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Dee Von Bailey and B. Wade Brorsen

ABSTRACT

An analysis is conducted to determine if USDA forecasts of beef and pork production and supply have improved over time (1982-96). Beef production and supply forecasts have improved during the study period, but pork has not. The results are consistent with findings that the variability in beef prices has decreased, but the variability in pork prices has not.
TRENDS IN THE ACCURACY OF USDA PRODUCTION FORECASTS FOR BEEF AND PORK

Introduction

The value of USDA outlook reports and forecasts has been discussed and analyzed frequently in recent years. This is likely the result of external pressure on the U. S. government to find areas of real or perceived cost inefficiencies within government. Also, since there are now many private market information sources, some have questioned the need for public information such as that provided by USDA. Economists have been especially interested in the costs and benefits associated with USDA outlook information. The literature has reflected this interest, especially relating to how these reports influence commodity futures contract prices and the accuracy of these forecasts in general (e.g., Sumner and Mueller 1989; Carter and Galopin 1993, 1995; Colling and Irwin 1990, 1995; Meyer and Lawrence 1988).

While arguments about the relative value and accuracy of USDA market information have continued, little attention has been paid to whether this information has improved over time. USDA forecasts increasing in accuracy over time mean improvements in efficiency and increases in the potential value and use of the information. This paper determines how the accuracy of USDA production and supply forecasts for beef and pork have changed over an extended period of time (1982-96), and also determines the rate that production and supply forecasts improve within the period between when forecasts for a year’s production begin and end.

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Price variability within livestock markets has changed significantly over time. For example, the monthly variance for changes in daily live cattle futures prices decreased during the 1990s (figure 1). An identical analysis for live hog futures shows that while hog prices have been less variable during the 1990s than during some periods of the mid- to late-1980s, the difference is less pronounced than for cattle. Indeed, prices for hogs in the 1990s appear to be more variable than during the early 1980s (figure 2).

There are at least three plausible explanations for the reduction in the variability of cattle prices. First, the substitutability of other products for beef may have increased as suggested by

Figure 1. Monthly Variance of Daily Cattle Futures Prices
Figure 2. Monthly Variance of Daily Hog Futures Prices

Purcell (1991), resulting in a more elastic demand for beef, and, hence, less price variability is experienced as supply changes. Second, inventory management by meatpackers through contracts or integration may have reduced price variability. However, Ward et al. (1996) indicate that cash price variability is positively related to the level of captive supplies held by meatpackers and is also not a determinant of the level of captive supplies (p. 21). Third, the accuracy of information in the market and specifically USDA forecasts may be improving, resulting in less variability because market shocks are systematically reduced. More accurate forecasts will reduce long-term price variability. However, past research has not determined if USDA production and supply forecasts have improved for beef and pork. This paper addressed this
third possibility, i.e., whether the accuracy of USDA production forecasts have improved, by examining USDA production and supply forecasts for beef and pork between 1982 and 1996. We also determine if USDA production forecasts improve during a forecast period for annual production and supply for a specific year.

Production and supply forecasts are used as the basis of the analysis rather than inventory reports because USDA estimates for beef and pork production and supply represent a consistent and continuous time-series and also have less “noise” than other types of data that could have been used. For example, data in USDA’s Cattle on Feed or Hogs and Pigs reports could have been used but that would have required placements (intended farrowing in the case of pigs) as a predictor of marketings. This is especially problematic for cattle since cattle are placed on feed at different weights, weather conditions vary, and marketings are not a perfect predictor of beef production since carcass weights vary as does nonfed cattle slaughter. In general, total meat production is also more closely related to price than are marketings, farrowings, etc.

**Methods**

The USDA makes monthly estimates for total annual beef and pork production beginning approximately 17 months prior to December of the year for which the estimate is being made. The potential value of this information depends on how accurate and relevant the information is (Lawrence 1991). The value of USDA outlook and production estimates has been tested mostly by the effect that the release of this information has had on commodity futures contract prices

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2 Production and supply forecasts for the coming year normally begin in the month of August of the preceding year.
(e.g., Colling, Irwin, and Zulauf 1996; Grunewald, McNulty, and Biere 1993; Sumner and Mueller 1989; Colling and Irwin 1990, 1995).

These past studies have attempted to determine if outlook and production estimates given in reports released by USDA represent a new and significant amount of information in the market that was not available prior to the report. For the most part, these studies have found that USDA reports have a significant influence on futures price movements at the time the report is released and, therefore, conclude that the USDA information represents valuable new information in the marketplace. However, USDA outlook and forecast information has also been criticized as being, in some cases, biased (Meyer and Lawrence 1988). Sumner and Mueller (1989) indicate that USDA annual crop supply estimates improve during their forecast period, but we are unaware of any published research examining whether government forecasts for meats have improved over a period of years or within their specific forecast period. We do not directly measure the value of information generated by the USDA production forecasts (Lawrence 1991), but rather examine if there has been a systematic decline in USDA forecast errors during the study period.

The model used in the study is as follows:

\[
\frac{(y_{kt} - y_{0t})}{y_{0t}} = \mu + \varepsilon_{kt}
\]

\[\varepsilon_{kt} \sim N(0, \exp(\alpha_0 + \alpha_1 k + \alpha_2 t)) \]

\[k = 1, \ldots, K_t ; t = 1, \ldots, 15\]

where \(y_{kt}\) is USDA's production estimate for year \(t\) given \(k\) months before the end of the year. Therefore, \(y_{0t}\) represents actual production. In most cases, \(K_t\) is 17, meaning that the first
estimate is 17 months before the end of the year. The dependent variable is the percentage forecast error (PFE). The mean equation only has an intercept (\(\mu\)), which measures any bias in the estimates. Equation (1) defines a model with multiplicative heteroscedasticity.\(^3\) The model was estimated with maximum-likelihood using the HET command in SHAZAM. Because the exogenous variables are the same in all four models and the variance is rescaled to one, all four models will have the same standard errors.

If \(\alpha_1 < 0\), then the PFEs systematically become smaller within the 17-month forecast period. It would be a surprise if \(\alpha_1\) was not negative since for \(k < 12\) the USDA has some information about production in the first few months of the year. If \(\alpha_2 < 0\), then USDA's forecasts have become more accurate overall since 1982.

**Data**

Data are taken from USDA's World Outlook Board's *World Agricultural Supply and Demand Estimates (WASDE)*. These estimates are published on basically a monthly basis and estimate year-end production and supply for meats and crops.

Since 1982, *WASDE* estimates of annual beef and pork production and supply have been available usually beginning about 17 months prior to the month of December of the forecast year. The data begin with the May 11, 1982 report and end with August 12, 1996 (260 observations). The difference between the production and supply series is the amount of imports of both

\(^3\) We also estimated a linear regression of absolute value of the percentage forecast errors against \(k\) and \(t\). The conclusions were unchanged. We report the maximum-likelihood estimates because they are slightly more asymptotically efficient.
commodities. Hence, differences in accuracy between production and supply are basically measures of USDA’s ability to forecast imports relative to domestic production.4

**Results**

Table 1 reports the parameter estimates of equation (1) for forecasts of domestic production and total supply of beef and pork. From these results, it can be concluded that USDA forecasts, as expected, improve during the forecast period for annual production and supply of both beef and pork. This is evidenced by the parameter estimates for the within period trend (\(\alpha_1\)), which are negative and significantly different than zero for all four models. Forecasts have also improved with the passage of time for beef production and beef supply models since the parameter estimates (\(\alpha_2\)) for these models also exhibit a significant negative overall trend during the 1982-96 study period. Although pork production and supply forecasts did improve slightly over 1982-96, the improvement is not statistically significant.

The intercepts in the mean equations for beef and pork production and supply are all negative, suggesting that a slight negative bias exists in these forecasts (\(\mu\) in Table 1). However, only the beef and pork production intercepts are statistically significant. Although this bias is statistically significant, it is still relatively small for beef at about 0.43%-0.3% under actual production and supply, respectively, and only about 0.3%-0.1% for production and supply of pork, respectively. From these results, one can conclude that USDA’s forecasts tend to be slightly conservative with regard to beef production and supply estimates and the pork production estimate.

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4Exports are not considered in the total supply figures.
### Table 1. Parameter Estimates for Equation (1) Testing for Improvements in USDA Forecast Accuracy for Domestic Production and Total Supply of Beef and Pork, 1982-96.

<table>
<thead>
<tr>
<th>Item</th>
<th>Constant for Mean Equation($\mu$)</th>
<th>Constant for Variance Equation ($\alpha_0$)</th>
<th>Trend Within the Forecast Period ($\alpha_1$)</th>
<th>Trend Over Study Period ($\alpha_2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Domestic beef production</td>
<td>-0.0041** (0.0008)</td>
<td>-4.9906** (0.2208)</td>
<td>-0.2415** (0.0181)</td>
<td>-0.0081** (0.0018)</td>
</tr>
<tr>
<td>Total beef supply</td>
<td>-0.0031** (0.0007)</td>
<td>-4.8146** (0.2208)</td>
<td>-0.2323** (0.0181)</td>
<td>-0.0134** (0.0018)</td>
</tr>
<tr>
<td>Domestic pork production</td>
<td>-0.0025* (0.0011)</td>
<td>-5.1476** (0.2208)</td>
<td>-0.2543** (0.0181)</td>
<td>-0.0020 (0.0018)</td>
</tr>
<tr>
<td>Total pork supply</td>
<td>-0.0013 (0.0013)</td>
<td>-5.3446** (0.2208)</td>
<td>-0.2000** (0.0181)</td>
<td>-0.0003 (0.0018)</td>
</tr>
</tbody>
</table>

Note: Numbers in parentheses are standard errors. A double asterisk (**) indicates significantly different from zero at the 1% level, while a single asterisk (*) indicates significantly different from zero at the 5% level.

Figure 3 presents the average standard deviations for the PFEs during the forecast period for beef and pork production and supply.\(^5\) It can be clearly seen that the variability of forecast errors declines dramatically during the forecast period. In the case of beef, the variability of the forecast errors declines in basically a linear fashion during the forecast period. Pork forecast variability is quite constant during the first eight months of the forecast period and then declines rapidly during the last eight months of the forecast period. The difference in variability between beef and pork forecast errors probably results because the production cycle for pork is shorter than for beef. The average age of slaughter hogs is about six months, but is about 14 months for

\(^5\)Average PFEs follow almost the same pattern as the standard deviations during the forecast period.
Figure 3. Average Standard Deviations of USDA Beef and Pork Forecasts

cattle. As a result, pork production is more sensitive to price changes than beef making the task of predicting pork production within the 17-month period relatively more difficult than for beef.

Conclusions

The analysis presented in this paper investigates whether or not USDA forecasts of domestic production and total supplies of beef and pork improve both during their forecast periods and over a period of years. The results suggest that USDA forecasts within a forecast
period have improved for both beef and pork production and supply while forecasts for beef production and supply have improved during the overall study period (1982-96). A small but significant downward bias was found for both beef and pork forecasts of production and supply.

The variability of beef forecast errors appears to decline in a steady manner during the forecast period while pork forecast variability does not begin to show a significant decline until about seven or eight months into the forecast period (February or March of the year for which the forecast is made). During the last six months of the forecast period, the variability of forecast errors for both beef and pork is quite similar.

The efficient gathering and dissemination of relevant market information contributes to reducing long-run price swings, thus reducing risk for both buyers and sellers in livestock markets. Most studies have found that USDA forecasts offer new and valuable information in the marketplace. This study shows that this information is not only relevant but also improves with the passage of time (at least for beef). This suggests that the USDA is doing a good job of gathering information and improving their forecasting techniques. This is evident in their efficient use of resources in this endeavor, since the USDA’s production and supply forecast information is timely and its accuracy is improving.

References


