



Factors Affecting Price Differences Between Wool and Hair Lambs in San Angelo, Texas

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Summary

Transaction records of 286,764 lambs sold in 25,916 lots at the largest sheep and lamb auction in the United States were collected from 2010 through 2014, in order to estimate factors affecting lamb prices. The data set was restricted to those lots where the average weight per lamb was between 40 pounds and 100 pounds. Lots were classified according to type (hair or wool). Type is an indicator of breed that best represents the lot. Wool lambs were primarily Rambouillet. Hair lambs were primarily Dorper. A hedonic price model was used to estimate price differentials for lambs sold

at auction in San Angelo, Texas. The fixed effects for type of lamb, year, month, weight class, lot size and 2-way interactions with type were significant sources of variation. The results indicate an overall discount of $\$3.42 \pm \0.33 per hundredweight for hair lambs relative to wool lambs. The discount was largest in 2011 ($\$30.72 \pm \0.51 per hundredweight). In 2012 the price paid for hair lambs was $\$9.62 \pm \0.61 per hundredweight higher than the price paid for wool lambs. The discount relative to wool lambs increased as lamb weights increased. Hair lambs sold for $\$3.18 \pm \0.83 per hundredweight more

than wool lambs in the 40-pound to 50-pound weight class. Wool lambs sold for $\$9.09 \pm \0.68 per hundredweight more than hair lambs in the 90-pound to 100-pound weight class. Prices increased as lot size increased. Wool lambs sold for a larger premium in the larger lot sizes. Wool lambs sold for $\$8.59 \pm \0.39 per hundredweight more than hair lambs when there were 35 or more lambs in the lot. The difference in price between hair lambs and wool lambs varied across years, months, weight class, and lot size.

Key words: Hedonics, Hair Sheep, Price Differentials, Lamb Auction, Texas

Introduction

Ranchers, as land or resource managers, continually seek production systems that will provide the greatest return to resources, management and risk. The area around San Angelo, Texas is suited for sheep production, with Texas being the nation's leading state for lamb production (NASS, 2015). Rambouillet has historically been the predominant sheep breed in Texas and much of the western United States. In the mid-1990s the Dorper was imported into the United States from South Africa. Sheep producers were interested in Dorper sheep because of their reported performance (Cloete et al., 2000) in arid conditions. Additionally, low wool prices of the late 1990s made wool production less attractive. The Dorper breed has a mix of hair and wool. While not strictly a hair breed, Dorper is a shedding breed that does not require shearing. For the purpose of this paper, Dorper will be considered a hair breed. The Dorper breed has increased in popularity to become the 3rd largest breed in number of sheep registered in the United States (Banner, 2015). Performance of Dorpers has been compared to U.S. breeds (Snowder and Duckett, 2003; Yeaman et al., 2013).

Many sheep producers sell their lambs at livestock auctions at, or shortly after, weaning. The largest live sheep auction in the United States is located in San Angelo, Texas. Lamb buyers at auctions include traditional lamb feeders, who feed lambs for the traditional lamb market, as well as those buying lambs for the non-traditional market. The livestock auction is where producers collect their primary market information (Williams and Davis, 1998). Formal analysis of lamb prices is limited. Ward (1984) focused on the impact of buyer competition and buyer market share on slaughter lamb prices, while Ward and Hildebrand (1993) studied factors affecting prices of slaughter lambs. No reports were found with estimates of factors affecting lamb prices for lambs sold at weaning. If producers are more aware of what factors affect the prices paid for lambs, then it will help them to make more profitable production and marketing decisions.

The objectives of this study are to 1) estimate the factors affecting prices paid for lambs sold at, or shortly after, wean-

ing in the San Angelo auction and 2) estimate the difference in value between hair sheep lambs and wool lambs. This information has the potential to strengthen the short-run decision making process of many sheep producers as they evaluate the production system best suited for their natural resources and management objectives.

Materials and Methods

Data

The transaction records from the weekly sales at Producers Livestock Auction Company years 2010 through 2014 were used for this study. The data included sales of 175,668 lots of sheep and goats. In a central market setting, sellers bring their animals to the sale facility. Auction staff typically sort a seller's animals into uniform groups according to type, weight and quality. If a seller delivers a group of 50 animals, they may sell as one lot if they are uniform, or be sorted into several lots to make each lot more uniform. The transaction records included number of head sold in the lot, price, total weight of the lot, and codes to describe the lot. Price was typically expressed as dollars per hundredweight (\$/cwt). Because prices are reported in \$/cwt, this paper uses pounds as the weight unit instead of kilograms. Some lots were priced by the head. Codes were used to distinguish among different classes of livestock. The data used in this study included only lots coded as lambs. Codes were also used to make a distinction among lambs of different types. The three types of lambs that made up the majority of the sales were 1) Rambouillet or other finewool breeds, which will be referred to as wool lambs, 2) Dorper or other hair sheep breeds which will be referred to as hair lambs, and 3) Suffolk or other blackface breeds, which will be referred to as blackface lambs. Because the goal of this study was to estimate factors affecting lamb prices received by typical range-flock lamb producers, and the majority of lambs produced in the area served by this auction are either Rambouillet (finewool) or hair breeds, transactions from lambs coded as blackface breeds were excluded. There were no codes for different breeds within those coded as hair sheep. The majority of lots coded as hair breeds were Dorper or Dor-

per-cross. A small proportion of the sheep coded as hair were Barbados Blackbelly or Katahdin, which are hair breeds. There was no code for a crossbred hair-wool lamb. The auction clerk chose a code that best represented the entire lot. There were 39,336 lots coded as lambs. Lots that were coded as blackface lambs (8 percent of the lots), shorn (6 percent of the lots) or had other codes indicating something unusual (approximately 5 percent of the lots) were excluded from further analysis.

Some of these lots (approximately 3.5 percent) were priced by the head instead of dollars per hundredweight. Lots that were typically priced by the head included those where the lambs were atypically small or young. The mean weight of lamb lots sold by the head was 33 pounds per head compared to the mean weight of 73 pounds for lambs sold by dollars per hundredweight. A small number of lots were sold by the head because of their value as potential breeding stock. All lots that were priced by the head were excluded from further analysis. After all edits, there remained 30,911 lots of lambs that were coded as either hair lambs or wool lambs and were sold by dollars per hundredweight. Table 1 shows number of lots, lambs, means of lot size, and weight, by year and type of lamb.

The wide range of lamb weights in the data set (Table 2) represents different segments of the lamb market. The light weight, young lambs were likely early weaned, or orphaned, or small for some other reason. The heavy weight lambs (> 100 pounds) have probably been on feed, rather than being recently weaned, and therefore were not representative of the target population for this study. The lambs with weights above 100 pounds were likely destined for the traditional lamb slaughter market. With the data available, there was no information to be used to divide the lots into the traditional categories of feeder and slaughter lambs. Therefore, to have a data set that is representative of the target for this study (lamb producers who sell lambs after weaning), all lots with an average weight less than 40 pounds or greater than 100 pounds were excluded.

After the weight restriction was applied, 25,916 lots with a total of 286,764 lambs remained in the data set. The average lamb weight was 70.8 pounds when each lot was weighted by

Table 1. Lots and lambs sold, number of head per lot, and average weight by year and type of lamb at San Angelo, TX.

Year	Hair				Wool			
	Lots	Lambs	Head/lot	Wt, lbs	Lots	Lambs	Head/lot	Wt, lbs
2010	2,939	31,798	10.8	66.2	3,410	45,358	13.3	76.8
2011	3,712	37,403	10.1	62.7	2,803	30,729	11.0	71.2
2012	3,087	26,641	8.6	72.8	2,006	22,005	11.0	84.3
2013	3,943	34,452	8.7	71.2	2,142	29,148	13.6	79.3
2014	4,915	41,298	8.4	70.4	1,954	21,794	11.2	79.2
All years	18,596	171,592	9.2	68.5	12,315	149,034	12.1	77.6

Table 2. Distribution of lots and lambs across weight classes within type of lamb sold at San Angelo, TX.

Weight Class	Pounds	Hair				Wool			
		Lots	Lambs	Lots, %	Lambs, %	Lots	Lambs	Lots, %	Lambs, %
1	< 20	1	8	0.01	< 0.00				
2	20 - <30	136	1,032	0.73	0.60	27	137	0.22	0.09
3	30 - <40	892	6,467	4.80	3.77	306	2,072	2.48	1.39
4	40 - <50	2,108	17,277	11.34	10.07	768	6,484	6.24	4.35
5	50 - <60	3,286	31,200	17.67	18.18	1,491	15,443	12.11	10.36
6	60 - <70	3,615	38,072	19.44	22.19	2,014	25,925	16.35	17.40
7	70 - <80	3,164	34,801	17.01	20.28	2,278	34,536	18.50	23.17
8	80 - <90	2,239	22,930	12.04	13.36	2,036	29,728	16.53	19.95
9	90 - <100	1,441	11,775	7.75	6.86	1,476	18,593	11.99	12.48
10	100 - <110	856	5,249	4.60	3.06	895	9,556	7.27	6.41
11	110 - <120	434	1,624	2.33	0.95	483	3,806	3.92	2.55
12	120 - <130	248	786	1.33	0.46	258	1,434	2.10	0.96
13	130 - <140	106	251	0.57	0.15	144	637	1.17	0.43
14	140 - <150	39	59	0.21	0.03	71	449	0.58	0.30
15	150 - <160	19	44	0.10	0.03	32	79	0.26	0.05
16	160 - <170	9	10	0.05	0.01	21	38	0.17	0.03
17	170 - <180	1	4	0.01	< 0.00	6	86	0.05	0.06
18	180 - <190	1	2	0.01	< 0.00	7	16	0.06	0.01
19	190 - <200	1	1	0.01	< 0.00	2	15	0.02	0.01
Total		18,596	171,592			12,315	149,034		

number of head in the lot. The distribution of lambs across 10 pound weight classes by type in this edited data set is shown in Table 3.

The number of head sold in each lot varied from 1 to 327. The mean number of head per lot was 9.2 head for hair lambs and 12.1 head for wool lambs (Table 1). The median of the distribution of lamb lots was 5 head. Number of head in each lot was assigned to lot-size categories as follows: A) 1 to 2 head, B) 3 to 5 head, C) 6 to 12 head, D) 13 to 34 head, and E) 35 or more head.

Statistical Analysis

Lamb prices, in dollars per hundred-weight, were analyzed with SAS PROC

Table 3. Percent of lots (L=25,916) and lambs (N=286,764) by weight class within type of lamb in edited data set

Weight Class, lbs	Hair		Wool	
	Lots, %	Lambs, %	Lots, %	Lambs, %
40 - <50	13.30	11.07	7.63	4.96
50 - <60	20.73	19.99	14.82	11.81
60 - <70	22.80	24.40	20.01	19.83
70 - <80	19.96	22.30	22.64	26.42
80 - <90	14.12	14.69	20.23	22.74
90 - <100	9.09	7.55	14.67	14.22

MIXED using a mixed linear model or hedonic price model (SAS, 2011) to estimate the price differences. The model included fixed effects for type (Hair or Wool), year (2010 to 2014),

month, weight class (six 10 pound classes), lot size (A, B, C, D, E), and all 2-way interactions with type. The model also included a random effect for sale day. The weight statement of PROC

MIXED was used to adjust for number of head in a lot. The LSMEANS statement of PROC MIXED was used to produce estimates and standard errors of least squares means of main effects and interaction effects. The ESTIMATE statement of PROC MIXED was used to produce estimates and standard errors of differences between least squares means.

Results

The trend from 2010 to 2014 has been an increasing proportion of hair lambs (Table 1) in the 40-pound to 100-pound weight range. The last year that there were more wool lambs than hair lambs was 2010, when hair lambs were 41 percent of all lambs sold. In 2014, hair lambs were 65 percent of all lambs sold. In general, hair lambs came to the auction at lighter weights than wool lambs. The data in Table 2 shows that the percentage of lambs in the weight classes less than 70 pounds was greater for hair lambs, while the percentage of

lambs in the weight classes greater than 70 pounds was greater for wool lambs.

The differences between the distributions of hair and wool lambs in the edited data set (Table 3) were similar to that shown in Table 2. Fifty-five percent of the hair lambs were in lots with an average weight of 70 pounds or less. Thirty-six percent of the wool lambs were in lots with an average weight of 70 pounds or less.

Because of the seasonal nature of sheep reproduction, there are substantial differences in numbers of lambs coming to market in different seasons of the year. The majority of lambs in the area from which the San Angelo auction draws are born in January, February, and March. Some flocks lamb earlier (October through December) or later (April and May). There are very few that lamb from June through September because of the high environmental temperatures and typically low quality of available pasture forage during those months. Lambs in the 40-pound to 100-pound weight range are

generally 4 months to 6 months old in the typical management systems used in this area. Consequently, the months with the lowest number of lambs sold within the 40-pound to 100-pound range were January with an average of 2,857 lambs sold per year and February with 2,210 lamb sold per year. There were from 5,318 to 6,861 lambs sold per month from March through September. Number of lambs sold per month decreased substantially in October and November for both types (Table 4).

A greater percentage of hair lambs came to market early in the calendar year, relative to wool lambs. June was the month with the highest number of lambs sold for both hair and wool lambs. Forty-three percent of the hair lambs were sold prior to June, whereas only thirty-six percent of the wool lambs were sold prior to June. Hair sheep reproduction is not as seasonal as wool sheep reproduction. Therefore a producer of hair lambs has the option of having lambs born earlier, which can be brought to the auction earlier in the year. Hair lambs coming to market earlier than wool lambs is likely a result of Dorpers being less seasonal in their reproduction than wool sheep. However, the lower weights of the hair lambs may also indicate that the hair lambs were coming to the auction at younger ages than wool lambs.

Table 5 provides information about the distribution of number of head per lot sold. The lot size categories were established so that each category included a significant proportion of the lots and lambs. The category with the smallest lots (1 to 2 head) included more than 25 percent of the lots, but less than 4 percent of the lambs. The category with the largest lots (35+ head) included only 5.5 percent of the hair lamb lots, but more than 30 percent of the hair lambs. The category with the largest lots (35+ head) included only 8.7 percent of the wool lamb lots, but more than 43 percent of the wool lambs. Thirty-five percent of the hair lambs were sold in lots of 12 or fewer head. Twenty-five percent of the wool lambs were sold in lots of 12 or fewer head. We do not have data to determine if the difference in lot size is due to hair lambs being brought to the auction in smaller lots, or hair lambs being divided into smaller lots by the auction staff in order to offer uniform lots of lambs.

Table 4. Number of lambs sold (40 to 100 pounds) and percent by month within type of lamb at San Angelo, TX 2010-2014

Month	Hair		Wool	
	Lambs	Lambs, %	Lambs	Lambs, %
January	8,454	5.4	5,834	4.5
February	6,248	4.0	4,803	3.7
March	17,397	11.2	13,388	10.2
April	16,932	10.9	9,656	7.4
May	17,325	11.1	13,234	10.1
June	17,741	11.4	16,564	12.7
July	14,315	9.2	11,296	8.6
August	15,122	9.7	15,126	11.6
September	14,620	9.4	13,666	10.5
October	10,533	6.8	13,424	10.3
November	9,225	5.9	7,546	5.8
December	8,143	5.2	6,172	4.7
Total	156,055		130,709	

Table 5. Percent of lots (L=25,916) and lambs (N=286,764) by lot size within type of lamb at San Angelo, TX 2010-2014

Head in Lot	Hair		Wool	
	Lots, %	Lambs, %	Lots, %	Lambs, %
1 - 2	27.9	4.0	25.0	2.7
3 - 5	26.0	10.2	23.0	6.9
6 - 12	24.5	20.8	23.4	15.0
13 - 34	16.1	33.2	19.9	32.0
35 +	5.5	31.7	8.7	43.4

Price Differences

All main effects and interaction effects were significant sources of variation for price ($P < .01$). Because of the significant interaction effects, the results of interest for this study are the least squares means estimates of the interaction effects (Table 6).

The least squares means estimates of the price for hair and wool lambs were $\$154.53 \pm \1.28 per hundredweight and $\$157.95 \pm \1.29 per hundredweight, respectively. However, the $\$3.42 \pm \0.33 (estimate of the difference \pm standard error of the estimate) discount for hair lambs was not uniform across years, months, weight classes or lot sizes.

Figure 1 illustrates price differences between hair lambs and wool lambs by year using the least squares mean estimates of this price model. There was substantial price variation during this five year period. The strong market of 2011 was followed by two weak years, which were followed by another strong year (2014). The price of wool lambs was significantly higher than hair lambs in 2010 and 2011. Feeder lamb prices in this period were being pulled successively higher by carcass prices that were on their way to record highs in July 2011. Carcass prices collapsed in early 2012 (Anderson, 2013). As market signals were transmitted back through the market channels, the price of wool lambs was significantly lower than hair lambs in 2012 and 2013.

Hair lambs are typically not sent to feedlots because they reach preferred levels of fatness at an earlier age or lighter weight than most wool breeds commonly used in the United States (Shackelford et al., 2012). Therefore, when lamb feeding was projected to be more profitable, wool lambs commanded a premium over hair lambs. From January of 2011 to January of 2012, Texas breeding-ewe numbers decreased by 18 percent (NASS, 2012), primarily because of drought in 2011 over much of the sheep producing regions of Texas. The number of lambs sold through this auction in 2012 decreased accordingly. The number of hair lambs sold within the 40-pound to 100-pound weight range in 2012 decreased by 30 percent from 2011. The total number of lambs sold in the same weight range increased the following year such that the number

Table 6. Least Squares Means and standard errors for Model Effects on Lamb Price.

Effect	Estimate	Hair	Wool
Year		\$/hundredweight	
2010	136.88 \pm 2.81	134.75 \pm 2.82	139.01 \pm 2.82
2011	185.72 \pm 2.78	170.36 \pm 2.79	201.08 \pm 2.80
2012	143.96 \pm 2.82	148.77 \pm 2.83	139.16 \pm 2.84
2013	128.22 \pm 2.90	131.78 \pm 2.91	124.65 \pm 2.92
2014	186.42 \pm 2.87	187.00 \pm 2.87	185.84 \pm 2.89
Month			
January	170.00 \pm 4.47	172.29 \pm 4.48	167.71 \pm 4.50
February	176.76 \pm 4.73	179.44 \pm 4.75	174.09 \pm 4.76
March	168.65 \pm 4.14	168.32 \pm 4.14	168.98 \pm 4.16
April	157.31 \pm 4.23	154.86 \pm 4.24	159.76 \pm 4.26
May	144.44 \pm 4.13	139.89 \pm 4.14	148.99 \pm 4.15
June	132.16 \pm 4.23	126.37 \pm 4.24	137.96 \pm 4.24
July	136.01 \pm 4.57	133.79 \pm 4.58	138.24 \pm 4.59
August	139.40 \pm 4.13	133.84 \pm 4.15	144.95 \pm 4.15
September	149.89 \pm 4.23	145.00 \pm 4.25	154.78 \pm 4.25
October	159.84 \pm 4.24	160.31 \pm 4.26	159.38 \pm 4.26
November	164.16 \pm 4.71	163.60 \pm 4.72	164.73 \pm 4.74
December	176.27 \pm 5.02	176.70 \pm 5.03	175.84 \pm 5.06
Weight Class, lbs			
40s	161.57 \pm 1.33	163.16 \pm 1.34	159.98 \pm 1.45
50s	164.64 \pm 1.30	164.65 \pm 1.31	164.62 \pm 1.36
60s	161.27 \pm 1.29	160.36 \pm 1.30	162.19 \pm 1.33
70s	156.46 \pm 1.29	153.88 \pm 1.31	159.04 \pm 1.32
80s	149.24 \pm 1.30	145.43 \pm 1.32	153.05 \pm 1.32
90s	144.26 \pm 1.31	139.72 \pm 1.37	148.81 \pm 1.34
Lot Size, Head			
1 - 2	146.78 \pm 1.39	145.80 \pm 1.44	147.77 \pm 1.55
3 - 5	152.69 \pm 1.32	152.80 \pm 1.34	152.57 \pm 1.39
6 - 12	157.28 \pm 1.29	156.58 \pm 1.30	157.97 \pm 1.33
13 - 34	160.83 \pm 1.28	158.15 \pm 1.29	163.51 \pm 1.30
35 +	163.63 \pm 1.28	159.34 \pm 1.30	167.93 \pm 1.30

Figure 1. San Angelo Lamb Prices by Type and Year; 2010-2014.

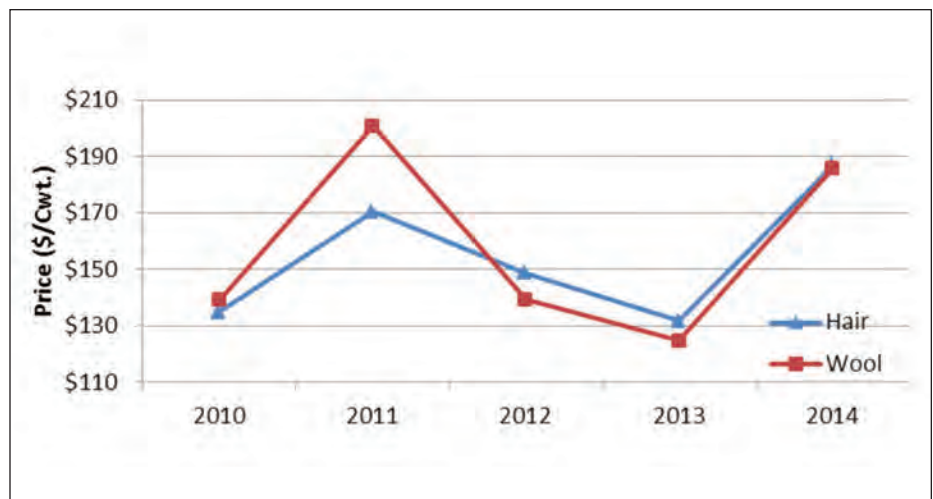


Figure 2. San Angelo Lamb Prices by Type and Month; 2010-2014.

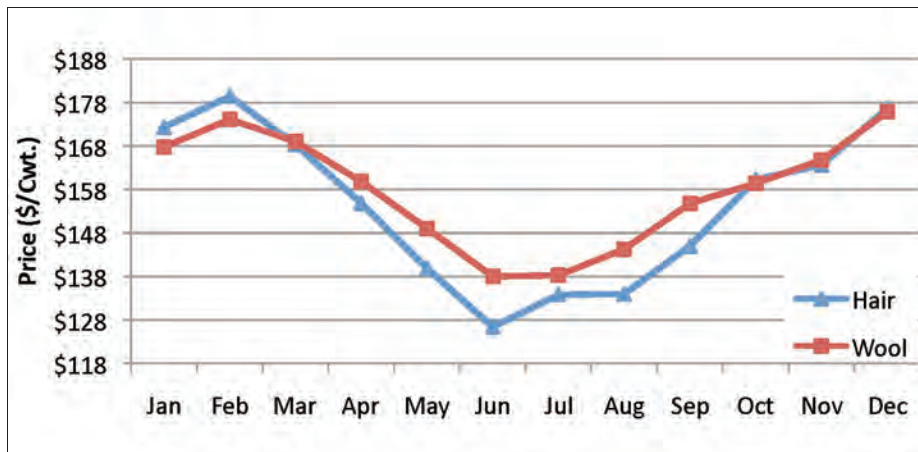


Figure 3. San Angelo Lamb Prices by Type and Weight Class; 2010-2014.

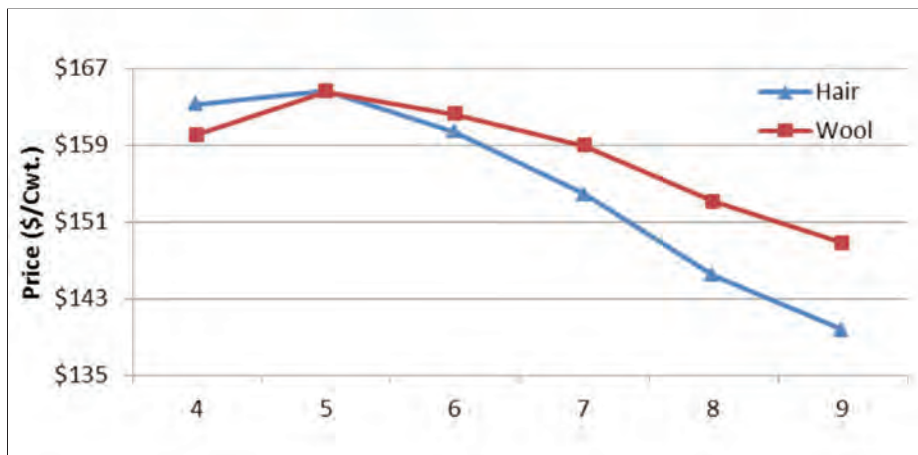
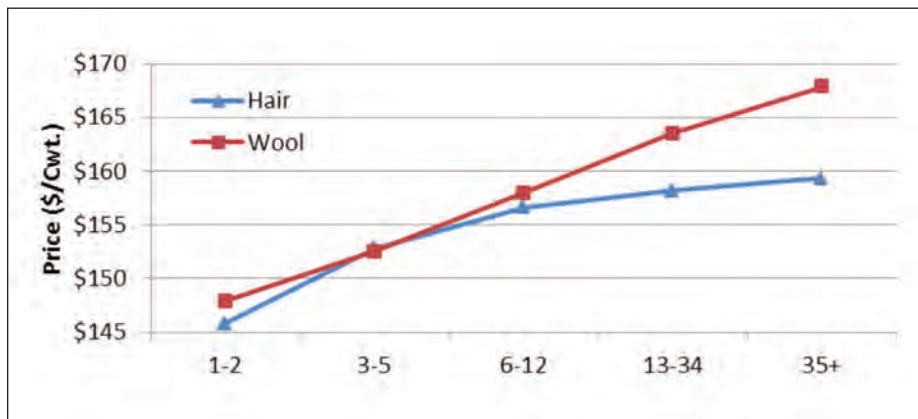


Figure 4. San Angelo Lambs Prices by Type and Lot Size; 2010-2014.



of lambs sold in 2013 was 5 percent below that of 2011. In 2014, the number of hair lambs sold increased and the number of wool lambs sold decreased. The increased proportion, and number, of hair lambs sold after 2012 suggest that as sheep producers, both commercial and small acreage, were restocking after the

2011 drought, they did so with hair sheep more than wool sheep. There was a significant premium paid for hair lambs in 2012 ($\$9.62 \pm \$0.61/\text{cwt}$) and 2013 ($\$7.13 \pm \$0.53/\text{cwt}$). From 2012 to 2014 there was an increasing proportion of hair lambs sold (Table 1). It is likely that producers were obtaining replace-

ment-ewe lambs to be used as breeding stock through this auction market, which contributed to the premium paid for hair lambs. However, sex of lamb was not recorded at the auction, so this cannot be verified from the available data.

Both types of lambs displayed traditional seasonal price movement (Table 6 and Figure 2). This pattern results from the seasonal reproduction of sheep in Texas, with most producers lambing in late winter through early spring, producing an associated increase in sales volume in May and June (Table 4). The months with the greatest number of hair lambs were March, April, May, and June. The months with the greatest number of wool lambs were June, August, September, and October. The largest difference in price was observed in June where the price of hair lambs was $\$11.58 \pm 0.64$ per hundredweight less than that of wool lambs. In January and February the price of hair lambs was significantly greater than the price of wool lambs. In January the lambs coming to the auction are a mix of old-crop and new-crop lambs. Old-crop lambs were born in the late spring of the previous calendar year. New-crop lambs were born in the fall of the previous year. Because of the less seasonal reproduction of hair-sheep breeds, the hair lambs coming to market in January and February are more likely to be new-crop lambs and the wool lambs are more likely to be old-crop lambs. At similar weights, new-crop lambs sell for a higher price than old-crop lambs.

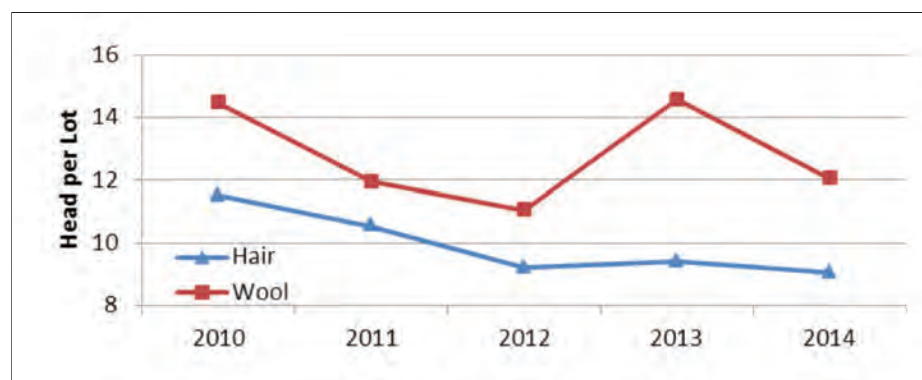
Prices per hundredweight generally decreased at successively higher weight classes. The highest prices were paid for lambs in the 50-pound to 60-pound weight class. Figure 3 presents the difference in lamb price by weight category. This figure can be interpreted as suggesting that at progressively heavier weights, hair sheep lambs receive an increasingly larger discount relative to wool lambs. Hair lambs sold for $\$3.18 \pm \0.83 per hundredweight more than wool lambs in the 40-pound to 50-pound weight class. The price advantage shifted toward wool lambs as lamb weight increased. Hair lambs sold for $\$9.09 \pm \0.68 per hundredweight less than wool lambs in the 90-pound to 100-pound weight class. This indicates 1) a market preference for lighter hair lambs, and 2) greater market competition for the heavier wool lambs. Wool lambs weighing from 70 pounds up

to 100 pounds are likely being sought for targeted slaughter markets, as well as by feeders looking to place them into feedlots. Hair lambs in these weight ranges are typically being purchased for the slaughter market only. The price differentials at weights above 70 pounds, illustrated in Figure 3, may also be symptomatic of thinner hair-lamb markets at these weights. Again, the percentage of lambs in the weight classes greater than 70 pounds was greater for wool lambs.

Prices tended to increase as lot size increased (Table 6 and Figure 4). The positive relationship between lot size and price has been well documented for feeder cattle (Faminow and Gum, 1986; Schroeder et al, 1988). Menzie et al.'s (1972) explanation of minimizing transaction costs remains plausible. The percentage of hair lambs in the San Angelo auction market has increased from 41 percent in 2010 to 65 percent in 2014. This rapid expansion may have come at the expense of uniformity as producers adapted their production systems to accommodate hair sheep. As the uniformity of groups of animals brought to the auction market decreases, auction staff sort the animals into smaller more uniform groups, Figure 5. The reduction in lot size may also be attributable to increased production from small acreage producers, who will initially deliver smaller "trailer loads" to the auction facility and then have those groups sorted into even smaller, more uniform lots. Realized-auction prices tend to increase with lot size, but the increase is more pronounced for wool lambs (Figure 4). Hair lambs do not appear to receive as great a premium for increased lot size. This largely reflects the heterogeneous nature of the non-traditional lamb market. Buyers responsible for sourcing lambs for these non-traditional markets are required to buy a wide variety of lambs. This may require lambs at different ages or weights, specific gender (intact male, ewe lamb or wether) or other specific criteria and may discourage bidding on larger lots of lambs.

The random effect of sale day accounted for 12 percent of the variation after the model was fitted. The variance component estimate for sale week was 373 and the residual variance was 2816. Sale-week effects can be from differences in short-term supply or demand. Short-term supply changes can be due to

Figure 5. Lot Size of Lambs Sold at San Angelo; 2010-2014.



weather events, such as rain in the days prior to the sale, which can result in fewer lambs brought to market. Short-term demand changes may be due to holidays, which are associated with lamb consumption. An analysis of the sale-week effects is needed, but is beyond the scope of this paper.

Conclusion

The analysis of lamb prices at the largest sheep auction in the United States was initiated to provide livestock producers more complete information on the differences between the recently introduced hair sheep breeds and the more traditional Rambouillet sheep. Hair lambs and wool lambs both exhibit seasonal price patterns that are driven by the seasonal reproduction of sheep.

The interaction of weight class by type of lamb suggests that at higher weight classes, hair lambs are subject to a greater price discount than wool lambs. This may be due to market preferences for lighter hair lambs or to wool lambs having two distinct market channels; slaughter markets or feeder markets. Hair sheep typically reach preferred levels of fatness at lower weights and are not as likely to enter the feedlot channel. Individual producers will need to incorporate a cost of production analysis to more closely identify optimal market weights.

Increased lot size generally translates to higher realized bid prices at auction for both types of lamb. Wool lambs benefit from a larger lot size premium than hair lambs. Additional market-channel research is necessary to identify the factors driving this response. Producer-management ability will be key to

increasing overall flock quality (sire and dam selection and breeding management) to limit sorting at the auction market.

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