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Effects of the Conservation Reserve Program on Elevator Merchandising Margins in Oklahoma

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The Conservation Reserve Program (CRP) takes cropland out of production for 10 years, reducing grain supplies available to elevators. Results suggest that the program has negatively impacted elevator merchandising margins, but that elevators adjusted rather quickly to CRP changes, making most of the adjustment within 1 year. The reduction in margins reflects an element of pressure on agribusinesses that has not been measured in previous studies.

Key Words: agribusiness, Conservation Reserve Program, country elevators, land retirement programs, merchandising margins

JEL Classifications: Q1, Q2, D4, L1

The Conservation Reserve Program (CRP) is a voluntary, long-term land retirement program that was established under Title XII (Conservation Title) of the Food Security Act of 1985. The legislation was passed in a period of rising agriculture surpluses and increased concern over the on-site costs and off-site damage of soil erosion (Dicks and Coombs). It was designed specifically to assist landowners in protecting their most highly erodible cropland. The CRP also reduces the quantities of goods and services purchased for production activities and expended for marketing activities. The more important agriculture is in the economy, the larger the reduction.

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Although much research has attempted to evaluate the environmental and budgetary impacts of CRP (e.g., Barbarika and Langley), little research has examined the impacts on agribusiness firms. A study by Hyberg, Dicks, and Hebert indicated that the CRP had only minor impacts nationally and regionally, but reduced economic activity by as much as 20% in areas with high enrollment. These impacts were directly attributable to the reduced output associated with the land idled under the program. However, that study did not consider the impacts of the program on specific agribusinesses such as equipment dealers and local grain elevators. Also, it did not consider price impacts in local economies.

Some grain elevator managers, particularly those in areas with high CRP participation, believe that the CRP has contributed substantially to their financial stress. In Oklahoma, for example, CRP enrollment for several counties exceeds 25% of the total cropland in the county. In addition to reducing quantities of grain handled in these areas, CRP enrollment may have caused prices to rise more locally than

nationally, reducing elevator merchandising margins and thus profits. Hence, the impacts of the CRP may have contributed to the declining profits and tight margins for several grain elevators in the state over the past few years. This paper measures the effect of CRP enrollments on merchandising margins for wheat at Oklahoma grain elevators.

Conservation Reserve Program

Farm price and income stabilization along with environmental problems were major concerns as the CRP was designed. Through the CRP, production surpluses could be reduced while also addressing environmental concerns by targeting cropland with highly erodible soils. Acreage enrollment in the CRP was geographically concentrated. Twenty-five percent of U.S. counties with land enrolled in the CRP contained nearly 80% of the total program acreage. In addition, more than 40% of the land came from farmers that enrolled more than 80% of their cropland in the CRP (Dicks and Coombs).

The concentrated enrollment resulted in a concentration of economic impacts on regional economies (Hyberg, Dicks, and Hebert). For example, under the first nine sign-up periods (March 1986 to August 1989), the CRP reduced the available U.S. wheat acreage by 10 million acres, corresponding to an average of approximately 288 million bushels annual production. About 50% of this was in the Northern and Southern Plains (Osborn, Llacuna, and Linsenbigler).[1] By October 1998 and the 18th signup, U.S. CRP enrollment exceeded 29.8 million acres, with more than 40% from the Northern and Southern Plains. Roughly two thirds of the acreage enrolled was considered base acreage for the purpose of base reduction. The Northern Plains region had 8.2 million acres enrolled in the CRP, whereas the Southern Plains had 4.6 million acres enrolled (Barbarika et al.).

Although many factors have contributed to the financial problems facing grain elevators, such as reduced grain exports, heavy borrowing and expansion in the late 1970s and early 1980s, and the overall weak farm economy, the evaluation of the effects of the CRP will provide useful information as the future of CRP or other long-term land retirement programs is debated.

This paper focuses on the effect of CRP on elevator profits by assessing the impacts of CRP on elevator merchandising margins. A theoretical model is developed for grain elevators performing grain merchandising services. Comparative static analysis shows the expected effect of land retirement programs on elevator merchandising margins. An empirical model is used to assess the impacts of CRP on grain elevator merchandising margins for wheat in major wheat-producing counties in Oklahoma.

Theoretical Framework

Consider a grain elevator providing a merchandising service, where grain purchased from farmers is sold directly to next-in-line (NIL) buyers. For this merchandising service, quantity purchased by the elevator equals quantity sold by the elevator.[2] The elevator's profit objective can be written as

$$(1) \qquad \pi = P_R Q - P_f Q - C_v Q - C_{fx},$$

where P_R is a price received from NIL buyers, P_f is price paid to farmers, C_v is variable merchandising costs, C_{fx} is fixed costs, and Q is quantity purchased from farmers and sold to NIL buyers.

The quantity of grain sold by farmers to an elevator (Q) depends on the price paid to farmers for the grain (P_f; the elevator has spatial "monopsony" power), the relative incentives for the producer to store or sell the grain at harvest and for the elevator to attract grain from storage (S), and the intensity of production in the area surrounding the elevator (I).

The intensity of production is a measure of the amount of grain produced on the land sur-

[1] The Northern Plains region includes Kansas, Nebraska, South Dakota, and North Dakota. The Southern Plains region includes Oklahoma and Texas.

[2] Although some shrinkage occurs, it is likely a small amount. To simplify the analysis, we ignore it.

rounding the elevator. Within a crop year, intensity of production is dependent on government farm programs, represented by G, and other variables, such as weather and local supply and demand conditions, represented by N. The quantity of wheat purchased by the elevator is positively related to the price paid by the elevator and to the density of production. Therefore, quantity of grain sold by farmers can be expressed as

$$(2) \quad Q = Q[P_f, I(G, N), S].^3$$

Rewriting Equation (1), the elevator's profit can be expressed as

$$(3) \quad \pi = P_R Q - (P_f Q + C_v Q + C_{fx}).$$

The elevator maximizes profit by choosing P_f so that marginal revenue equals marginal cost:

$$(4) \quad \frac{\partial \pi}{\partial P_f} = P_R \frac{\partial Q}{\partial P_f} - \left(P_f \frac{\partial Q}{\partial P_f} + Q + C_v \frac{\partial Q}{\partial P_f}\right) = 0, \quad \text{or}$$

$$(5) \quad P_R \frac{\partial Q}{\partial P_f} = \left(P_f \frac{\partial Q}{\partial P_f} + Q + C_v \frac{\partial Q}{\partial P_f}\right).$$

The condition says that price paid to farmers is chosen so that the additional revenue gained by raising price paid to farmers is equal to the additional cost incurred. The additional cost is in three parts: the cost of purchasing additional units of grain from farmers; the extra cost of buying the original quantity of grain at the new, higher price; and the added variable cost associated with the increased quantity.

Solving Equation (5), the elevator's optimal purchase price for grain is

$$(6) \quad P_f^* = P_f^*[P_R, I(G, N), S, C_v].$$

To increase the amount of grain handled, the elevator must increase its market area by increasing bids to farmers (Bressler and King, pp. 128ff). Price received is assumed given (each elevator's sales are too small to influence market price), so increases in prices bid to farmers, P_f, reduce merchandising margins.

Taking the partial derivative of Equation (4) with respect to I and using Equation (6) results in the following relation:

$$(7) \quad \frac{\partial P_f^*}{\partial I} = \frac{\dfrac{\partial Q}{\partial I}}{-2\dfrac{\partial Q}{\partial P_f^*} + (P_R - P_f^* - C_v)\dfrac{\partial^2 Q}{\partial P_f^{*2}}} < 0,$$

provided that the second term in the denominator is small or negative, which will be true if the second-order condition holds.[4] As inten-

[3] Equation (2) represents a spatial monopsonist, so it does not include price paid by competitors. To the extent the elevator does in fact have competitors within its trade area, it is assumed here that the elevator and any competitors are initially in an equilibrium with a price boundary between them at which producers are indifferent between selling to either elevator (see Bressler and King, pp. 128ff). The elevator and its competitors are assumed to respond to the same local supply and demand forces, but, having reached equilibrium, none of the elevators has an incentive to change its price. They recognize that an attempt to increase market share at the expense of competitors would be met by an equivalent response, and all would be worse off. If, in response to a change in a relevant variable (reduced production in the elevator's trade area, say), an elevator raises its price, its trade area and quantity purchased will increase at the expense of its competitors and other wheat users. To the extent that the elevator's competitors respond with price increases, the ability of the elevator to increase quantity purchased by raising price is limited. If elevators engage in a "price war," continuing to raise bids to farmers as competitors raise their bids to neutralize the quantity effects, margin changes reported here are greater than elevators' desired margin changes. Conversely, to the extent that elevators limit price increases because of potential response by competitors, margin changes reported here are less than elevators' desired margin changes. In any case, the margin changes reported here represent changes that elevators have actually made in response to the variables.

[4] The second-order condition for profit maximization is

$$\frac{\partial^2 \pi}{\partial P_f^2} = -2\left[\frac{\partial Q(\rho)}{\partial P_f}\right] + (P_m - P_f - C_v)\frac{\partial^2 Q(\rho)}{\partial P_f^2} < 0,$$

where $\rho = P_f, I(G, N), S,$ or

$$P_m \frac{\partial^2 Q(\rho)}{\partial P_f^2} < 2\left[\frac{\partial Q(\rho)}{\partial P_f}\right] + (P_f + C_v)\frac{\partial^2 Q(\rho)}{\partial P_f^2}.$$

This condition says that although both "value marginal product" (first term in Equation 5) and "marginal factor cost" (second term in Equation 5) are upward sloping, the slope of the first is less steep than the slope of the second.

sity of production in the area surrounding the elevator decreases, prices bid to farmers will increase, decreasing elevator merchandising margins. In the next section, an empirical model is specified to assess the effects of several variables, including acres enrolled in CRP, on elevator merchandising margins.

Empirical Specification

Acres typically are enrolled in CRP with 10-year contracts, with new acres enrolled each year as landowners enroll different parcels of land under succeeding annual sign-ups. Thus, some acres were enrolled beginning in 1987, and additional acres have been enrolled in each year since then, with some leaving the program after the contracts expired.

It is expected that elevator merchandising margins are affected by new enrollments as well as by past enrollments in CRP. However, because of the long-term enrollment of CRP acres, elevator managers can adjust their operations, including number of workers and utilization levels of fixed assets, to expected changes in production resulting from CRP enrollment. Thus, the current year's margin would be expected to depend most heavily on last year's enrollment in CRP, to a lesser extent on the previous year's enrollment, and to an even lesser extent on enrollment 2 years ago.

Adjustments might happen slowly if an elevator manager faces constraints such as fixed investment (unit train loading facilities, for example); long-term agreements with suppliers or purchasers; or "lumpiness" of labor resources. The quicker an elevator manager adjusts to new enrollments in CRP, the less effect enrollments in the more distant past would have on merchandising margins.

Thus, the model is specified as

$$
\begin{aligned}
(8)\quad Margin_{it} &= \beta_0 + \alpha_1 Proportional\ Change\ in\ CRP_{it-1,t} \\
&\quad + \alpha_2 Proportional\ Change\ in\ CRP_{it-2,t-1} \\
&\quad + \alpha_3 Proportional\ Change\ in\ CRP_{it-3,t-2} \\
&\quad + \cdots \\
&\quad + \alpha_n Proportional\ Change\ in\ CRP_{it-n-1,t-n} \\
&\quad + \beta_1 ARP\%_t + \beta_2 WheatYield_{it} + \beta_3 Time_t \\
&\quad + \beta_4 Total\ Stocks_t + \beta_5 OnFarm\ Stocks\%_t \\
&\quad + \beta_6 JulDec\ Spread_t + e_{it},
\end{aligned}
$$

where $Margin_{it}$ is elevator i's merchandising margin in year t at harvest (price received by the elevator minus price paid to farmers); $Proportional\ Change\ in\ CRP_{it-1,t}$ is the increase or decrease in county i's wheat base acres enrolled in CRP from the year whose production affects harvest in year $t-1$ to the year whose production affects harvest in year t, divided by county i's acres planted to wheat in 1980[5]; $ARP\%_t$ is the percentage of participating producers' wheat base acres set aside in year t in the Acreage Reduction Program; $WheatYield_{it}$ is county i's average bushels of wheat produced per harvested acre in year t; $Time_t$ is a time trend variable starting with 1 in the year 1980; $Total\ Stocks_t$ is the number of bushels in both on-farm and off-farm storage in Oklahoma on June 1 of year t; $OnFarm\ Stocks\%_t$ is the proportion of $Total\ Stocks_t$ that is in on-farm storage; and $JulDec\ Spread_t$ is the spread between the July and December KCBT futures contracts for hard red winter wheat on June 20 in year t. The number of years the variable $Proportional\ Change\ in\ CRP_{it-n-1,t-n}$

[5] Since winter wheat to be harvested in year t is planted in calendar year $t-1$, CRP acres expected to affect wheat markets in year t are those enrolled up through calendar year $t-1$. Here, the subscript t indicates that CRP enrollment in year $t-1$ affects wheat markets in year t. Since some counties had a much larger amount of acres in wheat than other counties, the same number of acres enrolled in CRP would be expected to have a smaller effect than in counties with fewer acres of wheat. In order to have a basis of comparison from county to county, the change in CRP acres was divided by the number of acres that had historically been planted to wheat. The year 1980 was chosen because in that year no land retirement programs were in effect, and for most counties that was the year with the largest number of wheat acres planted during this time period. To the extent that 1980 had larger than average wheat acres planted, choice of that year would tend to underestimate the proportion of acres taken out of wheat production due to CRP. This variable exceeds the value 1 for some observations, because some counties increased their wheat base acres to an amount greater than the number of acres planted to wheat in 1980. (*) Until 1986 there was no CRP, so the variable has zero values through 1986.

is lagged is selected using model selection criteria.

As explained in the *Theoretical Framework* section, the signs for both *Proportional Change in* $CRP_{it,t-1}$ and $ARP\%_t$ are expected to be negative. As additional acres of wheat base are taken out of production, a profit-maximizing elevator will tend to reduce merchandising margins by raising bids to producers. For a similar reason, the sign on $WheatYield_{it}$ is expected to be positive; greater production in the elevator's trade area provides less incentive to raise bids to producers.

The variable $Time_t$ is expected to capture technological and structural change over the time period. During this time period there has been an increase in excess storage and merchandising capacity, so the sign on this variable is expected to be negative.

In Oklahoma, most wheat is stored in commercial facilities. Since higher stocks indicate that elevator managers likely do not need to buy as much wheat, the sign on the variable $Total\ Stocks_t$ should be positive. The variable $OnFarm\ Stocks\ \%_t$ (on-farm stocks as a percentage of total stocks) could have either a positive or negative sign. If a higher percentage of on-farm stocks means that farmers are holding wheat off the market instead of selling, waiting for elevators to offer a higher price, a higher percentage of on-farm stocks should encourage elevators to pay higher prices, resulting in lower margins.

On the other hand, if producers with on-farm storage facilities view commercial storage as a residual storage outlet, and use on-farm storage first, the sign should be positive. As the percentage of stocks held on farms rises, producers have less on-farm capacity available heading into the harvest. With less on-farm storage space available, producers are forced to sell wheat at harvest or store in commercial storage for later sale, so that elevators have incentive to offer lower prices, resulting in larger margins.

The variable $JulDec\ Spread_t$ reflects opportunities for elevators to profit from purchasing and storing wheat, so its sign should be negative. A higher spread indicates that the market is offering greater incentive for elevators to purchase wheat and store until later in the crop year, so they have an incentive to pay higher prices to producers, resulting in lower current merchandising margins.

Finally, a binary (intercept-shifter) variable is included for each cross section. Since the number and location of elevator facilities did not change over this time period, these variables provide a proxy for differing levels of competition among elevators.

Data

Data used apply to 15 elevator locations from 10 counties in Oklahoma for the period 1980 through 1998. These elevators are selected because wheat is a significant part of their operations, and thus a continuous series of wheat price bids is available. The crop-reporting districts they represent accounted for 84% of Oklahoma's wheat production in 1998 (Oklahoma Agricultural Statistics, 1999). Variable descriptions are provided in Table 1, and statistics for each variable are provided in Table 2.

The dependent variable $Margin_{it}$ is the average of daily prices bid to farmers by each elevator subtracted from the average of daily prices received by the elevator from June 20 through June 30.[6] Price received is estimated by subtracting transportation costs from Oklahoma to Gulf port elevators from the average of daily prices bid by Gulf elevators from June 20 through June 30. Price data were obtained from various issues of Oklahoma Market Report, and transportation costs were

[6] Most Oklahoma wheat is harvested and delivered to an elevator or placed in on-farm storage by June 20. More than 30% of Oklahoma wheat is also sold by the end of June. Thus, prices during the period June 20–30 should reflect most of the effect of each year's harvest, including any effect of reduced production due to land retirement programs. However, it does not extend so far into the marketing year that other factors, such as wheat harvest in states farther north and speculative storage considerations other than those considered here, affect pricing decisions. Also, it is assumed that the wheat market is relatively efficient with respect to time, with prices at harvest related by storage costs to prices at other times of the marketing year so that prices at the end of June can be viewed as representative of prices at other times of the year.

Table 1. Description of Variables

Variable	Description	Unit
$Margin_{it}$	Elevator i's merchandising margin in year t calculated by subtracting average of June 20–30 elevator prices paid to farmers from average of June 20–30 prices received by elevators	\$/bu.
Proportional Change in $CRP_{it,t-1}$	Change from calendar year $t-2$ to $t-1$ (change from crop year $t-1$ to crop year t) in wheat base acres in county i enrolled in CRP, divided by the number of planted wheat acres in 1980, times 100	%
ARP%	ARP percentage in Oklahoma, applying to harvest in year t	%
$WheatYield_{it}$	Bushels of wheat per harvested acre in county i in year t	bu./A
$Time_t$	Time trend variable used to capture technological and structural change	Integer from 1 to 19
$Total\ Stocks_t$	Wheat stored in commercial and on-farm storage in Oklahoma on June 1 in year t	Million bushels
OnFarm Stocks $\%_t$	Wheat stored in on-farm storage (million bushels) on June 1 in year t divided by $Total\ Stocks_t$	%
$JulDec\ Spread_t$	December KCBT wheat futures price—July KCBT wheat futures price on June 20 in year t	\$/bu.

obtained from a central Oklahoma elevator using unit trains to ship to Gulf ports. Transportation costs were assumed to apply to all the elevators in the study because of the dominance of the Gulf market in determining wheat prices in the state.

Wheat base acres enrolled in CRP in each year in the counties where the elevators are located were taken from the CRP contract file of the U.S. Department of Agriculture's (USDA) Farm Services Agency. Cumulative CRP enrollment for four of these counties is shown in Figure 1. Figure 2 shows the data in the form of yearly additions to CRP acres for the same counties shown in Figure 1. These four counties represent the range of situations faced by elevators in the sample. A few counties had relatively few wheat base acres enrolled in CRP. For most counties, CRP enrollment increased rapidly from 1987 to about 1991, but showed little change through the mid-1990s. By the mid-1990s, much eligible land had already been enrolled. Also, in order to limit expenditures, USDA substantially reduced the allowable rental rates for new enrollments in CRP. This limited landowner incentive to enroll more acres.

As indicated in the previous section, the variable *Proportional Change in* $CRP_{it,t-1}$ represents incremental changes in wheat base acres in county i due to enrollment in CRP, divided by the number of planted wheat acres in 1980.

The variable $ARP\%_t$ is the mandatory set-aside percent for government program participation and represents the percentage of base

Table 2. Data Statistics

Variable	n	Mean	Std. Dev.	Variance	Min.	Max.
$Margin_{it}$	285	0.195	0.054	0.003	0.040	0.320
Proportional Change in $CRP_{it,t-1}$	285	0.202	0.551	0.304	−0.360	3.920
ARP%	285	9.684	10.123	102.470	0.000	28.000
$WheatYield_{it}$	285	30.005	6.192	38.335	13.100	48.980
$Total\ Stocks_t$	285	49.196	37.514	1,407.300	11.210	125.050
OnFarm Stocks $\%_t$	285	8.781	3.231	10.437	3.330	17.073
$JulDec\ Spread_t$	285	0.129	0.120	0.014	−0.255	0.350

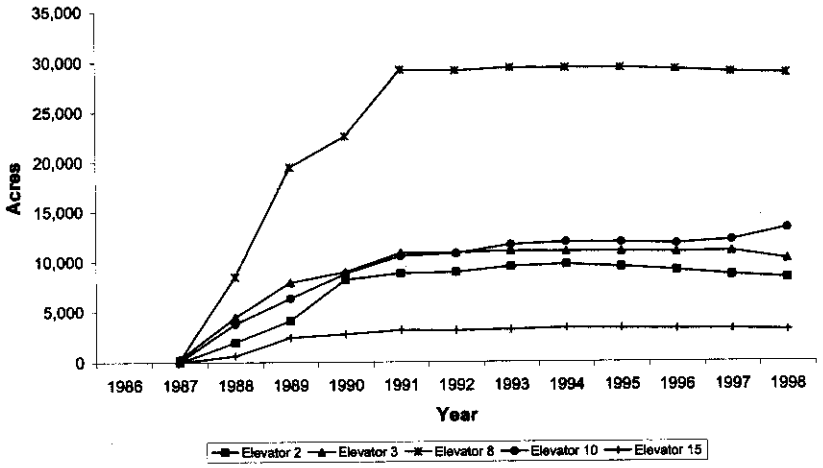

Figure 1. Cumulative Acres Enrolled in CRP by Year in Five Representative Counties

acres enrolled in government programs that cannot be used to grow program crops. These acres are required to be in addition to those enrolled in CRP, but are calculated as a percentage of wheat base acres not enrolled in CRP.[7] These data also were obtained from USDA's Farm Services Agency.

Futures price data for the variable *JulDec Spread*$_t$ were obtained from the Kansas City Board of Trade's web site. Stocks data for the variables *Total Stocks*$_t$ and *OnFarm Stocks %*$_t$ were obtained from Oklahoma Agricultural Statistics Service.

[7] Although legislation specifies that CRP acres cannot be used to meet ARP requirements, CRP acres that were enrolled from wheat base acres were not included in base acres from which the ARP was calculated. For example, if a producer had 100 wheat base acres, and 20 acres were enrolled in CRP, a 10% CRP was based on 80 base acres, rather than on the original 100 acres, so that a 10% ARP represented eight acres, not 10. However, rarely do 100 CRP acres equate to 100 acres of base reduction since the base reduction is based on the percent of base to total acres for the farm. Therefore, if that base of 100 acres existed on a farm with 200 acres of cropland, enrolling 20 acres in CRP would reduce base by only 10 acres. Thus, ARP would apply to 90 remaining base acres, and a 10% ARP would represent nine acres. Another consequence of this is that there is no way to estimate how much nonbase acreage was actually used to grow wheat. Using only wheat base acres in the CRP measure may have underestimated the number of acres taken out of wheat production and enrolled in CRP. To the extent this is true, the marginal effects of CRP on price margins reported here would be overstated.

Model Estimation

Since the observations are for a number of elevators over several years, the model is estimated using pooled cross-section and time-series methods. In order to allow for correlation among cross-sections and autocorrelation, a specification proposed by Kmenta is used in which the following are assumed:

$$(9) \quad E(\varepsilon_{it}^2) = \sigma_i^2 \quad \text{(heteroscedasticity)},$$

$$(10) \quad E(\varepsilon_{it}\varepsilon_{jt}) = \sigma_{ij} \quad \text{(correlation among cross sections), and}$$

$$(11) \quad \varepsilon_{it} = \rho_i \varepsilon_{i,t-1} + u_{it} \quad \text{(autoregression)}.$$

The parameters are efficiently estimated in SHAZAM using generalized least squares. To allow for different margin adjustment behavior by each elevator, a different specification of first-order autocorrelation for each cross-section is permitted.[8]

[8] This is a fixed effects model for panel data (see Hong and Greene, pp. 612–33). To check this specification, we have estimated a random effects model using the same variables except omitting the cross-section indicator variables. The results were very similar to the results presented here, with similar coefficient estimates. The p-values were slightly less significant, but all remained significant at the 0.003 level or better.

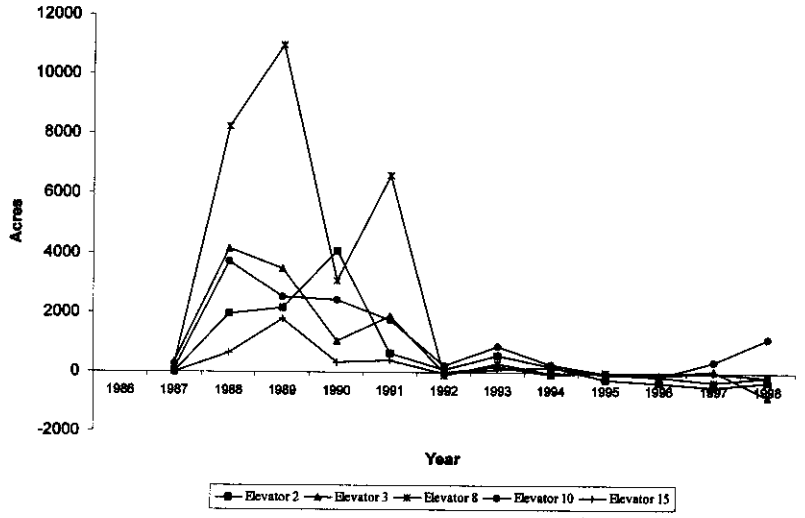

Figure 2. Incremental Acres Enrolled in CRP by Year in Five Representative Counties

Results

Regression results in Table 3 indicate that all coefficient estimates are statistically significant at the 1% level or better, and they all have the expected sign. According to model selection criteria, the number of lags appropriate on *Proportional Change in* $CRP_{it,t-1}$ is zero. Apparently, elevators made most of the operating adjustments they intended to make within 1 year after each year's change in CRP. The coefficient indicates that each year elevators reduced margins by nearly 1¢/bu. in response to a one-standard-deviation (0.55) increase in proportion of wheat base acres enrolled in CRP (e.g., an increase in wheat base acres enrolled in CRP from 0% of 1980 planted acres to 0.55% of 1980 planted acres, which gives a value for the variable of 0.55, multiplied by the coefficient estimate, −0.01784).

To put this in perspective, the coefficient on $ARP\%_t$ indicates that a one-standard-deviation increase in ARP (e.g., from 10% of base acres to 20% of base acres) caused elevators to reduce margins by 4.3¢/bu. The effects of a one-standard-deviation increase in ARP on margins are more than four times larger than the effects of a one-standard-deviation increase in CRP.

Conversely, comparing increases in percentage-point rather than standard deviation terms, a 1-percentage-point increase in base acres set aside for CRP reduced margins by 1.8¢/bu., whereas a 1-percentage-point increase in acres set aside for ARP reduced margins by 0.43¢/bu. The reduction in margins due to CRP was more than four times larger than the reduction from the same percentage-point increase in ARP. Although the marginal effect of an increase in CRP acres was larger than that for ARP, the total effects of CRP enrollment have been less than effects of ARP because fewer acres were taken out of production.

Riddel and Skold had suggested that longer-term programs such as CRP are likely to have a bigger effect than short-term programs such as ARP. The results here, however, consider only merchandising margins and indicate that when elevator managers perceive that the reduced production in their trade areas is long-term (as with CRP), they make larger operating adjustments (by hiring fewer workers, for example, or maintaining less infrastructure) so that the effect on margins is lessened.

Also, as shown in Figures 1 and 2, some elevators are in counties with much higher CRP enrollment. As a result, they have faced substantially greater reduction in production in their trade areas. Although the margin reduction for a given percentage of base acres enrolled in CRP is the same as for other eleva-

Table 3. Pooled Cross-Section Time Series Estimates of Country Elevator Merchandising Margins ($Margin_{i,t}$), 1980–1998

Variable	Estimated Coefficient	Standard Error	*p*-value
Proportional Change in $CRP_{it,t-1}$ (%)	−0.01784	0.002583	0.000
$ARP\%_t$ (%)	−0.00434	0.000394	0.000
$WheatYield_{it}$ (bu./acre)	0.00183	0.000203	0.000
$Time_t$(integer from 1 to 19)	−0.00403	0.000872	0.000
Total Stocks$_t$ (million bushels on June 1)	0.00048	0.000147	0.001
OnFarm Stocks $\%_t$ (%)	0.00382	0.000953	0.000
JulDec Spread$_t$ ($/bu. on June 20)	−0.22050	0.02503	0.000
Elevator 1	0.17552	0.02217	0.000
Elevator 2	0.21660	0.02215	0.000
Elevator 3	0.18993	0.02197	0.000
Elevator 4	0.20672	0.02079	0.000
Elevator 5	0.17389	0.02326	0.000
Elevator 6	0.20517	0.02068	0.000
Elevator 7	0.20514	0.02072	0.000
Elevator 8	0.22156	0.02800	0.000
Elevator 9	0.20203	0.02082	0.000
Elevator 10	0.18066	0.02342	0.000
Elevator 11	0.18416	0.02310	0.000
Elevator 12	0.17324	0.02403	0.000
Elevator 13	0.19348	0.02383	0.000
Elevator 14	0.23033	0.02133	0.000
Elevator 15	0.17911	0.02169	0.000

Notes: n = 285 (15 cross-sections and 19 years); Buse R^2 = 0.54.

tors, their total margin reduction is larger because the percentage of base acres enrolled in CRP is high.

The coefficient on $WheatYield_{it}$ indicates that a 10 bu./A reduction in yields reduced elevator margins by nearly 2¢/bu. The negative coefficient on $Time_t$ indicates that elevator margins decreased by about four-tenths of a cent per year over this time period for reasons in addition to those captured in the other variables, such as excess capacity and unit train facilities.[9]

The positive coefficient on *Total Stocks*$_t$ indicates that, as expected, elevators reduced bids to producers, increasing margins when they were holding larger stocks of wheat. The positive coefficient on *OnFarm Stocks* $\%_t$ suggests that producers with on-farm storage capabilities view elevator storage as residual storage. For higher percentages of stocks held in on-farm storage, elevators face reduced pressure to raise bids to producers to attract additional wheat, since producers are more likely to deliver wheat to elevators than to store on the farm. Finally, the negative coefficient on *JulDec Spread*$_t$ indicates that when the market provided greater opportunities for

[9] Since the theoretical model assumes each elevator is a spatial monopsony, it is reasonable to ask how change in competitive structure, which we have tried to capture in the $Time_t$ variable, might have affected the results. There were many mergers among elevators in the state during this time period, which may have reduced somewhat the overall level of competitiveness among grain elevators (making the industry more consistent with the theoretical model assumptions). However, among the sample elevators, none merged within the sample period. A study by Kenkel, Gilbert, and Spence found that most elevator mergers in Oklahoma during this time period were between cooperatives, rather than independent elevators. The study also showed that mergers tended to improve elevator profitability, either because of reduced costs or because of increased margins, or both. To the extent that mergers were related to increased margins, and to the extent that the time trend variable failed to capture this effect, the decrease in margins due to CRP would be understated.

Table 4. Predicted Difference in Margins with and without CRP for Average of Fifteen Elevators

Year	Predicted Margins Using Realized Values of *Proportional Change in* $CRP_{it,t-1}$ for All Years ($/bu.)	Predicted Margins Setting *Proportional Change in* $CRP_{it,t-1} = 0$ for All Years ($/bu.)	Difference in Predicted Values ($/bu.)	Percent Difference in Predicted Values (%)
1980	0.2392	0.2392	0.0000	0.00
1981	0.2248	0.2248	0.0000	0.00
1982	0.2005	0.2005	0.0000	0.00
1983	0.2481	0.2481	0.0000	0.00
1984	0.1857	0.1857	0.0000	0.00
1985	0.2041	0.2041	0.0000	0.00
1986	0.1843	0.1843	0.0000	0.00
1987	0.1466	0.1474	0.0009	0.60
1988	0.1166	0.1348	0.0181	15.56
1989	0.1608	0.1868	0.0260	16.16
1990	0.1986	0.2110	0.0124	6.22
1991	0.1654	0.1786	0.0133	8.03
1992	0.1721	0.1720	−0.0001	−0.04
1993	0.1969	0.1987	0.0018	0.92
1994	0.2093	0.2098	0.0004	0.21
1995	0.2042	0.2037	−0.0005	−0.24
1996	0.2561	0.2552	−0.0009	−0.35
1997	0.1848	0.1838	−0.0010	−0.52
1998	0.1778	0.1757	−0.0020	−1.13

profitable storage hedges, elevators were more likely to raise bids to producers.

To better understand these results, the estimated model is used to predict in sample the margins that would have prevailed had there been no CRP program. These predictions are compared with the model's in-sample predictions of margins under the CRP program. For predictions of margins under the CRP program, realized values of all variables are inserted into the model, and these values are multiplied by the corresponding coefficient estimates to get predicted margins for each year. To predict the margins that would have prevailed had there been no CRP program, values of zero are inserted for each year for the variable *Proportional Change in* CRP_{it}.[10]

The results for values of the independent variables averaged over the 15 elevators are shown in Table 4 and Figure 3. The merchandising margin is notably smaller for the years 1988 through 1991 owing to the effects of CRP acres taken out of production (about 2½¢/bu. in 1989), but from 1992 through 1998 the difference is negligible.

Figures 4 and 5 show results from representative elevators from the sample of 15. These elevators represent the range of situations elevators have faced over this time period. Although the marginal effects of additional CRP acres were assumed to be the same for each elevator, the proportion of wheat

[10] One might conjecture that had there been no CRP program, the percentage of ARP set-aside might have been larger, or that some other supply control measure might have been used to accomplish similar objectives (in fact, the variables *Proportional Change in* $CRP_{it,t-1}$ and *ARP%*, are negatively correlated, with $R = -0.48$, suggesting that over this time period CRP and ARP were partial substitutes). The comparative predictions here assume no change in the other independent variables.

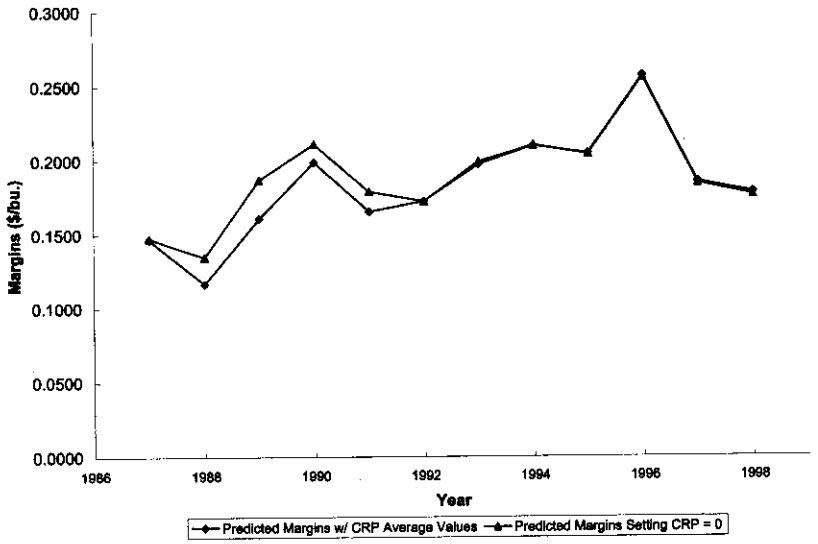

Figure 3. Predicted Margins Using Average Values of *Proportional Change in* $CRP_{it,t-1}$ versus Predicted Margins Setting *Proportional Change in* $CRP_{it,t-1} = 0$ (Average Values of Independent Variables for 15 Elevators)

acres enrolled in CRP differed substantially by county. For example, elevator 15's trade area had the smallest proportion of wheat base acres enrolled in CRP. Using its intercept parameter and inserting variable values applying to elevator 15 (Figure 4), the merchandising margin is also smaller for the years 1989–1991 because of CRP, but the reduction is less for elevator 15 than it is for the average of all elevators, since its proportion of wheat acres enrolled in CRP was smaller than average. In contrast, using values for elevator 8 (Figure 5), which had a larger proportion of wheat acres enrolled in CRP, CRP made a bigger difference, with a 7¢/bu. reduction in margins due to CRP in 1989, and a nearly 3½¢/bu. reduction in both 1988 and 1991.

For all of the sample elevators, the reduction in margins due to CRP is negligible after 1991. This result is consistent with Figures 1 and 2, which show that acres added to CRP after 1991 were low relative to those added from 1987 through 1991. The results suggest that since elevators have adjusted rather quickly to incremental changes in wheat production in their trade areas, small additions to CRP after 1991 have required little further adjustment by Oklahoma grain elevators.

Conclusions

Oklahoma elevators, as with other agribusiness firms, have faced reduced economic activity as a result of acres taken out of production under the CRP. The results here indicate that in addition to reducing economic activity, CRP and other land retirement programs have reduced elevator merchandising margins. The reduced merchandising margins are a redistribution from elevators to producers, rather than a net economic loss. However, the reduction in margins reflects an element of pressure on agribusinesses that has not been measured in previous studies.

Moreover, the results indicate that elevators have faced several sources of pressure. Both CRP and ARP set asides have reduced elevator margins. Structural and technological changes and competitive pressures associated with excess storage and merchandising capacity, as reflected in the $Time_t$ variable, have reduced margins as well.

The effect of CRP, although varying considerably across elevators, has been significant, reducing margins an average of 16% in 1989. This effect should be considered as the future of the CRP and similar programs is de-

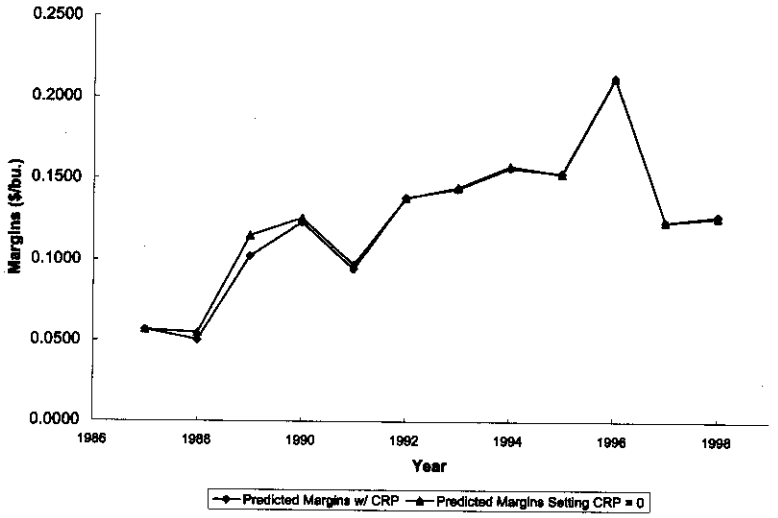

Figure 4. Predicted Margins Using Average Values of *Proportional Change in* $CRP_{it,t-1}$ versus Predicted Margins Setting *Proportional Change in* $CRP_{it,t-1} = 0$ (Values of Independent Variables for Elevator 15)

bated. However, the results indicate that elevators adjusted rather quickly to CRP changes, with most of the adjustment occurring within 1 year.

This also suggests that because of the long-term nature of CRP, elevators may have reduced the amount of capacity available in order to lessen the impact on merchandising margins. A question of concern for policy makers is, "If grain production increases, how much will it cost elevators to regain that lost capacity?" We have suggested that these results indicate that elevators have reduced margins in response to declining production in their trade areas, but that by making adjustments in operations they have been able to

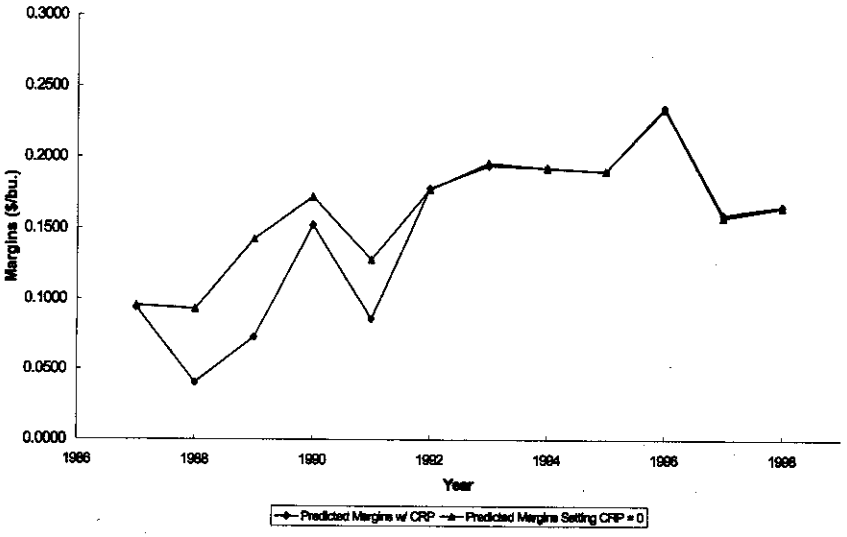

Figure 5. Predicted Margins Using Average Values of *Proportional Change in* $CRP_{it,t-1}$ versus Predicted Margins Setting *Proportional Change in* $CRP_{it,t-1} = 0$ (Values of Independent Variables for Elevator 8)

limit that reduction in margins. Those operational adjustments may have taken several forms, including sale or "mothballing" of physical assets. Those adjustments may be costly to reverse.

Further, although the results of this study provide evidence of the adverse consequences of federal land retirement programs on agribusinesses, current policy may have an even greater impact on agribusinesses in specific regions. The current Farm Security and Rural Investment Act of 2002 contains no provision for the annual land retirement programs but maintains the CRP. The regional changes in CRP acreage since then have been slight, and thus most elevators have adjusted to the change in marketing volume. Without the annual land retirements to reduce supply, farm prices have fallen, forcing areas with less productive soils or more highly variable rainfall to reduce planted acres. In some areas of Oklahoma, wheat production has fallen by as much as 40% between 1996 and 2001 (Dicks and Richter).

Our research suggests that agricultural policy must be scrutinized carefully for potential local impacts on agribusinesses. Although the impacts nationally may be minor, local impacts may be significant. These impacts may be transient, as in the case of the CRP, or they may push agribusinesses to a threshold beyond which the impacts may eliminate specific agribusinesses. Future research should examine the relationship between land use changes and agribusiness profit margins, with specific attention to increasing farm size, resulting pecuniary economies, and loss in market share of local and regional agribusinesses.

Although our model has attempted to capture the effects of external factors on elevator merchandising margins, it did not account for differences among elevators in their management and financial structures. Thus, firms may have had varying ways of responding to the pressures induced by land retirement programs related to their unique firm organization. In spite of these potentially varied responses, the average effect over all firms was to reduce merchandising margins and, by implication, profitability in the short run.

The purpose of this paper was to measure the average effect of CRP and ARP on elevator merchandising margins. To our knowledge, no other paper has attempted to measure the effects of CRP on a firm-level measure related to profitability. Our results show that these programs did reduce margins in the short run. We have not attempted to address the question of *why* they have had the effect of reducing margins. We hope that this will serve as a starting point for research that addresses those issues.

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