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RELATIONSHIP BETWEEN CATTLE PRICES AND SALES VOLUMES ON TENNESSEE AUCTION MARKETS

Dan L. McLemore, Emily A. McClain, and Glen D. Whipple*

Abstract

Regression analyses of feeder cattle and utility cow prices on Tennessee auction markets for 1982-83 showed that prices were significantly higher on markets with larger sales volumes than on markets with smaller volumes. Higher prices may result from increased buyer competition or from lower buyer operating costs per head on larger markets. Significant price differences were also found among market locations, sale days, and animal weighing practices.

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Introduction

Price differences among livestock markets are a source of concern to cattle producers, buyers, and market operators. Conventional wisdom implies that, at a given point in time, prices should typically be higher on markets that have larger sales volumes. Rationale for this rests heavily on the idea that larger numbers of livestock at a given market will attract larger numbers of buyers resulting in increased buyer competition and higher prices at that market.

This supposed linkage between numbers of livestock and the level of prices is based upon demand considerations only. It ignores the possibility that larger numbers of livestock may depress prices, other things being equal. Logic would suggest that the critical factor is whether the ratio of livestock to total buyer demand is smaller or larger in markets with larger volumes. If the ratio is smaller, increased buyer competition and higher prices should result.

A second reason to expect larger volumes to lead to higher prices is that, if buyers are able to purchase a larger or more uniform quantity of livestock on a single day at a larger market, buyers' costs of operation per head should be lower. This lower cost would enable buyers to pay higher prices at larger markets. However, this reasoning seems to be at least partially dependent upon the existence of a higher ratio of livestock numbers to buyer numbers at larger markets. Also, while lower buyer operating costs

per head would enable buyers to pay higher prices for livestock, competitive pressure among buyers would be necessary to force buyers to actually do so.

The question of whether greater sales volume leads to higher prices on individual markets has been explored by researchers with mixed results. Badenhop found that the relationship between sales volume and price was not clear for Tennessee auction markets for the 1953-55 period. However, there appeared to be some evidence that prices were somewhat higher on larger markets. A comprehensive study for the Southern region for the same time period also showed mixed results (Stout and Freund). Williamson et al., in a study of Virginia graded feeder cattle sales from 1951 to 1956, found a positive relationship between sales volume and price for steers but not for heifers. A study of Alabama auctions by Meadows and Danner found that prices were higher on larger auctions in 1962. However, Ssekitooleko and Kuehn found that prices were lower on larger feeder cattle auctions in West Virginia for 1976-77. A follow-up study by Kuehn for 1978 showed that prices increased as sale size rose from small to medium sizes, but prices fell as sale size increased from medium to large sizes.

Some of these results suggest that the conventional wisdom may not be valid. The research reported here was intended to provide additional evidence concerning the relationship between price differences and sales volume differences among livestock auction markets. Information on Tennessee markets was used to examine this relationship. Since feeder cattle and cull cows make up most of the volume on Tennessee auctions, these two types of livestock were chosen for analysis.

Several factors other than sales volume may affect price differences among markets within Tennessee. Three of these factors that are observable

are: 1) the geographic location of the market, which affects prices through distance to points of next use of the livestock; 2) day of the week on which the sale is held, which may affect price because of varying demand or supply patterns during the week; and 3) whether the particular market weighed animals as they were unloaded (in-weight) or as they were sold (out-weight), which affects prices because of animal shrinkage during marketing (out-weight markets typically exhibit higher prices). These three variables were included in the analysis to help isolate the effect of market volume on price.

Method

The hypothesized relationship between price and sales volume was tested by use of regression models that specified daily price in each market relative to the weekly average price over all markets, as a function of annual volume in each market relative to annual average volume over all markets. Daily prices in individual markets were expressed as ratios of average prices for all markets for a given week. Likewise, volumes in individual markets were expressed as ratios of average volumes for all markets. The use of ratios or indexes was intended to remove the affects of price and volume cycles, trends, or seasonality, any of which might obscure the relationship of interest. Dummy variables were included to account for price differences associated with market location, sale day, and weighing practice (in-weight or out-weight).

Daily price data on feeder cattle and on cull cows for 1982 and 1983 from 16 auction markets in Tennessee were used to estimate the parameters of the

models.[1] These markets make up the price-reporting sample used by Federal-State Market News and represent a cross-section of Tennessee auctions with respect to both sales volume and geographic location. The markets included in the study, along with information on each market, are shown in Table 1. Data on prices and sales volume were obtained from unpublished Federal-State Market News records. Prices for feeder cattle were for medium frame, number 1 muscled, 400-500 lb feeder steers. Prices for cows were for utility grade cull cows of all weights. A total of 1,436 daily price observations were available for feeder cattle, and 1,443 were available for cows. Volume data represented total head of cattle and calves sold annually on each market for 1982 and 1983.[2]

The complete regression model may be written as follows:

$$\frac{P_{ij}}{\sum_{i=j}^{n} P_{ij}/n} = \alpha + \beta_1 \frac{V_i}{\sum_{i=1}^{n} V_i/n} + \beta_2 L_1 + \beta_3 L_2 + \beta_4 D_1 + \beta_5 D_2$$

$$+ \beta_6 D_3 + \beta_7 D_4 + \beta_8 W$$

where:

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[1]Each market had only one sale day per week.

[2]Use of annual volume data was necessitated by the lack of appropriate weekly volume data. While weekly volume data might be preferable to match the weekly price data, relative annual volume should represent relative weekly volume reasonably well over several weeks. Buyers' expectations as to volume at a given market, and thus their willingness to attend the market, are probably based on experiences over several weeks or months.

Table 1. Characteristics of Selected Livestock Auction Markets in Tennessee, 1982-83

Market location	Annual sales volume 1982	Annual sales volume 1983	Sale day	Weighing practice	Geographic area[a]
	- - - - head - - - -				
Chattanooga	30,733	30,248	Mon.	Out	East
Columbia	29,832	23,513	Mon.	Out	Middle
Columbia	29,708	28,234	Thurs.	Out	Middle
Cross Plains	18,298	15,833	Mon.	Out	Middle
Dickson	50,299	52,186	Tues.	Out	Middle
Fayetteville	51,251	48,785	Thurs.	In	Middle
Huntingdon	29,493	33,124	Tues.	Out	West
Knoxville	61,019	63,732	Wed.	Out	East
Lebanon	9,101	7,495	Thurs.	In	Middle
Lexington	18,359	18,662	Mon.	Out	West
Maury City	26,371	28,231	Wed.	Out	West
Murphreesboro	15,246	16,964	Fri.	In	Middle
Pulaski	23,163	27,111	Fri.	Out	Middle
Sweetwater	48,629	52,960	Wed.	Out	East
Trenton	13,749	14,055	Thurs.	Out	West
Unionville	34,628	28,725	Wed.	In	Middle
Total	489,879	489,858			
Mean	30,617	30,616			

[a]Classification of markets as to geographic area was made according to the traditional "grand divisions" of Tennessee (East, Middle, and West).

P_{ij} is daily price in dollars per cwt on the ith auction market during the jth week (j = 1 through 104).

n is the number of markets reporting prices during the week (normally n = 16).

V_i is total annual volume (head of livestock) sold through the ith market.

L_1 and L_2 are 0,1,-1 dummy variables representing geographic section in which the market is located (East, Middle, or West Tennessee--West omitted).

D_1---D_4 are 0,1, or -1 dummy variables representing day of the week on which the sale was held (Monday through Friday--Friday omitted).

W is a 1 or -1 dummy variable representing weighing practice at the market (in-weight = 1, out-weight = -1)

In the cases of the location and sale day dummy variables, the final classes (West and Friday) were omitted to avoid matrix singularity during estimation. When an omitted class occurred the other dummy variables in the set were assigned a -1 value. For the weighing practice dummy (W), a 1 or -1 configuration was used. This method allowed comparisons between each of the classes and the mean or overall relationship between relative price and relative volume. It also prevented imbedding the effects of any of the classes in the intercept (α). Thus, statistical tests of significance for the coefficients on dummy variables are tests for differences between the class

represented by the coefficient and the mean of all the classes in that set (Pindyck and Rubinfeld, pp. 135-137).[3]

Results

The regression model parameters were estimated by ordinary least squares for feeder cattle and for utility cows separately. Estimated coefficients and associated standard errors are shown in Table 2. R^2 values were 0.08 for feeder cattle and 0.27 for cows. The low R^2 values suggest that there are other important factors that contribute to variations in prices among markets. However, the coefficients on relative volume in both equations were highly significant. Both coefficients were positive indicating that markets with relatively large volumes of sales showed relatively high prices. Based upon the coefficient for feeder cattle, markets with an annual volume that was 10 percent above the mean volume for all markets had feeder cattle prices 0.38 percent above the mean feeder prices for all markets. The coefficient for cows showed that markets with a volume that was 10 percent above the mean volume had prices 0.34 percent above the mean price. Over the range of market volumes reported in Table 1 for 1983, differences of $5.18 per cwt for feeder cattle and $2.35 per cwt for utility cows are implied at annual mean prices ($64.88 for feeder cattle and $38.51 for cows).

The association between larger volume and higher prices may reflect the existence of more competition among a larger number of buyers. On the other hand, it may be due to reduced buyer operating cost per head purchased when

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[3]The coefficients for the omitted classes were calculated by finding the negative sum of the estimated coefficients for the other classes in the set.

Table 2. Estimated Coefficients and Standard Errors from Regression Equations for Relative Prices of Feeder Cattle and Cows on Tennessee Auction Markets, 1982-83

Variable	Feeder cattle		Cows	
	Coefficient	Std. error	Coefficient	Std. error
Intercept	0.9559[a]	0.0047	0.9632[a]	0.0036
Relative volume	0.0380[a]	0.0042	0.0335[a]	0.0033
Geographic area				
East	-0.0180[a]	0.0031	0.0011	0.0024
Middle	0.0040	0.0022	-0.0105[a]	0.0017
West	0.0140[a]	0.0028	0.0093	0.0022
Sale day				
Monday	0.0099[a]	0.0029	0.0110[a]	0.0022
Tuesday	-0.0088[b]	0.0037	-0.0101[a]	0.0029
Wednesday	-0.0064[b]	0.0029	-0.0109[a]	0.0022
Thursday	0.0026	0.0025	-0.0001	0.0019
Friday	0.0027	0.0036	0.0101[a]	0.0027
Weighing practice				
In-weight	-0.0051[a]	0.0019	-0.0125[a]	0.0014
Out-weight	0.0051[a]	0.0019	0.0125[a]	0.0014
R^2	0.08		0.27	

[a]Statistically significant at the .01 level.

[b]Statistically significant at the .05 level.

the buyer is exposed to a larger volume of livestock at a given market on a single sale day. This reduced cost of operation to the buyer may result from larger, more uniform loads purchased at a single market and/or from the buyer having to travel less and spend less time at different markets.

Estimated coefficients on the dummy variables representing geographic location of the markets showed that feeder cattle prices were significantly higher than the state average in West Tennessee and significantly lower than average in East Tennessee. This result seems consistent with the typical shipment pattern of feeder cattle from Tennessee to feeding areas to the west. Prices for utility cows were lowest in Middle Tennessee and highest in West Tennessee, reflecting the relative locations of cow slaughtering plants and cow herd concentrations in the state.

Differences in sale days also were significant in some cases. Prices on Mondays were higher than average while prices on Tuesdays and Wednesdays were lower than average for both feeder cattle and cows. Friday prices were higher than average for cows. Higher Monday prices may indicate buyers' needs to fill orders early in the week for feeders and cows, while higher Friday prices for cows probably result from the need for Monday morning slaughter supplies.

The coefficients on the weighing practice dummy variables were also statistically significant for both feeder cattle and cows. As expected, in-weight markets showed lower prices. This result reflects the price adjustment made by buyers for weight loss in livestock between arrival at the market and actual sale.

Conclusion

Regression analyses of 1982 and 1983 data for 16 Tennessee auction markets indicate that prices tended to be higher on markets that handled

larger volumes of livestock. This result was true for feeder cattle and utility cows. Prices for feeder cattle tended to be higher in West Tennessee than East Tennessee. Sale day had a significant effect on price, with Monday showing higher prices and Tuesday and Wednesday showing lower prices for feeder cattle and cows. Prices tended to be lower on in-weight markets reflecting buyers' assessments of livestock shrinkage between unloading and sale.

The positive relationship between volume and price suggests either that buyer costs were lower on markets with larger volumes or that increased buyer competition reduced profit margins of buyers on markets with larger volumes. In either case, producers should consider selling through larger markets. Since larger markets imply higher producer transportation costs, the possibility of higher prices should be compared with those higher costs. Policy decisions concerning licensing of additional markets should be made in light of these findings.

References

Badenhop, M. B. Marketing Cattle and Calves Through Auction Markets in Tennessee, Bulletin 247, Agricultural Experiment Station, University of Tennessee, 1956.

Kuehn, J. P. An Analysis of the West Virginia Livestock Auction Pricing Mechanism. R. M. No. 77, Agricultural and Forestry Experiment Station, West Virginia University, 1979.

Meadows, J. R., and M. J. Danner. Movement of Cattle and Calves Through Alabama Auction Markets, Bulletin 360, Agricultural Experiment Station, Auburn University, 1965.

Pindyck, R. S., and D. L. Rubinfeld. Econometric Models and Economic Forecasts, 2nd ed., New York: McGraw-Hill Book Company, 1981.

Ssekitooleko, G. W. M., and J. P. Kuehn, Selected Factors Affecting Feeder Calf Prices in West Virginia, Bulletin 671, Agricultural and Forestry Experiment Station, West Virginia University, 1979.

Stout, R. G., and R. J. Freund. Marketing Cattle and Calves Through Southern Auctions--Analysis of Factors Contributing to Price Variation, Bulletin 54, Southern Cooperative Series, 1958.

Williamson, K. C., R. C. Carter, and J. A. Gaines. "Effects of Selected Variables on Prices of Calves in Virginia Feeder Calf Sales." Journal of Farm Economics, 43(1961):697-706.