Comparison of Livestock Price Forecasting Using Simple Techniques, Forward Pricing and Outlook Information

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Agricultural price instability has increased in the past several years increasing uncertainties in forming commodity price expectations. Increasing uncertainty of price expectations complicates farm firm decisions related to production, investment, and commodity selling. Production decisions whether made through simple strategies or analytically complex methods are dependent upon price expectations. In particular, production response decisions to commodity price changes are directly related to the accuracy of price expectations.

This paper examines and compares the estimation variability of several methods of forming livestock price expectations including methods of using simple techniques, forward prices and farm outlook information. An intermediate period of time of four months is used placing the context of the study on short-run production adjustment opportunities. Hence, the emphasis is not on a shorter-run commodity selling framework nor on long-run investment behavior. The accuracy of the simple price expectation models is not expected to be outstanding. Nonetheless, they are included as representative of an unlimited number of models used by producers including varying degrees of objectivity and subjectivity. The past is very frequently included in simple models as a primary basis or context.

A great deal of study has been given to related aspects of commodity price instability. These include risk models, diversification techniques, and simulated behavior of firms. For commodity price forecasts, a large number of econometric models have been estimated. A number of farm firm response adjustment models have been developed utilizing improved information (price estimates)

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in an optimizing framework. On the macro level, supply adjustment models, and simulated models of commodity sectors have studied both short and long-run response to commodity price movements. Surprisingly, little effort has been directed toward the study of price expectations formed by producers in evolving economic conditions.

Procedure

A hypothetical livestock feeding situation was created to compare actual livestock prices with expected prices formed by different forecasting techniques. Both cattle feeding and hog feeding situations were considered. Therefore, comparisons can be made not only among forecasting methods, but also in their effectiveness between cattle and hogs.

Eighteen continuous four month feeding programs were examined between June, 1969 and February, 1975. The producer is assumed to consider feetlot placement of feeder steers and pigs contingent upon prices at the market time four months in the future. Market prices were based on 900-1100 lb. choice steers and 200-220 lb. butcher hogs at Omaha, Nebraska. (USDA Livestock and Meat Statistics).

Two statistical measures of the performance of the forecasting techniques were made. The *average residual* was found from the difference between actual and predicted prices. It measures the bias of the estimator over the total 18 periods. The *standard error of residual* is a measure of the variability of the estimate. This variability estimate is based on squared residuals. Both statistical measures are critical to an evaluation of the accuracy of forecasting techniques. Some projection models were based on historical prices; hence, such estimators are unlikely to be unbiased. It is possible for an estimation technique to be

highly biased, yet have a low variability of estimation. Similarly, a forecasting method may have a low bias characteristic but have a high variability of estimation.

All simple price expectation models were based upon price data in a non-retrospective sense, i.e. each model used price information from an earlier period than the period studied and/ or the most current data at the time of projection.

Price Forecasting Models

Eight price expectation models were analyzed. These may be classified as simple, forward prices and outlook.

Simple Models

Model 1 estimated the livestock price for the future four month period to be the same as the corresponding week of the previous year.

In Model 2 forecasted price was the price currently experienced, e.g. expected price for June 15, 1969 same as the price received February 15, 1969, the time of the projection.

A random selection process generated price expectations in Model 3. Specifically, the expected prices were randomly selected from the previous 52 average weekly quotations, e.g. during the week of February 15, 1969 the feeder would randomly select a quotation from the pool of weeks between February 15, 1968 to February 15, 1969 to obtain an expected value for June 15, 1969.

In Model 4 a short-term (one year) average of previously observed prices was found e.g. the expected price for the week of June 15, 1969 was found as the average of prices quoted between February 15, 1968 and February 15, 1969.

Model 5 employed an eight month linear trend of prices extrapolated four months into the future. The expected price, for example, for June 15, 1969 was obtained from a trend from July 15, 1968 through February 15, 1969 projected to June 15, 1969.

Forward Prices

In Model 6 future price quotations for the relevant month are chosen four months earlier (Chicago Mercantile Exchange). Future prices for June 15, 1969 delivery are determined from the week of February 15, 1969, for example. No contracts are executed in this model thus, future prices are used only for price expectation purposes.

Outlook Information

In Model 7 price expectations were formed four months in advance from 1969-74 issues of *Successful Farming.* The outlook information available to feeders is quite subjective; hence, judgemental errors of the forecast influence the accuracy of the forecast as well as the forecast itself.

The second outlook information model (Model 8) was based on USDA forecasts over the time period. (USDA Livestock and Meat Situation). These forecasts appeared to be somewhat less subjective than forecasts in Model 7.

Results and Conclusions

The results of the eight price forecasting models are presented in table 1. Rankings are made with respect to estimation variability for the average residual and standard error of residual criteria. The size of errors were higher for each model when applied to hogs compared to cattle.

Cattle

Generally there was little difference between price forecasting models in regard to estimation variability. Standard error of residual estimates ranged from 4.61 to 6.08. Some simple models (Models 2, 3, and 4) performed nearly as well as the most accurate model (Model 8) and better than outlook Model 7 and forward price Model 6. Model 2 employed current prices and Model 4 used a yearly average. Surprisingly, Model 3 in using random prices from the past performed relatively well. The use of a linear trend (Model 5) and the use of prices of a comparable week a year earlier (Model 1) were less acceptable from an estimation variability standpoint. Forward pricing (Model 6) ranked in an intermediate position with respect to its accuracy, essentially no better

Table 1. Estimation properties of eight price forecasting models *

	900-1100 lb. Steers		200-220 lb. Hogs	
	Average residual	Standard error of residual	Average residual	Standard error of residual
Model	--------------------- *dollars* ---------------------			
1 (week of previous year)	1.69(7)	5.94(7)	2.46(7)	7.92(8)
2 (extension of current)	.37(2)	4.90(2)	1.07(3)	6.18(3)
3 (random from past year)	.59(4)	5.26(4)	1.24(4)	6.26(4)
4 (past yearly average)	1.40(6)	5.03(3)	2.18(6)	7.15(6)
5 (linear trend)	- .66(5)	5.67(6)	.20(1)	6.01(2)
6 (forward pricing)	- .39(3)	5.59(5)	.64(2)	6.96(5)
7 (*Successful Farming*)	1.71(8)	6.08(8)	2.48(8)	7.34(7)
8 (USDA *Livestock and Meat Situation*)	.04(1)	4.61(1)	1.69(5)	5.99(1)

*Numbers in parentheses refer to ranking of models starting with least average or standard error of residual.

than simple models. Forecasts from *Successful Farming* had the greatest variability of all methods. The USDA price projections ranked first among all methods.

The level of the average residual or bias largely followed the rankings for standard error of residuals. Not surprisingly, most methods underestimated cattle prices during this period of generally rising prices. Price estimates by USDA resulted in a very low average residual. Models 1 and 4 using historical prices had relatively high average residuals. Forecasts from *Successful Farming* had the highest average residual of $1.71 from actual prices. While most rankings between the two statistical measures were consistent for the models, Model 4 was an exception. Model 4 (past yearly average) had a high average residual but avoided large errors.

Hogs

Higher standard errors of residual and a greater range of standard errors of residual were observed for hogs compared to cattle. Considering estimation variability of simple models, Models 2 and 3 performed relatively well for hogs as was observed for cattle. Model 5 using a linear trend was the other simple strategy performing well for hog price estimates. Its standard error of residual estimate was only .02 greater than the most accurate forecasting technique (Model 8). Of the simple models, Models 1 and 4 had relatively high levels or estimation variability. Forward

prices (Model 6) ranked fifth for hogs, the same relative ranking as in cattle price estimates. Outlook information from USDA was the most accurate forecasting model, yet only slightly better than simple Models 2, 3, and 5. *Successful Farming* forecasts demonstrated a relatively high estimation variability exceeded only by Model 1.

All hog price projection models underestimated prices. The level of bias indicated by the average residual was higher for hogs than for cattle. The linear trend model (Model 5) had the smallest average residual of all methods. As with cattle, relative rankings with respect to standard error of residual follow closely the rankings for average residual. Two exceptions occur in this regard. Model 6 (forward pricing) had a relatively low average residual yet a relatively higher ranking in estimation variability. The USDA estimate had a relatively large positive average residual yet had the lowest estimation variability of all methods. The average residual of 1.69 is much higher than was observed for hog price estimates (.04).

Implications

It is likely that the results of the previous analysis would change for analyses of other time periods. The time period analyzed here included generally increasing but widely varying livestock price movements. The size of errors suggests that efficient resource allocation is very difficult under such economic conditions. Also prices were generally underestimated by the methods analyzed,

causing additional concern about efficient resource allocation.

A major conclusion of this analysis indicates that of the methods studied, little confidence can be placed in one method over another. Simple "rule of thumb" price projections should hardly be ruled out, yet must be treated with caution. Caution must also be given to the choice of outlook information. A major conclusion of this study is that as much difference exisits between outlook methods in price projection capacity as between simple vs. outlook, etc.

Because price expectations are critical to production decisions, the results suggest that more research emphasis could well be placed on the testing and development of commodity price projection models for agriculture. Models other than those examined here should be tested and price projection accuracy of all models reexamined over time. Perhaps simple models could be the comparison base against which to compare model performance.

References

Chicago Mercantile Exchange, *Chicago Mercantile Exchange Yearbook.* Market News Department, Chicago, 1968-74.

Successful Farming. Meredith Corporation, Des Moines. 1968-75 issues.

U.S. Department of Agriculture. *Livestock and Meat Situation.* ERS, Washington, 1968-74 issues.

U.S. Department of Agriculture. Livestock and Meat Statistics. ERS, SRS, Washington, 1968-75 issues.