NCCC-134
APPLIED COMMODITY PRICE ANALYSIS, FORECASTING AND MARKET RISK MANAGEMENT

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Suggested citation format:

Bacon, K. J., J. N. Trapp, and S. R. Koontz. 1992. "Forecasting Short-Run Fed Cattle Slaughter." Proceedings of the NCR-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management. Chicago, IL. [http://www.farmdoc.uiuc.edu/nccc134].

FORECASTING SHORT-RUN FED CATTLE SLAUGHTER

Kevin J. Bacon, James N. Trapp and Stephen R. Koontz*

ABSTRACT

The USDA seven states Cattle on Feed report provides significant market information to all stages of the cattle industry. Considerable effort has been spent both by public agencies and private industry to improve on the accuracy and timing of this information. Because this information has an impact on the market, many efforts have been made to forecast it prior to its release. A key question is if a more comprehensive data set were available, could more accurate forecasts of the information in the USDA report be completed in a timely manner. This effort uses traditional time series forecasting methods to examine models using both public and private information to forecast monthly fed cattle marketings. The public information model uses data for current and past releases of the USDA seven state Cattle on Feed report. The private information model consists of daily pen level transactions for over eighty-five feedlots covering eight states. Based on physical data in the private data set describing animal placement weight and date, the expected slaughter dates of current cattle inventories are forecasted and used to project future slaughter. This projected slaughter data is then used to forecast information in the USDA report beyond the current report. Preliminary results indicate that the public model augmented with private data provides marginally improved marketing forecasts for the current period.

INTRODUCTION

Cattle supply is more volatile than cattle demand. Thus, accurate forecasts of supplies should help in detecting price movements if the market is accurately reflecting all available information (Fama). Price movements in the fed cattle market are very dependent on the release of public information regarding supplies. Specifically the release of the USDA Cattle on Feed report, which details the level of Marketings, Cattle on Feed, and Feedlot Placements, has been found to influence prices (Hoffman; Schroder, et al.). Thus, having accurate advanced forecasts of these reports has potential value.

Previous effort to forecast cattle on feed and or anticipate the USDA estimate of Cattle on Feed and Marketings have been restricted to the use of public data (Trapp; Franzman). Because of the limitations placed on researchers by the type of data collected, limits were placed on the procedures available. Efforts were restricted to multiple regression models with lag structures on the available data. Franzman restricted his efforts to providing quarterly estimates. Trapp used estimated data to forecast monthly reports.

This effort has access to a private data set that contains detailed physical and economic data for all purchases and sales made by approximately eighty five feedlots covering eight states. The objective of this effort is to determine the significance of supplementing public data with private data for the purpose of forecasting future fed cattle marketings. Initial efforts will concentrate on forecasting the current report while later efforts will extend these results for up to three months into the future. The principal focus of this paper has been restricted to forecasting marketings because of the strong and immediate effect of reported marketings on price. However, the modelling process used can readily be extended to forecasting cattle on feed and placements. Additionally, if this private data is useful in addressing the objective as stated, then questions concerning the value of this information may be introduced.

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Implicit in the analysis of short run fed cattle slaughter are industry questions of how "current" the feedlots are. The USDA seven state Cattle on Feed report provides only the total number of cattle marketed in the previous month; it does not provide information on the flow of those marketings. Thus, there is interest in determining if knowledge about the flow of placements and the rate of flow through the feedlots is useful in explaining the level and pattern of marketings.

To accommodate this process, for forecasts beyond the current month, the modelling process actually occurs in two separate stages. First, the private data set is run through a simulation model. The output of this model is the short range projections of cattle on feed and marketings in the private data set. This information then serves as input to an econometric time-series model that contains both public and private data. The output of the econometric model is the short range projection of marketings.

DATA SOURCES

The USDA seven states Cattle on Feed report is released on a monthly basis. Samples are taken from feedlots in Arizona, California, Colorado, Iowa, Kansas, Nebraska, and Texas. These samples are then used to provide an estimate of the previous month's placements and marketings and the current month's beginning inventory of cattle on feed. The estimate provided for cattle on feed is for one point in time and the placements and marketings are for the entire month. Hence, these estimates are limited in explaining the flow of cattle through the feedlot cycle.

Professional Cattle Consultants (PCC) is a private Oklahoma based consulting firm that has been collecting feedlot performance data for the past seven years. PCC specializes in providing its clientele with industry marketing information and comparative animal performance reports. These reports are comparative in that they show how a given client's feedlot is performing in relation with the industry as a whole and other feedlots of similar size and in a similar geographical location. Clients are required to submit separate monthly reports that list cattle movement intentions, actual placement data, closeout performance data, and feedlot capacity. PCC's clientele base consists of over eighty-five feedlots which finish between 20 and 25 percent of the U.S. cattle on feed. PCC's services feedlots in Kansas, Texas, Oklahoma, Colorado, New Mexico, Nebraska, Iowa, and South Dakota. The heaviest concentration of their clientele is in Kansas, Texas, and Oklahoma with increasing membership in Nebraska.

Monthly placement reports, collected by PCC for each feedlot on each pen of cattle, contains a feedlot identification number, pen placement date, average pen placement weight, head placed per pen, and a sex code in addition to other variables not used such as purchase price and shrink allowance. The monthly closeout report, collected for each pen of cattle sold during the month, contains a feedlot identification number, pen closeout date, average pen closeout weight, head placed per pen, head closed per pen, average days on feed, and a sex code in addition to other variables not used such as sales price, feed conversion, and feed efficiency.

PROCEDURES

Aggregate Time Series Models

The modelling objective is to forecast monthly fed cattle marketings reported in the USDA seven states Cattle on Feed report using aggregate time series data. The simplest model specification (USDA) expresses marketings as a function of placements reported in the seven states Cattle on Feed report four to seven months earlier, seasonal factors, and a time trend. It is essentially an aggregate data growth model. Cattle that are placed on feed must eventually be marketed. The normal feeding horizon is four to seven months. Further, there may be some variation in the number of marketings given average placements due to season of the year and trend forces.

Different weights of feeder animals are placed or fed at different times in the year and different feeds and feeding programs are followed.

Fed cattle marketings may also be influenced by price incentives at the time of marketing. There is some flexibility in the timing of fed cattle sales. Animals can generally remain on a showlist (a list of feedlot cattle at different weights and grades that are available for sale) for up to four weeks and maintain a near optimal degree of finish. Cattle feeders may sell cattle as soon as they reach showlist weights or may hold cattle for several weeks on the showlist given price expectations for the future. A second model (USDA+) is specified where the aggregate data growth model is augmented with a futures price premium/discount variable. This variable captures the premium or discount between the live cattle futures contract closest to expiration and the contract next closest to expiration. The futures price premium/discount should capture market expectations for changes in future cash cattle prices. If there is sufficient flexibility in physical marketing, the variable should capture the marketing of relatively light cattle or any holding behavior which results in marketing relatively heavy cattle.

A third model (USDA/PCC) adds information on cattle marketings from a the PCC data set to the aggregate data growth model. The model is used to test if this private source of information accurately represents the occurrences in the seven states report. Professional Cattle Consultants (PCC) receives information on the number of animals marketed by feedlots who subscribe to their information service. This information is available prior to the release of the USDA report. However, it reflects actions by a subset of the cattle feeding industry. The USDA/PCC model uses the aggregate data growth model augmented with the PCC marketings numbers weighted by the total capacity of PCC subscriber feedlots. The base capacity and cattle marketings reported to PCC varies over time as the number of subscribers vary. Therefore it is necessary to use a marketings number weighted by the sample base.

A fourth aggregate data growth model is included in the analysis (USDA/PCC+). This model incorporates the futures market premium/discount variable and the PCC marketings information. The model will help evaluate the relative importance of the two variables (PCC marketings and the futures premium/discount) on predicting and forecasting USDA seven states fed cattle marketings.

The sample period to be modelled is from January 1986 through December 1990. The PCC marketings and capacity data is only available from January 1986 to the present. In addition to the modelling sample, post-sample forecasts will be constructed for the calendar year of 1991. Forecasts over this period should be interesting. Four times during 1991 there were sharp drops in live cattle futures prices due to unanticipated changes in marketings which, in industry circles, were attributed to the premium/discount structure of the nearby and next to nearby live cattle futures contract prices. These time periods were the months of April, August, October/November, and December.

Simulation Model

The detail provided in the PCC placement report permits the forecast of future marketings in greater detail than monthly aggregates. In fact, since the placement date is reported for each pen of cattle, a forecast of future marketings can be made by forecasting the days on feed for each pen of cattle. With this purpose in mind the following equation was specified and estimated to predict days on feed.

DAYSON = f(UNITINWT, WTSQ, TIME, TIMESQ, SEX, DFEB..DDEC, IDYARD)

Where UNITINWT is the average per head weight upon entry into the feedlot; WTSQ is the UNITINWT squared; TIME is a time trend variable; DFEB..DDEC is a set of dummy variables for months of the year with January as the base; and IDYARD is a dummy variable for feedlot identification.

The equation was estimated separately for each state in the PCC data set. The resulting set of equations have R-square's between .65 and .74 with a root mean square error between 13 and 18 days. The root mean square error can be interpreted as the feedlot manager's window of flexibility for marketing the cattle exiting the feedlot. PCC has confirmed these numbers as being reasonable.

During the historical period, over 90 percent of the cattle placed in the PCC sample require more than 90 days to finish. An additional 8.4 percent are placed with between 60 and 90 days to finish. Less than 1/2 of one percent are placed with less than 60 days to finish.

An inventory accounting model was then developed to determine the flow of cattle entering and exiting the feedlot. By placing an incoming pen of cattle into an array arranged by days left before slaughter, it is possible to show the flow of cattle in the feedlot at any point in time (Figure 1.). If a pen already exists at that point in the array, the model adds the new pen to the existing value. As the model iterates (on a daily basis) cattle move forward through the array until they eventually exit the feedlot and are placed in a output (marketings) array. The model is designed to provide a number of point in time reports, including a fourteen week projection (by week), a moving total of all cattle in the feedlot, and current, T+2, T+3, and T+4 month projections of cattle exiting the feedlot (anticipated marketings). A daily model is used to capture the full detail of the data set. It is believed that this detail is the key to providing increased accuracy over the more traditional time series models. The results of each state are then added together to determine the flow of cattle in the PCC sample.

Given that the USDA Marketings equation is not dependent on anything more current than USDA Placements lagged four periods, it is possible to use the anticipated marketings from the simulation model to extend the forecast range of USDA Marketings Equation up to three months out. Preliminary analysis of PCC data shows that the majority of cattle are placed in the feedlot with well over 90 days before being marketed. Further effort shows that only a very small percentage are placed with under 60 days to marketing. The only caveat is the stability of the PCC customer base. While this does show some variation with the cattle price cycle, it is reasonably stable over the span of two to three months.

RESULTS

Results for the Aggregate Time Series Models

Table 1 reports the regression results for the four aggregate data growth models used to describe fed cattle marketings. In general, the model R-squares are relatively high; they range from 85% to 90%. Durbin-Watson statistics reveal no significant first-order serial correlation. Other test statistics reveal no significant higher order serial correlation. Table 2 reports post-sample forecast statistics using the modelling results to forecast marketings from January 1991 to December 1991. Tests of the post-sample residuals suggest they are distributed normally so that evaluating the forecast performance based on mean square errors and Theil coefficients is appropriate.

The model which uses only information available through the Cattle on Feed report (USDA), explains 84.6% of the variation in fed cattle marketings. Placements four to six months prior explain a large portion of the marketings as do the seasonal factors. The total multiplier on the placement distributed lags suggests a 1,000 head increase (decrease) in placements results in a 430 head increase (decrease) in markets after seven months. Post-sample statistics reveal the root mean square error of the one-month-ahead marketings forecast is 70.247 thousand head. Marketings were more volatile during the post sample period than the sample period. The root error variance from the regression is considerably smaller than the root mean square error of the post-sample forecast; the model root error variance is 50.807. The R-square between the predicted and actual marketings suggests the model explains 69.6% of the variation in actual marketings in the post sample period. This also reflects the marketings volatility in the post-sample period. However, the root mean square percent error suggests the forecast errors are only 4.6% of the size of the actual marketings. Thus, this simple model provides relatively accurate forecasts of fed cattle marketings during 1991. The Theil inequality coefficient is 0.552. The range of this statistic is between zero and one with values closer to zero indicating smaller forecast errors. More importantly, the decomposition of the Theil coefficient suggests there is very little systematic pattern in the forecast error. Little forecast error is due to bias or regression error; most is due to the model disturbance.

The results of the second model (USDA+), which incorporates a futures premium/discount variable in the aggregate data growth model, reveals there is no statistically significant change in marketing patterns due to price incentives. The coefficients are in fact the wrong sign. A premium (discount) between the nearby and next to nearby contract seems to suggest an increase (decrease) in current marketings. This is not a response by cattle feeders to price incentives. There may in fact be a simultaneity problem. It may be that the nearby futures contract is at a discount (premium) to the next to nearby contract reflecting the increased (decreased) current marketings. Criticisms of the live cattle futures market for causing variability in cattle marketings, and the related cash fed cattle price variability, due to premiums and discounts between nearby contracts is apparently not justified. At least from the standpoint of the variability in numbers of cattle marketed. Variability in the marketing weights may be the true issue. The R-square of the second model is 85.3 percent which is less than a one percent improvement over the aggregate data model. The post-sample one-month-ahead forecast statistics also show a negligible improvement over the aggregate data model.

The regression results of the third model (USDA/PCC) reveals the sample of marketings information from PCC subscribers improves the explanatory model of the aggregate data growth model. The R-square for the model is 89.8 percent as opposed to a R-square of 84.6 percent for the aggregate growth model (USDA). Thus, one-third of the remaining variation is explained by adding the private data. The coefficient on the PCC marketings as a percent of capacity variable is statistically significant. An increase (decrease) in marketings as a percent of capacity of 1 percent suggests USDA seven states marketings will increase (decrease) by 3,015.5 thousand head. The distributed lags on USDA placements four to seven months prior remain significant. However, the reduction in the coefficient size on the four month lagged placement variable suggests PCC member feedlots generally feed cattle for four months. A portion of the seasonal factors remain significant and the trend variable is also significant in this model. For this sample, the total capacity of PCC feedlots was shrinking relative to the total number of USDA reported marketings. This is likely the cause of the significant trend. Post-sample statistics reveal an observable improvement in root mean square error and an improvement in the R-square between the predicted and actual marketings. However, the test for improvement in mean square error reveals that the change is not statistically significant at the alpha =.05 confidence level. This evidence is supported by the change in the root mean square percent error. Forecast errors of the third model are 3.9 percent of the actual marketing levels. This is an improvement of 0.7 percent over the simple aggregate data growth model. The decomposition of the Theil inequality coefficient suggests no systematic biases in the forecast are introduced when the PCC information is used in the forecast. The forecast error is largely due to the model disturbance.

Findings of the fourth model (USDA/PCC+) reenforce the results of the previous three. The futures price premium/discount variable does not improve the explanatory power of the USDA/PCC model.

Figure 1 presents the USDA seven states fed cattle marketings from January 1990 (the last year in the sample) through December 1991 (the post-sample year). Predicted values for the first model, the aggregate data growth model, and the third model, the aggregate data model augmented with the PCC marketings variable, and the actual marketings are plotted on the figure. Predicted values for the second and fourth model are not presented because of their weak improvement over the two reported models. The figure visually reveals the variability of marketings in 1991. The aggregate data model and the model including the PCC data both track the changes in marketings in 1990 well. The model performance is less impressive in 1991. However, given the scaling on the vertical axis the general level of predictions for 1991 are rather accurate; the root mean percent error is less than 5% for both models. The figure also reveals two other issues about the models and data. First, the PCC data does identify some directions and turning points in the marketings series which would be missed with the aggregate data model. This is seen in April, October, and December. For April, the aggregate model predicts a decrease in marketings from the previous month while the PCC model predicts an increase. A sharp increase was observed. For October and December, the aggregate model predicted a decrease in marketings while the PCC model actually foresaw the increase in marketings. However, as seen in the statistics from table 2, the PCC is not a global improvement over the aggregate data model. The PCC model is worse than the aggregate data model in February and March, and in July, August, and September of 1991, underestimating marketings. This leads into the second issue about the models and data. PCC member feedlots are typically large professional and commercial cattle feeding enterprises. While information about the actions of these cattle feeders is significant in explaining marketings and to some degree does improve marketing forecasts, the information does not significantly improve forecasts and in some periods is inferior to aggregate data indicators. It is our perception that surprises in the numbers of cattle marketed are due to the actions of smaller part-time feeders. Improving forecast techniques may require focusing on the actions of these smaller feeders. Further, calls for improved information in cattle markets need to focus on the actions of or conditions in these smaller feeding operations. In general, incorporating the heterogeneity of cattle feeding operations may be important for improving forecasts of short-run cattle marketings and slaughter.

Simulation Model Results

Initial application of the simulation model using the days on feed prediction equation has resulted in reasonably accurate projections of PCC marketings. Table 3 presents statistics describing the accuracy of the simulation model. On average, PCC member feedlots have approximately 286,700 head of cattle on feed to be marketed within the next 30 days. The simulation model yields a mean percent error of less than 1 percent for the current, two, and three month forecasts. The root mean square error for forecasts of PCC marketings up to three months into the future is very constant at just under 21,000 head or an error of approximately 7.4 percent. As expected, all measures of model performance begin to deteriorate rapidly in the four month forecast. This is the case because the inventory projection system bases its slaughter forecast upon only those animals currently in the feedlot. A significant number of animals slaughtered four months in the future will not be in the current feedlot inventory, thus they will not be included in the forecast. This predictably results in a low slaughter forecast, i.e., note that the mean percent error is significantly negative for the four month forecast at -9.01. By contrast the mean percent error for the current, two, and three month forecasts are less than one percent and indicate very little negative bias.

Given the ability of the simulation model to accurately project future PCC marketings, use of the USDA/PCC model can be expanded to make not only current month marketings forecasts, but also future month forecasts up to at least three months into the future, i.e., this would be done by using the forecasts of PCC slaughter in the USDA/PCC equation as if they were actual reports of slaughter for the past month. A graphical presentation of the within sample tracking accuracy of the USDA/PCC and USDA models for forecasts of up to four months into the future is presented in Figure 3. Inventory data are currently not available to operate the simulation model outside of the sample data period. Thus, a post sample evaluation of the forecasting accuracy of this approach cannot be made. Therefore, no statistical evaluation of the potential of this forecasting approach is reported here. Future research plans include undertaking such an evaluation.

The most valuable use of the simulation model's ability to project future marketings may not be for predicting the USDA report of monthly fed cattle marketings. It may instead be for exploring the timing of significant changes in the future flow of steer and heifer slaughter on a weekly or perhaps even a daily basis. Aggregation of the simulation model's forecasts to monthly totals does not utilize the daily flow information the model generates. Future research into the accuracy and usefulness of the simulation model for forecasting major turning points in the rate of flow of federally inspected steer and heifer slaughter on a weekly/daily basis is planned.

FURTHER RESEARCH

The simulation model provides an avenue for exploring several research questions that have not been included in this effort. First, it is known that producers face a marketing window for selling feedlot cattle. This window is expressed by the RMSE of the days on feed prediction equation. An attempt was made to explain how short run price expectations influences this variation by using the what the feedlot industry considered as the relevant variable (the premium variable). However, this variable was shown to be insignificant. Yet market holding actions (holes) and overselling action (bulges) do occur. Second, since the simulation model provides daily flow information, it is possible to see if daily marketings from the private data set are correlated with the daily federally inspected slaughter. A third area of interest involves estimating marketings from a show list rather than a days on feed equation. Cattle are regularly purchased from listings of available cattle at a given weight and grade. By forecasting show lists it may be possible to model potential holes and bulges in the marketings well before they occur.

SUMMARY AND CONCLUSIONS

This project focuses on improving the accuracy and range of forecasts of marketing information. Time series models were developed and tested to determine if the addition of private data can significantly improve forecasts of information contained in the Cattle on Feed report. A simulation model was developed to provide current and future information concerning the private data set's marketings and cattle on feed. The time series model (USDA/PCC) was linked to the simulation model to provide forecasts of future USDA marketings for the historical period.

All the time series models provide reasonably accurate forecasts of fed cattle marketings. The premium variable (the difference between the live cattle futures contract closest to expiration and the next to nearby contract) was found to be insignificant and in fact the wrong sign. The USDA/PCC model provided a significantly improved R-square over the USDA aggregate growth model. However, the USDA/PCC model was not a global improvement as it failed to catch some turning points that the USDA aggregate growth model did catch.

The simulation model provided reasonably good results that allow the forecasting of USDA marketings several months in advance. Major turning points are readily noticed but minor ones were are more difficult to depict. The true value in the simulation model may be its ability to use daily flow information for detecting marketing irregularities such as holes or bulges.

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Table 1. Results of the Regressions Modelling Monthly USDA Seven States Fed Cattle Marketings for January 1986 through December 1990.

Variables	USDA	USDA+	USDA-PCC	USDA-PCC+
Intercept	952.54 (171.61)	1072.3 (192.50)	357.70 (199.43)	372.75 (243.19)
Futures Premium	------	6.1011 (4.6133)	------	0.4643 (4.1626)
PCC Marketings Ratio	------	-----	3015.5 (712.25)	2985.4 (771.25)
USDA Placements (t-4)	0.2235 (0.0578)	0.2108 (0.0580)	0.1370 (0.0518)	0.1369 (0.0526)
USDA Placements (t-5)	0.0420 (0.0597)	0.0195 (0.0615)	0.0761 (0.0500)	0.0741 (0.0538)
USDA Placements (t-6)	0.0265 (0.0601)	0.0121 (0.0605)	0.0004 (0.0500)	-0.0004 (0.0512)
USDA Placements (t-7)	0.1377 (0.0566)	0.1118 (0.0594)	0.2060 (0.0494)	0.2034 (0.0555)
Trend	-0.4300 (0.4629)	-0.4910 (0.4605)	1.1662 (0.5365)	1.1456 (0.5747)
February	-324.23 (49.399)	-308.70 (50.285)	-202.80 (49.824)	-202.83 (50.543)
March	-155.44 (71.401)	-95.129 (84.104)	-119.80 (59.486)	-115.57 (71.288)
April	-115.45 (81.906)	-52.092 (94.166)	-40.650 (69.824)	-36.575 (79.699)
May	-79.254 (75.460)	-30.017 (83.453)	-110.43 (62.670)	-106.37 (73.247)
June	129.81 (58.263)	157.49 (61.348)	54.204 (51.263)	57.065 (57.985)
July	68.912 (47.039)	61.230 (46.919)	11.193 (41.121)	11.184 (41.714)
August	55.769 (53.734)	59.393 (53.254)	-4.7775 (46.567)	-3.8975 (47.893)
September	-66.392 (47.594)	-61.514 (47.250)	-18.557 (40.846)	-18.663 (41.446)
October	21.709 (64.073)	36.366 (64.378)	-8.8924 (53.336)	-7.4715 (55.584)
November	-76.675 (60.696)	-69.742 (60.303)	-13.519 (52.234)	-13.621 (52.995)
December	-197.11 (49.497)	-182.33 (50.249)	-160.25 (41.740)	-159.50 (42.882)
R-Square	0.8458	0.8532	0.8981	0.8981
Durbin Watson	2.0369	2.0318	2.1223	2.1175
Root Error Variance	50.807	50.286	41.902	42.506

Table 2. Mean Square Errors and Other Statistics from the Out of Sample Forecast of USDA Seven States Fed Cattle Marketings from January 1991 through December 1991.

Statistics	USDA	USDA+	USDA-PCC	USDA-PCC+
Mean Square Error	4934.7	4495.2	3865.6	3790.6
Reduction in Mean Square Error F-Test and P-Value	-----	0.5557 (0.5904)	0.5279 (0.6054)	0.5745 (0.5805)
Root Mean Square Error	70.247	67.046	62.174	61.568
Root Mean Square Percent Error	4.57	4.41	3.94	3.91
Out of Sample R-Square	0.6956	0.7153	0.7649	0.7679
Theil Inequality Coefficient	0.552	0.528	0.481	0.476
Coefficient Decomposition				
Bias	0.0009	0.0076	0.0070	0.0062
Regression	0.0348	0.0024	0.0423	0.0364
Disturbance	0.9643	0.9900	0.9507	0.9574
Jarque-Bera Normality Test Chi-Square Test and P-Value	0.9624 (0.6180)	0.1643 (0.9211)	1.6413 (0.4402)	1.6685 (0.4342)

Table 3. Mean Square Errors of the Simulation Model for January 1986 through December 1990. (Per Head Basis)

Statistics	Current	Two	Three	Four
Mean Percent Error	-0.76	-0.76	-0.91	-9.01
Absolute Mean Percent Error	5.72	5.72	5.76	9.55
Mean Square Error	4.1E+08	4.1E+08	4.1E+08	1.1E+09
Root Mean Square Error	20128.8	20129.4	20229.5	33555.0
Root Mean Square Percent Error	7.34	7.34	7.42	13.75
Average Volume per Month	286732	286681	284923	260816

FIGURE 1. USDA Fed Cattle Marketings

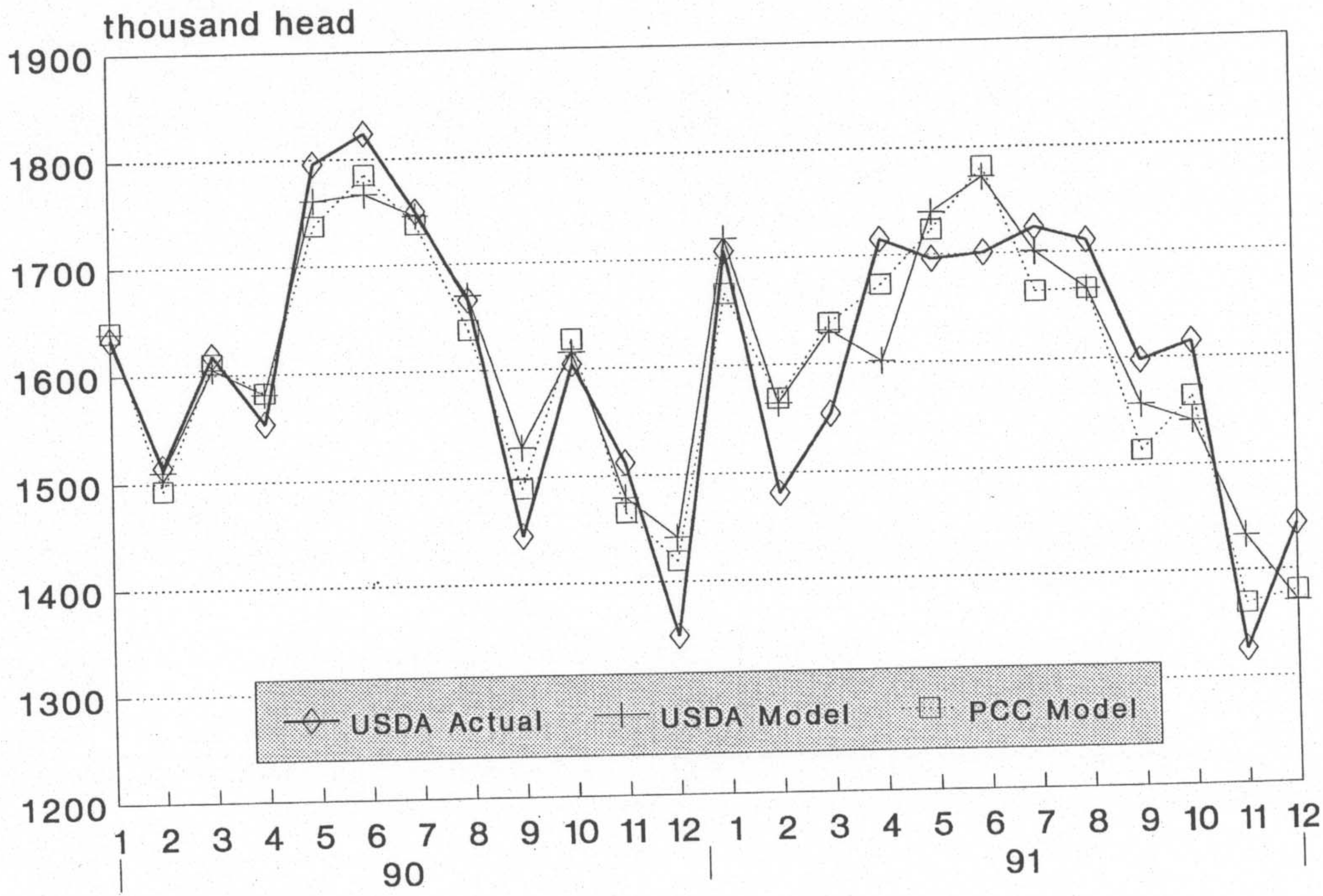


FIGURE 2. SIMULATION MODEL

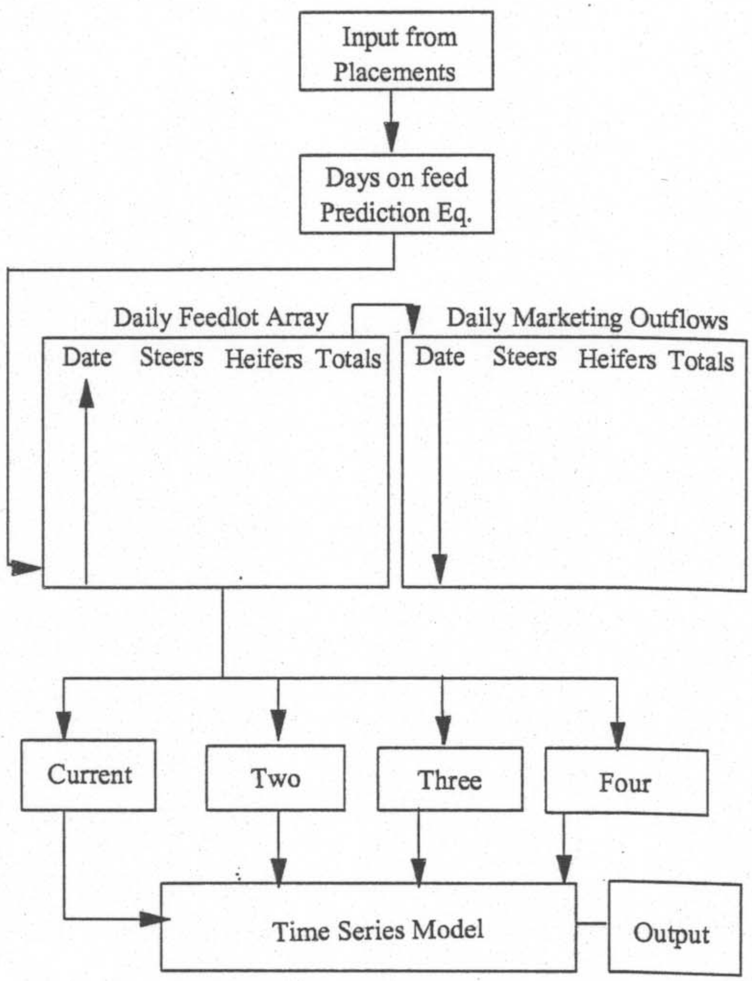


FIGURE 3. PROJECTIONS OF USDA MARKETINGS COMPARED WITH ACTUAL USDA MARKETINGS USING SIMULATION MODEL.

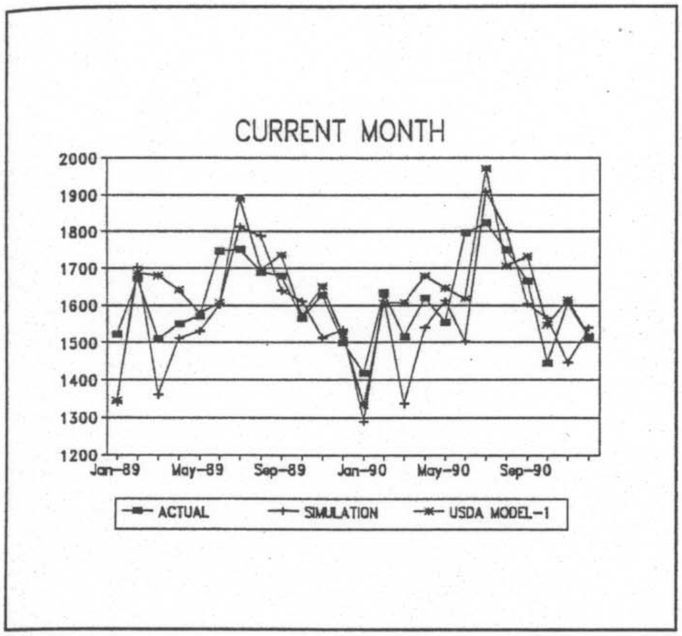


Figure 3-A.

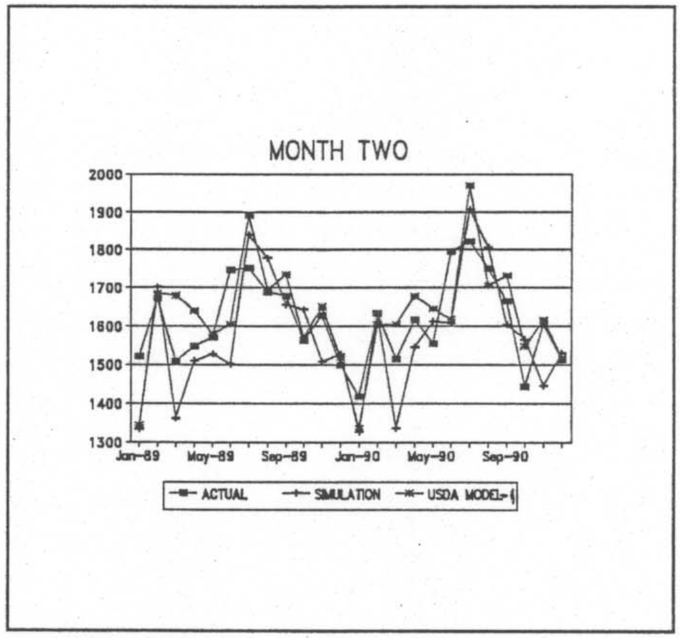
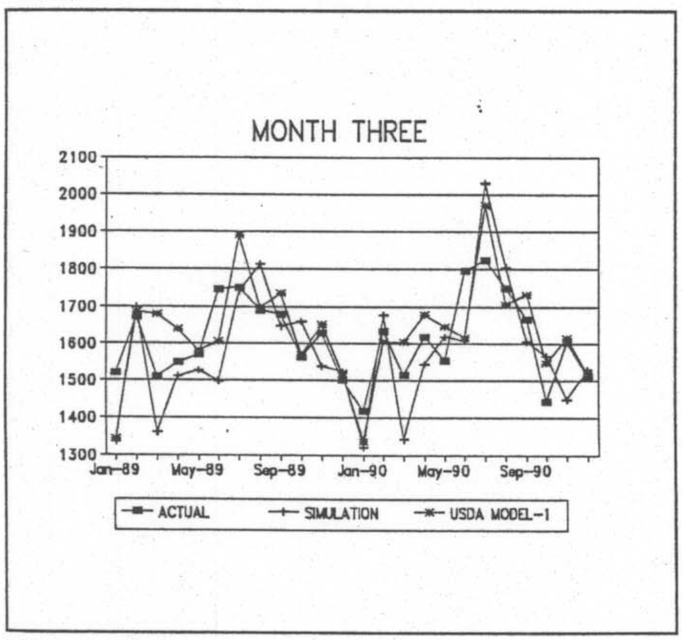


FIGURE 3-B.



Figue 3-C

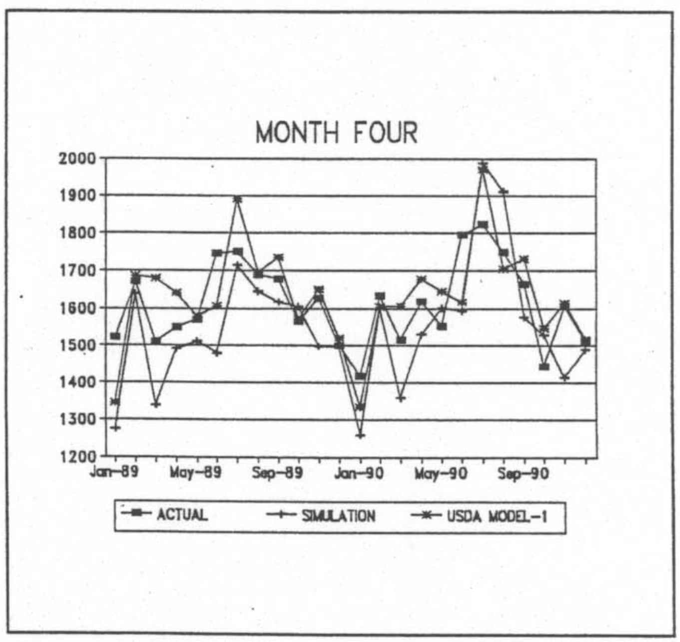


Figure 3-D.