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## **Farmers' Use of Normal Flex Acres: A Glimpse of the Future**

by

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## Farmers' Use of Normal Flex Acres: A Glimpse of the Future

Brian Willott, Gary Adams, Robert Young and Abner Womack

Given the new direction of farm policy, farmers in the future will be less constrained in making their planting decisions. This paper shows how farmers respond to market signals in allocating flex acres. By examining the five years of data that exist, researcher will begin to understand how producers may react when planting for the market prices and not for government subsidies. The estimated elasticities are much higher than those found in other studies.

### Introduction

Government subsidies comprise a large part of U.S. net farm income and also make up a significant portion of many individual farmers' incomes. Government payments totaling \$8.6 billion were a major portion of the \$45 billion of net farm income in 1994. Also in 1994, over \$3.8 billion in direct payments were made to feed grain, wheat, cotton and rice farmers.

Yet, with federal deficits of \$150 to \$200 billion per year and a total federal debt of over \$3.5 trillion, the U.S. government is seeking ways to reduce subsidy payments. Farmers will be forced to rely more on the market and less on the government. The effects of the current farm legislation on farmers' production decisions are known: in return for subsidies, the legislation puts certain constraints on the farmer. Once the restrictions are removed and the subsidies are reduced, the outcome is less definite. Understanding the consequences of this market orientation before it is invoked is paramount.

Numerous studies have attempted to estimate supply response to both government programs and the market. However, while subsidies are in place, it is difficult to achieve a reliable picture of the response to market returns. Ironically, now a government program gives a tool for finding acreage response to market signals.

Triple Base began with the Omnibus Budget Reconciliation Act (OBRA) of 1990. With farmers asking for more flexibility and government accountants asking for budget savings, Congress attempted to satisfy both at the same time with triple base acres.

The three bases referred to are the crop acreage base, permitted base, and payment base. Crop acreage base was in place before OBRA of 1990 as it began with the Agriculture and Food Act of 1981. This base is a moving average of the number of acres the farmer plants to a program crop. The permitted base is the number of acres the farmer is allowed to plant to crops, calculated as crop acreage base minus any idling of land required as a prerequisite to participating in subsidy programs. The payment base is the number of acres which will receive government payments. Before OBRA of 1990, payment base and permitted base were the same. After OBRA of 1990, payment base is the permitted base minus the crop acreage base multiplied by the Normal Flex Rate which is currently set at fifteen percent. The farmer can voluntarily reduce

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the payment base further, giving up subsidies for additional planting freedom on up to ten percent of crop acreage base. These acres would be called optional flex. The producer does not receive deficiency payments on either normal flex acres or optional flex acres. The farmer is allowed to plant any crop on that land with certain limitations for fruits, vegetables and specialty crops. In short, the farmers make decisions on how to allocate flex acres on the basis of market returns.

Flex acres were proposed to reduce government outlays, allow producers to rotate crops effectively, and reduce the amount of land idled each year. Possible environmental benefits were also considered.

The advent of flex acres holds an additional significance that alone would warrant intense study. The allocation of these acres since 1991 gives researchers a glimpse of the future: how will farmers respond when planting only for market generated returns?

### **Objective of the study**

The purpose of this study is to quantify how farmers respond to market signals when making production decisions and how this response differs in various regions of the United States. While other researchers have endeavored to use econometric models to quantify farmers' acreage decisions, the presence of government supply controls and income support confound the estimates. Alternatively, using flex acres to obtain estimates clarifies the issue.

A model will be created that provides a detailed estimate of flex acre use. Seven categories will be estimated. Data exist for the number of acres flexed to soybeans, minor oilseeds, other program and non-program crops, and acreage that goes fallow. Further, the number of flex acres that are planted back to the own program crop is also known. For example, data on the number of acres planted to corn on flex acres that were generated by corn base is available.

State-level data are to be grouped using USDA's cost of production aggregations. For most crops, four or five distinct production regions are defined. This research shall detail regional differences in flex use as well as differences in elasticities between regions. Using the regions as cross sections and the five points in the time series, the data will be pooled. The equations will then be estimated using the pooled cross section/time series data. This new research utilizes a logit function to allocate the flex acres. Each category of flex use will be estimated as a percentage of total eligible flex acres. The logit function insures that the estimated percentages will range between zero and one.

The results of the research will give the sought-after quantified estimates of the farmers supply response on those acres. Estimating equations of flex acre planting decisions provides own- and cross-price elasticity estimates. These estimates can be compared across regions thus providing the answer to the stated problem.

This work is both relevant and significant because it will provide analysts and economists with a better idea of how producers of feed grains, wheat, cotton and rice will make planting decisions under greater flexibility. Such an investigation is extremely practical and timely given the recent passage of the Federal Agricultural Improvement and Reform (FAIR) Act of 1996.

### Review of relevant government policy

The problem of understanding flex acres is confounded by a number of government policies. To fully understand flex acres, one must first be familiar with the general premises of federal commodity programs and then with the variety of different policies that may affect flex.

The United States government has been actively involved in agriculture for decades. Various policies have been implemented to stabilize prices, idle land, raise farm income, subsidize exports, minimize stocks, etc. While the current policies receive the legislative authority from the Agricultural Adjustment Act of 1949, the basic framework of today's commodity programs began with the Agriculture and Food Act of 1981.

Beginning in 1981, producers of feedgrains, wheat, cotton and rice were assigned a crop-specific acreage base. Cotton or rice base is calculated as the three year moving average of the number of acres planted and considered planted to cotton or rice on that farm. For feedgrains and wheat, this was defined as the five year moving average of the number of acres planted and considered planted. For example, a farmer who planted 100 acres of corn every year for five years would in the sixth year have a 100 acre base. However, if the farmer had only planted 75 acres of corn in one of those five years, that farmer would then have only a 95 acre base in the sixth year. Because of the moving average calculation and the relatively high payoff for being in the government program, farmers have great incentive to "protect their base" and not plant less acres than their base allows. A farmer who does not plant their entire base loses base and consequently some of the benefits of participating for several years. Base has value.

Flex has a base saving effect. Producers may respond to market signals and plant something other than the program crop on flex acres and maintain their original base.

Also in the 1981 Act, the government established a target price for the major commodities. When the market price fell below this level, producers were paid the difference between the target and the market; this was called a deficiency payment.

### Flex policy

Data exist for at least seven categories of flex. The first category is the number of flex acres planted to another program crop. These program crops would include wheat, corn, sorghum, barley, oats, cotton and rice. Another similar category is the number of flex acres planted to non-program crops, not including soybeans or minor oilseeds. For the purpose of this analysis, these two categories will be modeled as one. Given the restrictions on planting flex acres, these acres cannot be sugar, peanuts, fruits, vegetables, or trees. No more specific data is available to the make-up of these acres.

The next and possibly most significant category is flex planted to soybeans. Soybeans have been the highlight of flex acre use. Another important category on flex is the number of flex acres planted to minor oilseeds. These crops are both economically and politically significant. Minor oilseeds include sunflower, safflower, mustard, rapeseed, canola and others.

Data are also available for the use of the normal flex acres alone, excluding the use of optional flex acres. USDA reports how many of the acres are planted to the crop for which the original program base existed. USDA also reports how many of these acres are flexed to another crop. In some cases like corn and sorghum, data exist for how many normal flex acres of corn were planted to sorghum and vice versa.



The number of eligible optional flex acres is ten percent of the crop base. The number of the acres that are planted to something other than the program crop is known. While no specific breakout is given for these acres, it is assumed that the farmer would not voluntarily give up deficiency payments and then idle the acres or plant them to the program crop. Thus, these acres are planted to a competing crop.

A number of equations will be estimated. For each crop, the number of acres that remain in the program base crop will be estimated. Also the number of acres that are planted to other crops, soybeans and minor oilseeds will be estimated. Finally the number of acres which are idled will be found by subtracting the percentages flex to other uses from one.

### **Flex specific literature**

While numerous flex-type options were analyzed before the 1985 and 1990 farm bills, little empirical study has been performed on the topic since. Only one study of flex use is currently in print. Zulauf and Tweeten (1995) examined the number of normal flex acres idled and planted back to the original crop. Using state level data, the study shows that the higher the percentage of land that is idled, the lower the productivity of the land and the higher the percentage of land planted to the own crop, the more competitive that crop is in that state. This is all true and the paper meets the authors' purposes well. However, enough data on the various uses of flex exist that a more detailed study is possible.

Zulauf and Tweeten's paper is important because it does meet the authors' stated purpose and it adds to the body of literature on flex. It also begins the process of quantifying the elasticities implied by farmers' flex acre use, a process that this work continues.

### **Theoretical framework and methodology**

The microeconomic theories of supply response undergird this study. Farmers' use of flex acres will be explained using the theory of the firm. These producers are in a competitive market and use a number of inputs to produce a range of outputs. They are constrained by technology and respond to prices of inputs and outputs. The supply functions used by Beattie and Taylor (1985) and Varian (1992) are applicable.

The firms have an implicit production function

$$F(y, x) = 0,$$

$y$  being a vector of outputs and  $x$  being a vector of possible inputs. This function is assumed to be strictly quasiconvex over the appropriate domain.

Revenue for this firm is defined as the product of the vector of prices of the outputs and vector of the quantities of the outputs. Cost is the product of the input price vector and the input quantity vector. Assuming that these firms wish to maximize profits, a profit function of the form

$$\pi = \sum p_i y_i - \sum w_j x_j$$

is created which is the difference between revenue and cost. Only variable costs are considered because this producer is making a short term period by period planting decision. Fixed costs

would be included in a longer term decision. A simpler and perhaps for familiar statement for this firm's profit function is

$$\pi = TR - VC.$$

However, this firm operates under the technological constraint,  $F(y,x)=0$ . Profit maximization is then a matter of constrained optimization. The Lagrangean is used where

$$L = \sum p_i y_i - \sum w_j x_j + \lambda F(y,x).$$

Using the first partial derivatives set equal to zero, the first order conditions used to maximize this equation are

$$\frac{\partial \pi}{\partial y_i} = p_i + \lambda F(y) = 0$$

$$\frac{\partial \pi}{\partial w_i} = w_i + \lambda F(x) = 0.$$

Solving these equations gives the constrained input demand and output supply functions,

$$x_j^* = f_j(p, w)$$

$$y_i^* = g_i(p, w).$$

Thus, the constrained supply of  $y$  is a function of both the input and output prices. Since the  $p$  vector contains the prices all possible outputs of this multiproduct firm, the supply of  $y$  is a function of a number of prices. For example, the supply of a wheat firm in the Northern Plains of the United States is influenced by wheat and barley prices because both are possible outputs. This is entirely appropriate.

### Methodology

Modeling flex is complicated by a number of factors. First, flex has only been in existence for five years. The small number of observations presents some problems. Second, the percentage that is flexed to each category will be modeled using a logit function. Because all of the acres must be accounted for, the percentages must add to one. If six categories of flex exist, five must be estimated equations and the sixth must be found with an identity. Whichever category is not estimated is treated as a residual. Third, while using pooled data facilitates comparing flex across regions, pooled data must be handled with care. An F test will be used to examine if the cross sections are significantly different.

The only remedy for the first problem may be time. The small number of observations is without argument undesirable. Not having a large sample limits the number of statistical tools that can be used for analysis. Also, techniques that can be used may be suspect. Because planting

decisions are only made once a year for the major U.S. crops, only annual data are available; the number of observations cannot be increased by searching for monthly or quarterly data. Nevertheless, after recognizing, understanding and noting the problems of a small sample, the research can continue. As more data become available, it will be included.

The second problem concerns the use of the logit function and finding one category of flex via an identity. The true obstacle is creating a model that correctly accounts for all of the flex acres without "creating" land. The amount of land in the U.S. is fixed. This model is restricted to allocate the predetermined number of total flex acres. When one category of flex is found by an identity, any change in the other categories is reflected in the residual category. For example, when the soybean price rises, the number of wheat acres flexed to soybeans is hypothesized to increase. Because the idle category is the residual in the case of wheat, the number of wheat flex acres idled falls as the soybean price rises.

The third area of concern deals with the use of pooled data. Questions arise about the estimated parameters and the error term when using pooled data. The estimated parameter may not necessarily have the minimum variance when estimated using ordinary least squares. The errors across crops and across regions may be correlated. Both of these problems would suggest using a form of generalized least squares or seemingly unrelated regressions. Unfortunately, the small sample size prevents this from being done. The number of degrees of freedom required to correct for the correlation and possible heteroskedasticity is high. After attempting to use several other estimation techniques, ordinary least squares with dummy variables representing each region was chosen to be the best. The models developed in this work follow the development of the dummy variable model work in Judge et al (1982).

To test the dummy variable coefficients, an F test is used. Any regional dummy variable that fails a F test at the .05 percent level is excluded. The test is of the form

$$F = \frac{(\bar{e}'\bar{e} - e'e)/(N-1)}{(e'e/NTNK)},$$

where

$\bar{e}'\bar{e}$  is the sum of squares of the errors from the restricted model and  $e'e$  is the sum of squares of the errors from the unrestricted model. Every category of every crop displays intercepts that are different at the 5% significance level, with the exception of oats. Flex acres from oat base could not be assumed to have different intercepts.

### Empirical results

Now that the foundation for the task has been laid, the work is presented here. Variable mnemonics are self-explanatory. As a consequence of the assumptions made and the estimation technique used, the parameter estimates for the returns variable is the same across the regions in each equation while the intercepts are different. Oats is an exception as noted earlier; the intercepts for oats equations may be the same.

Percentages that will be referred to below are the portion of total flex area that is devoted to a specific use. Total flex area includes all of the normal flex area, but only the part of optional flex that is actually used.

Data for soybean and minor oilseeds planted on flex are known. The portion that remain in the program crop that generated the base acres is also known. However, crops other than soybeans and minor oilseeds are reported simply as "other crops." Other crops includes any allowed crop other than soybeans or minor oilseeds.

The decision to flex to another crop is made by comparing the returns from the own-crop to the returns of another competing crop. For corn flexing out of corn, the other crops which are planted varies by region. Wheat is assumed to be a competing crop in every region. Oat returns are averaged in for the Corn Belt as are cotton returns in the Southeast and both oat and cotton returns in the Other region. The Southeast and Other regions make the most use of this option, averaging nearly 21% per year. Presumably, much of this acreage is planted to cotton which typically has higher market returns than corn. The Northern Plains flexes to other crops about 9% of its flex acres and the Corn Belt flexes the least, at around 4%.

- 1) **CRLFOTCB CORN FLEX PLANTED TO OTHER CROPS, CORN BELT**

$$\begin{aligned} \text{CRLFOTCB} = & - 2.386 - 0.725 * (\text{CRENRMCB} - (0.5 * \text{WHENRMCB} \\ & + 0.5 * \text{OTENRMCB}) / \text{PPICROP} \end{aligned}$$

$$R^2 = 0.868$$

- 2) **CRLFOTNP CORN FLEX PLANTED TO OTHER CROPS, NORTHERN PLAINS**

$$\text{CRLFOTNP} = - 2.386 - 0.725 * (\text{CRENRMNP} - \text{WHENRMNP}) / \text{PPICROP}$$

$$R^2 = 0.868$$

- 3) **CRLFOTSE CORN FLEX PLANTED TO OTHER CROPS, SOUTHEAST**

$$\begin{aligned} \text{CRLFOTSE} = & - 1.368 - 0.725 * \text{CRENRMSE} - (0.5 * \text{WHENRMOT} \\ & + 0.5 * \text{CTENRMOT}) / \text{PPICROP} \end{aligned}$$

$$R^2 = 0.868$$

- 4) **CRLFOTOT CORN FLEX PLANTED TO OTHER CROPS, OTHER STATES**

$$\begin{aligned} \text{CRLFOTOT} = & - 0.644 - 0.725 * \text{CRENRMOT} - (0.333 * \text{CTENRMSP} \\ & + 0.333 * \text{WHENRMSP} + 0.334 * \text{OTENRMOT}) / \text{PPICROP} \end{aligned}$$

$$R^2 = 0.868$$



Soybeans are by far one of the most important crops in the U.S. The crop has very low cost for the federal government and has almost \$14 billion in annual cash receipts. Flexing to soybean comprises nearly ten percent of total soybean plantings.

As with the other flex categories, the decision to flex to soybeans is made by the farmer comparing the expected returns from growing soybeans to the expected returns from growing the program crop. Soybean returns usually fair well in this comparison.

Corn producers use the flex to soybean option more than producers of any other crop, both in terms of actual acres and percent of total area. Corn and soybean market returns tend to equalize in the long run. One reason is because the same land can be used to grow each in most cases. When returns for corn increase, acreage moves out of soybeans and into corn until the returns equalize again. As evidence, note that in the equation for corn flexing to soybeans in the Corn Belt, the elasticity is the same. The reason is that both were calculated using the same parameter estimate and the mean returns are equal over the estimation period.

Corn Belt farmers flex one-third of their corn flex acres to soybeans each year. In 1994, the percentage was 44%, resulting in 3.2 million acres being planted on corn flex acres in the Corn Belt alone. Total planted area of soybeans in 1994 was just under 62 million acres.

The Southeast region uses this option on one-quarter of its corn flex acres. The absolute elasticity with respect to soybeans of 0.321 is slightly higher than the absolute elasticity with respect to corn of 0.316. While this equation is labeled a 'corn' equation, it generates the area planted to soybeans. Therefore, the equation responding more to soybean returns than corn returns is not a problem.

The Northern Plains and Other regions use the flex to soybean provision less than the other two regions. While the Delta States are major producers of soybeans and are a part of the Other aggregation for the purpose of modeling corn, the Other region as a whole uses the provision the least at 11% of total corn flex acres. The Northern Plains averaged 18% flexed to soybeans over the last five years.

5) CRLFSBCB CORN FLEX PLANTED TO SOYBEANS, CORN BELT

$$\text{CRLFSBCB} = - 0.708 - 0.673 * (\text{CRENRCB} - \text{SBENRCB}) / \text{PPICROP}$$

$$R^2 = 0.810$$

6) CRLFSBNP CORN FLEX PLANTED TO SOYBEANS, NORTHERN PLAINS

$$\text{CRLFSBNP} = - 1.718 - 0.673 * (\text{CRENRMNP} - \text{SBENRMNP}) / \text{PPICROP}$$

$$R^2 = 0.810$$

7) CRLFSBSE CORN FLEX PLANTED TO SOYBEANS, SOUTHEAST

$$\text{CRLFSBSE} = - 0.933 - 0.673 * (\text{CRENRMSE} - \text{SBENRMOT}) / \text{PPICROP}$$

$$R^2 = 0.810$$

8) CRLFSBOT CORN FLEX PLANTED TO SOYBEANS, OTHER STATES

$$\text{CRLFSBOT} = - 1.718 - 0.673 * (\text{CRENRMOT} - \text{SBENRMDS}) / \text{PPICROP}$$

$$R^2 = 0.810$$

The choice to plant minor oilseeds on flex acres is an interesting subject area. While not a large category in terms of acreage when compared to soybeans or idling, minor oilseeds are very important in some regions. Also, studying the decision to plant minor oilseeds shows another way farmers maximize their profits using the flex provision.

Due to data limitations, sunflower returns will be used as a proxy for all minor oilseed returns. Cost of production data for other minor oilseeds is not available. Also, sunflower area account for over 70% of total minor oilseeds planted area.

While few corn acres are flexed to minor oilseeds, the decision is highly responsive to market signals. The Corn Belt and Other regions show elasticities greater than 2.0 and the Northern Plains and Southeast regions have elasticities between 1.0 and 2.0. Only the Northern Plains uses the minor oilseed option on more than 1% of its corn flex acres.

9) CRLFMRCB CORN FLEX PLANTED TO MINOR OILSEEDS, CORN BELT

$$\text{CRLFMRCB} = - 6.816 - 1.899 * \text{CRENRMCB} / \text{PPICROP}$$

$$+ 1.801 * \text{FSENRM} / \text{PPICROP}$$

$$R^2 = 0.914$$

10) CRLFMRSE CORN FLEX PLANTED TO MINOR OILSEEDS, SOUTHEAST

$$\text{CRLFMRSE} = - 8.312 - 1.899 * \text{CRENRMSE} / \text{PPICROP}$$

$$+ 1.801 * \text{FSENRM} / \text{PPICROP}$$

$$R^2 = 0.914$$

11) CRLFMRNP CORN FLEX PLANTED TO MINOR OILSEEDS, NORTHERN PLAINS

$$\text{CRLFMRNP} = - 3.808 - 1.899 * \text{CRENRMNP} / \text{PPICROP}$$

$$+ 1.801 * \text{FSENRM} / \text{PPICROP}$$

$$R^2 = 0.914$$

- 12) CRLFMROT CORN FLEX PLANTED TO MINOR OILSEEDS, OTHER

$$\begin{aligned} \text{CRLFMROT} = & - 4.715 - 1.899 * \text{CRENRMOT} / \text{PPICROP} \\ & + 1.801 * \text{FSENRM} / \text{PPICROP} \end{aligned}$$

$$R^2 = 0.914$$

The amount of flex acres that remain in the crop for which the original base existed is estimated for cotton, rice, and wheat regions. For the remaining crops, the amount of flex that is idled is estimated. In either case, the category not estimated is treated as a residual.

The decision to idle is a simple one. If producing a crop on that acre will not cover production costs, nothing is planted. In some regions and some crops, this represents a significant number of acres. Corn regions idle land in different proportions. The Other region fallows over one fourth of its flex acres. In contrast, the Corn Belt idles less than 5%.

With regard to elasticities, the Corn Belt is again the most elastic corn growing region with an elasticity of -0.418. The Other region is second with -0.355, the Northern Plains is third with -0.260 and the Southeast is last with -0.163. This result is consistent with findings elsewhere in the model.

- 13) CRLFIDCB CORN FLEX IDLED, CORN BELT

$$\text{CRLFIDCB} = - 2.564 - 0.322 * \text{CRENRCB} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 14) CRLFIDSE CORN FLEX IDLED, SOUTHEAST

$$\text{CRLFIDSE} = - 1.270 - 0.322 * \text{CRENRMSE} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 15) CRLFIDNP CORN FLEX IDLED, NORTHERN PLAINS

$$\text{CRLFIDNP} = - 1.883 - 0.322 * \text{CRENRMNP} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 16) CRLFIDOT CORN FLEX IDLED, OTHER STATES

$$\text{CRLFIDOT} = - 0.608 - 0.322 * \text{CRENRMOT} / \text{PPICROP}$$

$$R^2 = 0.950$$

Due to program provisions that allow corn and sorghum producers to treat their bases as interchangeable, USDA tracks data on the number of corn flex acres planted to sorghum and vice versa. This level of detail is not available for any other crops.

A small number of corn flex acres are planted to sorghum. Nationally, only 1% of corn flex acres shift to sorghum. The Other region leads with 4.2 %, followed by the Northern Plains

- 12) **CRLFMROT      CORN FLEX PLANTED TO MINOR OILSEEDS, OTHER**

$$\begin{aligned} \text{CRLFMROT} = & - 4.715 - 1.899 * \text{CRENRMOT} / \text{PPICROP} \\ & + 1.801 * \text{FSENRM} / \text{PPICROP} \end{aligned}$$

$$R^2 = 0.914$$

The amount of flex acres that remain in the crop for which the original base existed is estimated for cotton, rice, and wheat regions. For the remaining crops, the amount of flex that is idled is estimated. In either case, the category not estimated is treated as a residual.

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- 13) **CRLFIDCB      CORN FLEX IDLED, CORN BELT**

$$\text{CRLFIDCB} = - 2.564 - 0.322 * \text{CRENRCB} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 14) **CRLFIDSE      CORN FLEX IDLED, SOUTHEAST**

$$\text{CRLFIDSE} = - 1.270 - 0.322 * \text{CRENRMSE} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 15) **CRLFIDNP      CORN FLEX IDLED, NORTHERN PLAINS**

$$\text{CRLFIDNP} = - 1.883 - 0.322 * \text{CRENRMNP} / \text{PPICROP}$$

$$R^2 = 0.950$$

- 16) **CRLFIDOT      CORN FLEX IDLED, OTHER STATES**

$$\text{CRLFIDOT} = - 0.608 - 0.322 * \text{CRENRMOT} / \text{PPICROP}$$

$$R^2 = 0.950$$

Due to program provisions that allow corn and sorghum producers to treat their bases as interchangeable, USDA tracks data on the number of corn flex acres planted to sorghum and vice versa. This level of detail is not available for any other crops.

A small number of corn flex acres are planted to sorghum. Nationally, only 1% of corn flex acres shift to sorghum. The Other region leads with 4.2 %, followed by the Northern Plains

with 2.2% and the Corn Belt and Southeast who each flex less than one percent of their corn flex acres to sorghum. The number of acres affected by the corn flexing to sorghum is highest in the Northern Plains at 50,000 acres.

17) CRLFSGCB CORN FLEX PLANTED TO SORGHUM, CORN BELT

$$CRLFSGCB = - 5.563 - 0.157 * CRENRCB / SGENRMOT$$

$$R^2 = 0.966$$

18) CRLFSGSE CORN FLEX PLANTED TO SORGHUM, SOUTHEAST

$$CRLFSGSE = - 4.801 - 0.157 * CRENRMSE / SGENRMOT$$

$$R^2 = 0.966$$

19) CRLFSGNP CORN FLEX PLANTED TO SORGHUM, NORTHERN PLAINS

$$CRLFSGNP = - 3.619 - 0.157 * CRENRMNP / SGENRMNP$$

$$R^2 = 0.966$$

20) CRLFSGOT CORN FLEX PLANTED TO SORGHUM, OTHER STATES

$$CRLFSGOT = - 2.472 - 0.157 * CRENRMOT / SGNEMRSP$$

$$R^2 = 0.966$$

### Summary and conclusions

This work began with two purposes: to quantify farmers' response to market signals and to find how this response varies across regions of the U.S. In reaching these objectives, a model was created.

A detailed examination of flex use has been completed. The results of this work were surprising, yet intuitively appealing. The first general conclusion is that the elasticities found on flex acres are higher than those estimated recently by Adams (1994) or Chembezi (1990) on non-program acres. The estimated short-run elasticities are presented in Tables 1 and 2. Of course, there are some exceptions where the elasticity found in this work is equal to or less than that on other research. In most cases however, elasticities in this work are roughly three times the size of those estimated by Adams or Chembezi.

University researchers predicted this result, stating that the higher elasticity is because flex acres have more "choices" and are therefore more elastic. Flex acres actually have fewer "choices" than a acre not enrolled in a government programs. Flex acres cannot be planted to certain specialty crops. Perhaps a better conclusion is that flex acres are less restricted than payment base acres so a higher elasticity makes sense.

Another general conclusion is that some regions consistently exhibit higher elasticities than other regions. A general ranking of the regions from highest elasticity to lowest would vary from crop to crop. For instance, the ranking for rice regions may be opposite of the ranking for



**Table 1: Comparison of Estimated Short Run Elasticities, U.S Corn**

Dependent Variable	Area/Region	Name of Author(s)	Year of Study	Price Variable	Short-Run Elasticity
Acreage	U.S.	Houck, et al.	72	Support Price	0.130
Acreage	U.S.	Gallagher	78	Support Price	0.178
Acreage	Cornbelt	Gallagher	79	Market Price	0.112
Acreage	Cornbelt	Gallagher	79	Net Returns	0.185
Acreage	U.S.	Bancroft	81	Net Returns	0.150
Acreage	U.S.	Bancroft	81	Net Returns	0.080
Acreage	U.S.	Shideed, et al.	87	Support Price	0.137
Program Acreage	U.S.	Young	86	Net Returns	0.080
Nonprogram Acreage	U.S.	Young	86	Market Price	0.050
Program Acreage	Cornbelt	Chembezi	90	Net Returns	0.738
Program Acreage	Northern Plains	Chembezi	90	Net Returns	0.360
Program Acreage	Southeast	Chembezi	90	Net Returns	0.659
Nonprogram Acreage	Cornbelt	Chembezi	90	Net Returns	0.318
Nonprogram Acreage	Northern Plains	Chembezi	90	Net Returns	0.241
Nonprogram Acreage	Southeast	Chembezi	90	Net Returns	0.230
Participation Rate	Cornbelt	Adams	94	Net Returns	0.721
Participation Rate	Northern Plains	Adams	94	Net Returns	0.194
Participation Rate	Southeast	Adams	94	Net Returns	0.388
Participation Rate	Other U.S.	Adams	94	Net Returns	0.563
Nonprogram Acreage	Cornbelt	Adams	94	Net Returns	0.127
Nonprogram Acreage	Northern Plains	Adams	94	Net Returns	0.094
Nonprogram Acreage	Southeast	Adams	94	Net Returns	0.292
Nonprogram Acreage	Other U.S.	Adams	94	Net Returns	0.204
Acreage	U.S.	FAPRI Staff	95	Market Price	0.264
Acreage	Cornbelt	FAPRI Staff	95	Market Price	0.180
Acreage	Northern Plains	FAPRI Staff	95	Market Price	0.194
Acreage	Southeast	FAPRI Staff	95	Market Price	1.134
Acreage	Other U.S.	FAPRI Staff	95	Market Price	0.364
Flex Acreage	Cornbelt	Willott	95	Net Returns	0.760
Flex Acreage	Northern Plains	Willott	95	Net Returns	0.570
Flex Acreage	Southeast	Willott	95	Net Returns	0.850
Flex Acreage	Other U.S.	Willott	95	Net Returns	2.180

**Table 2: Comparison of Estimated Short Run Elasticities, U.S. Wheat**

Dependent Variable	Area/Region	Name of Author(s)	Year of Study	Price Variable	Short-Run Elasticity
					0.246
Acreage	Southern Plains	Bailey and Womack	85	Market Price	0.124
Acreage	Northern Plains	Bailey and Womack	85	Market Price	0.172
Acreage	Northwest	Bailey and Womack	85	Market Price	0.547
Acreage	Cornbelt	Bailey and Womack	85	Market Price	0.620
Acreage	Southeast	Bailey and Womack	85	Market Price	1.230
Nonprogram Acreage	U.S.	Bailey	89	Net Returns	0.580
Program Acreage	U.S.	Bailey	89	Net Returns	0.290
Nonprogram Acreage	U.S.	Bancroft	81	Net Returns	0.470
Program Acreage	U.S.	Bancroft	81	Net Returns	0.140
Acreage	Cornbelt	Hoffman	73	Support Price	0.390
Acreage	Northern Plains	Hoffman	73	Support Price	0.500
Acreage	Southern Plains	Hoffman	73	Support Price	0.140
Acreage	Southern Plains	Young	86	Support Price	0.110
Acreage	Northern Plains	Young	86	Support Price	0.110
Acreage	Northwest	Young	86	Support Price	0.180
Acreage	Cornbelt	Young	86	Support Price	0.100
Acreage	Southeast	Young	86	Support Price	0.348
Program Acreage	Cornbelt	Chembezi	90	Net Returns	0.417
Program Acreage	Northern Plains	Chembezi	90	Net Returns	0.424
Program Acreage	Southern Plains	Chembezi	90	Net Returns	0.298
Program Acreage	West	Chembezi	90	Net Returns	0.512
Nonprogram Acreage	Cornbelt	Chembezi	90	Net Returns	0.842
Nonprogram Acreage	Northern Plains	Chembezi	90	Net Returns	0.656
Nonprogram Acreage	Southern Plains	Chembezi	90	Net Returns	0.311
Nonprogram Acreage	West	Chembezi	90	Net Returns	0.378
Participation Rate	Cornbelt	Adams	94	Net Returns	0.220
Participation Rate	Northern Plains	Adams	94	Net Returns	0.321
Participation Rate	Southern Plains	Adams	94	Net Returns	0.473
Participation Rate	West	Adams	94	Net Returns	0.434
Participation Rate	Other U.S.	Adams	94	Net Returns	0.677
Nonprogram Acreage	Cornbelt	Adams	94	Net Returns	0.332
Nonprogram Acreage	Northern Plains	Adams	94	Net Returns	0.439
Nonprogram Acreage	Southern Plains	Adams	94	Net Returns	0.647
Nonprogram Acreage	West	Adams	94	Net Returns	0.352
Nonprogram Acreage	Other U.S.	Adams	94	Net Returns	0.423
Acreage	U.S.	FAPRI Staff	95	Market Price	0.665
Acreage	Cornbelt	FAPRI Staff	95	Market Price	0.287
Acreage	Northern Plains	FAPRI Staff	95	Market Price	0.399
Acreage	Southern Plains	FAPRI Staff	95	Market Price	0.911
Acreage	West	FAPRI Staff	95	Market Price	0.568
Acreage	Other U.S.	FAPRI Staff	95	Market Price	2.320
Flex Acreage	Cornbelt	Willott	95	Net Returns	1.570
Flex Acreage	Northern Plains	Willott	95	Net Returns	1.700
Flex Acreage	Southern Plains	Willott	95	Net Returns	4.150
Flex Acreage	West	Willott	95	Net Returns	3.150
Flex Acreage	Other U.S.	Willott	95	Net Returns	

cotton regions. Still, some prevalent patterns do appear. Equations for the Far West region show high elasticities. The Southern Plains equations are at the opposite end of the spectrum with low relative elasticities. The Corn Belt and Northern Plains regions are very close in terms of elasticity and fall second and third respectively behind the Far West in the ranking. The Southeast and Delta States were similar in elasticity and rank below the Corn Belt and Northern Plains.

Knowing the above conclusions, some areas of further research are worth pursuing. This research is very telling in a number of regards. One, it shows how farmers with base treat their land when not receiving government payments. This may give researchers a stepping-off point for putting a dollar value on holding base acres. That base has a value has never been disputed, but research on quantifying the value needs to be done.

Studying triple base also demonstrates how farmers act to maximize profits. The producers shift their acreage mix to adjust for market signals. Some producers even give up subsidies voluntarily and use the optional flex provision. Knowing that farmers use flex to capture all the market has to offer, research could be done to show how much flex adds to net farm income.

Also, suppose triple base had been in place three years sooner. In 1988, the U.S. experienced a severe drought causing commodity prices to soar to record levels. Had farmers had triple base at the time, they may have been able to capture more revenue using flex. Examination of flex leads to an answer to the question, how much higher could farm income have been in 1989?

While government spending has fallen since the inception of flex, how much is attributable to triple base? Certainly some portion of the reduction is due to flex, but weather events like the flood of 1993, the record yields in 1992 and then again in 1994, and the late planting in 1995 obscure the issue.

At the time of this writing, the FAIR Act of 1996 has been signed into law and is being implemented. One major aspect of the bill is the total decoupling of farm subsidies from farmers' production. Farmers will in the future make their short-term planting decisions solely based upon the free market prices. American agriculture's reaction to such a radically difference policy is veiled in uncertainty. Hopefully, this research can be used to clear the picture.

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