ARE CATTLE ON FEED REPORT REVISIONS RANDOM

AND DOES INDUSTRY ANTICIPATE THEM?

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Abstract

Cattle on Feed (COF) reports are an important source of beef supply information. This study investigates whether COF report revisions are unbiased, random, and anticipated. Initial COF reports are biased, but the bias is economically small. Revisions to COF estimates are not random. Market analysts do not correctly anticipate revisions.

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The *Cattle on Feed* (COF) report is the most important source of new supply information to the beef industry. New information contained in the COF report often significantly impacts live cattle futures prices (Grunewald, McNulty, and Biere; Colling and Irwin). Many industry decisions, including marketing and risk management strategies, cattle production, processor investment, and policy developments rely on accurate COF estimates. Because of the importance of the report, its sizable short-run market impact, and its influence on long-run decisions, understanding its accuracy over time is critical.

The general purpose of this study is to determine the accuracy of initial USDA COF reports relative to revised reports released later. All *Cattle on Feed* reports explicitly stipulate that sampling variability may exist, as well as many forms of non-sampling error (omissions, duplications, and mistakes in reporting, recording, and processing data). Small random errors in COF reports are inevitable. However, systematic error would suggest correctable sampling error. The first objective is to determine whether the *Cattle on Feed* report is efficient. Efficiency here specifically refers to whether report revisions are unbiased, random, and unrelated over time. Efficiency of cattle on feed, placements on feed, and fed cattle marketings are tested.

The second objective is to determine whether unanticipated market information contained in initial reports and COF inventory revisions are related. The difference between initial COF estimates and industry analysts' expectations of initial COF estimates is considered unknown or unanticipated market information (similar to Colling and Irwin; Grunewald, McNulty, and

Biere).[1] The difference between initial and revised COF estimates is considered USDA estimation error (this is the amount of error the USDA report contained in its initial release assuming the revised report is accurate). If a relationship between unanticipated market information and USDA estimation error exists, then new information contained in a COF report is at least partially attributable to estimation error by the USDA. In essence this objective amounts to testing whether industry analysts anticipate USDA COF estimate revisions prior to their occurrence.

Cattle on Feed Report Background

The USDA releases the monthly *Cattle on Feed* report on the second or third Friday of each month.[2] Prior to 1996, all feedlots were surveyed. Since 1996, only 1,000 head or larger capacity feedlots have been included in the survey. The COF report estimates number of cattle on feed, number of cattle placed on feed during the previous month, number of fed cattle marketed during the previous month, and other disappearance.[3] During January and July all known feedlots in the U.S. with capacity of 1,000 head or more are surveyed. During other months, all known feedlots in 17 leading cattle feeding states are surveyed.[4]

The USDA often revises its initial COF estimates in order to improve month-to month COF estimate relationships and correct any errors. Any estimate made for any state in the previous month's report is subject to revision when current estimates are made. When revisions

[1] The basic argument here is that industry analysts' expectations represent the market's anticipated component of the information contained in the COF report.
[2] The COF report has been released exclusively on Fridays since 1992 in order to allow the information to be fully disseminated and assessed before futures market trading initiates the following Monday. The intent was to reduce the amount of possible over-reactions or wild price moves increasing market volatility in response to the report.
[3] Other disappearance is a residual that makes number of cattle on feed at the beginning of the month plus placements minus marketings during the month equal to number of cattle on feed at the end of the month.
[4] The 17 states account for 98% of all COF in feedlots with 1,000 or more head capacity (Kansas Agriculture Statistics Service).

are made, the USDA releases the revised estimates in subsequent reports. COF estimate reviews are largely based on slaughter data, state check-off or brand data, and any other data that may have been received after the original estimate was made, and/or data released in the Census of Agriculture. In February, all estimates are reviewed. For the previous year, all monthly estimates are evaluated and for the previous two years, the number of feedlots and annual marketings are reviewed and subject to revision. No revisions are made beyond two years after an initial release. Once two years have passed, COF estimates are considered final (USDA *Cattle on Feed*).

Previous Research

Several studies have evaluated the accuracy and market price effects of a variety of USDA reports. Bailey and Brorsen evaluated the USDA's World Outlook Board's *World Agricultural Supply and Demand Estimates* for annual beef and pork production and supply. They concluded that in recent years USDA forecasts were optimal. However, forecasts made in the early 1980's were significantly biased downward, the bias disappeared as the forecast dates approached 1996. Sanders and Manfredo, expanded Bailey and Brorsen's work, and found unbiased, but inefficient USDA forecasts for quarterly beef, pork, and poultry production. In contrast to Bailey and Brorsen, Sanders and Manfredo found no evidence that USDA forecast accuracy was improving over time. Correlation was also found in beef and poultry forecast errors suggesting USDA forecast errors were related across animal species.

Meyer and Lawrence investigated the *Hogs and Pigs Report* to determine if systematic error existed within the report. They found that the 180 pounds and over hog inventory estimate was typically underestimated and the 120 to 179 pound inventory was overestimated. Colling

and Irwin found that hog futures reacted to unanticipated information in the *Hogs and Pigs* report. Carter and Galopin argued that information contained in USDA *Hogs and Pigs* reports was incorporated into live hog futures price before report release. The futures price reacted when the *Hogs and Pigs* report was released, but they argued it could not be concluded that it was necessarily caused by new information.

Sumner and Mueller found evidence of significant new information contained within the U.S. Department of Agriculture's harvest forecasts for corn and soybeans. Barnhart found further support of new information existing in government reports. He reported significant futures price changes when unanticipated information was introduced by 13 separate government reports.

Grunewald, McNulty, and Biere examined effects of COF reports on live cattle futures. They separated known market information from unanticipated information contained in the COF. Live cattle futures reacted to unanticipated information and the price response did not extend beyond the first trading day following the report release. Schaefer and Myers determined that the COF report may not provide new information because those with private information may be able to forecast revised placement and marketing estimates. The present study provides a formal test of whether private analysts correctly anticipate COF report revisions.

Methods and Data

A simple direct test for bias of COF revisions is to calculate the average revision over time. A revision is defined as:

(1) $Revision_{it} = Revised\ Estimate_{it} - Initial\ Estimate_{it}$

where *i* refers to cattle on feed inventory, placements on feed, or fed cattle marketings, *t* refers to month, *Initial Estimate* is the initial value reported in the monthly COF when it was originally released, *Revised Estimate* is the revised numbers provided in subsequent COF reports. The underlying hypothesis is that, on average, there is no difference between initial and revised values reported in the *Cattle on Feed* report, which implies a mean revision of zero.

An additional test is conducted to determine bias and to test for randomness of revisions over time by estimating:

(2) $Revised\ Estimate_{it} = ß_0 + ß_1\ Initial\ Estimate_{it} + e_{it}$

If estimates contained in the COF report are unbiased, the intercept ($ß_0$) will be zero and $ß_1$ will be one. Further, revisions should be unpredictable or random over time suggesting no autocorrelation in the residual (*e*). Autocorrelated residuals would indicate persistence in revisions over time regardless of whether they were biased. Durbin-Watson tests are conducted to determine if autocorrelation is present. Cattle on feed inventory is by definition a function of placements, marketings, and other disappearance, therefore errors that occur in one inventory estimate are likely correlated with errors in another. Therefore, (2) is estimated using seemingly unrelated regression (SUR).

To accomplish objective two (determining whether unanticipated information in original estimate is related to revisions), we need to account for information the market knows prior to the release of the COF report. That is, prior to a COF release, market participants anticipate some portion of the information forthcoming in the report. Therefore, the relevant new information in the report that markets are likely to react to is the unanticipated information. Analyst's pre-release estimates have been used in several studies to determine how new information introduced by government reports affects commodity futures prices (e.g.,

Dhuyvetter; Grunewald, McNulty, and Biere; Colling and Irwin). Industry analyst's pre-release estimates are used as a proxy for anticipated information contained in a report.

The difference between analyst pre-release inventory estimates and initial COF report inventory estimates serves as a proxy for unknown market information (referred to here as *Forecast Error*). The difference between revised COF inventory estimates and initial COF inventory estimates (*Revision*) is USDA estimation error. The two differences, *Forecast Error* and *Revision,* are hypothesized not to be related to each other. If the two are related this would indicate that how analysts' expectations differ from an initial COF report, enables predicting the magnitude of future revisions to the report. Future COF revisions should be random and unpredictable if the report is informationally efficient. To test this, *Forecast Error* is regressed as a function of *Revision*.

(3) $Forecast\ Error_{it} = a_0 + a_1 Revision_{it} + e_{it}$,

where *Forecast Error* is analysts' pre-release estimates minus initial USDA COF estimates for each element *i* of the report. Any statistically significant relationship between forecast error and report revisions would suggest at least some ability on the part of market analysts to anticipate subsequent revisions. A positive slope coefficient (a_1) would be expected if analysts correctly anticipate the direction of USDA COF estimate revisions.

Industry analyst expectations are reported as a percentage of year ago cattle on feed estimates. Therefore, they must be converted from percentage estimation to an actual inventory number of cattle. To convert industry expectations to comparable units, the percent increase/decrease forecasted by industry analysts is multiplied by year-ago inventory estimates reported in the COF report. This yields an actual number of cattle on feed, placements, and marketings analysts are expecting. Analysts have two choices of inventory estimates that could

be used to formulate inventory expectations. The initial inventory estimate, or the most recent (possibly revised) inventory estimate available at the time they formulate their expectations. We assume analysts use the most recently revised, more accurate information when formulating their inventory expectations.

The seven-state historical COF initial estimates were collected from May 1981 to August of 2000 with revised estimates through August of 2001.[5] Two different data sets were considered, with one for all feedlots, prior to the time 1,000+ feedlot estimates were reported (May 1981 – December 1994), and the other for 1,000+ feedlot estimates reported (January 1993 – August 2000 with revisions up through August 2001).[6]

Pre-release analyst estimates are released by Bridge News prior to the monthly *Cattle on Feed* Report. The estimates released by Bridge are formulated by surveying major retail commodity trading firms and other industry livestock market analysts. Bridge forms a composite forecast of expected cattle on feed, placements, and marketings. Forecasts are reported as a percent of year-ago values. The composite is a simple average of the remaining analysts' expectations, after throwing out the high and low forecasts.[7] Bridge News composite forecasts were available for each month from May 1981 through August 2000.

Revisions to Cattle on Feed occur frequently (table 1). For 1,000+ head capacity feedlots from January 1993 to August of 2000 (revisions through June 2002) cattle on feed, placements, and marketings, were revised about 60 percent of the time. Similar revision rates were present for the all feedlot data.

[5] The seven-states included in the monthly estimates are Arizona, California, Colorado, Iowa, Kansas, Nebraska, and Texas. The starting month of May 1981 was necessitated by only having a continuous series on analysts' expectations from May 1981 forward.
[6] For a two-year time period (1993-1994) USDA reported both all feedlot numbers and 1,000 plus head capacity feedyard numbers.
[7] Bridge composite forecast are used as a proxy for market expectations of COF reports. Dhuyvetter found that the composite Bridge prerelease estimates were relatively accurate and efficient forecasts of COF reports.

Results

Summary statistics of initial and revised estimates and their differences for cattle on feed, placements, and marketings for 1,000 head and greater capacity feedlots, January 1993-August 2000 and all feedlots, May 1981 to December of 1994 are reported in table 2. Although average revisions appear modest (all less than 1% of initially reported estimates), revisions have ranged from more than a 4% decrease to greater than a 6% increase relative to initial estimates. Because of the large number of cattle contained in the reports, and an inelastic demand for fed cattle (Wohlgenant), small revisions to cattle on feed numbers suggest economically important differences in fed cattle prices. Average revisions to cattle on feed, placements, and marketings over both time periods were positive and statistically different from zero. Thus, on average, the USDA adds cattle to cattle on feed, placements, and marketings when it makes revisions (i.e., initial reports have are biased downward). Further, the magnitude of the bias appears to have increased in more recent years when only 1,000 head and greater feedlots were included in the USDA surveys relative to the all feedlot data.

Additional insights into USDA revisions can be discerned by graphing the percentage revisions over time. Figures 1 and 2 illustrate revisions to the 1,000+ head feedlot and all feedlot COF surveys. Revisions to cattle on feed, placements, and marketings tend to be positively correlated with each other during both time periods.[8] This suggests revisions are often made to all three categories at the same time (on feed, placements, and marketings) in the form of adding or dropping cattle (e.g., reducing double counting). There are apparent time periods when revisions are correlated over time as well. For example, revisions to cattle on feed were

[8] For example correlations between revisions in cattle on feed and marketings is 0.30 (0.49), cattle on feed and placements is 0.34 (0.59), and between marketings and placements 0.68 (0.67) for the 1,000+ head data (all feedlot data).

consistently positive during the first three years of the USDA switching over to the 1,000+ head feedlot survey (figure 1). If an analyst anticipated this, an opportunity may have been present to develop a profitable trading scheme from this error persistence. Figure 1 suggests the magnitude of revisions may have declined substantially during more recent years, perhaps suggesting it took time for USDA to develop a stable data collection process after changing over to the 1,000+ head capacity feedlot surveys.

To determine whether COF revisions are biased and whether they are persistent, Seemingly Unrelated Regression (SUR) was used to estimate equation (2) for cattle on feed, placements, and marketings.[9] Results are presented in table 3. Several key findings emerge. As anticipated, revised and initial COF estimates are highly correlated with an R-squared for each equation of 0.97 or greater. However, the null hypothesis of the intercept equal to 0 and the slope equal to 1 is rejected at the 0.05 level for all three cattle inventory numbers for both time periods. At face value, this reconfirms the biases in initial estimates revealed in the simple means reported in table 2. That is, COF revisions are not random around zero. Further review indicates the slope coefficients on the initial estimates variables in all six equations are all very close to 1.0 and most of the intercept estimates are not statistically different from zero by themselves. This suggests that although we statistically rejected the joint null hypotheses of unbiasedness, it appears that from an economic perspective the biases are quite small, again consistent with results from table 2.

Though biases in initial COF estimates are small, there is significant positive autocorrelation in the residuals of every equation (except Placements in the "all feedlot"

[9] By definition, the number of cattle on feed each month is a function of the previous month's placements and marketings, so it is logical to assume errors in one equation are related to errors in another. However, under small samples, SUR estimators may not be asymptotically efficient and consistent. Statistical efficiency may be gained at the expense of parameter specification (Pindyck and Rubinfeld). Therefore, a Breusch-Pagan LM test for a diagonal covariance matrix was conducted for the OLS Models. The test indicated SUR was statistically more efficient.

estimates). This indicates persistence in revisions to COF estimates over time. Knowing the most recent revision provides information regarding the next revision as recent biases in the initial estimates tend to be related. This is logical, if for example, a group of feedlots were being missed in the survey process for a period of time.

Prior to the release of each COF Report, industry analysts publish their predictions of what they expect to be reported in the upcoming COF report. The difference between collective expectations of industry analysts and initial COF report estimates is considered unanticipated market information. If a relationship exists between unanticipated market information contained in the initial report and subsequent revisions made by the USDA, then inaccuracies in initial COF estimates are actually anticipated and could be predicted by analysts.

To determine whether analysts anticipate revisions, equation (3) was estimated using SUR for the 1,000+ head feedlot COF estimates and for the all feedlot estimates (table 4). The overwhelming result is there is no evidence that the average industry analyst anticipates revisions. The correlation between composite industry analysts' forecast errors of initial COF reports and revisions are very low for each equation with R-squared values of 0.04 or smaller. Further, none of the slope coefficients on USDA revisions are statistically different from zero at the 0.05 level. This indicates that when average industry analysts' and initial COF report estimates differ, this provides no information regarding future anticipated revisions to COF estimates by the USDA.

Conclusions

The monthly *Cattle on Feed* (COF) report is used by industry to determine inventory of cattle on feed, number of cattle placed on feed in the previous month, and number of cattle

marketed during the previous month. The COF report is the most important source of evolving supply information and thus often significantly impacts cattle prices. Because of the importance of the report and its market impact, it is vital that the COF report be efficient and accurate.

Revisions to the COF report over the May 1981-December 1994 for all feedlots and January 1993-August 2000 for 1,000+ head feedlots are not randomly distributed around zero. Statistically significant biases were present in all categories of the initial reports. However, biases were economically small averaging 0.22% to 0.35% for the all feedlot data and 0.60% to 0.84% for the more recent 1,000+ head data. Nonetheless, at times revisions were substantial, exceeding 5%. There appeared to be a learning curve in making revisions to the 1,000+ head feedlot reports as the magnitude of typical revisions has declined over time.

Though biases were not large, persistence of revisions was found. In particular, revisions were autocorrelated over time suggesting one revision was related to the subsequent one. Whether one could identify this in real time, remains to be seen, but either way systematic errors in COF reports is a concern. Despite persistence of revisions, industry analysts were not able to anticipate revisions. Thus, differences between industry analysts' pre-release and actual initial COF estimates did not indicate anything about probable revisions. From this measure, though perhaps not random, revisions were not predictable by the average analyst.

Figure 1. USDA Monthly COF Revisions (Revised Minus Initial as a Percent of Initial) for 1000+ Head Capacity Feedlots for Cattle on Feed, Placements, and Marketings, January 1993-August 2000

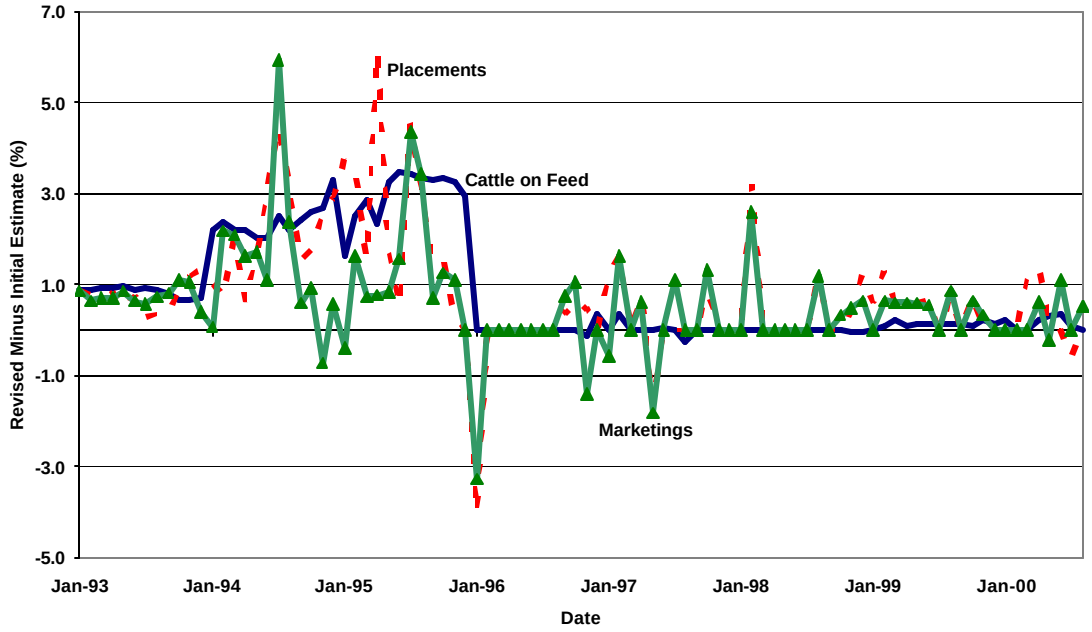

Figure 2. USDA Monthly COF Revisions (Revised Minus Initial as a Percent of Initial) for all Feedlots for Cattle on Feed, Placements, and Marketings, May 1981 - December 1994

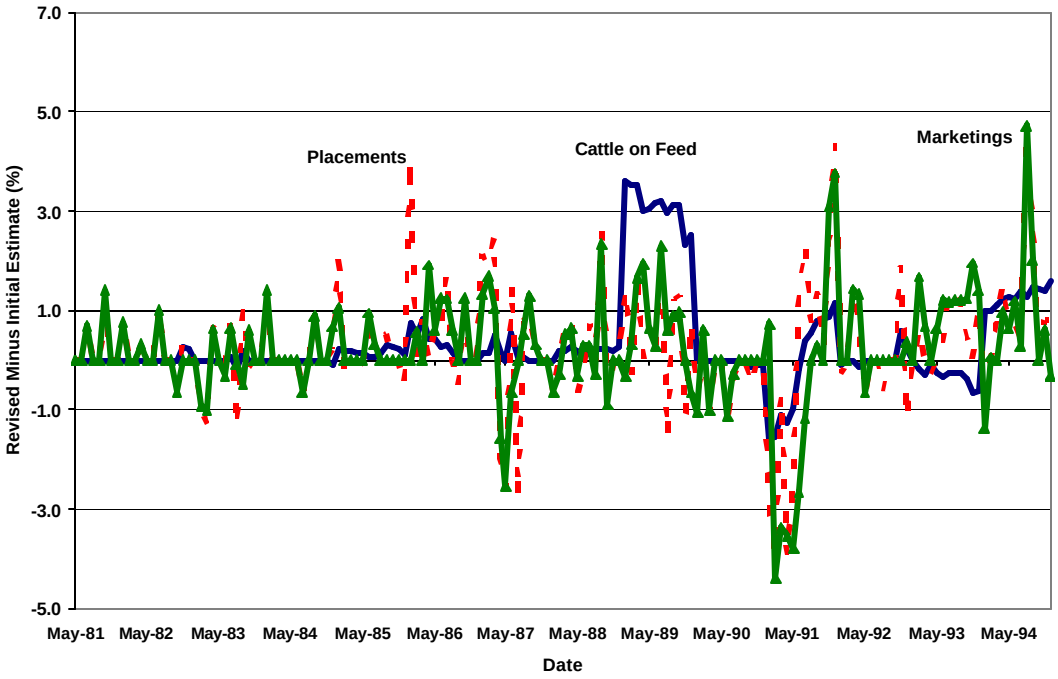

Table 1. Cattle on Feed Revision Frequencies, 1,000+ Head Feedlots, January 1993 - August 2000; All Feedlots, May 1981 - December 1994.[a]

COF Estimate	Reports	Number of Revisions	Percent Revised
1,000+ Head Feedlots			
Cattle on Feed	92	59	64%
Placements	92	61	66%
Marketings	92	62	67%
All Feedlots			
Cattle on Feed	164	97	59%
Placements	164	110	67%
Marketings	164	97	59%

[a] Dates refer to months of initial COF report releases.

Table 2. Cattle on Feed Summary Statistics, 1,000+ Head Feedlots, January 1993 - August 2000; All Feedlots, May 981 - December 1994.[a]

Variable	N	Initial Report		Revised Report	
		(1,000 head)			
1,000+ Head Feedlots		Mean	Std. Dev.	Mean	Std. Dev.
Cattle on Feed	92	8184.01	860.83	8248.79	829.33
Placements	92	1642.30	356.88	1655.14	356.52
Marketings	92	1576.20	147.14	1585.29	145.32

		Report Revision (%)					
		Mean	Std. Dev	Min.	Max.	t-stat.[b]	p-value
Cattle on Feed	92	0.84	1.17	-0.26	3.48	6.93	0.00
Placements	92	0.83	1.34	-4.02	6.13	5.91	0.00
Marketings	92	0.60	1.11	-3.27	5.95	5.17	0.00

		Initial Report		Revised Report	
		(1,000 head)			
All Feedlots		Mean	Std. Dev.	Mean	Std. Dev.
Cattle on Feed	164	7668.68	736.03	7694.43	731.58
Placements	164	1683.71	364.06	1687.88	365.03
Marketings	164	1575.32	110.36	1578.73	111.38

		Report Revision (%)					
		Mean	Std. Dev.	Min.	Max.	t-stat.[b]	p-value
Cattle on Feed	164	0.35	0.91	-1.59	3.61	4.88	0.00
Placements	164	0.25	1.18	-3.95	4.35	2.77	0.01
Marketings	164	0.22	1.11	-4.39	4.72	2.53	0.01

[a] Dates refer to months of initial COF report releases.
[b] Null hypothesis of report revision equal to zero.

Table 3. Seemingly Unrelated Regression Results of Revised Cattle on Feed Regressed against Initial Estimates; 1,000+ Head Feedlots, January 1993 - August 2000, All Feedlots, May 981 - December 1994.[a]

Revised Estimate of:	Intercept	Initial Est.	R^2	N	D.W.[b]	Chi-Squared[c]	Pr >? [2]
1,000+ Head Feedlots							
Cattle on Feed	284.42*	0.97*	0.99	92	0.21**	66.66	0.00
	(70.96)[d]	(0.01)					
Placements	7.70	1.00*	0.99	92	0.92**	39.85	0.00
	(7.03)	(0.00)					
Marketings	2.31	1.00*	0.99	92	1.34**	25.64	0.00
	(15.28)	(0.01)					
All Feedlots							
Cattle on Feed	69.04	0.99*	0.99	164	0.24**	22.85	0.00
	(53.84)	(0.01)					
Placements	4.97	1.00*	0.99	164	1.68	7.38	0.02
	(5.31)	(0.01)					
Marketings	4.44	1.00*	0.97	164	1.02**	5.98	0.05
	(14.45)	(0.01)					

* indicates coefficient statistically different from zero at 0.05 level.

** indicates statistically significant positive residual autocorrelation (0.05 level).

[a] Dates refer to months of initial COF report releases.

[b] Durbin-Watson test statistic for residual autocorrelation.

[c] For testing joint null hypothesis of intercept=0 and slope=1.

[d] Standard errors are in parentheses.

Table 4. Seemingly Unrelated Regression Results of Analyst Forecast Error Regressed against USDA Revisions to Cattle on Feed Estimates; 1,000+ Head Feedlots, January 1993-August 2000, All Feedlots, May 1981-December 1994.[a]

Analyst Forecast Error of:	Intercept	USDA Revision	R^2	N	D.W.[b]
1,000+ Head Feedlots					
Cattle on Feed	-33.46*	-0.22	0.03	92	1.35**
	(15.80)[c]	(0.14)			
Placements	-10.04	-0.33	0.00	92	2.37
	(21.60)	(0.92)			
Marketings	-6.42	0.96	0.04	92	2.55
	(10.44)	(0.53)			
All Feedlots					
Cattle on Feed	-17.84*	0.01	0.00	164	1.89
	(8.99)	(0.03)			
Placements	-8.84	0.21	0.01	164	1.94
	(8.03)	(0.14)			
Marketings	8.63*	0.25	0.03	164	2.34
	(3.47)	(0.14)			

* indicates coefficient statistically different from zero at 0.05 significance level.
** indicates statistically significant positive residual autocorrelation (0.05 level).
[a] Dates refer to months of initial COF report releases.
[b] Durbin-Watson test statistic for residual autocorrelation.
[c] Standard errors are in parentheses.

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