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Harun Bulut, John D. Lawrence

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The Value of Third-Party Certification of Preconditioning Claims at Iowa Feeder Cattle Auctions

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Abstract

After controlling a variety of feeder cattle characteristics and market and sale conditions, we estimate the price premiums for preconditioning (vaccinations and minimum 30 days weaning) claims with and without third-party certification (TPC) as \$6.15/cwt and \$3.40/cwt, respectively, in Iowa feeder cattle auctions. These premiums differ statistically (p-value less than 0.0001) and their difference exceeds the additional participation cost of TPC (\$1/cwt) on average. This indicates that the third party certification is valued in the market to credibly signal preconditioning investment under asymmetric information.

Key Words: Asymmetric information, Feeder cattle auctions, Quality, Signaling, Third party certification.

JEL Classifications: Q11, Q12, Q13, C23

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[*] Post-Doctoral Fellow (harun@iastate.edu) and Professor (jdlaw@iastate.edu), respectively. Both are with the Department of Economics at Iowa State University. The support of the U.S. Department of Agriculture, through a National Research Initiative grant, is gratefully acknowledged. This is Working Paper # 06031, Department of Economics, Iowa State University.

Introduction

The U.S. beef industry is striving to meet consumer demands for consistent, high quality product in both domestic and foreign markets amid health concerns such as Bovine Spongiform Encephalopathy (BSE) and foot and mouth diseases, as well as intense competition from other animal protein sources. The recent proliferation of beef alliances, value-added programs, beef brands, and quality and process assurance programs are among these efforts. In this context, considerable interest is placed on the preconditioning investment (which generally refers to vaccinations and minimum 30-day weaning along with other good management practices, e.g. dehorning, castration, etc.) in feeder calves at the farm of origin. The purpose of preconditioning is to boost the immunization system of cattle in feedlots. This makes them less susceptible to disease, which, in turn, decreases treatment costs and mortality rates, and increases feedlot efficiency and prospects for achieving a higher quality grade. It has been reported that preconditioning efforts create value for the entire chain (Nyamusika, et al., 1994, Lalman and Smith, 2002, Busby, et al., 2004, Dhuyvetter, Bryant, Blasi, 2005).

Based on the data including 19,172 lots of calves sold in various sale barns in Iowa in 2005 (see Table 1 and Data Sources section), we observe the following pattern for the preconditioning claims: 54% of calves were preconditioned to two factors, vaccination and minimum 30-day weaning periods. Of the preconditioned calves, 68% had third party-certification; the seller claimed the remaining 32%. Partial preconditioning claims—e.g., vaccinations but less than 30-day weaning or proper weaning but no vaccinations—were made on 37% of all calves. Finally, no preconditioning work was done or claimed for nearly 9% of all lots of feeder calves.

The value of preconditioning programs relative to price premiums is reported in the literature (Ward and Lalman, 2003, Avent, Ward and Lalman, 2004, King and Seeger, 2004, Dhuyvetter, Bryant, Blasi, 2005, Corah, et al, 2006). However, none of these studies has explicitly focused on whether third party preconditioning adds greater value than seller preconditioning or vice versa. In this paper, we investigate the following questions: (1) Is the higher cost of third-party preconditioning offset with a sufficiently higher premium? (2) Does the market make a distinction between the value of uncertified and partial preconditioning claims? These questions are of interest because more than 54% of the calves in our data set had preconditioning claims that were either uncertified or incomplete. Assuming these claims are true, they imply a real cost to producers. However, these quality enhancing efforts may not be fully rewarded because of information asymmetry between seller and buyer as we elaborate in the following.

While auctions are very efficient at bringing buyers and sellers together for price discovery and also for transferring a large volume of cattle from ranchers to feeders (possibly backgrounders and stockers in between), signaling the value of cattle at auction is often a challenge. Objective means of measuring quality exist but they are difficult to employ at auctions, where transactions are done quickly and involve a large volume of animals. Feedlots typically hire order buyers, who are experienced in visually assessing cattle but this, of course, has limitations. It is particularly difficult to discern unobservable traits related to past management, such as vaccinations, treatment, nutrition history, weaning status, etc. Incentives exist for sellers to overstate the condition of their animals or fail to disclose unfavorable information, which is at least what buyers will take into consideration. The reputations of sellers are of less concern in a feeder auction environment, where the majority of producers sell a small number of cattle once or twice a year (Nyamusika, et al., 1994, Chymis, et al., 2006). Moreover, reselling based on speculative motives is not uncommon; buyers and sellers are not negotiating one-to-one as they do in a contract environment. Therefore, at feeder auctions, it can be assumed that buyers typically are uncertain about the heterogeneous characteristics of the cattle. Unless sellers can verify the quality of their cattle, buyers will base their pricing decision based on the average quality in the market, which may not be enough to fully capture any investments undertaken by sellers in improving the health or quality of their cattle.

Sellers can make their claims more credible via TPC, which can include state-sanctioned green or gold tag preconditioning programs (vaccinations are done and documented by a veterinarian) or similar private company programs. [1] Although TPC programs have the potential to mitigate the asymmetric information problem, there are potential shortcomings as well. In order for these programs to be successful, buyers must trust the integrity of programs and procedures. There are multiple protocols and procedures, which are not equally monitored and controlled. It is known that feedlots routinely revaccinate the cattle they receive, partly due to lack of trust in vaccinations claims as well as the commingling of cattle with multiple protocols from various regions (Chymis, et al., 2006). Also, the cattle certified by a third party should be offered at sufficient volume to be of some value to buyers.

The information asymmetry between buyers and sellers at feeder cattle auctions is recognized in the literature (Allen, 1993, Nyamusika, et al., 1994, Hueth and Lawrence, 2002, and Chymis, et al., 2006). Nyamusika, et al., (1994) reports an insufficient amount of vaccinations due to the asymmetric information problem in the market, and shows that vaccinations against Bovine Respiratory disease complex bring in $40/head return at the herd level (considered as the closed system of cow/calf producers and feedlots). Chymis, et al. (2006)

analyzes the welfare loss effects of the problem of asymmetric information in cattle auctions by focusing on the “revaccination issue,” and suggests more research, particularly empirical research, to quantify this problem. Nyamusika, et al., (1994) and Chymis, et al., (2006) also argue that a sufficiently low-cost third party certification (TPC) could improve the efficiency of the system by partially separating high-quality and low-quality cattle. Other studies considering TPC to correct asymmetry between buyers and sellers at various markets include Anderson, Daly, and Johnson (1999), Sporleder and Goldsmith (2001), Hatanaka, Bain, and Busch (2005), and Dewally and Ederington (2006).

Data Sources

Four recorders hired by the Iowa Beef Center at Iowa State University collected data from 105 sales that took place in nine sale barns located in southern, southeastern, southwestern, and western Iowa. The sales, which took place between October 20, 2005, and February 24, 2006, included 20 preconditioned and five featured sales. The rest were “special” or regular sales. The preconditioned sales were restricted to cattle weaned and vaccinated according to a certain protocol (e.g. all green tag preconditioned calves, or all according to Merial ® Surehealth™ protocol). The featured sales were advertised as “featuring ‘all-vaccinated’ calves”, i.e. most of the animals were vaccinated, although both certified and uncertified protocols may have been followed. Finally, sales advertised as “special” were, in fact, regular feeder cattle sales that featured cattle of various weaning and vaccinations status. The data included detailed items relevant to price formation; recorders worked with USDA market reporters who were present in the sales. The unit of observation in the data set is a lot. After adjusting for the observations, including missing price or feeder cattle characteristics, the data set included 20,051 lots of cattle sold. In addition, daily live cattle futures prices were obtained from the Livestock Marketing Information Center database. Daily corn prices were obtained from Iowa State University Extension database.

Modeling

The price received for feeder cattle is modeled as a linear function of a set of explanatory variables or characteristics. This type of modeling, known as the hedonic pricing model, is commonly used to study the valuation of feeder cattle (Dhuyvetter and Schroeder, 2000, Ward and Lalman, 2003, Avent, Ward and Lalman, 2004, King and Seeger, 2004, Dhuyvetter, Bryant, Blasi, 2005, Corah, et al, 2006). We adopt a similar specification to Avent, Ward and Lalman (2004) and Dhuyvetter, Bryant, Blasi (2005)

The hedonic pricing equation can be generically written as

$$P = \beta_0 + \beta_1 X_1 + \ldots + \beta_K X_K + u \quad , \tag{1}$$

where P is the average lot price per hundredweight, X_i for $i = 1,\ldots,K$ are the explanatory variables (characteristics), β_i for $i = 1,\ldots,K$ are the corresponding parameters, β_0 is the intercept parameter, and u is the disturbance term to the equation. Note that including the intercept term, we consider 27 explanatory variables in equation (1) (that is, $K = 26$).

We consider explanatory variables to the extent they impact buyers' expected profits from growing and finishing the feeder cattle which in turn determines the price that feeder cattle receive at the bidding process. For example, it is known that an animal's daily gain depends on its initial weight, genetic potential, sex, and overall health . Corn prices directly affect the profitability of feeding as an input cost. Live cattle futures are proxy for the expected price of the finished product. Preconditioning is expected to decrease health risks and mortality rates. Similarly, other variables are presumed to have impact on the expected profits of buyers. Below we introduce our variables: Table 1 presents the summary statistics on select variables.

Dependent Variable:

Price (P): The average lot price in our data set is around $120/cwt. A nearly $90/cwt price range is covered here.

Explanatory Variables- Lot Specific

Weight and Weight Squared (X_1 and X_2) are continuous variables. The previous literature consistently confirmed a negative relationship between price and weight. The lower the initial weight, the more weight that animal can gain for the buyer. The squared term is added to capture the curvature of this relationship. The average cattle in our data set weigh 590 lbs. A nearly 900-pound weight range is covered in this study.

Age: Yearling (X_3) is a dummy variable, which takes the value of one if cattle are yearlings, and zero if they are calves. Lots of calves are the base. The impact of age is not estimated in the literature studying the valuation of feeder cattle. Yearlings are mature enough to prove their health, and therefore can be assumed as preconditioned.

Sex: Steer (X_4) is a dummy variable that takes the value one if a lot consists of steers and zero otherwise. Similarly, Bull (X_5) is a dummy variable that takes the value one if a lot consists of bulls and zero otherwise. Lots of heifers are the base for the sex variable. We expect that steers and bulls have premium over heifers, and this premium relatively higher for steers due to the value of castration in the market.

Color: Black and black mixed (X_6) is a dummy variable, which takes the value one if a lot includes black cattle and zero otherwise. Base is non-black lots. Black hair coat typically signal Angus breed genetics. Whether black cattle bring in significant price premium over non-black cattle is of interest.

Horns: Lots with cattle with horns (X_7) is a dummy variable, which takes the value one if there are cattle with horns in a lot and zero otherwise. Base are lots of cattle without horns.

Fleshy: Fleshy (X_8) is a dummy variable, which takes the value one for lots of fleshy cattle and zero otherwise. Lots without fleshy cattle are the base. We do not have a priori expectation for the sign of the coefficient of this variable. A fleshy look can be sign of health but it can decrease the potential gain for the buyer.

Health and Appearance: Dummy variables, which take value one if a lot consists of cattle with the corresponding condition, and zero otherwise. Lots of healthy and clean (not dirty) cattle are the base. Equation (1) includes X_9, X_{10} and X_{11} for sick and dirty, sick and clean, and healthy but dirty cattle, respectively. The "sick" category applies to cattle that are sick and/or non-conformant, e.g., rat-tail, lame, bad foot, bad eye, etc. Dirty and muddy cattle may be discounted as their appearance may signal poor previous management practices and accommodations. We expect that the order of discount from highest to lowest should be for sick and dirty, sick and clean, healthy but dirty cattle with respect to the base. Preconditioned cattle are conditioned to have stronger immune systems and more likely to be healthy, thus avoiding these discounts.

Explanatory Variables- Marketing Related:

Lot Size and Lot Size Squared (X_{12} and X_{13}) are continuous variables, which account for the impact of total head number in a given lot on the price that lot receives. Buyers may find efficiency gains in larger lot sizes to fill and ship truckload of cattle. The previous literature has found a quadratic relationship between lot size and price. The squared term is added to capture this relationship.

Sale Size and Sale Size Squared (X_{14} and X_{15}) are continuous variables, which account for the impact of total number of head in a given sale on the lot prices. Larger sales are more aggressively advertised by sale barns and therefore may attract more buyers. In turn, this may increase the intensity of competition among buyers, thus positively impacting the feeder price. We add a squared term to learn if the returns (if any) to the size of sale level off, or even decline after some point.

Explanatory Variables for Market Conditions:

Dhuyvetter and Schroeder (2000) found that live cattle futures and corn futures (expected output price and input costs to cattle feeding, respectively) are important factors in the price-weight relationship (price-slides). We also considered these variables here:

Live Cattle Futures: (X_{16}) This is the live cattle future price of the month that cattle are expected to be marketed. We follow Dhuyvetter and Schroeder (2000) in using the same rule to determine the expected marketing month for cattle of different weights. The fifth, fourth, third, second, and first distant contract were used, respectively, for the following weight ranges: 300-499, 500-699, 700-899, 900-1199, and more than 1200 lbs.

Corn prices: (X_{17}) In Iowa, the main input of cattle feeding is corn, and we believe that local cash prices (taken as Iowa average) are more relevant to farmers' feeding decisions than corn futures, which were used in Dhuyvetter and Schroeder (2000). In particular, during the time of this study, corn basis (cash price minus future price) varied widely.

Monthly Time Dummy variables: A value of one is given for the corresponding month and zero otherwise. Base is October. Denote the other monthly time dummies with X_{18}, X_{19}, X_{20}, and X_{21} for November, December, January, and February, respectively. These variables primarily capture the seasonality of feeder cattle prices but they may also reflect opportunity costs of labor, weather, stress, and other non-price variables. With preconditioning, there may be an opportunity for marketing cattle in upward trending market due to seasonal price trends. It is known that from October to November, the biggest supply of non-weaned calves are brought to the market, which leads to lower prices compared to other months *ceteris paribus*. For example, between 1991 and 2000 in Colorado, prices for 400-500 lb steers were 3.7% and 5.9% higher on January, and February, respectively, whereas they were 4.9%, 3%, and 2.4% lower in October, November, and December, respectively, compared to the yearly average (Peel and Meyer, 2002).

Explanatory Variables for Vaccinations and Weaning Categories for Calves:

Dummy variables take a value of one if cattle belong to the corresponding vaccinations and weaning category, and zero otherwise. The base is unvaccinated, non-weaned calves. Given their age, yearlings can be assumed to be preconditioned, therefore, no separate variable was considered for vaccinations and weaning claims for this age group.

Certified Vaccinated and Weaned at least 30 days Calves (X_{22}): The majority of cattle in this category are vaccinated according to the protocols of the Iowa green tag program (tags are displayed). The category also includes cattle vaccinated under the Iowa gold tag programs (nearly 10%), and similar private company programs (nearly 5%), such as Merial ® Surehealth™. The minimum weaning requirement to obtain a preconditioning certificate from the Iowa green tag program is 30 days; the minimum weaning requirement in the Iowa gold tag program and Merial ® Surehealth™ is 45 days.

Uncertified Vaccinated and Weaned at least 30 day Calves (X_{23}) In this category, sellers made claims of vaccinations and at least 30 days weaning, which is considered here as competing claims to third-party documentation. Vaccination claims include such comments as “green tag-like” claims (including the green tag claim for calves but no tags are displayed), a specific set of vaccinations, individual shots such as 4-way or 7-way, vaccinations claims without specifics, etc. The common denominator for these claims is that they are made by an auctioneer on behalf of sellers and not certified by a third-party agent.

Vaccinated and Weaned Other Calves: (X_{24}) Vaccinations claims may include certified or uncertified claims. In terms of weaning claims, preconditioning requirements were not met either because the producer indicated a weaning period of less than 30 days or made a weaning claim without specific weaning date or length of time. The overwhelming majority of weaning claims was in the latter category.

Vaccinated but Not Weaned Calves: (X_{25}) In this category, vaccination claims (certified or uncertified) were made but there were either no weaning claims or buyers provided information that calves were not weaned.

Weaned but Not Vaccinated Calves: (X_{26}) For these calves, a weaning claim was made but either without a vaccination claim or sellers explicitly provided information that calves were not vaccinated.

Estimations and Results

We estimated the model described in the previous section with Ordinary Least Squares (OLS) estimation procedure under standard Gauss-Markov assumptions. In addition, given the size of the random sample, we expect OLS procedures to yield unbiased estimators (Wooldridge, 2002). We used the PROC REG procedure in SAS™ software (SAS Institute, 2003).

Table 2 presents the estimation results. Note that all coefficients represent price premiums/discounts (in $/cwt unless otherwise noted) relative to the base, which is defined as dehorned, non-black, not fleshy, healthy and clean, heifer, calves, marketed in October, and without vaccination and weaning claims. The number of observations is 20,051 lots. The fit measure of adjusted R-Square ($\bar{R}^2$) equals 0.71, which is close to the value reported in Avent, Ward and Lalman (2004). The explanatory variables considered here explain the 71% variation in price. White and Breusch-Pagan tests strongly rejected the null hypothesis of homoskedasticity (with p-value less than 0.0001), which points out that OLS estimates may not be efficient. Note that Avent, Ward and Lalman (2004) also reported the same problem. Based on the inspection of residuals and fitted values, this is due to some low-weight cattle that are predicted as higher valued than their actual price. In cattle, low weight can be indicator of potential to gain but it also can be a signal of previous health problems. In terms of inference, the problem has almost no bearing because heteroskedasticty robust standard errors and usual standard errors are very close. Our inference and the tests are based on these robust standard errors per se, which we obtained with ACOV option under PROC REG procedure of SAS. Note that all reported p-values are based on chi-square statistics with the corresponding number of restrictions as the degrees of freedom. This includes the individual significance of explanatory variables, for which the degrees of freedom is one. The values of t-statistics for the individual significance of explanatory variables can be obtained by taking the square root of the corresponding values of chi-square statistics. All estimates of parameters are individually significant with p-value less than 0.0001 except December dummy, which is not significant at 10% (with p-value 0.19). In the following, we elaborate more on the results.

The parameter estimates for lot specific variables are consistent with the previous estimates such as Dhuyvetter and Schroeder (2000), Ward and Lalman (2003), Avent, Ward and Lalman, (2004), and Dhuyvetter, Bryant and Blasi (2005). Price and weight have a negative, convex relationship, that is, as weight increases price decreases but at a decreasing rate. For example, the price slide for weights of 500 to 700 lbs at 50 lbs increments is calculated as -$5.33, -$5.03, -$4.73 and -$4.44, respectively.

Yearlings have a nearly $5.95 premium over non-vaccinated and non-weaned calves, which is close to the premium that certified vaccinated and weaned at least 30 days calves have over non-vaccinated, non-weaned calves. Yearlings can be assumed as preconditioned per se. For the sex variable, both steers and bulls have premiums over heifers, which are $8.71 and $2.51, respectively. Note that the $6 difference in premiums of steers over bulls is the value of castration in the market.

For breed effect, the market places a greater value on lots with black and black mixed cattle. The premium over lots of non-black cattle is $3.06. There is comparative information on premiums for breed effects in the literature: Corah, et al., (2006) had breed data recorded over a five-year-period—2001 to 2005— on 14,382 lots in Superior Livestock Auction. They found the premium of $4.42 for black and black white-faced lots over Brahman influence cattle. Note that in our study, the premium appears to be lower but this is due to the fact that our base choice is non-black, which may include British, British and Continental crosses, which had also premiums over Brahman influence cattle in Corah, et al., (2006).

For the variable regarding horns, lots including cattle with horns are discounted by $1.70, indicating the market value placed on dehorning. Fleshy cattle are discounted in the market by $2.41, which may go against preconditioned cattle if they appear too fleshy. For health-related variables, the market discounts lots that include sick and dirty, sick and clean, and healthy but dirty cattle by $12.4, $9.36, and $1.18, respectively, over healthy, clean cattle. Because preconditioned cattle have better health care and are subject to management practices, they are more likely to avoid these discounts.

The lot and sale size variables are economically and statistically significant. Price premiums increase as the number of head in the lot reaches 78 head, which is about truckload, and then it levels off and declines for higher lot sizes. One can verify from the estimated regression equation in Table 2 that, other things being equal, the lots of five, 10, 20, 40, and 78 head bring in $1.26, $2.74, $5.39, $9.42, $12.43 premium, respectively, over single lot. We are finding higher premiums than Avent, Ward and Lalman (2004), yet the results are qualitatively consistent. Premiums also increase with the size of the sale, *ceteris paribus*, at a decreasing rate. The estimated coefficients (which are for sale size in thousand head) suggest that, other things being equal, instead of selling at small sale, such as 0.5 thousand head, seller can obtain additional $1.06, $2.75, $3.88, $4.45 more by selling in sales with 1, 2, 3, and 4 thousand head, respectively. The premium for sale size reaches its maximum at 4.5 thousand head, and then slightly declines.

As in Dhuyvetter and Schroeder (2000), we also found that live cattle futures and corn prices are statistically significant variables in determining feeder cattle price although economic impacts are rather lower here. We find that a $1 increase in live cattle futures increases the price for cattle by $0.72. Also, a $0.01 increase in corn price decreases the price of cattle by $0.05. For monthly time dummies, our estimations show that there is a significant premium for marketing calves in November, January, and February compared to October. As mentioned, the December coefficient is not significant with p-value of 0.19, and has a lower premium compared to November. This can be due to rather exceptional weather-related conditions in December in Iowa this year. The premium for December would be expected to fall between the November and January values based on a typical seasonal pattern.

All parameter estimates for vaccinations and weaning categories are individually and therefore jointly significant (with p-value less than 0.0001). The implication here is that the vaccinations and weaning status categories are statistically important determinants of price. Calves without vaccination and weaning claims are the base; calves with certified vaccination and at least 30 days weaning claims have a premium of $6.15, whereas calves with uncertified vaccinations and at least 30 days weaning claims bring in $3.40. The null hypothesis of the equality of the coefficients of both categories is rejected with p-value of less than 0.0001 from Table 3. Therefore, the relative premium between the two categories, which is nearly $2.75, is statistically significant. If calves were brought to market without a minimum 30-day weaning claim (i.e., either no weaning date was mentioned or the date mentioned was less than 30 days) and vaccinations claim made, they earn an average premium of $3.14 compared to the base. In fact, this premium is not statistically different than the one for uncertified vaccinations and at least 30 days weaning (see Table 3). Therefore, buyers offer a pooling price for these two categories and thus do not distinguish between them in terms of the premiums they offer. Nevertheless, they are distinguished with respect to calves without claims on either or both components based on the tests of equality of corresponding coefficients (with p-values less than 0.0001) from Table 3. Finally, having a claim in either of the components—vaccinations or weaning— brings in statistically higher premiums compared to no claims at all. Particularly, the premium for calves with vaccinations but no weaning ($2.42) is statistically different than the premium ($1.70) for calves with weaning claims but no vaccinations at the 5% significance level (with p-value of 0.043) from Table 3.

The foregoing shows how vaccination and weaning claims segment the market with respect to preconditioning. Focusing on the first two types of claims (preconditioning with and without TPC), we now ask whether the found relative premium of nearly $2.75 covers the cost difference, i.e., the participation cost. Some estimates in the literature on the participation cost for average producer, are as follows: Avent, Ward and Lalman (2004) reports $5/hd for the additional marketing costs for ear tags, commissions, etc.; Dhuyvetter, Bryant and Blasi (2005) places costs at 3$/head in the baseline and $5/head in the high-cost scenario. For a 500-pound calf this means $1/cwt at maximum, which is nearly one-third of the found relative premium.

Application

Based on the estimated regression equation, we also looked at the profitability of third-party certified preconditioning compared to the option of selling at weaning (without weaning and vaccinations claims). Whether preconditioning is profitable for producers is an ongoing discussion in the literature. Avent, Ward and Lalman (2004) report the total cost of preconditioning at $60.92 for 67.5 lbs total gain in a 45-day period (1.5 lbs gain per day), and calculates $6.93/head loss from preconditioning in the baseline but $5.14/head gain under a higher weight gain scenario. Dhuyvetter, Bryant, Blasi (2005) report $56.97/head for the total cost of preconditioning for 60 lbs total gain in a 45-day period (1.33 lbs gain per day), and calculates $12.94/head net return in the baseline from preconditioning.

We consider the following scenario: Assume that calves are black, dehorned steers, healthy and clean from a lot size of 10 and a sale size of 2 thousand head. The calves can be sold at weaning (without weaning and vaccinations) on November 1, 2005, with a pay-weight (net of shrinkage) of 500 lbs. Alternatively, the producer could precondition the calves for 45 days and sell on December 15, 2005, with a third-party certification of vaccination and weaning. The preconditioning option targets a pay-weight gain of 100 lbs in a 45-day period (2.22 average daily gain). Note that preconditioned calves can shrink less but this is ignored here. Because the average fleshy cattle in our data set weighs 651 lbs in November as opposed to the 600-pound calf in this example, we assume calves do not look fleshy after preconditioning. There is $6.15/cwt premium for calves with both certified vaccinations and minimum 30-day weaning. The December 15 quote for June live cattle futures and corn prices are unknown on November 1. We initially assume the same live cattle price and corn price for both dates. (We later report the impact of changes in these prices on profit.) At November 1, the latest available live cattle future prices for June (fourth distant contract) were $85.65 and corn prices were $1.43/bu. The coefficients of monthly time dummies indicate that December calves are discounted $1.09/cwt to November (normally December would be higher).

We plug the data from both scenarios into the estimated regression equation in Table 2 and predict the following prices. We recall that the estimated impact of sale size is for a thousand head; therefore, we enter “2” as the appropriate value for sale size.

The predicted price under selling at weaning option is 130.45, which is calculated as

(2) $$\$130.45 = 124.98\times1 - 0.17\times500 + 0.000059\times(500)^2 + 8.71\times1 + 3.06\times1$$
$$+0.33\times10 - 0.00211\times(10)^2 + 2.54\times2 - 0.28\times4 + 0.72\times85.65$$
$$-0.05\times143 + 1.55\times1$$

Alternatively, holding the live cattle futures and corn prices the same, the preconditioned calf would be expected to bring the price/cwt of \$125.14 as follows:

(3) $$\$125.14 = 124.98\times1 - 0.17\times600 + 0.000059\times(600)^2 + 8.71\times1 + 3.06\times1$$
$$+0.33\times10 - 0.00211\times(10)^2 + 2.54\times2 - 0.28\times4 + 0.72\times85.65$$
$$-0.05\times143 + 0.46\times1 + 6.15\times1$$

Using these estimated prices, the gross revenues per head are calculated as $\$652.23 = 130.45\times5$ and $\$750.87 = 125.14\times6$ for selling at weaning and preconditioning options, respectively. The latter yields additional revenue of \$98.64/head compared to the former, mainly due to selling more weight. We estimated that the targeted gain in preconditioning would cost \$51.35/head, which includes \$28.3 in feed cost, \$1.83 in possible death loss at 0.25% probability, \$1.00 in possible treatment cost at 5% probability, \$11 in vaccinations and participation cost, \$5 in labor and equipment cost, and \$7 in interest expense. Subtracting the cost of preconditioning from the resulting revenue increase yields \$47.29/head profit.

Of course, the estimated profit figure will change with producers' different cost figures and marketing scenarios, also with changes in live cattle futures and corn prices. For the latter, on December 15, the latest available live cattle future prices for June (fourth distant contract) and corn prices turned out to be \$87.35 and \$1.66/bu, respectively. When we use these values in the calculation of the price for preconditioned calf in equation (3), we find a minor increase in the price of preconditioned calves to \$125.2/cwt, therefore, on the profit to \$47.62/head. This is because both live cattle futures prices and corn prices increase relative to November 1. The impact of the former (positively related with the price) is slightly higher than the latter (negatively related with the price).

Conclusion

We have estimated a hedonic pricing equation based on the data collected from more than 20,051 lots of feeder cattle sold at auctions in Iowa between October 2005 and February 2006. Controlling a set of lot specific characteristics, sale and market conditions, we find that preconditioning claims with TPC obtain a premium ($6.15) that is nearly two times higher than the premium ($3.40) for uncertified preconditioning claims (see Table 2). The null hypothesis of equality of these coefficients is strongly rejected (see Table 3), which suggests that the difference in these premiums is statistically significant. Furthermore, the difference exceeds the additional participation cost of TPC ($1/cwt) on average. This implies that the same uncertified preconditioning work has lost more value than the cost savings obtained by avoiding the additional third-party participation cost. Therefore, at the same preconditioning cost, sellers would be worse off on average by not certifying their preconditioning claims through a third party. This evidence is consistent with the hypothesis in the literature that a low-cost TPC can partially separate feeder cattle under asymmetric information regarding the vaccinations and weaning claims towards preconditioning.

We also found that the premium for uncertified preconditioning claims is not statistically different than the premium for partial preconditioning claims, which has vaccinations but does not satisfy the minimum 30-day weaning requirement (either no date specified or specific information of less than 30 days weaning provided). This implies that the market pools these claims in value even though more work is claimed in the former than the latter, which refers to the pricing based on the average quality in the market under asymmetric information. The premiums for other partial preconditioning claims (those without claims on either vaccinations or weaning components) are estimated as significantly lower. These findings also point out that significant value can be lost if information is not delivered to the market even though all work is really done.

The estimated premiums for certified preconditioning claims are found to be higher compared to some of previous studies (Ward and Lalman, 2003, Avent, Ward, Lalman, 2004) but consistent with the others (King and Seeger, 2004 and Corah, et al., 2006). The parameter estimates for other explanatory variables are also consistent with the previous literature. Other things being equal, price decreases at a declining rate as weight increases; steers and bulls bring more than heifers; and hide color, horns, appearance and condition of cattle have an impact on price. The price increases with lot size up to the nearly 78 head of cattle, which is about truckload. Selling in a larger sale brings in additional price premium. The adjustments to feeder prices due to live cattle futures, cash corn prices, and seasonality are also estimated. The explanatory variables we considered take into account the main aspects of feeder cattle marketing decisions, therefore, the estimated regression equation should have practical value to producers as they can evaluate alternative production, preconditioning, and marketing strategies by plugging the relevant data. We provided an example for a typical scenario in the Application section.

Footnotes

[1] In the Iowa green tag program, calves must be vaccinated for IBR, BVD, BRSV, PI-3, 7-Way Clostridia, Haemophilus somnus, treated for internal and external parasites, castrated and dehorned, if necessary. They can be further vaccinated for Mannheima (formerly Pasteurella) and other diseases and/or implanted with growth promotant but these are optional. All vaccinations and health procedures must be done by a veterinarian. For gold tag level, calves must be revaccinated two weeks or later after the first round of vaccinations. Once these are done, green or gold tag are placed in the upper part of left ear of calf by the veterinarian. Calves can be sold as green or gold tagged but they are not considered as preconditioned yet, and are not supposed to be represented as such. To obtain preconditioning certificate, calves must be weaned at least 30 or 45 days for green and gold tag programs, respectively. In the certificate, additional information on weaning ration, breed type, and source (home raised or not), etc., can be provided but this is optional. More information about the preconditioning program can be found at the website http://www.iowavma.org.

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Table 1. Data Summary [a]

Variables (Part I)	Mean	Standard Deviation	Min	Max
Price ($)	120.4	14.5	90	186
Weight (lb)	589.5	131.8	305	1,265
Lot Size (head)	8.4	12.1	1	229
Sale Size (in thousand head)	1.64	0.81	0.31	4.14
Live Cattle Futures ($)	86.7	2.4	82.4	96.9
Corn Cash Prices (cents)	166.2	14.5	142.5	186.5

Variables (Part II)	Frequency	Percentage [b]
Yearling	879	4.4
Steer	10,439	52.1
Bull	606	3
Black and Black Mix	13,792	68.8
Certified Vaccinated and Weaned at least 30 days	7,123	37.2
Uncertified Vaccinated and Weaned at least 30 days	3,297	17.2
Vaccinated and Weaned Other (No date or less than 30 days)	2,092	10.9
Vaccinated but Not Weaned Calves	4,135	21.6
Weaned but Not Vaccinated Calves	849	4.4
Not Vaccinated and Not Weaned Calves	1,676	8.7

[a] (Number of observations: 20,051).

[b] Percentages are out of 19,172 lots for calves-only-categories, otherwise, out of 20,051 lots.

Source: see text.

Table 2. Estimated Premiums and Discounts at Iowa Feeder Cattle Auctions for Specific Cattle and Market Attributes, 2005-2006

Dependent Variable: (P) Average Lot Price /cwt Number of Observations: 20,051 lots, $\bar{R}^2 = 0.71$ Explanatory Variables [a]		Estimates ($) [b]	Chi-Square Statistics [c]
	Intercept	124.98	836.8
X_1	Weight	-0.17	1,813.7
X_2	Weight Squared	0.000059	363.4
X_3	Yearling	5.95	271.9
X_4	Steer	8.71	5,493.4
X_5	Bull	2.51	35.4
X_6	Black and Black Mixed	3.06	612.7
X_7	Horns	-1.70	26.6
X_8	Fleshy	-2.41	92.8
X_9	Sick and Dirty	-12.40	16.4
X_{10}	Sick and Not Dirty	-9.36	180.4
X_{11}	Healthy but Dirty	-1.18	15.1
X_{12}	Lot Size	0.33	365.8
X_{13}	Lot Size Squared	-0.002110	58.8
X_{14}	Sale Size (in thousand head)	2.54	82.8
X_{15}	Sale Size (in thousand head) Squared	-0.00028	17.9
X_{16}	Live Cattle Futures	0.72	428.3
X_{17}	Corn Prices (in cents)	-0.05	11.9
X_{18}	Monthly time dummy for November	1.55	28.6
X_{19}	Monthly time dummy for December	0.46	1.7
X_{20}	Monthly time dummy for January	3.39	40.6
X_{21}	Monthly time dummy for February	6.61	98.9
X_{22}	Certified Vaccinated and Weaned at least 30 days	6.15	518.5
X_{23}	Uncertified Vaccinated and Weaned at least 30 days	3.40	148.5
X_{24}	Vaccinated and Weaned Other (No date or less than 30 days)	3.14	108.4
X_{25}	Vaccinated but Not Weaned	2.42	84.0
X_{26}	Weaned but Not Vaccinated	1.70	18.1

[a] Bases: Calves, Heifer, Non Black, No Horns, Not Fleshy, Healthy and Clean, Monthly time dummy for October, Not Vaccinated and Not Weaned.

[b] All variables are significant with p-value < 0.0001 except monthly time dummy for December, which is not significant with p-value 0.19. P-values are based on chi-square statistics with one degree of freedom using heteroscedasticity robust standard errors.

[c] The values for t-statistics can be obtained by taking square root of the values of Chi-Square statistics.

Table 3. Tests on the Coefficients of Preconditioning Claims

Hypotheses:		Chi-Square Statistics	P-values [a]	Decision on Null Hypotheses (H_0)
$H_0: \beta_{22} = \beta_{23}$ $H_1: \beta_{22} \neq \beta_{23}$	Certified Vaccinated and Weaned at least 30 days vs. Uncertified Vaccinated and Weaned at least 30 days	280.44	<0.0001	Reject at the 1% level of significance
$H_0: \beta_{23} = \beta_{24}$ $H_1: \beta_{23} \neq \beta_{24}$	Uncertified Vaccinated and Weaned at least 30 days vs. Vaccinated and Weaned Other (No date or less than 30 days)	1.49	0.222	Do not reject at the 10% level of significance
$H_0: \beta_{23} = \beta_{25}$ $H_1: \beta_{23} \neq \beta_{25}$	Uncertified Vaccinated and Weaned at least 30 days vs. Vaccinated but Not Weaned	26.66	<0.0001	Reject at the 1% level of significance
$H_0: \beta_{24} = \beta_{25}$ $H_1: \beta_{24} \neq \beta_{25}$	Vaccinated and Weaned Other (No date or less than 30 days) vs. Vaccinated but Not Weaned	10.31	0.0013	Reject at the 1% level of significance
$H_0: \beta_{25} = \beta_{26}$ $H_1: \beta_{25} \neq \beta_{26}$	Vaccinated but Not Weaned vs. Weaned but Not Vaccinated	4.11	0.0427	Reject at the 5% level of significance

[a] P-values are based on chi-square statistics with one degree of freedom using heteroscedasticity robust standard errors.