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Implications of an Early Corn Crop Harvest for Feed and Residual Use Estimates

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Approved by USDA's World Agricultural Outlook Board

Abstract

U.S. corn plantings this spring were ahead of a typical pace, suggesting that prospects may be good for an early harvest of the 2012 corn crop. An early harvest—before the August 31 end of the previous marketing year—creates an overlap of supply-and-use data between the old and new marketing years that can alter the patterns of corn use and ending stocks, with implications for official USDA projections and estimates. Early harvest and usage of new-crop corn can raise non-feed-and-residual use categories and/or ending stocks in the old marketing year. Feed and residual use of corn is the accounting category used to balance corn supply and demand, derived as total supply minus all other (non-feed-and-residual) uses minus ending stocks. Thus, any increases in non-feed-and-residual uses or ending stocks in the old marketing year related to an early harvest of the next year's corn crop would lower the residual derivation of corn feed and residual use for the old marketing year. To analyze this effect, an econometric and statistical model for marketing-year feed and residual use for total feed grains is developed. The model augments typical economic explanatory factors for feed demand with statistical factors related to the residual nature of this balance sheet component. The effect of an early harvest of the corn crop is represented in the model by the percent of the corn crop rated mature on August 31, a statistic reported by USDA's National Agricultural Statistics Service (NASS). Results suggest that for each 10-percentage-point increase in the August 31 new-corn-crop maturity rating, estimated old-crop feed and residual use of corn falls by almost 120 million bushels.

Keywords: Corn feed and residual, supply-and-demand balance sheet, demand analysis, real corn prices, grain-consuming animal units, corn used in ethanol production, corn production, crop maturity rating

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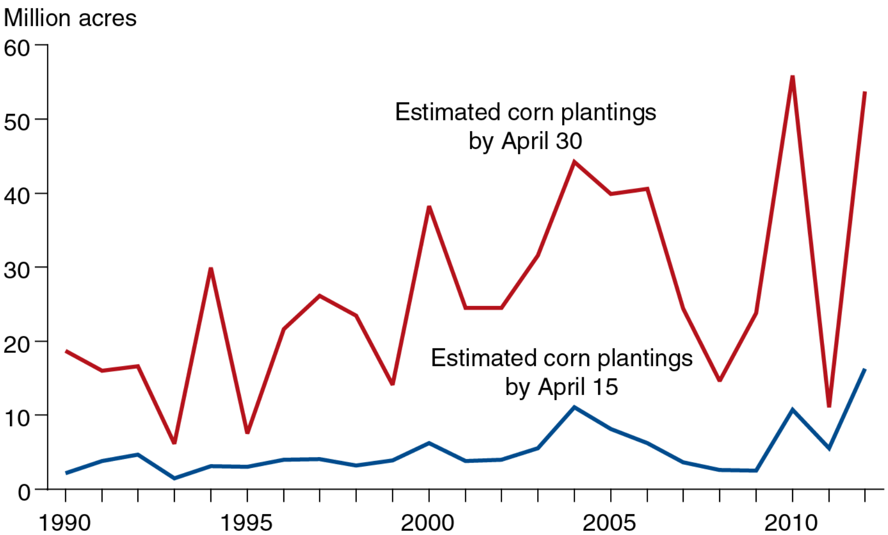
Introduction

With relatively mild weather this past winter across much of the United States, prospects were favorable for the 2012 U.S. corn crop to be planted early this year. Planting progress data for corn indicated an advanced pace through much of the spring. Figure 1 shows that corn plantings as of mid-April and late April 2012 were ahead of the typical pace.[1] As a result, prospects also may be good for an early harvest, with the possibility of a higher than typical portion of the 2012 crop being harvested before September 1, the start of the official 2012/13 U.S. corn marketing year.

An early harvest of new-crop corn has potential implications for non-feed-and-residual usage, ending stocks, and the derivation of feed and residual usage of corn for the old marketing year, as well as for available supplies in the first quarter of the new marketing year. To understand how these potential effects can occur, we first discuss the role of the supply-and-demand balance sheet in agricultural commodity market analysis and the sources of information used for its different components.

[1]Estimates of corn plantings shown in figure 1 are based on *Prospective Plantings* and estimates of planting progress for 18 major corn producing States (17 States in the 1990s). These States represented 92 percent of corn plantings in 2011. For 2012, this 18-State planting progress aggregate measure may understate total corn planting progress since several Southern States, with total prospective plantings of more than 3 million acres, are not included.

Figure 1
Estimated corn plantings through April 15 and April 30



Source: USDA, Economic Research Service calculations, derived from USDA, National Agricultural Statistics Service March *Prospective Plantings* for U.S. total intended corn plantings times the 18-State (17-State in 1990s) aggregate corn planting progress as of April 15 and April 30 (USDA, National Agricultural Statistics Service, *Quick Stats*).

Feed and Residual Usage Balances Corn Supply and Demand

The supply-and-demand balance sheet is the primary vehicle used by USDA for commodity market analysis. It is used to summarize commodity markets historically as well as the Department's short-term and long-term outlook projections (USDA (a) and USDA (b)). It is also used as the basic analytical and reporting framework for studies of commodity market effects resulting from alternative scenarios for agricultural policies or supply-and-demand prospects.

Table 1 shows the corn supply-and-demand balance sheet for marketing years 2006/07 through 2010/11. Major supply-and-demand categories are included as well as marketing year farm-level corn prices. Supply components of the U.S. corn balance sheet are survey-based statistics collected by USDA's National Agricultural Statistics Service (NASS) or statistics reported by other official U.S. Government sources. NASS provides data on planted and harvested acreage, yields, and production. Imports are based on data from the U.S. Department of Commerce. Stocks data are survey-based estimates from NASS. The sum of beginning stocks, production, and imports gives total supply. Thus, all components of supply are statistically based.

Table 1

U.S. corn supply-and-demand balance sheet, 2006/07 - 2010/11

Item	2006/07	2007/08	2008/09	2009/10	2010/11
Area (*million acres*):					
Planted acres	78.3	93.5	86.0	86.4	88.2
Harvested acres	70.6	86.5	78.6	79.5	81.4
Yields:					
Bushels per harvested acre	149.1	150.7	153.9	164.7	152.8
Supply and use (*million bushels*):					
Beginning stocks	1,967	1,304	1,624	1,673	1,708
Production	10,531	13,038	12,092	13,092	12,447
Imports	12	20	14	8	28
Supply	12,510	14,362	13,729	14,774	14,182
Feed & residual	5,540	5,858	5,182	5,125	4,793
Food, seed, & industrial	3,541	4,442	5,025	5,961	6,428
Ethanol and byproducts	2,119	3,049	3,709	4,591	5,021
Domestic use	9,081	10,300	10,207	11,086	11,220
Exports	2,125	2,437	1,849	1,980	1,835
Total use	11,207	12,737	12,056	13,066	13,055
Ending stocks	1,304	1,624	1,673	1,708	1,128
Prices (*dollars per bushel*):					
Farm price	3.04	4.20	4.06	3.55	5.18

Note: Marketing year beginning September 1 for corn.

Source: USDA, Economic Research Service, *Feed Grains Database*.

Most of the demand categories also reflect available data sources. Exports are based on data from the U.S. Department of Commerce. Seed use is derived from acreage data from NASS. Components of food and industrial use (other than corn used in ethanol production)—which include uses for production of high fructose corn syrup, glucose and dextrose, starch, beverage and manufacturing alcohol, cereals, and other food items—are based on data from various Governmental and nongovernmental sources. Corn used in the production of ethanol and related feed byproducts is estimated by USDA based on ethanol production data reported by the Energy Information Administration of the U.S. Department of Energy.

In the balance sheet, supply minus demand must be equal to the survey-based ending stocks estimate reported by NASS. In the corn balance sheet, there is no direct measure of feed use.[2] Thus, the category used to obtain the required balance is the residually derived feed and residual use of corn. In the balance sheet, feed and residual use is derived to equal supply minus all other uses minus ending stocks. Implicitly, this derived component of the balance sheet includes actual feed use, measurement and estimation errors in other components of the balance sheet, and postharvest crop loss factors such as waste and shrinkage that occur throughout the corn marketing channel. To illustrate, with recent U.S. corn crops of 12-13 billion bushels, if production estimate errors and crop losses combine to represent 1 percent of production, feed and residual would change by 120-130 million bushels.

[2]USDA does not survey for grain used in feeding and relies on survey-based production and quarterly stocks estimates to indicate grain disappearance. Surveying for feeding would require a substantial increase in resources. Such a survey might also prove impractical, given the vast array of feeding operations that make up the Nation's swine, beef cattle, dairy, broiler, layer, and turkey production sectors. These operations are diverse and use a wide and complex variety of feed products in addition to grains. There is also a significant amount of feed use of grain that occurs outside the conventional livestock, dairy, and poultry sectors and includes feeding of horses, household pets, and aquaculture, all of which present additional challenges to any comprehensive survey of grain used in feeding.

Potential Effects of an Early Corn Harvest

The official marketing year for corn starts September 1 and runs through August 31 of the following year. An early harvest of the corn crop—before the August 31 end of the previous marketing year—creates an overlap of supply-and-use data between the old and new marketing years. This overlap can affect the residual derivation of corn feed and residual use for the previous marketing year in two ways.[3]

First, when the harvest of the new crop occurs early (before August 31, the end of the previous corn marketing year), some of the new crop may be used by August 31, augmenting use at the end of the previous marketing year without displacing old-crop usage. If this occurs for uses other than feed and residual, estimates for those use components would be increased without changing old-crop ending stocks.[4] As a result, the derived feed and residual use calculation for that previous marketing year would be lowered.

Second, early use of the new crop in the previous marketing year may displace some use of old-crop corn in that same marketing year. If new-crop use displaces some old-crop use, the estimate of old-crop stocks on September 1 would be higher than in the absence of this early new-crop usage since the displaced corn would be part of ending stocks. This increase in year-ending old-crop stocks lowers the derived feed and residual use estimate for the old-crop marketing year in the supply-and-demand balance sheet.

Another potential effect of an early corn harvest is that total available supplies of corn in the new marketing year may be less than the sum of beginning stocks, new-crop production, and imports because of early usage of some of the new-crop production. As a consequence, derived feed and residual use for the new-crop marketing year would be increased, particularly during the harvest quarter (September-November).

[3]See the appendix for numerical illustrations of these types of effects.

[4]The NASS estimate of September 1 corn stocks covers only old-crop corn rather than a comingled pool of both new- and old-crop corn (see, for example, USDA/NASS, September 2011 *Grain Stocks* report).

Feed and Residual Use Model

An annual econometric and statistical model was developed to investigate how an early corn harvest can affect the residually derived feed and residual corn use category.[5] Because of the residual nature of the calculation used to derive this utilization variable, both economic and statistical factors are used in the model as explanatory variables. The economic factors are intended to provide measures of effects related to actual feed use, while the statistical factors are intended to provide measures of effects related to the residual component. The model draws on information and data readily available to USDA interagency commodity estimates committees and is typical of models used by those committees in their market analysis process.

Model's Dependent Variable Is Feed and Residual Use of Total Feed Grains

Although corn is the dominant feed grain used in animal feeding, overall livestock sector demand for feed also includes feed use of other feed grains. Thus, the model uses annual data for feed and residual use for total feed grains, covering feed and residual use of corn, sorghum, barley, and oats.[6]

Data for the different feed grains are converted from units of million bushels to metric tons to allow aggregation in common units. This step is needed because standard bushels of the different feed grains have different physical weights—56 pounds per bushel for corn and sorghum, 48 pounds for barley, and 32 pounds for oats.[7] Implications for corn can be drawn from models using this aggregate feed demand approach by netting out feed uses for the other feed grains and then converting the result back to 56-pound corn bushels.[8]

[5]The analysis does not cover quarterly patterns of feed and residual use within a marketing year.

[6]Annual data for corn and sorghum reflect a marketing year that begins September 1. Annual data for barley and oats are for a marketing year beginning June 1. In the model discussed in this report, no adjustment was made to account for the different periods covered in these marketing years. This follows the approach used for the aggregated U.S. feed grains balance sheet in USDA's monthly *World Agricultural Supply and Demand Estimates* report (USDA (a)). However, implications are similar from an alternative version of the model reported here that does adjust all feed and residual use data to a common September-August time period.

[7]For oats, 38-lb bushels are used for imports. Implicitly, this means that feed and residual use for oats is a blend of 32-lb bushels and 38-lb bushels. This difference is not accounted for here in the aggregation of feed and residual uses across the different feed grains. Its effect on the aggregate series is small, on the order of 0.3 million metric tons or about 0.2 percent, and its effects on the model estimation and implications would be negligible.

[8]While the model could be specified for corn feed and residual use directly, accounting for the four feed grains provides a more complete representation of overall livestock-sector feed demand and improves the statistical explanatory power for corn feed and residual use. On the other hand, wheat feed and residual use is not included in the model since doing so reduces the model's explanatory power for corn feed and residual use. Although wheat feed and residual use is somewhat larger than that for sorghum, barley, or oats, it is much smaller relative to the crop's production, and thus may have a larger residual component.

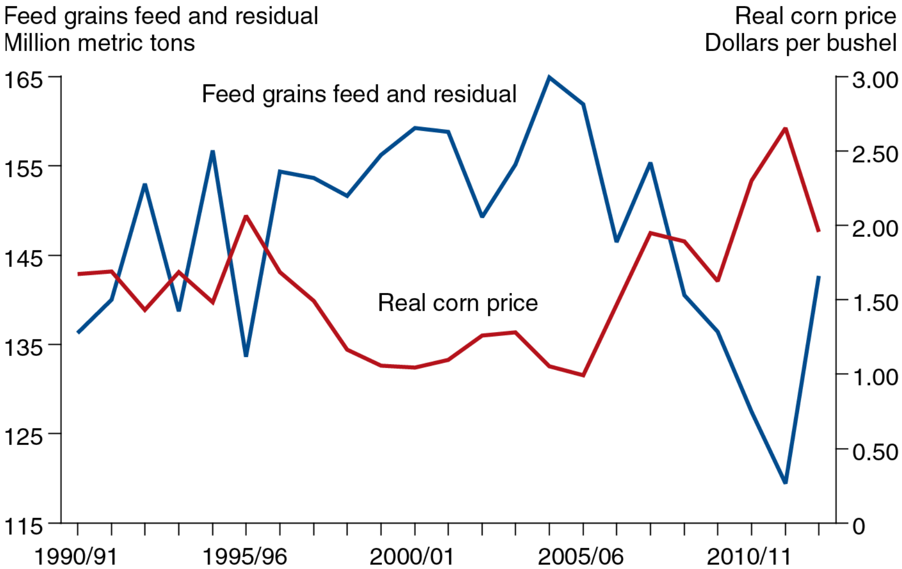
Economic Factors Affecting Feed and Residual Use

Three variables are included to represent economic factors affecting actual feed use.

Corn prices. The first economic variable is the price of feed. This is represented in the model by the real corn price, calculated as the nominal marketing-year weighted-average corn price received by farmers divided by the consumer price index (CPI). The annual CPI used for this real corn price calculation is for the calendar year following the year of harvest of the corn crop, chosen because more months of the corn marketing year occur in that calendar year. Thus, for example, the CPI for 2011 is used to deflate the 2010/11 marketing year corn price. Also, while the CPI data are in units of 1982-84 = 100, they are converted to units of 1982-84 = 1.0 so that the resulting real corn prices are in similar units to the original nominal prices.

Economic theory suggests that feed use of feed grains would decrease if the price of corn rose, implicitly representing a movement up the feed demand curve. Thus, the sign on the coefficient of this variable in the model is expected to be negative. Figure 2 shows historical data for total feed grains feed and residual use and the real corn price. A general negative relationship is illustrated.

Figure 2
Economic variables and feed use:
Feed grains feed and residual use and real corn price



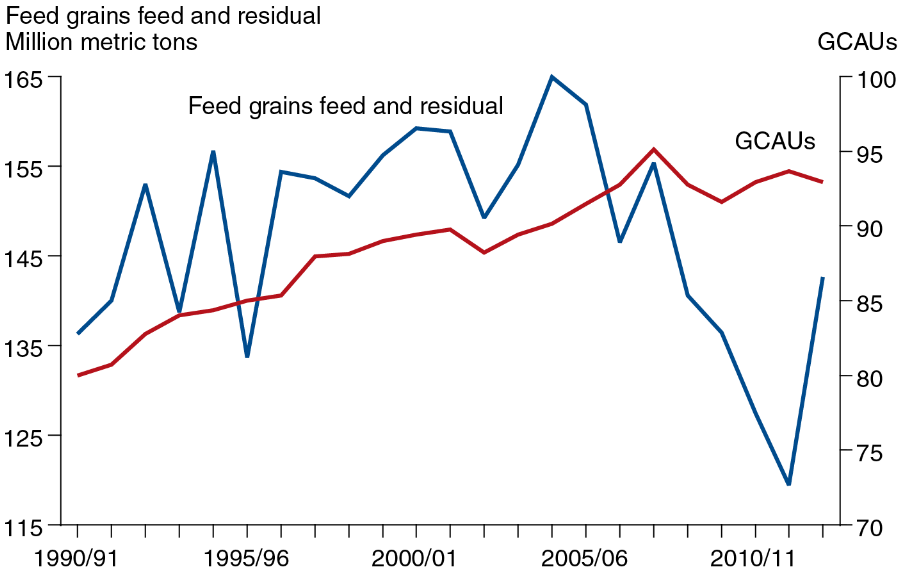
Note: 2011/12 and 2012/13 data are based on USDA's May 2012 *World Agricultural Supply and Demand Estimates* report. Real corn price is the nominal corn price deflated using the consumer price index (converted to 1982-84 = 1.0).

Sources: USDA, Economic Research Service, *Feed Grains Database* and U.S. Department of Labor, Bureau of Labor Statistics.

Size of the livestock sector (grain-consuming animal units). A second economic variable included in the model is a measure of the size of the overall livestock sector. An index of grain-consuming animal units (GCAUs) has been published by USDA for many years (Allen, Hodges, and Devers, 1974; Baker, 1998). This index weights animal numbers for different livestock categories by technical factors related to their feed requirements and their feed conversion efficiency in a manner that allows a summation across the groups. Although this statistic has been criticized at times as a stand-alone feed demand measure because of its use of weighting factors that do not reflect changing feed efficiencies, it still provides a useful overall indicator of feed demand.

The larger the size of the livestock sector, as measured and indicated by a larger GCAU, the greater overall feed demand would be, so the sign on the coefficient of this variable in the model is expected to be positive. From an economic perspective, this would depict a shift of the feed demand curve to the right. Figure 3 shows historical data for total feed grains feed and residual use and this economic explanatory variable. There is much less variation in GCAUs than there is in real corn prices shown in figure 2.

Figure 3
Economic variables and feed use: Feed grains feed and residual use and grain-consuming animal units (GCAUs)



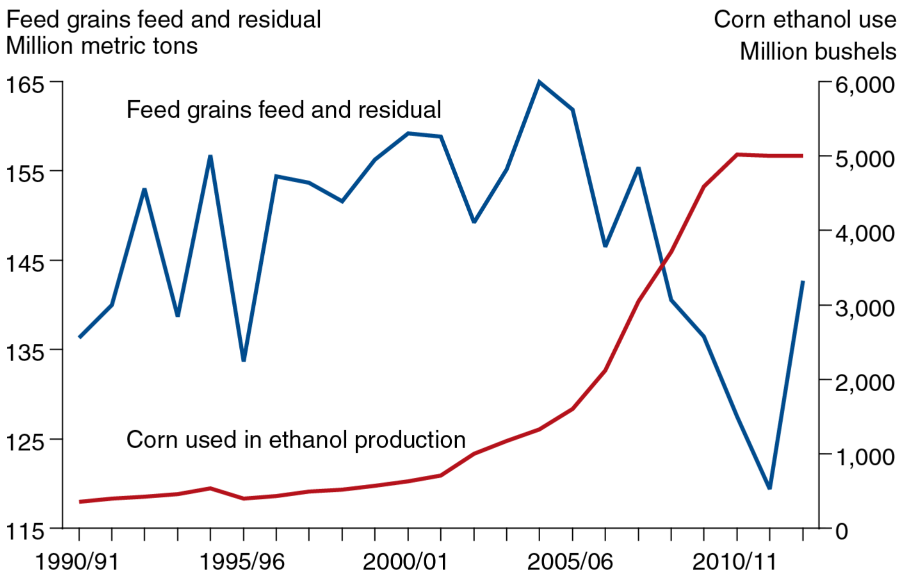
Note: 2011/12 and 2012/13 data are based on USDA's May 2012 *World Agricultural Supply and Demand Estimates* and *Feed Outlook* reports.

Source: USDA, Economic Research Service, *Feed Grains Database.*

Availability of competing feeds (distillers' dried grains). The third economic variable included in the model is the amount of corn used in the production of ethanol. This variable serves as a proxy for the availability of distillers' dried grains (DDGs) as a competitive feed source to feed grains. There has been a large and rapid expansion of the ethanol sector in the United States over the past decade. Since corn is the primary feedstock used for U.S. ethanol production and since most of the expansion has been in the dry mill ethanol production process, supplies of the DDGs co-product have expanded sharply as well (Hoffman and Baker, 2010). The aggregate substitution of DDGs for other feeds in U.S. livestock rations depends on the overall share of DDGs production that is used in the United States, the shares of DDGs that go to the feeding of different livestock, and the substitution of DDGs for corn and other feeds in animal-specific rations (Hoffman and Baker, 2011). The variable used here for the model, corn used in the production of ethanol, is intended to represent the net effect of these considerations.

The greater the availability of DDGs, as represented by higher levels of corn used in the production of ethanol, the lower the amount of overall feed demand for feed grains. Thus, the sign on the coefficient of this variable in the model is expected to be negative. From an economic perspective, this would depict a shift of the feed demand curve to the left. Figure 4 shows historical data for total feed grains feed and residual use and this economic explanatory variable. The large expansion of ethanol production over the past decade (and the related increase in availability of DDGs) appears to have a strong negative relationship to feed grains feed and residual use.

Figure 4
Economic variables and feed use:
Feed grains feed and residual use and corn used in ethanol production



Note: 2011/12 and 2012/13 data are based on USDA's May 2012 *World Agricultural Supply and Demand Estimates* report. Corn used in ethanol production is a proxy for the availability of distillers' dried grains, a competing feed.

Source: USDA, Economic Research Service, *Feed Grains Database*.

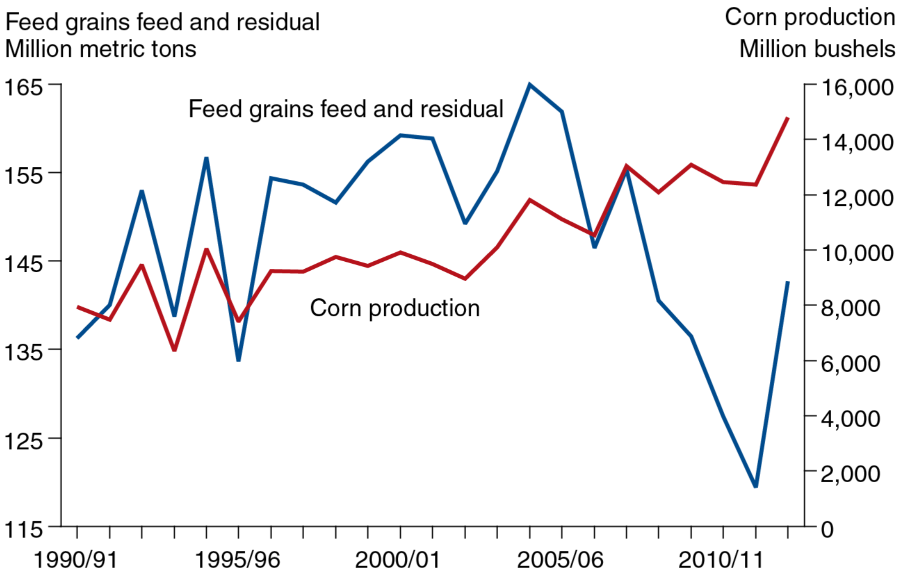
Statistical Factors Affecting the Estimation of Feed and Residual Use

Two variables are included in the model to represent statistical issues that can have effects due to the residual nature of the derivation of feed and residual use.

Size of the corn crop. Corn production is included in the model to represent the size of the crop.[9] Its inclusion is based on the hypothesis that the larger the size of the crop, the larger the potential for crop shrinkage and losses and for measurement and estimation errors in other components of the supply-and-demand balance sheet.[10]

Since potential losses and errors would be positively correlated with the size of the crop, the residual component of the feed and residual measure would also be positively correlated with this variable. Thus, the sign on the coefficient of corn production would be expected to be positive. Figure 5 shows historical data for total feed grains feed and residual use and this potential explanatory variable for the statistical "residual" component. A general positive relationship is illustrated.

Figure 5
Statistical variables related to "residual" use: Feed grains feed and residual use and corn production



Note: 2011/12 and 2012/13 data are based on USDA's May 2012 *World Agricultural Supply and Demand Estimates* report. Corn production is a proxy for potential measurement errors and post-harvest crop losses.

Source: USDA, Economic Research Service, *Feed Grains Database.*

[9]Typically, a supply variable would not be included in a demand equation because of technical identification issues. However, here the crop production variable is intended to capture statistical aspects of the residual component of the feed and residual variable rather than economic aspects of feed demand.

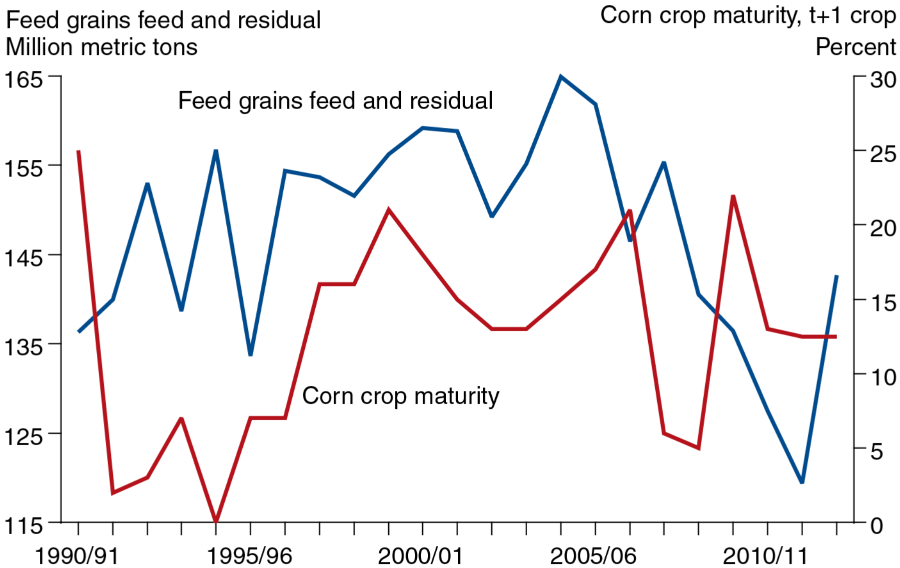
[10]Some crop shrinkage can result from differences in the quality of the crop due to moisture content and test weights that affect estimates of crop production. This factor would be independent of the size of the crop and, thus, would not be represented in the model.

Early harvest of following year's corn crop. As discussed earlier, the larger the early harvest of the following year's corn crop, the higher the potential for early new-crop usage and a larger year-ending old-crop stocks estimate. As a consequence, early new-crop harvesting can result in a smaller feed and residual calculation for the old-crop marketing year.

Ideally, to represent the effects of an early harvested crop, one would use data for the amount of the crop harvested prior to September 1. However, while such data is available for some years for some States, this information is readily available only on an irregular basis over the past 20 years. As a proxy for that information, the model uses the percent of the corn crop that is rated "mature" by August 31, since this would be a precondition for the crop to be harvested. This data is reported by NASS in the weekly *Crop Progress* and is repeated in the joint U.S. Department of Commerce and USDA *Weekly Weather and Crop Bulletin*.[11] Because the early harvest of a corn crop is hypothesized to reduce the estimate of the previous year's feed and residual use, a time period lead of 1 year (t+1) applies to the corn maturity variable. Figure 6 shows historical data for this corn maturity variable with feed grains feed and residual use since 1990, suggesting a rough negative relationship.

[11]This data is typically first reported for late August or early September. Data were interpolated between weekly reports to approximate a corn crop maturity rating for August 31. For years that the first maturity ratings were not available until September, data were extrapolated back to August 31.

Figure 6
Statistical variables related to "residual" use: Feed grains feed and residual use and corn crop maturity by August 31 (for the following year's crop)



Note: 2011/12 and 2012/13 feed and residual data are based on USDA's May 2012 *World Agricultural Supply and Demand Estimates* report; corn crop maturity ratings (for the following year's crop) shown for 2011/12 and 2012/13 are assumed at the 1990-2010 average. The corn crop maturity rating is a proxy for early new-crop corn harvesting and use.

Sources: USDA, Economic Research Service, *Feed Grains Database* and USDA, National Agricultural Statistics Service, *Quick Stats*.

Model Results and Selected Model Properties

The model for feed grain feed and residual use discussed here was estimated using annual marketing-year data for the period 1990/91 through 2010/11. The ordinary least squares (OLS) method was the model estimation procedure. Results are shown in table 2. Overall, the model performs very well, with over 95 percent of the variation of feed grain feed and residual use explained. Each of the estimated coefficients on the explanatory variables has the expected sign and is significant at the 1 percent level.

Figure 7 shows a plot over the estimation period of the actual observations for feed grain feed and residual use as well as the model estimates. Also shown in the figure are two beyond-sample actual- and model-observations for 2011/12 and 2012/13. These beyond-sample period estimates are based on projected independent variables from USDA's May 2012 *World Agricultural Supply and Demand Estimates (WASDE)* and *Feed Outlook* reports. Also, corn crop maturity in these beyond-sample estimates was assumed to be at the average over the model estimation period.

Model Implications for Corn Feed and Residual Use

Of primary interest are the implications of this model for feed and residual use of corn. To obtain these results, feed and residual use for sorghum, barley, and oats are subtracted from the model estimates for total feed grains feed and residual use. The result for corn feed and residual use is then converted from units of million metric tons to million bushels.[12] Figure 8 shows the resulting model implications for corn feed and residual use along with the actual data for that series. These model implications explain over 96 percent of the variation of corn feed and residual use over the 1990/91-2010/11 estimation period. Again, beyond sample estimates are based on projected independent variables from the above cited sources and assume the average for crop maturity on August 31 over the model estimation period.

[12]A metric ton is 2,204.622 pounds. A bushel of corn weighs 56 pounds. Thus, to convert from metric tons to corn bushels, one multiplies by the ratio of these two factors, or 39.36825 bushels per metric ton.

Table 2

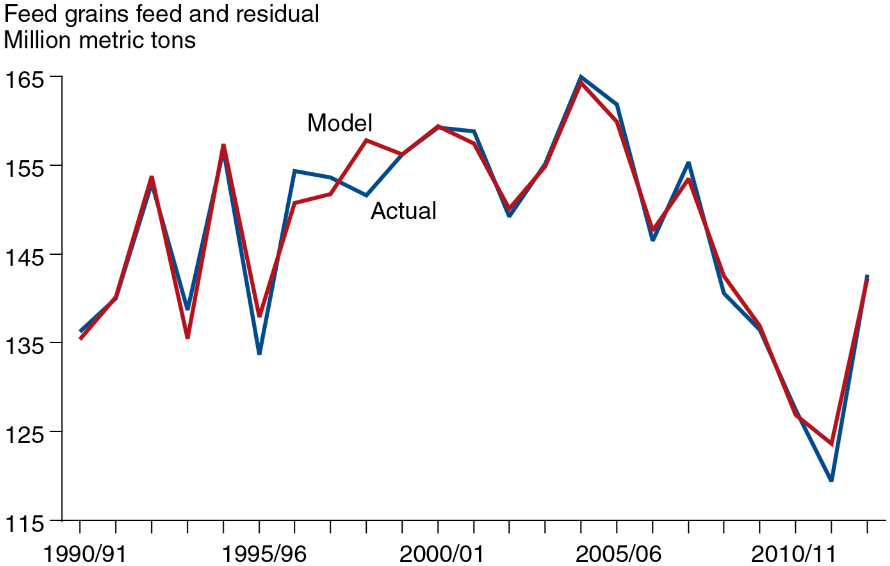
Econometric regression results: Feed grains feed and residual use model

	Intercept	Real corn price	GCAU	Corn used in ethanol production	Corn production	Corn crop (t+1), percent mature, August 31
Coefficient	58.710	-10.771	0.838	-0.00810	0.00480	-0.303
Standard error of coefficient		2.902	0.262	0.00115	0.00077	0.101
t-statistic		-3.712	3.201	-7.034	6.232	-3.006

R-squared	0.953	Estimation period	1990/91 - 2010/11
Standard error	2.601	Number of observations	21
F-statistic	61.1	Degrees of freedom	15

Figure 7

Feed and residual use, total feed grains: Actual and model estimates

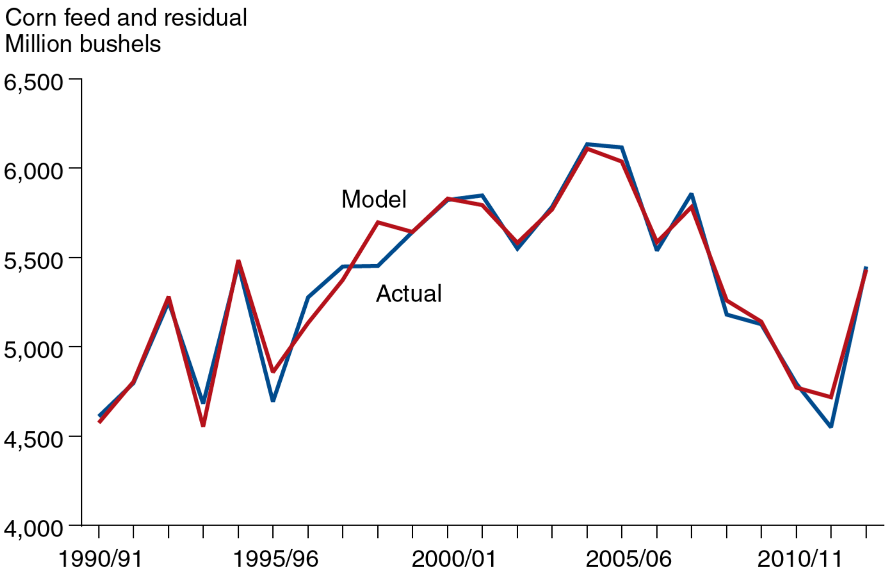


Note: 2011/12 and 2012/13 “actual” data are projections from USDA’s May 2012 *World Agricultural Supply and Demand Estimates* report. Model estimates for those years are beyond-sample projections based on independent variables from the May 2012 *WASDE* and *Feed Outlook* reports, with the corn crop maturity rating (for the following year’s crop) assumed at the 1990-2010 average.

Source: USDA, Economic Research Service, *Feed Grains Database.*

Figure 8

Feed and residual use of corn: Actual and model estimates



Note: 2011/12 and 2012/13 “actual” data are projections from USDA’s May 2012 *World Agricultural Supply and Demand Estimates* report. Model estimates for those years are beyond-sample projections based on independent variables from the May 2012 *WASDE* and *Feed Outlook* reports, with the corn crop maturity rating (for the following year’s crop) assumed at the 1990-2010 average.

Source: USDA, Economic Research Service, *Feed Grains Database.*

Other important model implications for corn feed and residual use include:

Economic factors related to feed demand

- The implicit corn feed and residual use change for a 1-percent change in the real corn price, evaluated at 2010/11 prices is -9.8 million bushels. This result implies an own-price feed demand elasticity of -0.20.
- The implicit corn feed and residual use change for a 1-unit increase in GCAUs is +33.0 million bushels, derived as the GCAU coefficient of 0.838 times the bushels-per-metric-ton conversion factor of 39.36825.[13] For 2010/11, this implies a change of about 0.64 percent corresponding to a 1-percent change in GCAUs. This inelastic result, where a 1-percent increase in GCAUs results in less than a 1-percent increase in feed use, partly reflects improvements in feed efficiency, including a growing share of broilers (the most efficient feed converter) in the mix of animals fed.
- The implicit corn feed and residual use change for a 100-million-bushel increase in corn used for ethanol is -31.9 million bushels. This result suggests an aggregate substitution of DDGs for corn in livestock rations somewhat larger than 1 for 1, consistent with some of the alternatives discussed in Hoffman and Baker (2011).

[13]The GCAU coefficient of 0.838 provides this impact in million metric tons. Multiplying by 39.36825 converts this result to units of million bushels.

Statistical factors related to residual component

- The implicit corn feed and residual use change for a 100-million-bushel increase in corn production is +18.9 million bushels, an estimate of the marginal effect of larger production on postharvest crop losses and measurement errors across all other components of the corn supply-and-demand balance sheet. The relatively large size of this impact could also suggest that an increase in corn production results in higher actual feed use beyond what is captured by the economic factors included in the model.
- The implicit old-crop corn feed and residual use change for a 10-percentage-point increase in the new-corn crop rated mature by August 31 is -119.4 million bushels.

Model projections for corn feed and residual use

The model can be used to make projections for years beyond its estimation period. For the illustrations here, model projections are based on independent variables from the May 2012 *WASDE* and *Feed Outlook* reports. Also, the corn crop maturity rating (for the following year's crop) is assumed at the 1990-2010 average.

- Based on these assumptions, the model projection for 2011/12 corn feed and residual use is 4,717 million bushels.
- With these assumptions, the model projection for 2012/13 corn feed and residual use is 5,432 million bushels.

Other Modeling Considerations

Two alternative specifications of the annual model discussed in this report were used to test for effects of an early harvest on new-crop feed and residual use—no statistically significant effect was indicated. Since any such effect would be expected to be mostly in the harvest quarter (September-November), a similar model was estimated for feed and residual use in the first quarter of the new marketing year. Results from this model suggest a marginally statistically significant increase of about 33 million bushels (standard error of 21 million bushels) in first quarter feed and residual use of corn for a 10-percentage-point higher new-crop maturity rating on August 31.

This is a relatively small impact compared with the estimated effects on annual feed and residual use in the previous marketing year corresponding to the same crop maturity change. One possible reason for this smaller result may be that residual effects may show up more readily at the end of the crop year, when total market supplies are seasonally low, than in the first quarter of the new crop year when the new-crop production dominates supplies.

Implications of an Early 2012 Corn Harvest

As reported above, the estimated model implies a corn feed and residual use level of 4,717 million bushels for the soon-to-be completed 2011/12 corn marketing year. This model projection assumed the percent of the corn crop rated mature on August 31 would be equal to the average over the model estimation period, which was 12.5 percent. Also reported above, for each 10 percentage point increase in the new-corn-crop maturity rating, the model estimates a reduction of 119.4 million bushels in the old corn crop's feed and residual use.

Using these results, model projections can be derived for 2011/12 corn feed and residual use for various levels of the 2012 corn crop maturity rating. Table 3 shows implications of different 2012 corn crop maturity ratings from 10 percent to 30 percent. For example, the model projection for 2011/12 corn feed and residual use is lowered to 4,568 million bushels if the 2012 corn crop rated mature by August 31 is at the sample maximum of 25 percent rather than the average of 12.5 percent.

Table 3

2011/12 model projections for corn feed and residual use for different shares of the 2012 corn crop rated mature by August 31

2012 corn crop maturity rating, August 31	Model projection for 2011/12 corn feed and residual use	Difference from model projection based on sample average maturity rating
Percent	--------------------- *Million bushels*	---------------------
10	4,747	30
11	4,735	18
12	4,723	6
12.5, sample average	4,717	0
13	4,711	-6
14	4,699	-18
15	4,687	-30
16	4,675	-42
17	4,663	-54
18	4,651	-66
19	4,639	-78
20	4,627	-90
21	4,615	-102
22	4,604	-113
23	4,592	-125
24	4,580	-137
25, sample maximum	4,568	-149
26	4,556	-161
27	4,544	-173
28	4,532	-185
29	4,520	-197
30	4,508	-209

Based on projections for other model variables from USDA's May 2012 *World Agricultural Supply and Demand Estimates* and *Feed Outlook* reports.

Conclusions

The 2012 U.S. corn crop has the potential to have a larger than typical amount harvested early, before the August 31 end of the 2011/12 marketing year. To the extent that some early-harvested, new-crop corn is used before the start of September, some old-crop corn usage may be displaced. If so, this could raise estimated old-crop ending stocks for the 2011/12 marketing year and result in a correspondingly lower derived calculation for feed and residual use. Further, even if early new-crop usage does not displace old-crop usage, it may augment use at the end of the 2011/12 marketing year. If this additional use occurs for uses other than feed and residual, again the derived 2011/12 feed and residual use calculation will be lowered.

The model discussed in this report includes both economic factors and statistical measurement considerations underlying historical feed and residual use. The model provides a framework for projecting effects on derived 2011/12 feed and residual use for different economic conditions and for different assumptions regarding the amount of the early-harvested 2012 corn crop.

Another implication of an early harvest is that available supplies of corn in the new marketing year may be less than the sum of beginning stocks, new-crop production, and imports because of early usage of some of the new-crop production.

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Appendix—Impacts of Early New-Crop Usage on a Supply-and-Demand Balance Sheet

Early new-crop usage results when some of the next marketing year's crop is harvested and consumed before the end of the current marketing year. Although some early usage likely occurs every year, as long as that volume of consumption is relatively consistent from year to year, effects tend to be offsetting across marketing years in the supply-and-demand balance sheet. However, if the pattern of early harvesting and usage changes between years, the balance sheet for both the current and following marketing years can be affected.

Appendix table 1 provides a simplified supply-and-demand balance sheet for a hypothetical commodity to illustrate the impacts resulting from early new crop usage. This balance sheet assumes a base scenario where stocks, production, and use are the same in both the current marketing year ($year_t$, shown as items 1-7), and the next marketing year ($year_{t+1}$, shown as items 8-14). For simplification, the base scenario assumes no early harvest and use of the next marketing year's crop in the current marketing year. Different assumptions regarding early harvest and use and the associated effects on the balance sheet are then illustrated in the other scenarios.

Scenario 1 assumes 10 units of the next year's ($year_{t+1}$) production is consumed in the current year ($year_t$) as an additional reported use (use other than for feed and residual), with no displacement of use of current-year supplies, thereby raising other uses to 510 units. Since no displacement of current-year supplies occurs, old-crop ending stocks as surveyed by NASS remain unchanged at 100 units. Thus, derived feed and residual use declines in the current year to offset the increase in other uses. Supplies in the next year now include 10 units of production that have already been used in the previous year. These already-used units will not be part of reported stocks at the end of the second year, so ending stocks are reduced to 90 units. With no changes in other uses in the second year, calculated feed and residual use increases by 10 units.

Scenario 2 also assumes 10 units of the next year's ($year_{t+1}$) production is consumed in the current year ($year_t$). Here the early usage is assumed to displace 10 units of the current year's supplies from use, leaving other uses unchanged at 500 units. The displaced supplies become part of the NASS-surveyed, old-crop ending stocks. With ending stocks thus raised 10 units to 110, calculated feed and residual use declines 10 units in the current year. As in scenario 1, 10 units of production for the next year have already been consumed in the preceding year and will not be part of reported stocks at the end of the second year, so ending stocks are 10 units lower than beginning stocks. Thus, calculated feed and residual use is again 10 units higher in the second year.

Each of these scenarios demonstrates that changes in the pattern of early usage have multi-year impacts on the supply-and-demand balance sheet. Both situations are likely to occur when there is an early harvest of a crop, so a combination of effects such as depicted in scenarios 1 and 2 would be reflected in commodity balance sheets. By holding production levels and other uses (reported uses for non-feed-and-residual-use categories) in the second year the same as in the base scenario, implications for ending stocks and the derived residual use category can be clearly shown.

In the real world, with the supply-and-use elements of the balance sheet affected by numerous additional factors, separating these early-harvest effects into measurable impacts is not possible. What is evident, however, is that an increase in early harvest and usage of a new crop (1) affects the derived estimates of old-crop feed and residual; and (2) reduces actual available supplies in the following marketing year from those calculated based on reported data, thereby implying an offsetting increase in that year's derived feed and residual use in the supply-and-demand balance sheet.

Appendix table 1

Scenarios for early new crop usage in a hypothetical commodity supply-and-demand balance sheet

Item no.	Simplified balance sheet categories	Source	Base scenario	New-crop usage scenarios: Scenario 1[1]	Scenario 2[2]
	Year_t				
1	Beginning stocks	Reported	100	100	100
2	Production	Reported	900	900	900
3	Total supply[3]	(1 + 2)	1,000	1,000	1,000
4	Feed & residual use	(3 - 7 - 5)	400	390	390
5	Other uses	Reported	500	510	500
6	Total use	(4 + 5)	900	900	890
7	Ending stocks	Reported	100	100	110
	Year_{t+1}				
8	Beginning stocks	Reported	100	100	110
9	Production	Reported	900	900	900
10	Total supply[3]	(8 + 9)	1,000	1,000	1,010
11	Feed & residual use	(10 - 14 - 12)	400	410	410
12	Other uses	Reported	500	500	500
13	Total use	(11 + 12)	900	910	910
14	Ending stocks	Reported	100	90	100

[1]Scenario 1 assumes early usage of year_{t+1} production raises reported other uses in year_t by 10 units.
[2]Scenario 2 assumes early usage of year_{t+1} production displaces usage of year_t supplies, raising ending stocks in year_t by 10 units.
[3]Assumes no imports.