

Model Results and Properties

The models were estimated with annual marketing year data from 1975 through 1996 using ordinary least squares regression in SAS (SAS Institute).

Corn Equation

The estimated logarithmic regression equation for corn is:

$$\begin{aligned}
 (7a) \text{ Ln}(p) &= 1.619 - 0.2813 \text{ Ln}(K/U) && (8.6) \\
 &+ 0.0149 (CCC/U) && (3.1) \\
 &+ 0.2269 \text{ Ln}(LR) \text{ Dum}7885 && (6.8) \\
 &- 0.3256 \text{ Dum}86 && (3.6)
 \end{aligned}$$

$$R^2 = 0.908$$

$$F\text{-value} = 41.812$$

$$\text{Standard error of the estimate} = 0.0583$$

$$\text{Durbin-Watson statistic} = 1.931$$

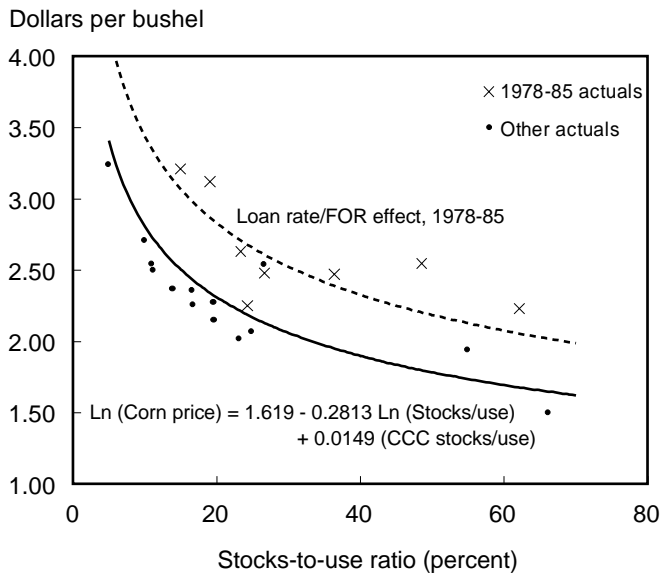
$$\text{Estimation period: } 1975 - 1996$$

Numbers shown in parentheses under each coefficient are t-statistics. Variable definitions are summarized in table 1.

Nearly 91 percent of the variation in the logarithm of annual corn prices is explained by estimated equation 7a. Transforming the equation to price levels, close to 90 percent of the variation of annual corn prices is explained. Each coefficient has the expected sign, with a negative sign for the total stocks-to-use variable and positive signs for the government-owned stocks-to-use variable and the 1978-85 loan-rate shift variable. Each coefficient is significant at the 1-percent level. The F-value for the overall significance of the equation greatly exceeds the 1-percent critical F-value (4 and 17 degrees of freedom) of 4.67. The Durbin-Watson statistic indicates that first-order autocorrelation is not a problem with the equation.

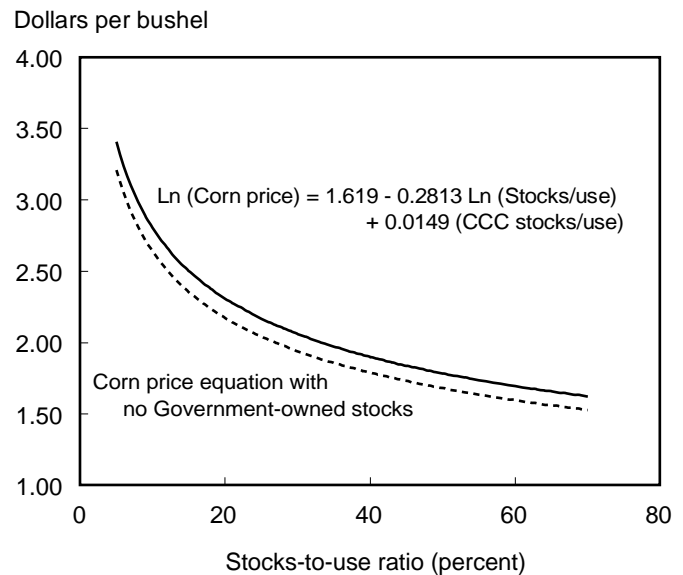
Graphs highlighting the regression equation results for corn are shown in figures 7 and 8. In each figure, corn prices are plotted against ending stocks-to-use ratios. Figure 7 illustrates the price effects in 1978-85 of the higher loan rates and the FOR. The higher price curve incorporates the average price-supporting effect of high loan rates in 1978-85, while the lower price curve omits

Figure 7
Corn price equation—1978-85 loan rate/FOR effect



Note: Both curves evaluated at sample mean value for CCC stocks relative to use, with the 1986 dummy variable set equal to 0.

Figure 8
Corn price equation—Government stocks effect



Note: Higher curve evaluated at the sample mean value for CCC stocks relative to use, corresponding to CCC stocks of about 300 million bushels. Both curves assume the 1986 dummy variable equals 0.

that effect. To isolate the loan-rate effect, both price curves in figure 7 are evaluated at the sample-average value of the government-owned stocks-to-use variable. Both curves assume the 1986 dummy variable is equal to 0. The circles and "x's" in figure 7 represent the historical observations for the 1975-96 estimation period, with "x's" representing the 1978-85 observations corresponding to the loan rate/FOR shift variable and the circles representing the other years.

The average difference between the two price curves in figure 7 for the mean stockholding level of the 1978-85 period is about 46 cents per bushel. Net price impacts would be smaller, however. Depending on the aggregate demand elasticity for corn, a net corn-price effect is estimated at 30 cents (-0.5 demand elasticity) to 35 cents (-0.3 demand elasticity), using a static analytical framework, without multi-year dynamic supply response.

Figure 8 indicates the sensitivity of the corn price function to governmental stockholding. It repeats the curve from figure 7 without the loan-rate effect, evaluated at the sample average value of the government-owned stocks-to-use variable, which corresponds to government stockholding of about 300 million bushels. It also shows the function evaluated at government-owned corn stocks of 0, representative of recent years with

only small levels of government stockholding for corn. As in figure 7, the 1986 dummy variable is assumed to equal 0 in both curves in figure 8. The difference between the two curves is about 6 percent, ranging from 10 to 20 cents per bushel over the portion of the function shown. With a small amount of corn currently in government stocks, the lower price curve shown in figure 8 is slightly lower than the equation that would currently be used for forecasting corn prices.

Wheat Equation

The estimated logarithmic regression equation for wheat is:

$$(7b) \quad \ln(p) = 3.283 - 0.3413 \ln(K/U) \quad (7.2)$$

$$+ 0.008132 (CCC/U) \quad (3.5)$$

$$+ 0.1703 \ln(LR) \text{ Dum7885} \quad (5.9)$$

$$- 0.3118 \ln(C4K/C4U) - 0.1111 \ln(FS/U) \quad (4.5) \quad (4.5)$$

$$+ 0.2191 \ln(PCS) \quad (3.0)$$

$$R^2 = 0.929$$

$$F\text{-value} = 32.561$$

$$\text{Standard error of the estimate} = 0.0569$$

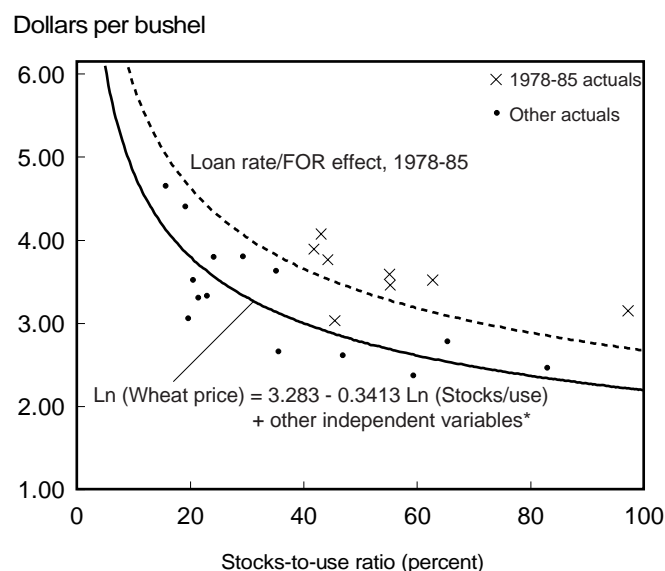
$$\text{Durbin-Watson statistic} = 2.055$$

$$\text{Estimation period: 1975 - 1996}$$

As with the corn equation, numbers shown in parentheses under each coefficient are t-statistics. Again, definitions of the variable names used are summarized in table 1.

Nearly 93 percent of the variation in the logarithm of annual wheat prices is explained by estimated equation 7b. Transforming the equation to price levels, about 92 percent of the variation of annual wheat prices is explained. Each coefficient has the expected sign, with negative signs for the total stocks-to-use variable, competitor stocks-to-use, and wheat feed use, and positive signs for the loan-rate shift variable, government-owned stocks-to-use, and summer-quarter corn prices. Each coefficient is significant at the 1-percent level. The magnitude of the summer-quarter corn price coefficient is larger than the share of total wheat use accounted for

Figure 9
Wheat price equation—1978-85 loan rate/FOR effect



"Other independent variables" include Government-owned stocks relative to use, foreign competitor stocks to use, summer-quarter feed use relative to annual use, and summer-quarter corn prices. For both curves, each of these variables is evaluated at its sample mean.

by wheat feeding, suggesting that additional corn-price/wheat-price correlations beyond the feed wheat price effect are reflected in that coefficient estimate.

The F-value for the overall significance of the wheat price equation is well above the 1-percent critical F-value (6 and 15 degrees of freedom) of 4.32. First-order autocorrelation is not a problem with the equation, as indicated by the Durbin-Watson statistic.

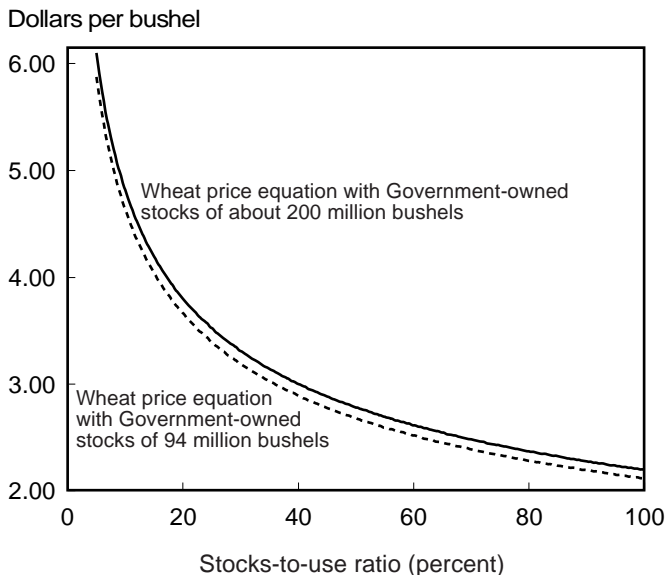
Graphs showing different features of the regression equation results for wheat are shown in figures 9 through 13. In each graph, wheat prices are plotted against ending stocks-to-use ratios and effects of different shift variables are highlighted. As with corn in figure 7, the circles and “x’s” in figure 9 represent the historical wheat-price observations for the 1975-96 estimation period—“x’s” represent the 1978-85 observations corresponding to the loan rate/FOR shift variable and the circles represent the other years. The higher price curve in figure 9 incorporates the average price-supporting effect of high loan rates in the years 1978-85 combined with the FOR. The lower price curve omits the effect of the high loan rates. Other independent vari-

ables from the wheat regression—government-owned stocks-to-use, competitor stocks-to-use, wheat feed use, and summer-quarter corn prices—are assumed at their sample means in each curve.

The average difference between the two price curves in figure 9 for the stockholding levels of the 1978-85 period is about 59 cents per bushel. As with corn, net wheat-price impacts would be smaller. Again, using a static analytical framework without multi-year dynamic supply response, a net wheat-price effect is estimated at 41 cents (-0.5 demand elasticity) to 47 cents (-0.3 demand elasticity).

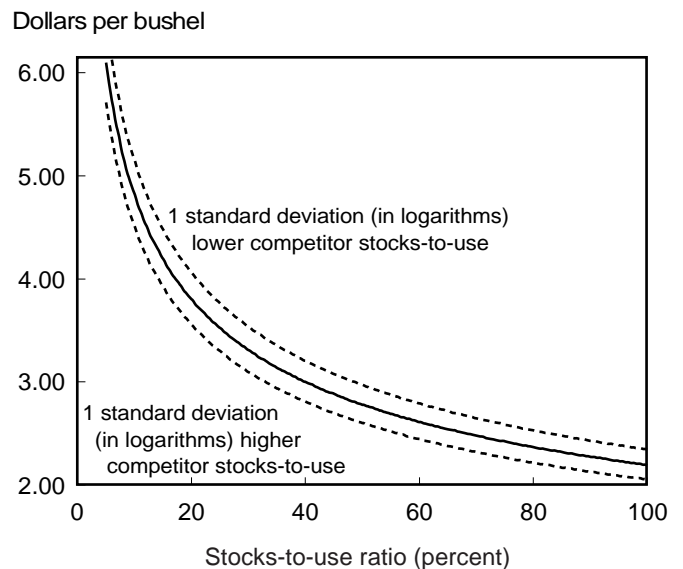
Figure 10 indicates the sensitivity of the wheat price function to government stockholding. It repeats the curve from figure 9 without the high loan-rate/FOR effect of 1978-85, evaluated at the sample average value of the government-owned stocks-to-use variable, and corresponds to government stockholding of about 200 million bushels. It also shows the function evaluated at 1997/98 ending levels of government-owned wheat stocks of 94 million bushels. The difference between the two curves is about 4 percent, ranging from 8 to 23 cents per bushel over the part of the function shown.

Figure 10
Wheat price equation—Government stocks effect



For both curves, other independent variables (except the 1978-85 loan rate shifter) are evaluated at their sample means.

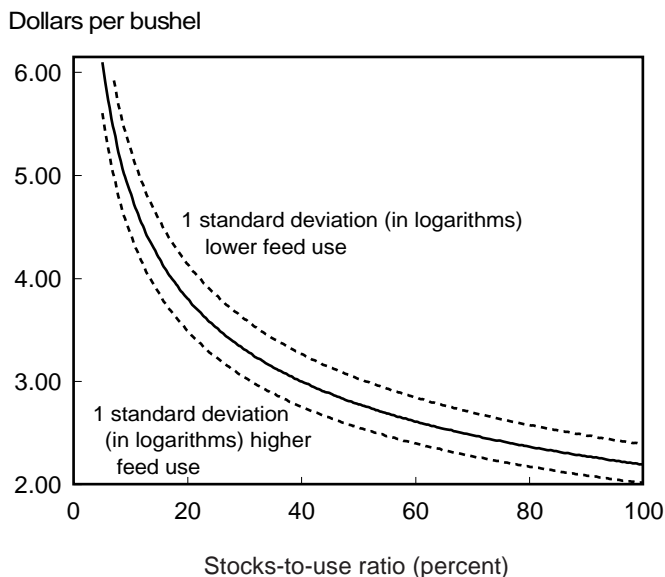
Figure 11
Wheat price equation—Competitor stocks effect



For each curve, other independent variables (except the 1978-85 loan rate shifter) are evaluated at their sample means.

Figure 12

Wheat price equation—Feed use effect



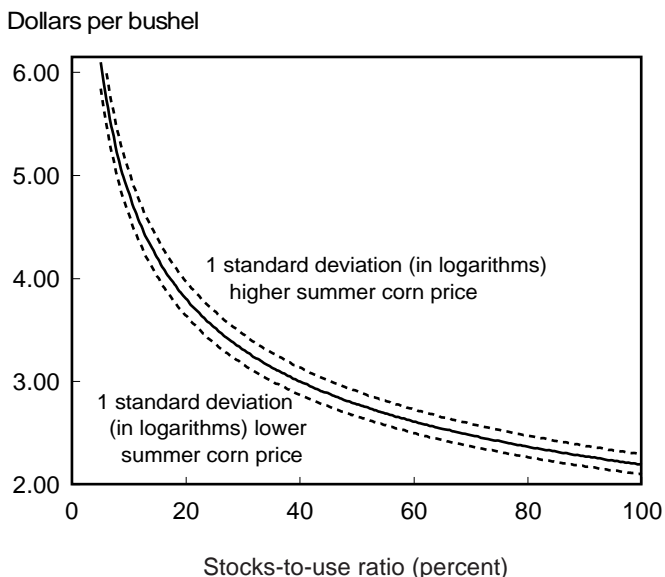
For each curve, other independent variables (except the 1978-85 loan rate shifter) are evaluated at their sample means.

Figure 11 shows the effects on the wheat price function for different levels of competitor stocks-to-use ratio. The middle curve repeats the curve from figure 9 without the loan-rate effect, evaluated at the sample average value of the logarithm of competitor stocks-to-use. The other two curves assume logarithms of competitor stocks-to-use ratios 1 standard deviation higher and lower, corresponding to competitor stocks-to-use ratios from 17.5 percent to 26.8 percent. Price impacts shown are about -14 to -39 cents per bushel with higher competitor stocks-to-use and about 15 to 42 cents per bushel with lower competitor stocks-to-use for the portion of the function shown.

Figures 12 and 13 similarly show the effects on the wheat price function for different levels of summer-

Figure 13

Wheat price equation—Summer corn price effect



For each curve, other independent variables (except the 1978-85 loan rate shifter) are evaluated at their sample means.

quarter feed use of wheat and summer-quarter corn prices, respectively, within 1 standard deviation of their sample averages (in logarithms). In figure 12, the wheat feed-use range shown corresponds to about 120 to 455 million bushels. Corresponding price effects for the part of the function shown range from -18 to -50 cents per bushel with higher feed use and 20 to 54 cents per bushel with lower feed use, in each case keeping the total stocks-to-use ratio constant. In figure 13, the range shown for the summer-quarter corn prices is \$2.06 to \$3.08 per bushel, with corresponding wheat price effects for the part of the function shown ranging from -9 to -26 cents per bushel with the lower corn price and 10 to 27 cents per bushel with the higher corn price.