54.16	532	58.91	780	62.30
Mixed, #2 & #3	12	0.40	1	0.12	7	0.78	4	0.32
Light, all #3	39	1.31	1	0.12	4	0.44	34	2.72
Uniformity								
Uniform	2959	99.53	818	100.00	897	99.34	1244	99.36
Not uniform	14	0.47	0	0.00	6	0.66	8	0.64

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	All Calves		OQBN Calves at OQBN Sales		Non-OQBN Calves at OQBN Sales[a]		Non-OQBN Calves at Non-OQBN Sales[a]	
Lot Characteristic	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**	**Freq.**	**Percent**
Fill								
Gaunt	22	0.74	2	0.24	9	1.00	11	0.88
Average	2455	82.58	669	81.78	695	76.97	1091	87.14
Full	496	16.68	147	17.97	199	22.04	150	11.98
Frame								
Large	415	13.96	76	6.29	131	14.51	208	16.61
Medium/Large	774	26.03	292	35.70	207	22.92	275	21.96
Medium	1784	60.01	450	55.01	565	62.57	769	61.42
Horns								
Horns	187	6.29	0	0.00	77	8.53	110	8.79
No horns	2786	93.71	818	100.00	826	91.47	1142	91.21
Health								
Healthy	2950	99.23	813	99.39	893	98.89	1244	99.36
Not healthy	23	0.77	5[b]	0.61	10	1.11	8	0.64
Age & Source								
Verified	152	5.11	103	12.59	1	0.11	48	3.83
Not verified	2821	94.89	715	87.41	902	99.89	1204	96.17
Reputation								
Not announced	2036	68.48	521	63.69	545	60.35	970	77.48
Seller announced	937	31.52	297	36.31	358	39.65	282	22.52

Notes: Frequency indicates number of lots in each category.
[a] Non-OQBN calves refer to non-vaccinated and non-weaned calves.
[b] Any unhealthy cattle were pulled from lot and sold individually.

of physical characteristics, management practices, and market forces, similar to Schroeder et al. (1988), Coatney, Menkhaus, and Schmitz (1996), Lawrence and Yeboah (2002), and Avent, Ward, and Lalman (2004). Additionally, we model sale location as a random effect (see Leupp et al., 2009). By estimating basis rather than price, we control for the effect of weekly market fluctuations. Basis is calculated as a lot's auction sale price less the corresponding weekly average price ($/cwt) for a 750-pound steer (Medium and Large #1) from the National Stockyard, Oklahoma City, Oklahoma (U.S. Department of Agriculture, Agricultural Marketing Service, 2010). The impact of calf weight on price is modeled as a quadratic function, similar to previous studies (Faminow and Gum, 1986; Avent, Ward, and Lalman, 2004).

The impact of lot size on price received is typically modeled as a quadratic relationship (Faminow and Gum, 1986; Bulut and Lawrence, 2007). Leupp et al. (2009) deviated from the traditional quadratic form by using dummy variables for lot size differences. We consider three functional forms: quadratic, lot size dummy variables, and natural logarithms. Figure 1 illustrates the shape of the lot size effect under different functional forms. J-tests were used to compare models and all models with different functional forms for lot size were rejected. Thus, each model has unique information and no single model is superior to another statistically (Davidson and MacKinnon, 1981). Ultimately, lot size impact was modeled with the inclusion of the natural log of lot size as it has visual appeal when explaining results to the public.

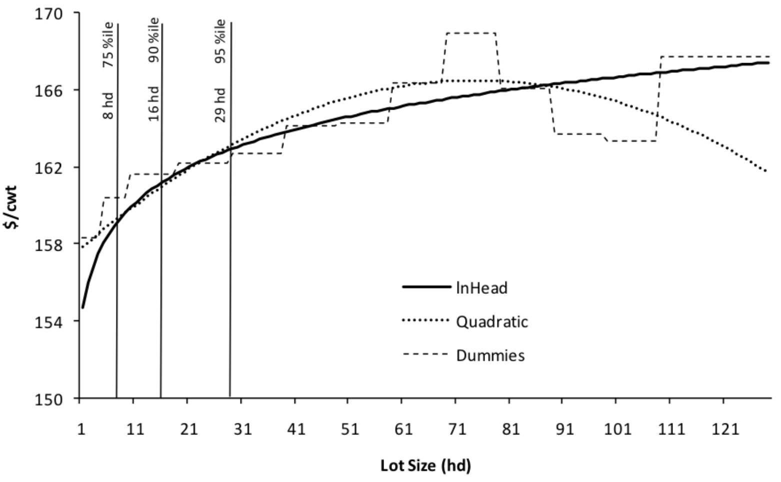

Figure 1. Lot Size Distribution and Illustration of Lot Size Impact Using Dummy Variables, Natural Log, and Quadratic Models.

The hedonic model to be estimated is:

$$\begin{aligned}(2)\quad & Basis_i = \beta_0 + \beta_1 Ln(head_i) + \beta_2 avgwt_i + \beta_3 avgwt_i^2 + \beta_4 vac_i + \beta_5 wean_i + \beta_6 cert_i + \\ & \sum_{j=1}^{2} \beta_{6+j} gender_{ij} + \sum_{j=1}^{8} \beta_{8+j} hidecolor_{ij} + \beta_{17} Brahman_i + \beta_{18} horns_i + \sum_{j=1}^{3} \beta_{18+j} frame_{ij} + \\ & \sum_{j=1}^{4} \beta_{21+j} muscle_{ij} + \sum_{j=1}^{2} \beta_{25+j} cond_{ij} + \sum_{j=1}^{2} \beta_{27+j} fill_{ij} + \beta_{30} health_i + \beta_{31} uniform_i + \\ & \beta_{32} agesource_i + \beta_{33} reputation_i + \sum_{j=1}^{6} \beta_{33+j} location_{ij} + \beta_{40} OQBNsale_i + \beta_{42} avgwt_i \times \\ & cert_i + \beta_{42} avgwt_i^2 \times cert_i + \mu_i + e_i\end{aligned}$$

where $i = 1, \ldots, 2982$ denotes each sale lot; *head* is the number of animals in lot i; *avgwt* is the average weight of animals in lot i; *vac* equals 1 if lot is vaccinated; *wean* equals 1 if lot is weaned; *cert* equals 1 if third-party verification of vaccination and weaning; $gender_{i1}$ equals 1 if heifers; $gender_{i2}$ equals 1 if the lot is bulls or mixed gender; $hidecolor_{ij}$ are dummy variables for hide colors (black is base color); *Brahman* equals 1 if Brahman influence is visibile in at least 25% of the lot; *horns* equals 1 if horns are present in the lot; $frame_{ij}$ are dummy variables for frame size (medium framed is base); $muscle_{ij}$ are dummy variables for muscle score (1&2 is base); $cond_{ij}$ are condition (fleshiness) scores (medium is base); $fill_{ij}$ are dummy variables for fill (average is base); *health* equals 1 if there are unhealthy animals in lot; *uniform* equals 1 if the lot is not uniform (usually in terms of weight or hip height); *agesource* equals 1 if the lot is age and source verified; *reputation* equals 1 if the seller's name is announced; $location_{ij}$ is comprised of dummy variables for sale date/location; *OQBNsale* equals 1 if the sale is an OQBN sale date; μ_t are error terms associated with each sale date/location; and e_i are error terms for each observation.

The model is estimated using the MIXED procedure in SAS 9.2. Diagnostic tests using the likelihood ratio test indicated heteroskedasticity stemming from the average weight variable. The

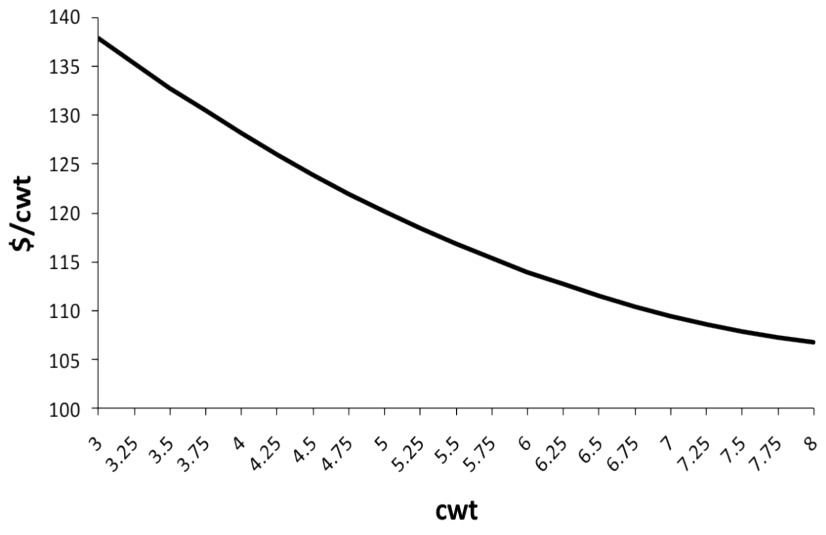

Figure 2. Effect of Average Weight on Price per Cwt.

model was corrected for heteroskedasticity (Judge et al., 1988) by specifying:

(3) $$E[e_i^2] = \sigma_i^2 = e^{(\alpha_1 + \alpha_2 avgwt_i)}.$$

Results

Table 2 reports estimated coefficients from the mixed model estimation. Most variables are significant at the 5% level, except interactions between certification and weight. Some subjective traits are not significant. Results for most lot characteristics are qualitatively similar to recent studies (Bulut and Lawrence, 2007; Leupp et al., 2009; Zimmerman, 2010). In most cases, the magnitudes of our results are also similar to these studies. Differences in estimated coefficients and significance are likely due to changing market structure (see, e.g. Oklahoma Farm Report, 2011; Stotts, 2011) and differences in functional form, variables included in the analyses, and data sources, since many recent studies rely on data collected at video auctions.

As expected, black-hided lots receive a higher price/cwt than all other hide colors because of the potential for acceptance in the Certified Angus Beef program. The largest discount from the base of black-hided cattle is for Dairy/Longhorn lots, \$27.71/cwt ($p \leq 0.001$). Hide colors that received prices most similar to the black-hided base were black mixed and white/grey lots, with discounts of \$1.21/cwt ($p = 0.029$) and \$1.81/cwt ($p = 0.015$). Hide color/breed effects are similar to recent studies (Avent, Ward, and Lalman, 2004; Bulut and Lawrence, 2007; Leupp et al., 2009; Zimmerman, 2010) but in contrast to earlier work (Bailey, Peterson, and Brorsen, 1991; Coatney, Menkhaus, and Schmitz, 1996).

Lots recorded as Brahman-influence receive discounts in addition to hide color value averaging \$3.48/cwt ($p \leq 0.001$), similar to recent studies. Heifers receive a significant discount of \$11.78/cwt ($p \leq 0.001$), while lots of bulls or mixed gender are discounted \$5.78/cwt ($p \leq 0.001$).

Four subjective characteristics (fleshiness, frame, muscling, and fill) are not statistically significant, in contrast to some previous literature (e.g. Bulut and Lawrence, 2007), but similar to Zimmerman (2010). Avent, Ward, and Lalman (2004) report that frame, muscling, and condition are significant in determining price differentials, but fill is not.

Table 2. Parameter Estimates for Hedonic Pricing Model (N = 2,973 feeder calf lots)

Variable	Coefficient	Standard Error	t-value	P-value
Intercept	59.11	4.07	14.51	≤ 0.001
Ln(head)	3.04	0.21	14.64	≤ 0.001
Avgwt	−15.77	1.42	−11.10	≤ 0.001
Avgwt^2	0.87	0.12	7.05	≤ 0.001
Vaccinated	1.44	0.61	2.38	0.018
Weaned	2.05	0.51	4.04	≤ 0.001
Certification	15.54	7.95	1.95	0.051
Avgwt×cert	−5.00	2.77	−1.80	0.072
Avgwt^2*×cert*	0.39	0.24	1.64	0.102
Hide Color				
Red	−3.48	0.64	−5.46	≤ 0.001
Hereford	−7.47	1.25	−5.99	≤ 0.001
White/Grey	−1.81	0.74	−2.44	0.015
Dairy/Longhorn	−27.71	2.19	−12.67	≤ 0.001
Other	−13.76	1.77	−7.76	≤ 0.001
Black mixed	−1.21	0.55	−2.19	0.029
Red mixed	−2.91	1.02	−2.86	0.004
Mixed	−4.39	0.67	−6.51	≤ 0.001
Brahman				
Influenced	−3.48	0.63	−5.51	≤ 0.001
Gender				
Heifer	−11.78	0.33	−35.95	≤ 0.001
Bull/mixed	−5.77	0.73	−7.86	≤ 0.001
Condition				
Thin	−9.26	1.35	−6.85	≤ 0.001
Fleshy	0.63	0.40	1.57	0.117
Frame				
Large	0.07	0.60	0.12	0.905
Medium/Large	−0.12	0.46	−0.26	0.799
Uniformity				
Not uniform	−15.31	2.42	−6.34	≤ 0.001
Health				
Unhealthy	−32.79	1.86	−17.66	≤ 0.001
Horned Status				
Horns	−3.15	0.66	−4.81	≤ 0.001
Muscling				
Thick, all #1	0.44	0.57	0.77	0.442
Mixed, #1 & #2	−0.15	0.45	−0.34	0.737
Mixed, #2 &# 3	−10.11	3.23	−3.13	0.002
Light, all #3	−20.07	2.36	−8.52	≤ 0.001
Fill				
Gaunt	−0.42	1.84	−0.23	0.822
Full	−0.61	0.48	−1.27	0.203
Age & Source				
Verified	0.95	0.77	1.24	0.216

(continued on next page...)

Table 2. – continued from previous page

Variable	Coefficient	Standard Error	t-value	P-value
Reputation				
Seller announced	0.22	0.42	0.51	0.608
Sale Value				
OQBN sale	−0.56	0.51	−1.10	0.272
Location Effect				
Barn 1	−2.36	0.90	−2.62	0.009
Barn 2	−8.21	1.13	−7.29	$\leq$ 0.001
Barn 3	−8.75	0.94	−9.33	$\leq$ 0.001
Barn 4	1.54	0.82	1.87	0.062
Barn 5	−2.70	0.78	−3.44	$\leq$ 0.001
Barn 6	−0.08	0.79	−0.11	0.916

Notes: Bases are non-vaccinated, non-weaned, non- certified preconditioned, black, non-Brahman influenced, steers, average flesh, uniform, healthy, no horns, medium (#2) muscled, average body condition, non-age and source verified, non-reputation, at a non-OQBN sale, and at barn 7.

Table 3. Management Practice Premiums Per Hundredweight by Weight

	Units	Vaccinated only	Weaned only	Certification premium[a]	OQBN Value
350 lbs.	$/cwt	1.44	2.05	2.81	5.74
450 lbs.	$/cwt	1.44	2.05	0.92	3.85
550 lbs.	$/cwt	1.44	2.05	−0.19	2.78
650 lbs.	$/cwt	1.44	2.05	−0.52	2.39
750 lbs.	$/cwt	1.44	2.05	−0.09	2.83

Notes: [a] Certification premium is the value of certifying preconditioning of cattle.

The remaining subjective traits have statistically significant impacts on sale price. Lots deemed thin in body condition earn a discount of $9.26/cwt ($p \leq 0.001$). Lighter muscled lots are also discounted. Lots of mixed #2 and #3 muscle score cattle are discounted $10.11/cwt ($p = 0.002$) and lots of #3 cattle are heavily discounted at $20.07/cwt ($p \leq 0.001$). Muscling is significant in other studies (Avent, Ward, and Lalman, 2004; Bailey, Peterson, and Brorsen, 1991; Schroeder et al., 1988).

As in previous studies, the number of head marketed per lot significantly affected the price/cwt received ($p \leq 0.001$). Using single head lots as the base, lot size effect is modeled as a function of the natural logarithm of the number of head in a lot, indicating that premiums increase rapidly with lot size and then flatten out. For example, sale lots containing five and ten head receive a premium of $4.89/cwt and $7.00/cwt above the base lot size of one head, respectively, while 20 and 30 head lots receive premiums of $9.11/cwt and $10.34/cwt, respectively. Increasing lot size from 5 to 10 head yields a $2.11/cwt advantage while increasing lot size from 20 to 30 head only provides a $1.23/cwt marginal benefit.

Price/cwt decreased at a decreasing rate with respect to a lot's average calf weight. Figure 2 reveals how marketing a heavier average weight lot results in receiving a lower price/cwt. Lots with an average calf weight of 350 pounds received $8.82/cwt more than 450 pound calves. The price discount was $7.08/cwt from 450 to 550 pounds, $5.35/cwt from 550 to 650 pounds and $3.61/cwt from 650 to 750 pounds. Even though lighter weight calves generally have a higher selling price per cwt, most producers find it advantageous to wean and sell heavier calves as added weight increases revenue per head. This also allows producers to spread the fixed costs of cow ownership and calf production over more pounds sold, such that average production costs of production decreases with increased weight.

One objective of this paper is to measure the price premium received for OQBN preconditioned cattle. Table 3 shows premiums across five weight categories ranging from 350 pounds to 750 pounds for different levels of management practices and/or certification, as compared to non-vaccinated, non-weaned, and non-certified calves. In all categories, calves with vaccinations alone receive a premium of $1.44/cwt ($p = 0.018$), while weaning alone increased sale price received by $2.05/cwt ($p = 0.001$). Premiums are modeled as constants across weight, while the value of OQBN certification is allowed to change across defined weight categories.

The weight-specific premium indicates that a 350-pound, OQBN certified lot receives a premium of $5.74/cwt ($p = 0.001$) over non-vaccinated, non-weaned, non-certified lots. Other OQBN premiums were $3.85/cwt, $2.73/cwt, $2.39/cwt, and $2.83/cwt for 450, 550, 650 and 750 pound lots, respectively. These results show that buyers place higher premiums on certified preconditioned lighter weight calves than certified preconditioned heavier weight calves. There is biological and economic justification for this behavior. Lighter weight cattle have a higher probability of morbidity and mortality when moved to the next phase of production. This equates to a higher probability that feedlots will incur higher expenses associated with medicinal therapies, reduced weight gains, and death losses. Since heavier cattle are less likely to become sick and/or die, there is a lower probability that the feedlot will incur these expenses. Additionally, buyers might assume that most heavier weight cattle are weaned and bunk broke. Consequently, at heavier weights, it seems reasonable to observe lower premiums for preconditioning.

Age and source verified cattle received no statistically significant premium in our analysis, but this is likely due to small numbers, as only 5% of the cattle were age and source verified. A likely possibility is that too few age and source cattle were available to justify order buyers traveling to these sale barns. Age and source verified cattle are intended for export markets. Thus, it might be the case that small numbers of age and source cattle do not attract such buyers to these sale barns.

The reputation variable included in the model was insignificant. It is difficult to capture the full ramification of reputation with the proxy of "seller announced," as some livestock markets are in the practice of announcing most sellers, whether long-time customers or one-time sellers. *OQBN Sale*, the variable measuring the impact of selling at an OQBN sale versus a non-OQBN sale, was also not significant, indicating that the price of non-OQBN calves is statistically equal at OQBN and non-OQBN sales.

To evaluate the net value of OQBN participation to a producer, both revenues and costs are needed. While no available data exist for definitive analysis, published studies can be useful. Lalman and Smith (2001) report costs for preconditioning programs range from $35 to $60 per head. Donnell (2007) collected cost data from producers participating in the preconditioning program certified by the Samuel Roberts Noble Foundation. In 2004 and 2005, the average cost for Noble cooperators to precondition calves was $49.25 per head. This included nutrition costs (feed, mineral, and hay), interest cost, and labor. If we calculate the returns to preconditioning based on an average weight of 550 pounds using Donnell's cost estimates, we find the break-even average daily gain to be less than 0.5 pounds per day over 45 days.[7] This estimate assumes a base animal from the model. However, one must be cautious, as these cost estimates are outdated and the sample size was only forty producers. Extensive data pertaining to producer costs for participating in the program is needed to determine the overall economic value for the program. Preconditioning decision tools that assess benefits and costs are available to potential participants (e.g. McGrann, 2004; DeVuyst, Raper, and Stein, 2010).

Summary and Conclusions

We investigate prices received for calves participating in a certified preconditioning program and sold in special sales at participating livestock markets. The Oklahoma Quality Beef Network

[7] The feed value in the estimated costs will result in additional weight gain not accounted for in our estimate.

(OQBN) is a brand-neutral third-party health management certification program (VAC-45) for calves. The program is a joint effort of the Oklahoma Cattlemen's Association and the Oklahoma Cooperative Extension Service. Producers are required to follow specific health and management protocols to be eligible for program certification. Although producers may dual certify in OQBN and an industry defined program, OQBN has no ties to the animal health industry. Data from 2,973 lots representing 22,363 head of cattle were collected at sixteen sales during a period spanning from October 27, 2010, to December 13, 2010. Approximately one-third of the data represent OQBN-certified cattle. The data from seven Oklahoma sale barns contain physical, management, and market characteristics of each lot.

Previous studies have investigated the impact of value-added practices, including preconditioning, on market prices. Many recent studies rely on video auction data, with Bulut and Lawrence (2007) being a notable exception. Although this data source has advantages, there are reasons to suspect that calves sold through video auction are not representative of cattle sold at traditional sale barn auctions. It is likely that the average producer using video auction services is more receptive to new technologies and marketing techniques than producers at a typical rural sale barn. Cattle sold via video auction may be, on average, higher quality than the average sale barn calf. Finally, average lot sizes are likely larger for video auctions, and the low end of the range of lot sizes is likely much larger for video auctions. For example, the average lot size in data used by Blank, Forero, and Nader (2009) is approximately 139 head. The average lot size from our data, collected in traditional sale barns, averaged around eight head per lot. Bailey, Peterson, and Brorsen (1991) report that prices at video auctions are higher than at regional sale barns, even when prices are adjusted for several factors influencing price. While we cannot generalize our results to as wide a population as studies using video auction data, there are reasons to believe that our results may be more representative for the typical producer at traditional sale barn auctions holding value-added special sales.

The objectives of this study are to measure the value of OQBN preconditioning certification at Oklahoma auctions, determine the marginal value of various cattle traits at auction, and measure the value of OQBN age and source verification at auction. A hedonic pricing model is used to estimate basis for each lot of cattle. Explanatory variables include phenotypic information and management information. As expected, physical attributes, except for more subjective attributes, significantly affected price. Results suggest that cattle enrolled and sold through OQBN value-added sales during Fall 2010 received higher prices as compared to non-preconditioned cattle. Vaccinations and weaning are valued at $1.44/cwt and $2.05/cwt, respectively. Certification premiums range from $2.81/cwt for 350 pound calves to slightly negative, but insignificant for 650 pound calves. Black and black mixed hide color lots receive the highest prices while dairy/Longhorn lots receive the largest discount. Heifers are discounted $11.48/cwt while lots with horns were discounted $3.15/cwt. Age and source verified lots do not earn significant premiums, likely due to small numbers of age and source verified calves.

While not all OQBN participants realized premiums, most participants did. Without adjusting for other quality factors, OQBN producers received an average price of over $6/cwt above non-certified calves, even though OQBN calves averaged 20 pounds per head more than non-certified calves. These results are key for extension personnel. Although these results are specific to Oklahoma cow-calf producers, the proximity of cow-calf producers in Texas, Kansas, Arkansas and Missouri to Oklahoma sale barns suggest that they may realize similar returns to value-added practices.

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