Factors Affecting Feeder Cattle Prices in the Southeast

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Abstract

This work examines feeder cattle pricing factors from internet auctions and preconditioned feeder calf sales. In addition to examining traditional pricing factors, factors were also examined relating to the marketing conditions and characteristics of the feeder cattle sold. A negative relationship was found to exist between corn and feeder cattle price, with some evidence that the magnitude may be smaller than in previous work. Value-added premiums were moderate, roughly $11 per head for age and source verification and $17 per head for certified natural. Evidence was also found that market conditions may have shifted such that the incentive to underestimate weight in video auctions may no longer exist.

Background and Literature Review

Generally, feeder cattle demand is thought to be a derived demand largely driven by the eventual value of feeder cattle as slaughter cattle and the costs of finishing them (primarily feed costs). Therefore, corn price has long been established as a major pricing factor in the literature. Early work on the relationship between feeder cattle price and corn price can be traced back to the work of Buccola (1980), who found a negative relationship to exist. An interesting note to Buccola's 1980 work is that it combined a simulated breakeven analysis with an empirical analysis using actual feeder cattle prices from Virginia. It is noteworthy that he found that the breakeven simulation did quite well predicting the direction of the impact of changes in corn prices, but the magnitude of the impact was found to be higher in the simulation than in the empirical results.

This finding was largely consistent with the 2000 work of Anderson and Trapp who determined that simple breakeven analysis ignores the fact that many other changes may be made in the system in response to changes in corn price (Anderson and Trapp, 2000). As corn price increases, other feeds become more attractive and thus are more readily included in feeding rations. Secondly, as corn price increases, changes are made in the placement weights of feeder cattle. These adjustments were most likely the reason they found actual responses to changes in corn price of lower magnitude than budget derived responses, and why Buccola (1980) found the same basic difference in his two approaches.

In the mid-2000's several studies supported the negative relationship between corn price and feeder cattle price in Kentucky. In 2003, an application to the Holstein feeder steer market found roughly a negative 8:1 relationship to exist between corn price and heavy (above 700 lbs) Holstein feeder steer prices (Burdine, 2004). The same work found a much larger magnitude in the relationship between corn price and lighter cattle, which was consistent with the work of Buccola (1980) and Trapp and Eilrich (1991) from many years earlier, and more recent work by Dhuyvetter and Schroeder (2000). Using a different Kentucky dataset, Eldrige (2005) found the same negative relationship, but his results suggested that the impact was greater for heavier feeder cattle. This was an unexpected result and may have been partially due to the fact that little corn price variation was present during the time period that dataset covered (Eldridge, 2005).

However, the fundamental factors that drive feeder cattle markets have been questioned over the last several years as periods of high corn prices have, at times, been associated with high feeder cattle prices. More recent work outside Kentucky has provided some doubt in this long-held negative relationship. Schultz et al. stressed the importance of using current data due to the rapidly changing beef environment. In a hedonic model using Kansas and Missouri data for fall 2008 and spring 2009, they found that corn price was not a significant factor in explaining feeder cattle price in that dataset (Schultz et al., 2010).

Tejada and Goodwin looked at causality relationships across many commodity markets from 1998 to 2009, dividing the data into two groups separated by the 2005 Energy Act. They did not find that corn prices Granger caused feeder cattle prices in either of the two periods, but did find weak evidence to suggest that a long term negative relationship existed (Tejada and Goodwin, 2011). The recent work of Tejada and Goodwin (2011) and Schultz et al. (2010) both suggest that there is good reason to evaluate the existing price relationship between corn and feeder cattle prices and evaluate the possibility of a structural change in feeder cattle markets over the last few years.

Value added marketing traits have also been considered extensively in the feeder cattle pricing literature. Feeder cattle health is considered to be a key factor that affects profitability, so it is no surprise that healthy cattle, and those managed according to an accepted health program, have been found to sell for higher prices than their cohorts (Shultz et al., 2010, Bulut and Lawrence, 2007, Lunsford, 2005, Edridge, 2005). Since the time of these studies, many preconditioned sales in Kentucky have incorporated age and source verification into their requirements. Kentucky CPH prices have not been examined since this change, but recent work outside Kentucky has been somewhat inconsistent on these premium levels. Two studies using data from Superior Livestock auctions found modest premium levels in the range of $1-$2 per cwt. (Zimmerman et al., 2012, Kellom et al., 2008). Donnell and Ward (2008) found similar premiums in one sale analyzed, slightly larger premiums in another, and found no premium in a third sale. Finally, a recent study using Oklahoma sale data did not find any price premiums associated with age and source verification (Williams et all, 2012).

While most work has focused on external factors and actual cattle characteristics, some factors affecting feeder cattle prices relate to the way in which feeder cattle are marketed. In cases where there is some uncertainty about weight, cattle are typically marketed using a base weight of some type, and a price slide is offered by which the price can be adjusted downward if cattle weight exceeds the base weight. The price slide is intended to protect the buyer from paying a higher price for cattle based on a weight that the seller underestimated. However, due to information asymmetry, sellers are in a much better position to estimate the likely weight of the cattle than buyers.

The work of Brorsen et al. (2001) looked specifically at the impact of these price slides on prices of feeder cattle in Superior Livestock Auctions. Their findings suggested that price slides did affect the prices for feeder cattle. Of specific interest, the slides offered in the auctions were not steep enough to provide a disincentive for sellers to underestimate weight. In other words, sellers were generally better off to sell more pounds at the lower, slide adjusted, price. Consequently, sellers did appear to underestimate the weight of the cattle. The authors found that by offering a larger slide, higher sale prices more than offset the negative effects of the price slide, suggesting that higher price slides lead to higher sale prices for feeder cattle (Brorson et al., 2001).

Data, Methodology, and Diagnostics

One of the strengths of this work was the unique and reliable datasets that were made available to the authors. Bluegrass Stockyards, LLC is one of the largest auction markets in the United States and were especially interested in evaluating the premium levels being received for cattle selling as age and source verified and certified natural. They made available sale data from their bi-monthly internet sales and preconditioned feeder cattle sales from January 2008 to April 2011. The opportunity to employ these data opened opportunities to address other feeder cattle pricing topics as well.

The first dataset used in the analysis was from Bluegrass Stockyard's bi-monthly internet sales and included over 1,600 lots of feeder cattle from AL, FL,GA, IN, KY, NC, OH, TN, VA, and WV. Electronic files included price, weight, and lot size information and were supplemented by manual entry of data from sale catalogs made available to buyers on sale days including descriptions of cattle, selling conditions, location, and other pricing factors.

The second dataset consisted of sale results from Bluegrass Stockyards pre-conditioned feeder cattle sales and consisted of more than 1,300 observations. Kentucky Certified Preconditioned for Health (CPH) sales are held between four and seven times per year and targeted towards producers who wish to sell cattle managed under a uniform health program. General requirements included that calves be weaned a minimum of 45 days, be bunk and trough broke, be castrated, dehorned and healed, and have received 2 rounds of shots, the second of which is required to be modified live. In addition, there is a monetary guarantee that no heifers are bred and no males are in-tact. Sale weight, lot size, sex, and color sort were all included in the CPH dataset.

Data for the CPH sales were available electronically by sale and combined into a single data set using Microsoft Excel and Microsoft Access. Data for the internet sales was available electronically by sale and combined similarly after being augmented with data from sale catalogs to include additional information such as baseweight, cattle description, weigh and sale conditions, implants, and any additional marketing claims.

Additional data came from several sources. Historical diesel fuel price data were available from the Energy Information Administration (EIA) and included in the analysis. According to EIA, their data are collected each Monday through a phone survey. Since this was weekly data, it was assumed that the Midwest diesel price from the EIA survey applied to any cattle sales that occurred during that week (Energy Information Administration, 2011).

Daily feeder cattle and corn futures prices were available from the Livestock Marketing Information Center (Livestock Marketing Information Center, 2011), which databases futures prices from the Chicago Mercantile Exchange (CME). In the case of both the internet and CPH sales, the closing price for the nearby corn and feeder cattle futures contract on the day of the sale was used.

Since feeder cattle are likely to be on-feed for several months, a determination had to be made as to which deferred live cattle contract was relevant for a given group of cattle. The Livestock Marketing Information Center tracks data from Kansas State University's Focus on Feedlots Survey. This is a monthly survey of feedlots that serves as an excellent source of information about the cattle finishing industry. During the time period of the data, average steer slaughter weight was 1337 lbs, while average heifer slaughter weight was 1216 lbs (Kansas State University, 2008-2011). So, these became the assumed slaughter weights for cattle in the dataset. Steers were assumed to gain 3.5 lbs per day and heifers were assumed to gain 3.15 lbs per day (a 10% discount). The assumed slaughter weight, combined with the average daily gain, allowed the authors to make an estimate of slaughter date for each group of cattle. Once the estimated slaughter date was estimated, the next expiring live cattle futures contract to that date was used.

In order to accomplish the goals of this research, statistical analysis was utilized. A hedonic model, using Generalized least squares (GLS) was the primary method of analysis. Hedonic models are common in the literature (Shultz et al., 2010, Bulut and Lawrence, 2007, Kellom et al., 2008, Zimmerman et al., 2012, Williams et al., 2012) and generalized least squares was attractive because it was deemed to be sufficient to answer the questions, but at the same time provided results with intuitive interpretation. Descriptive statistics for the two datasets can be found in Tables 1-4. In order to better understand the meaning and definition of variables in these four tables and in the analysis, a comprehensive list of variables with explanations follows.

Description of Individual Variables – Internet Sales

Bid price – the price the cattle actually sold for on the day of the internet sale. This does not include any price slide adjustments. This was calculated using the final price, actual weight, and advertised slide.

Corn futures – the closing price of the nearby corn futures contract on the day of the sale.

Lot size – number of cattle in the internet sale lot.

Base weight – the advertised weight of the cattle in the internet sale catalog.

Slide – price adjustment per 100 lbs for cattle that weigh above their specified base weight.

Live futures – the closing price of the relevant live cattle futures contract on the day of the sale. The relevant live cattle futures contract month was determined by making an assumption about days on feed based on average slaughter weight and average daily gain as discussed previously.

Diesel price – the weekly published diesel price from the Energy Information Administration (EIA) for the week of the sale.

Mileweigh – the number of miles the cattle were to be hauled to certified scales.

Time – continuous time variable. A 1 is assigned to the first internet sale date, 2 following day, and so on. Time can be thought of as days from the first sale date.

Steer – binomial variable, 1 if steer, 0 if otherwise.

Heifer – binomial variable, 1 if heifer, 0 if otherwise.

Imp – binomial variable, 1 if cattle were implanted, 0 otherwise.

Jan – binomial variable, 1 if sale in January, 0 if otherwise.

Feb – binomial variable, 1 if sale in February, 0 if otherwise.

March – binomial variable, 1 if sale in March, 0 if otherwise.

April – binomial variable, 1 if sale in April, 0 if otherwise.

May – binomial variable, 1 if sale in May, 0 if otherwise.

June – binomial variable, 1 if sale in June, 0 if otherwise.

July – binomial variable, 1 if sale in July, 0 if otherwise.

Aug – binomial variable, 1 if sale in August, 0 if otherwise.

Sept – binomial variable, 1 if sale in September, 0 if otherwise.

Oct – binomial variable, 1 if sale in October, 0 if otherwise.

Nov – binomial variable, 1 if sale in November, 0 if otherwise.

Dec – binomial variable, 1 if sale in December, 0 if otherwise.

Al – binomial variable, 1 if location in Alabama, 0 if otherwise.

FL – binomial variable, 1 if location in Florida, 0 if otherwise.

GA – binomial variable, 1 if location in Georgia, 0 if otherwise.

IND – binomial variable, 1 if location in Indiana, 0 if otherwise.

KY – binomial variable, 1 if location in Kentucky, 0 if otherwise.

NC – binomial variable, 1 if location in North Carolina, 0 if otherwise.

OH – binomial variable, 1 if location in Ohio, 0 if otherwise.

TN – binomial variable, 1 if location in Tennessee, 0 if otherwise.

VA – binomial variable, 1 if location in Virginia, o if otherwise.

WV – binomial variable, 1 if location in West Virginia, 0 if otherwise.

Bbwf – binomial variable, 1 if cattle were predominantly black or black / white faced, 0 if otherwise.

Char – binomial variable, 1 if cattle were predominantly Charolais, 0 if otherwise.

Red – binomial variable, 1 if cattle were predominantly Red, 0 if otherwise.

Hols – binomial variable, 1 if cattle were predominantly Holstein, 0 if otherwise.

Mixed – binomial variable, 1 if cattle were mixed, 0 if otherwise.

PVP – binomial variable, 1 if cattle were PVP enrolled (age and source verified) and not natural, 0 otherwise.

Nat - binomial variable, 1 if cattle were certified natural and not PVP enrolled, 0 otherwise.

Pvpandnat – binomial variable, 1 if cattle were both PVP enrolled and certified natural, 0 otherwise.

Description of Individual Variables – CPH Sales

Sale price – the price the cattle sold for on the day of the CPH sale.

Corn futures – the closing price of the nearby corn futures contract on the day of the sale.

Lot size – number of cattle in the CPH sale lot.

Weight – the average weight of the lot of CPH cattle.

Live futures – the closing price of the relevant live cattle futures contract on the day of the sale. The relevant live cattle futures contract month was determined by making an assumption about days on feed based on average slaughter weight and average daily gain as discussed previously.

Diesel price – the weekly published diesel price from the Energy Information Administration (EIA) for the week of the CPH sale.

Time – continuous time variable. A 1 is assigned to the first CPH sale date, 2 to the following day, and so on.

Steer – binomial variable, 1 if steer, 0 if otherwise.

Heifer – binomial variable, 1 if heifer, 0 if otherwise.

Jan – binomial variable, 1 if sale in January, 0 if otherwise.

Feb – binomial variable, 1 if sale in February, 0 if otherwise.

March – binomial variable, 1 if sale in March, 0 if otherwise.

April – binomial variable, 1 if sale in April, 0 if otherwise.

June – binomial variable, 1 if sale in June, 0 if otherwise.

Nov – binomial variable, 1 if sale in November, 0 if otherwise.

Dec – binomial variable, 1 if sale in December, 0 if otherwise.

Black – binomial variable, 1 if cattle were sorted as blacks, 0 if otherwise.

Blackx – binomial variable, 1 if cattle were sorted as black cross, 0 if otherwise.

Charx – binomial variable, 1 if cattle were sorted as Charolais cross, 0 if otherwise.

Smoke – binomial variable, 1 if cattle were sorted as smokes, 0 if otherwise.

Mix – binomial variable, 1 if cattle were sorted as mixed, 0 if otherwise.

Small - binomial variable, 1 if cattle were sorted as small framed, 0 if otherwise.

Buyer 1 - binomial variable, 1 if cattle were purchased by buyer 1, 0 if otherwise.

Buyer 2 - binomial variable, 1 if cattle were purchased by buyer 2, 0 if otherwise.

Buyer 3 - binomial variable, 1 if cattle were purchased by buyer 3, 0 if otherwise.

Buyer 4 - binomial variable, 1 if cattle were purchased by buyer 4, 0 if otherwise.

Other buyers - binomial variable, 1 if cattle were purchased by any other buyer, 0 if otherwise.

Table 1: Descriptive Statistics (Internet Sales: Continuous Variables)

Variable	Mean	St. Dev	High	Low
bid price	$94.64	$12.39	$131.46	$61.00
feeder futures	$104.18	$9.52	$132.20	$87.35
basis	-$9.54	$9.23	$13.94	-$42.63
lotsize	73.61	39.14	639.0	10.0
corn futures	$4.56	$1.17	$7.55	$3.06
base weight	799.69	111.72	1075.0	420.0
live futures	$95.88	$9.62	$123.10	$80.82
diesel price	$3.15	$0.74	$4.67	$1.99
slide 1	$4.35	$0.92	$10.00	$4.00
slide 2	$6.35	$0.92	$12.00	$4.00
mileweigh	11.45	14.02	125.0	0.0
time	511.38	327.73	1203.0	1.0

Table 2: Descriptive Statistic (Internet Sales: Binomial Variables)

Variable	% of Observations
Heif	22.7%
Steer	87.3%
Jan	12.2%
Feb	7.8%
Mar	7.6%
Apr	7.6%
May	7.4%
June	8.1%
July	9.4%
Aug	10.7%
Sept	9.3%
Oct	8.0%
Nov	7.7%
Dec	4.0%
AL	1.7%
FL	0.1%
GA	5.1%
IND	0.1%
KY	23.1%
NC	4.7%
OH	4.5%
TN	31.2%
VA	26.2%
WV	3.3%
Imp	50.2%
bbwf	72.9%
char	3.6%
mix	12.0%
red	0.1%
hols	11.4%
pvponly	7.3%
natonly	0.009%
pvpandnat	2.8%

Table 3: Descriptive Statistics (CPH Sales: Continuous Variables)

Variable	Mean	St. Dev	High	Low
sale price	$95.32	$17.39	$169.00	$41.00
feeder futures	$102.40	$11.75	$132.70	$87.20
basis	-$7.08	$13.05	$36.30	-$52.95
lotsize	19.47	36.11	286.0	1.0
corn futures	$4.54	$1.29	$7.54	$3.18
weight	615.93	145.84	1063.97	314.0
live futures	$94.82	$11.03	$123.75	$81.05
diesel price	$2.97	$0.61	$4.57	$2.03
time	547.26	348.11	1190.0	1.0

Table 4: Descriptive Statistics (CPH Sales: Binomial Variables)

Variable	% of Observations
Heif	47.5%
Steer	52.5%
Jan	18.2%
Feb	14.1%
Mar	11.8%
Apr	13.0%
June	13.1%
Nov	10.2%
Dec	19.7%
black	25.7%
blackx	16.3%
charx	24.8%
mix	5.2%
small	7.2%
smoke	20.9%
buyer 1	15.1%
buyer 2	11.5%
buyer 3	31.1%
buyer 4	19.5%
other buyers	22.7%

The models below were estimated using SAS (Statistical Analysis Software).

1) Bid price = B_0 + B_1 *lot size* + B_2 *lot size*^{2} + B_3 *base weight* + B_4 *live futures* + B_5 *corn futures* + B_6 *diesel price* + B_7 *heifer* + V_8 month + V_9 location + B_{10} *slide1* + B_{11} *imp* + V_{12} cattle type + B_{13} *mileweigh* + B_{14} *shrink* + B_{15} *PVP* + B_{16} *Nat* + B_{17} *PVPandNat* + B_{18} *PVPxTime* + b_{19} *time*,

where all variables are specified as described previously. V_8 month is series of binomial variables for each month excluding January. V_9 location is a series of binomial variables for each state in which cattle originated except Tennessee. V_{12} cattle type is a series of binomial variables for each cattle type except *Bbwf*.

2) CPH price = B_0 + B_1 *lot size* + B_2 *lot size*^{2} + B_3 *weight*^{2} + B_4 *live futures* + B_5 *corn futures* + B_6 *diesel price* + B_7 *heifer* + V_8 month + V_9 buyers + V_{10} cattle sort + B_{11} *time*, where all variables are specified as described previously. V_8 month is a series of binomial variables for each month excluding January. V_9 buyers is a series of binomial variables for each major order buyer, V_{10} cattle sort is a series of binomial variables for each CPH cattle sort group except *Black*.

Diagnostics were examined using SAS (Statistical Analysis Software). A Durbin Watson Test yielded a t-statistic outside the accepted range, suggesting the presence of autocorrelation. And, a regression of the squared-residuals from the models against dependent and independent variables suggested the presence of heteroskedasticity. It was decided to address these problems by using the robust estimator in SAS, which adjusts the variance-covariance matrix without introducing bias so parameter estimates are unaffected. There were enough observations in each dataset to allow for some decrease in efficiency.

The models were tested for multi-collinearity through a variance of inflation (VIF) test. VIF statistics for corn and live cattle price in both models were between 10 and 20. While this is slightly higher than desirable, the problem suggested was small, and both were crucial variables explaining feeder cattle price, so excluding one of them seemed inappropriate.

The only case where VIF statistics suggested major concern were in initial model specifications where both *slide1* and *slide2* were included. For clarity, *slide1* is the price slide for the first 50 lbs over the base weight and *slide2* is the price slide once the payweight exceeds 50 lbs over the base weight. Further, VIF statistics were so high (greater that 200) that not addressing this problem did not seem to be an option. The only logical solution to the problem was to exclude the second slide variable, *slide2,* from the model. Once deleted, VIF statistics returned to highly acceptable levels.

Results and Overlying Themes

First, general explanatory power of both models was quite strong. Coefficients of determination on both models were very high, over 90% for the internet sale price model and over 77% for the CPH sale model. Further, general results provided evidence of consistency with previous literature in terms of signs on parameters and variables that were found to be significant. Tables 5 and 6 report results from equations 1 and 2. This work makes significant contribution to the literature in three primary areas, (1) the evolving relationship between corn price and feeder cattle prices, (2) current market incentives with respect to price slides in internet sales, and (3) the price premium for cattle selling as age and source verified and certified natural.

First, results from this work suggested that feeder cattle prices were negatively affected by corn price as they have been thought to be for years, despite some recent evidence in the literature that this may have changed (Schultz et al., 2010, Tejada and Goodwin, 2011). While parameter estimates may have been smaller in magnitude than expected, the fundamental relationships were found to exist when holding other factors constant. The magnitude of these corn price effects are also worth discussion.

Smaller magnitudes could be the result of the uniqueness of these datasets or existing market conditions. The effect of corn price would be expected to be less for heavier feeder cattle and the average weight for both of these datasets was relatively high. This expectation is supported in the literature (Bucolla, 1980, Trapp and Eilrich, 1991, Dhuyvetter and Schroeder, 2000, Burdine, 2003), and in this very study, as the parameter estimate on corn price was larger in the CPH price model (where average weight was lighter) than in the internet sale price model.

However, there is another explanation that is also likely at play in this work. Overall corn price levels were much higher during the time period of this study (2008 to 2011) than in many earlier studies. With higher corn prices, the incentives for feedlots and backgrounders to explore alternative feeds and feeding systems are greater. If alternative feeds become more attractive and their prices do not increase as sharply as corn, the effect of the rising corn price may well be less.

One can also consider how the feeder cattle market chain may have adjusted over the last several years to higher corn prices. Higher corn prices tend to narrow price slides for feeder cattle as feedyards look to place heavier cattle. This potential increased margin provides increased incentive for backgrounders and backgrounding cost of gain may be lower than feedyard cost of gain as backgrounders may have more ability to utilize alternative feeds, including pasture. The increased role of backgrounding and stockering during high feed price times would also tend to decrease the magnitude of corn price effects as substitution comes into play. This would be consistent with the discussion from Anderson and Trapp (2000).

One of the unique aspects of the internet sales is the element of uncertainty that is present. The cattle are not seen in the flesh, weight is not known with certainty, and other factors are largely only known to the extent that they are visible via video or revealed by the consignor. This allows for analysis of some unique factors, most especially the price slide that is used to adjust price downward for cattle that weigh above their advertised base weight in the sale catalog. Brorsen et al. (2001) found that price slides were typically not large enough to provide a disincentive to underestimate weight. Hence, they found evidence that cattle typically weighed more than advertised in Superior Internet Auctions. However, little evidence of weight underestimation was present in the dataset employed in this analysis.

In the Bluegrass internet sales, cattle actually weighed on average only two lbs over the advertised *base weight* compared to 15 to 20 lbs in the Brorsen study. One could argue that reputation and repetitive procurement relationships explain this or that after ten years the cattle market has evolved and moved towards a more efficient system. However, it is most likely that market conditions have changed such that this incentive that Brorsen et al. found in 2001 may not be near as prevalent today.

As mentioned before, the average weight of cattle in the internet sale dataset was just under 800 lbs. The absolute smallest price slide offered in the internet dataset was $4 per cwt. In order for an incentive to exist for producers to underestimate weight, the actual negative price effect of weight in the market would need to exceed $4 per cwt. While this likely was the case in 2001, our data suggest that it did not exist from 2008 to 2011. Note the parameter estimate on the weight variable; a one hundred pound increase in weight was associated with a price decrease of only $2.54 per cwt. In other words, cattle advertised as weighing 800 lbs, but actually weighing 850 lbs would bring a lower price than the same group of cattle advertised at 850 from the very beginning. The current environment actually provides much greater incentive for producers to know the weight of their cattle as the typical price slide offered in the catalogs likely provides less penalty than the market itself.

Finally, as the price effects of age and source verification were the initial motivation for this work and the primary interest of stakeholders, further discussion of these estimates is warranted. Results in Table 5 provide evidence that price premium existed, as a significant positive price relationship was found to exist of $1.35 per cwt for age and source verification, nearly $11 per head. While producers may not find this especially enticing, the result is very consistent with recent estimates in the literature (Kellom et al., 2008, Zimmerman et al., 2012) but inconsistent with Williams et al. (2012) where no significant premium was found. This study provided the first estimate of age and source verification for cattle in the southeast.

In addition to providing further insight on premiums for age and source verification, this study moved the literature further by also examining premiums for certified natural cattle and cattle selling with both attributes. Cattle selling as certified natural were associated with a significant positive price difference of $2.18 per cwt and cattle selling with both attributes were associated with a positive price impact of $3.97 per cwt. These were considerably higher premium levels than those found in the work of Zimmerman et al. (2012).

Table 5: Regression Results: Factors Affecting Internet Bid Price (Dollars / cwt.)

Variable	Parameter Estimate	Standard Error
Intercept	20.312***	2.674
lot size	0.019***	0.0044
lot size^2	-0.000029***	0.0000090
base weight	-0.025***	0.0014
Live Futures	1.116***	0.039
Corn Futures	-2.968***	0.273
Diesel Price	-0.756**	0.328
Heifer	-6.988***	0.272
Feb	0.505	0.406
Mar	-0.477	0.398
Apr	1.639***	0.391
May	3.419***	0.417
Jun	2.588***	0.465
July	1.772***	0.417
Aug	0.915**	0.443
Sept	-2.355***	0.414
Oct	-3.356***	0.496
Nov	-3.854***	0.428
Dec	-2.203***	0.453
slide 1	0.495***	0.185
AL	-1.142	0.763
FL	-5.324***	0.970
GA	-1.302***	0.476
IND	4.855***	0.683
KY	0.425*	0.248
NC	-1.262***	0.466
OH	0.176	0.466
VA	-1.003***	0.258
WV	-1.160**	0.524
Imp	0.394*	0.207
Char	-0.508	0.479
Hols	-22.693***	0.414
Red	-1.209	0.904
Mix	-1.286***	0.283
Mileweigh	-0.019**	0.0083
Shrink	-0.111	0.117
PVP	1.354*	0.748
Nat	2.176***	0.623
PVPandNat	3.966***	0.717
PVPxTime	0.00102	0.0013
Time	0.00952***	0.00044
R^2	91.92%	
F Value	452.83	

*, **, and *** denote statistical significance at the .10, .05, and .01 levels, respectively

Table 6: Regression Results: Factors Affecting CPH Bid Price (Dollars / cwt.)

Variable	Parameter Estimate	Standard Error
Intercept	17.420***	5.551
Lot size	0.093***	0.018
Lot size^2	-0.00046***	0.000093
Weight^2	-0.000028***	0.0000016
Live Futures	1.207***	0.092
Corn Futures	-4.204***	0.643
Diesel Price	0.331	0.898
Heifer	-10.822***	0.475
Feb	0.932	0.817
Mar	-1.080	0.896
Apr	2.690***	0.908
Jun	2.304***	0.819
Nov	-3.840***	0.873
Dec	-3.213***	0.874
Order Buyer 1	0.179	0.751
Order Buyer 2	1.379	0.908
Order Buyer 3	-1.819***	0.716
Order Buyer 4	0.048	0.866
Blackx	-11.042***	0.968
Charx	-9.595***	0.796
Small	-21.176***	1.328
Smoke	-1.577**	0.675
Mix	-17.613***	1.422
Time	0.0083***	0.0011
R^2	77.94%	
F Value	202.08	

*, **, and *** denote statistical significance at the .10, .05, and .01 levels, respectively

Conclusions and Implications

If stakeholders were expecting a drastic price impact from age and source verification, they were most likely disappointed. The $1.35 per cwt price difference associated with *pvp* amounted to about $11 per head on an 800 pound steer. While certainly significant and consistent with some previous work (Zimmerman et al., 2012, Kellom et al., 2008), most producers likely expected a greater price impact. The interaction term with PVP premium and time provided evidence that the premium levels were not trending in either direction during the time of this study.

While the price premium for cattle selling as natural appeared to be greater than that associated with age and source verification, it may actually be less appealing to producers. The primary cost associated with age and source verification is time. In the case of selling cattle as natural, the primary cost is likely lost production. Without the aid of implants, rates of gain and pounds sold are likely to be lower, resulting in lower revenues. As producers consider the cost-benefit of selling natural calves, this data suggests that the benefit may only be around $17 per head on an 800 pound steer. This benefit must be carefully weighed against the additional feed costs needed to compensate for slightly lower feed conversion, potentially higher medical costs, and the probability of calves getting sick, needing antibiotic treatment, and becoming ineligible for the program. Finally, the two value-added opportunities together provide additional opportunities, but parameter estimates suggest only slightly more than the two individually.

Ultimately, it will be a specific type of producer who will choose to participate in these programs and price premium may only be a piece of that decision. In truth, the internet sales only represent a portion of the age and source verified and natural cattle that are sold. Many other markets exist for these types of calves and the premiums that result from access to those markets is not observed in this study. This work addresses the question of price premiums that were found to exist within the internet sales and does not place a value on additional markets that may be available to producers selling age and source verified cattle and certified natural cattle. Regardless, having a better understanding of these price premiums should aid managers of the internet sales as they consign cattle. No doubt, the question regularly arises as to what these price differentials tend to be. This research should provide an objective assessment that can be used by managers as they target cattle for the sales and consignors as they consider the best options for cattle they wish to market.

While the initial motivation for this work may have been on value-added markets, the opportunity to analyze two very unique datasets provided additional opportunity to add to the existing literature. As was discussed earlier, there was both antidotal evidence and recent empirical work (Shultz et al., 2010, Tejada and Goodwin, 2011) to cast doubt upon the long held relationships between feeder cattle and corn prices. However, the results from this study were more in line with earlier work, finding the traditional negative price relationship to exist between these two variables. The smaller magnitude suggested from these results likely speaks to the uniqueness of these two datasets and the market adjustments that result from the feeder cattle market absorbing drastically higher corn prices.

Other findings may have more micro-level implications for the marketing system as a whole. The uncertain nature of weight in the internet sales creates a real marketing challenge for consignors, buyers, and sale administrators. Price slides have been used for years to deal with weight uncertainties and they remain the tool of choice today. However, in an age where information is power, this is an area where savvy individuals can capitalize on incentives and disincentives in the marketplace.

For years, producers were told that price slides would not hurt them; they would always be better off to sell more lbs at reasonable price slides. However, this adage is partially true, at best, in today's market environment. The ultimate reason for the difference is that price slides (as they are used to adjust prices to weight differences) have not evolved with the actual price-weight relationships in the marketplace. Brorsen et al. (2001) noted that price slides amounted to an "option" for sellers. When price slides are less steep than actual price-weight relationships in the market, consignors have incentive to deliver heavier cattle and they found a tendency towards this in their work. It would appear that this incentive has changed over the last several years and is evidenced by a much smaller tendency to underestimate weight in this work.

Results reported in table 5 confirm that current price discounts by weight are actually less dramatic than price slides offered in sale catalogs. In theory, one would want those to be equal in order for neither party to have a marketing advantage. In one sense, the market is more efficient than it used to be as sellers do not have this same incentive today. However, due to the flexible nature of the delivery times, the current system may offer some perverse incentives to the buyer.

In most cases, the buyer has some control over delivery times, generally within some window of time. Given the current conditions, it may actually benefit the buyer to delay receipt of cattle as they gain weight. Examination of sale catalogs from 2008 through 2011 suggests that most delivery ranges are about one week, but two or three weeks were offered in some cases. In cases were a great deal of flexibility is available, it would not be surprising to see delivery dates pushed back and cattle weights start to increase. Of course this incentive is probably less of a problem than the one that Brorsen et al. (2001) discovered as consignors can simply tighten up delivery windows. But to do this, they must be aware of why doing so makes economic sense.

As sale managers work with consignors, they should make them aware that, in most cases, the price discount for heavier cattle is likely to be lower in magnitude than the common price slides of $4 and $6 per cwt. One option would be reducing the magnitude of the price slides offered, but results suggest that doing so would negatively affect price. Short of doing that, sellers should be aware that pricing incentives will favor cattle that come in close to *base weight* in the current environment.

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