The Dynamics of Flex

by

Chad Hart, Darnell Smith, and John R. Kruse

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Abstract

As debate begins on the 1995 Farm Bill, one of the leading proposals for future farm policy is the expansion of the flex provision. This move would further limit the number of acres eligible for deficiency payments and increase the farmer's ability to respond to market and weather conditions. But how has the current flex provision affected agriculture? This paper examines how flex has been applied in different regions of the country and for different crops. The major producing regions of program crops often retain most of the flex acreage in the base crop, while other regions use the flex acreage to shift to other crops or to idle the land. An econometric specification is put forth to investigate the impacts of market, weather, and farm program factors on flex usage. Responses to these factors vary across regions and across crops. Thus, flex has had vastly different regional impacts. Implications for the proposed expansion of flex are then discussed.

Introduction

With the 1990 Food, Agriculture, Conservation, and Trade Act (FACTA), Congress introduced U.S. agriculture to the concept of flex acreage. When a farmer participates in government commodity programs, certain restrictions are placed on how the land is used and how much of the land will be eligible for deficiency payments. Flex acreage is commodity base acreage that the farmer can plant to any program or industrial/experimental crop (or idle) while still participating in the government program. Flex acreage is not eligible for deficiency payments, but it is protected for future commodity base programs and payments. The flex provision has both a required and optional component. Currently, the normal (required) flex rate is set at fifteen percent of the farmer's participating base. The farmer also has the option to allocate ten percent more of his/her participating base acres to flex. Thus, up to twenty-five percent of a farmer's participating base can be dedicated to crops other than the base crop.

Two factors which led Congress to the idea of flex acreage are the federal budget deficit and the wish to allow farmers more freedom in planting decisions under government commodity programs. Government expenditures on farm programs reached historically high levels in the mid to late 1980's. So as Congress looked to reduce deficits, agricultural spending was put under the microscope. The introduction of flex acreage provides spending cuts by reducing the number of acres on which producers can receive deficiency payments. To maintain commodity

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program participation and supply management control, the government allows farmers to plant nearly any crop on flex acreage except fruits and vegetables in exchange for the loss of government payments on this acreage.

Before the flex provision was enacted, producers were limited in that they could only plant the base crop or idle the land while participating in commodity programs. This promoted monocultural farms and did not allow for rotations which could have both positive productive and environmental impacts. Also, some have argued that commodity programs have dampened farmers' responses to market conditions. Flex helps to alleviate both of these issues. Since the flex acreage is not under any cropping restrictions, farmers can employ the land as they see fit. Rotations can be adopted using the flex acreage. Since crops grown on flex land do not receive any deficiency payments, their profitability is dependent upon market conditions. Flex gives the producer freedom to respond to market conditions while still participating in farm programs.

As Congress begins to tackle both the 1995 Farm Bill and the budget deficit, one of the leading proposals for accomplishing both is the expansion of the flex rate. But other than government cost and producer flexibility effects, questions arise as to other impacts of flex policy on U.S. agriculture. For example, to our knowledge no studies have examined how flex land is allocated across crops by commodity and region and how possible expansion of the flex rate would affect this allocation. This study will investigate those issues by presenting information on how flex acreage has been and is being used and by econometrically examining what factors impact flex land allocation.

The Distribution of Flex Acreage

To obtain some sense of the impact flex has on agriculture, it is useful to examine regional differences in how flex land is used. In the ASCS sign-up and compliance reports, state level data on flex land intentions and applications is available. We have employed this data to form regional figures for flex for all of the program crops. These figures indicate that flex has had different impacts depending on the base crop and region in question. The following tables illustrate some of the more interesting details of the flex impact on agriculture.

Table 1
Corn Flex Land Proportions

Corn Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Corn	% Flex Idled	% Flex to Other Non-program Crops
Southeast	0.2808499	0.1873485	0.3289092	0.1517681	0.0511243
Delta States	0.2741156	0.2282761	0.3497840	0.1352533	0.0125710
N. Plains	0.1645568	0.0531036	0.6372149	0.0999051	0.0452196
Corn Belt	0.2938843	0.0217787	0.6161342	0.0588999	0.0093029

Table 1 represents the proportions of corn flex acreage allocated to different uses in the Southeast, the Delta States, the Northern Plains, and the Corn Belt. Region definitions are provided in Annex 1 along with the complete table of regional flex percentages for all of the program crops. As shown in the table, corn flex acreage is dispersed in a variety of ways. The major corn producing regions (Corn Belt and Northern Plains) retain over sixty percent of flex land in corn. Soybeans are planted on sixteen and twenty-nine percent of flex acreage for the Northern Plains and Corn Belt, respectively. Other program crops are rarely planted on corn flex acres in these regions. The Southeast and the Delta States show a different pattern. Corn is planted on only a third of the corn flex acreage. Soybeans account for twenty-eight percent of the flex land and other program crops are planted on twenty percent of the land. The overall pattern that emerges for corn flex acres is that acres in the main corn producing regions will tend to stay in corn; acres outside of these regions are more likely to flex to another crop or to be idled.

Table 2
Cotton Flex Land Proportions

Cotton Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Cotton	% Flex Idled	% Flex to Other Non-program Crops
Southeast	0.0827691	0.0275572	0.7215174	0.1391173	0.0290390
Far West	0.0501707	0.1171498	0.4526361	0.2852760	0.0947674
Delta States	0.1022698	0.0207718	0.7857645	0.0881209	0.0030730

Cotton flex land allocation is given in Table 2. In the Southeast and the Delta States, roughly seventy-five percent of the cotton flex land returns to cotton production with soybean acreage and idled acreage making up approximately ten percent of flex each. Rarely is cotton flex land planted to other program crops in these regions. In the Far West, however, cotton flex land tends to leave cotton production with only forty-five percent of cotton flex land returning to cotton production. Nearly thirty percent of the flex land is idled and ten percent goes into other program crops. The overall pattern parallels corn flex allocation behavior; the major producing regions stay with the base crop, while other regions shift to other crops or idle the land.

Table 3 contains rice flex land allocation for the Southern Plains, Delta States, and Far West. Three different regional effects can be seen here. In the Southern Plains, over seventy percent of rice flex acreage is idled. Only 3 percent is planted to the base crop, rice. Soybeans are planted on thirteen percent. In the Far West, a third of the rice flex land is idled and a third is planted to other non-program crops. Thus, soybeans and the seven program crops combined only account for a third of Far West rice flex acreage. In the Delta States, soybeans is the leading crop on rice flex acreage with nearly fifty percent of the land. Rice is planted on one-third of the land. Only eight percent of the rice flex land is idled in the Delta States. The large variation in the percentage of idled rice flex acreage may indicate the availability of reasonable crop alternatives (or lack thereof) in the regions. It is interesting to note that the Delta States idle very little while the Southern Plains idle approximately seventy percent of the rice flex acreage.

Table 3
Rice Flex Land Proportions

Rice Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Rice	% Flex Idled	% Flex to Other Non-program Crops
Far West	0.0700636	0.0618133	0.2131448	0.3309626	0.3240157
Delta States	0.4533060	0.1245710	0.3334268	0.0792701	0.0094261
S. Plains	0.1349458	0.0638023	0.0347847	0.7020948	0.0643724

Regional wheat flex land percentages are presented in Table 4. Forty to fifty percent of wheat flex land is idled in the Far West and Southern Plains. Roughly thirty-five percent of the wheat flex is brought back into wheat production in these regions. The Southern Plains dedicates higher percentages of flex to soybeans and other program crops than the Far West. In the Far West, nearly fourteen percent of wheat flex is planted to non-program crops. The Northern Plains returns wheat flex to wheat production at a sixty percent rate. Twenty percent of the wheat flex is idled and the other twenty percent is planted to other crops (program and non-program). Wheat flex acreage in the North Central region is allocated more evenly over four choices: soybeans, other program crops, wheat, and idle.

Table 4
Wheat Flex Land Proportions

Wheat Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Wheat	% Flex Idled	% Flex to Other Non-program Crops
Far West	0.0170137	0.0566866	0.3300821	0.4581206	0.1380970
N. Plains	0.0683554	0.0685231	0.5885639	0.1910921	0.0834655
N. Central	0.2663521	0.1991401	0.3820430	0.1384050	0.0140598
S. Plains	0.0738577	0.1061974	0.3637109	0.4140184	0.0422156

These four examples show how flex has had different impacts across the country. Some general trends which can be seen across crops are flex acreage movements to other non-program crops in the west, and soybeans in the mid-west and southeast. Regional differences in flex application imply that impacts due to potential flex policy changes will also vary across regions. Because many of the flex impacts are regional in nature, any change in the flex provision can have significantly different effects in different areas of the country. Regional flex differences are expected since certain crops will have a comparative advantage over others in each region.

Variation in comparative advantage forms the conceptual foundation for econometric evaluation in the following section.

Econometric Analysis

Flex land allocation can be affected by several factors. Some of these might include market conditions, farm program provisions, and weather conditions. To examine how these factors might impact flex, we have estimated the following system of equations for corn, cotton, rice, and sorghum.

%Flex to Soybeans = f(expected net returns, planting progress, participation rate, and Acreage Reserve Program (ARP) rate)

%Flex to Other Program Crops = f(expected net returns, planting progress, participation rate, and ARP rate)

%Flex to the Base Crop = f(expected net returns, planting progress, participation rate, and ARP rate)

%Flex Idled = f(expected net returns, planting progress, participation rate, and ARP rate)

All of the data is at the state level. Flex acreage data, participation rates, and ARP rates are taken from the ASCS preliminary sign-up and final compliance reports for 1991-94. Planting progress percentages are available on a weekly basis for the major producing states in these four crops from the *Weekly Weather and Crop Bulletin*. Expected net returns have been calculated using state level farm prices from *Agricultural Prices*, regional costs of production from the USDA, and estimated trend yields.

Since farmers have the ability to change their flex decisions throughout the planting season, we have chosen to examine both flex intentions as stated in the preliminary sign-ups and flex applications as shown in the final reports. The flex intentions should give us an unbiased estimate of how farmers would apply their flex acres given conditions as of early April. As market and weather conditions shift throughout the planting season, farmers can change their flex allocations to match these conditions. Since both flex intentions and applications are used in the econometric analysis, the planting progress and expected net return variables are built to match the farmer's information set at the time. For the flex intentions, planting progress figures are taken from the first week in April and expected net returns are based on March farm prices. For the flex applications, planting progress figures are taken from the last week in May and expected net returns are based on May farm prices.

The expected net returns measure is the ratio of the base crop's expected net return and a competing crop's expected net return. Competing crops were chosen by examining the state's agricultural statistical abstract and linking crops by major production areas in the states. A list of the states and competing crops is available from the authors upon request. The relevant net returns are market net returns since flex acres do not receive government payments. All net returns are deflated by the implicit price deflator of the gross national product.

To capture regional differences in flex behavior, we shall pool flex acreage data across states. Also, this will provide a larger information set since the current flex program has only been in place for four years. Certain other simplifying assumptions have been made to conserve degrees of freedom. We have constrained net return, ARP rate, and participation rate effects to be the same across all of the states while allowing state level variation for planting progress and the intercept. A complete data set for corn is available for fifteen states. These states produce nearly ninety percent of the U.S. corn crop. Complete data sets for cotton, rice, and sorghum include fourteen, five, and twelve states, respectively. In each case, the state coverage captures at least ninety-two percent of the U.S. crop.

The proposed system of equations is estimated using seemingly unrelated regressions techniques. Errors are expected to be correlated across equations in each state, since the given proportions and the proportion of flex to other non-program crops (the residual proportion) must sum to one for all states. The explanatory variables are the same for all equations within the system and are mean-corrected to reduce possible proportional violations (values less than zero or greater than one).

In estimating variables which come in percentage, proportion, or share form, the traditional method is to use a logistic approach. The logistic approach limits the range of estimation to the zero-one interval, and thus, holds estimated values within the true bounds of actual values for the dependent variable. Usually though, only two alternatives are examined under this modeling structure. There is no readily available extension of the logistic approach for more than two alternatives. One example of estimation of more than two alternatives in a share form is the Almost Ideal Demand System. Commodity shares of an overall budget are estimated based upon the commodity prices, income, and an aggregate price index. Constraints are placed upon the parameters to insure the shares sum to one. Individual shares may still violate the zero-one bounds. Since we have divided flex land allocation into five separate categories, the application of an Almost Ideal Demand System type modeling structure seemed to be the most appropriate avenue to follow.

Table 5
Corn Planting Progress Parameters

Planting Progress Parameters	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Corn	% Flex Idled
Colorado	-0.037336 (-2.46)*	0.00563050 (0.56)	-0.00447890 (-0.24)	0.018063 (0.91)
Iowa	0.031544 (2.11)*	0.00202079 (0.21)	-0.01841800 (-1.02)	-0.013638 (-0.70)
Minnesota	0.056880 (3.79)*	0.00503253 (0.51)	-0.04249500 (-2.35)*	-0.022540 (-1.15)
Missouri	0.046210 (2.77)*	0.00680955 (0.62)	-0.03702300 (-1.84)	-0.010377 (-0.48)
Ohio	0.033908 (2.23)*	0.00464567 (0.47)	0.00810913 (0.44)	-0.044186 (-2.22)*
Wisconsin	0.016845 (1.11)	0.01654700 (1.66)	-0.03989600 (-2.18)*	0.014864 (0.75)

* significant at the 0.05 level (t-ratios in parentheses)

Since even the smallest system of flex equations has over 50 estimated parameters, only statistically significant results will be brought out in the text. A set of variable descriptions, equation forms, and parameter estimates are provided in Annex 2. A complete set of variable descriptions, equation forms, and parameter estimates is available from the authors on request. The results for corn indicate that as the state participation rate in the corn program increases, the percentage of corn flex idled also increases. More marginal acres seem to enter the program. Also, as the ARP rate increases, the percentage of corn flex idled decreases. State level corn planting progress has varying effects across the country. Table 5 presents the planting progress parameters for Colorado, Iowa, Minnesota, Missouri, Ohio, and Wisconsin for each of the four equations. In Colorado, as the planting season improves for corn, a smaller percentage of corn flex is planted to soybeans. However, in the midwest, the opposite effect is seen. For Minnesota and Wisconsin, a good corn planting season implies less corn is planted on corn flex. In Ohio, the idled corn flex percentage decreases with an increase in the corn planting progress. After examining the data, the most substantial shifts in flex acreage in the midwest occurred during the 1993 floods. With the limited number of observations on flex, the effects of an important event, such as the floods, are likely to overwhelm any other influences.

Table 6
Cotton Planting Progress Parameters

Planting Progress Parameters	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Cotton	% Flex Idled
Arizona	-0.050286	0.047491	-0.00735963	0.07133400
	(-2.08)*	(3.02)*	(-0.20)	(1.86)
California	-0.042487	0.047400	-0.03066600	-0.00291242
	(-2.34)*	(4.01)*	(-1.09)	(-0.10)
New Mexico	-0.049884	0.044897	-0.01830500	0.05073400
	(-3.07)*	(4.24)*	(-0.73)	(1.97)
Oklahoma	-0.089878	0.013324	-0.00553932	0.08196400
	(-5.75)*	(1.31)	(-0.23)	(3.31)*
Texas	-0.021694	0.033702	-0.04820400	0.04481900
	(-0.94)	(2.25)*	(-1.36)	(1.23)

* significant at the 0.05 level (t-ratios in parentheses)

As cotton net returns improve relative to competing crop net returns, the percentage of cotton flex going to soybeans decreases. The state level participation rate for the cotton program has a negative impact on the percentage of cotton flex that is idled, quite the opposite of what has happened for corn. The level of the cotton ARP rate has several impacts on flex allocation. As the ARP rate increases, the percentages of cotton flex to other program crops and back to cotton rise, while the flex percentage to soybeans falls. Significant state level planting progress results are given in Table 6. In Arizona, California, and New Mexico, higher cotton planting progress is linked with a lower percentage of cotton flex to soybeans and a higher percentage of cotton flex to other program crops. Texas has a similar reaction for cotton flex to other program crops. The percentage of idled cotton flex increases in Oklahoma with a better cotton planting season.

Table 7
Rice Planting Progress Parameters

Planting Progress Parameters	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Rice	% Flex Idled
California	-0.062222 (-1.95)	0.018322 (3.04)*	-0.01389300 (-0.86)	0.162959 (6.15)*
Louisiana	-0.144858 (-2.26)*	0.010064 (0.83)	-0.01261900 (-0.39)	0.165245 (3.10)*
Texas	-0.065095 (-1.28)	0.021316 (2.22)*	0.00479005 (0.19)	0.097888 (2.32)*

* significant at the 0.05 level (t-ratios in parentheses)

The results for rice yield several net returns effects. As rice net returns improve relative to a competing crop net return, the percentage of rice flex to soybeans decreases. Meanwhile the percentage of idled rice flex and the percentage of flex retained in rice production increase. As the rice ARP rate rises, the percentage of flex idled increases. This movement is the opposite of the ARP effect on corn flex. Table 7 displays rice flex reaction to rice planting progress figures. California and Texas have similar reactions to a higher rice planting progress figure. In both states, the percentages of rice flex idled and planted to other program crops increase. For Louisiana, a higher rice planting progress is connected to an increase in the percentage of idled flex and a drop in the percentage of flex planted to soybeans.

Table 8
Sorghum Planting Progress Parameters

Planting Progress Parameters	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Sorghum	% Flex Idled
Colorado	-0.079270 (-2.51)*	0.00598869 (0.48)	-0.015857 (-0.74)	0.100081 (2.88)*
Mississippi	0.046709 (1.15)	-0.03870400 (-2.39)*	-0.017833 (-0.64)	0.018670 (0.42)
New Mexico	-0.067348 (-2.12)*	0.01086400 (0.86)	-0.028096 (-1.29)	0.055778 (1.59)
Oklahoma	-0.078151 (-2.71)*	0.00840239 (0.73)	-0.017832 (-0.91)	0.107018 (3.37)*

* significant at the 0.05 level (t-ratios in parentheses)

All of the statistically significant effects for sorghum are from the state level planting progress variables. In Colorado and Oklahoma, an increase in the percentage of idled sorghum flex occurs in years of high sorghum planting progress. Also, the percentage of flex to soybeans decreases in those years. New Mexico's percentage of sorghum flex to soybeans has a similar reaction to a favorable sorghum planting season. Better sorghum planting seasons in Mississippi are linked with lower percentages of sorghum flex to other program crops.

Through these four example we can see that flex land allocation is a regional and crop specific process. Market factors, weather conditions, and farm program requirements all impact how flex land is used. Regional aspects have been brought out and the planting progress results show how farmers can adjust their flex applications to meet the ever-changing planting conditions.

Conclusion

This paper has presented evidence on the usage of flex acreage and the variables which impact their allocation. From regional percentages of flex land use, it can be seen that flex has had a varying effect across the country. While the major producing regions in the program crops have tended to return a sizable portion of the flex acreage to the base crop, other regions have shifted to soybeans, other crops (program and non), or have idled the flex land. An econometric analysis of flex land use has shown that market, weather, and farm program factors have substantial effects on the flex allocation. Also, it has been shown that states vary in their responses of flex acreage to different exogenous factors.

As stated in the introduction, one of the proposals for the 1995 Farm Bill is the expansion of the required flex rate. Based on the information given above, this proposal will have significantly different effects for the various crops and for different regions in the country. Would we expect the expanded flex acreage to follow a pattern similar to what is seen here? Will it behave more like non-participating acreage? The argument could be made that the expanded flex acreage would behave in a pattern similar to what has been shown above, but the shifts will be less drastic. Within the expanded flex acreage, we would expect a higher percentage of this flex to be retained in base crop production, and lower percentages in the other categories. Thus it could well be that most of the major movements to other crops have been captured by the current flex provision. However, with the limited number of observations that are available, inferences about future behavior involve a high degree of uncertainty.

References

Deaton, A. and J. Muellbauer. "An Almost Ideal Demand System." *American Economic Review* 70(1980):312-26.

Food and Agricultural Policy Research Institute. *FAPRI 1994 U.S. Agricultural Outlook.* Staff Report #1-94. April 1994.

U.S. Dept. of Agriculture. Program Sign-Up and Final Compliance Reports. Various issues 1991-94.

U.S. Dept. of Agriculture. *Agricultural Prices*. Various issues 1991-94.

U.S. Dept. of Agriculture, Agricultural and Rural Economy Division, Economic Research Service. *Economic Indicators of the Farm Sector: Costs of Production -- Major Field Crops & Livestock and Dairy, 1992*. ECIFS 12-3. August 1994.

U.S. Dept. of Commerce and U.S. Dept. of Agriculture. *Weekly Weather and Crop Bulletin*. Various issues 1991-94.

Annex 1

Tables of Regional Flex Land Allocation and Region Definitions

Corn Flex Land Proportions

Corn Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Corn	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.2808499	0.1873485	0.3289092	0.1517681	0.0511243	596493.2
Far West	0.0574143	0.1947683	0.2792769	0.2710007	0.1975398	51090.9
Delta States	0.2741156	0.2282761	0.3497840	0.1352533	0.0125710	44950.1
N. Plains	0.1645568	0.0531036	0.6372149	0.0999051	0.0452196	2229749.7
Northeast	0.2171505	0.0850254	0.4312775	0.2417889	0.0247577	242354.0
Corn Belt	0.2938843	0.0217787	0.6161342	0.0588999	0.0093029	6472609.0
S. Plains	0.0487023	0.2173313	0.3997658	0.2532624	0.0809382	256847.1

corn regions: southeast: AL, FL, GA, KY, NC, SC, TN, VA
far west: AZ, CA, ID, OR, UT, WA
delta states: AR, LA, MS
northern plains: CO, KS, MT, NE, ND, SD, WY
northeast: DE, MD, NJ, NY, PA, WV
corn belt: IL, IN, IA, MI, MN, MO, OH, WI
southern plains: NM, OK, TX;

Barley Flex Land Proportions

Barley Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Barley	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.2908736	0.2471282	0.3547566	0.0816661	0.0255755	9255.3
Far West	0.0416930	0.1599430	0.2144940	0.4309593	0.1529107	282221.9
N. Plains	0.0861196	0.2508467	0.3484733	0.2000321	0.1145283	1018565.0
Northeast	0.1829605	0.3950260	0.2870533	0.0899113	0.0450489	12405.8
S. Plains	0.1280967	0.3083344	0.0355582	0.4590513	0.0689594	44172.0

barley regions: southeast: KY, NC, SC, VA
far west: AZ, CA, ID, NV, OR, UT, WA
northern plains: CO, MN, MT, NE, ND, SD, WY
northeast: DE, MD, MI, NJ, PA, WI
southern plains: KS, OK, TX;

Cotton Flex Land Proportions

Cotton Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Cotton	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.0827691	0.0275572	0.7215174	0.1391173	0.0290390	187910.8
Far West	0.0501707	0.1171498	0.4526361	0.2852760	0.0947674	219271.9
Delta States	0.1022698	0.0207718	0.7857645	0.0881209	0.0030730	578535.3
S. Plains	0.0286546	0.0893524	0.6850778	0.1696551	0.0272601	995554.1

cotton regions: southeast: AL, FL, GA, NC, SC, VA
far west: AZ, CA
delta states: AR, LA, MS, MO, TN
southern plains: NM, OK, TX;

Rice Flex Land Proportions

Rice Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Rice	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Far West	0.0700636	0.0618133	0.2131448	0.3309626	0.3240157	89425.3
Delta States	0.4533060	0.1245710	0.3334268	0.0792701	0.0094261	432903.5
S. Plains	0.1349458	0.0638023	0.0347847	0.7020948	0.0643724	85974.0

rice regions: far west: CA
delta states: AR, LA, MS, MO
southern plains: TX;

Sorghum Flex Land Proportions

Sorghum Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Sorghum	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.2347677	0.2869749	0.1244029	0.2743773	0.0794772	26827.1
Delta States	0.3820246	0.2877250	0.2361245	0.0865484	0.0075775	92679.2
C. Plains	0.1831181	0.1273700	0.4325811	0.2195183	0.0374125	885334.2
S. Plains	0.0526986	0.2616110	0.3558548	0.2683668	0.0614688	536983.4

sorghum regions: southeast: AL, GA, KY, NC, SC, TN
delta states: AR, LA, MS
central plains: CO, IL, KS, MO, NE, SD
southern plains: NM, OK, TX;

Oats Flex Land Proportions

Oats Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Oats	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.2484767	0.3788382	0.1346370	0.1716122	0.0664359	9011.6
Far West	0.0418821	0.2374512	0.1486074	0.3338027	0.2382566	8722.2
N. Plains	0.1330389	0.4014598	0.2049098	0.1426180	0.1179735	273908.5
Northeast	0.1324019	0.3899173	0.2275537	0.2408768	0.0092503	14462.3
N. Central	0.2133982	0.4947894	0.1911504	0.0673698	0.0332922	152172.9
S. Plains	0.1102942	0.4198840	0.0896195	0.3079178	0.0722845	47220.1

oats regions: southeast: AL, AR, GA, NC, SC
far west: CA, ID, OR, UT, WA
northern plains: MT, NE, ND, SD, WY
northeast: MD, NY, PA, WV
north central: IL, IN, IA, MI, MN, MO, OH, WI
southern plains: CO, KS, OK, TX;

Wheat Flex Land Proportions

Wheat Flex Land Proportions	% Flex to Soybeans	% Flex to Other Program Crops	% Flex to the Base Crop, Wheat	% Flex Idled	% Flex to Other Non-program Crops	Total Flex Land (Ave. 1991-94) in acres
Southeast	0.2419790	0.2825931	0.2185283	0.2163297	0.0405699	298050.0
Far West	0.0170137	0.0566866	0.3300821	0.4581206	0.1380970	878748.8
Delta States	0.3008866	0.3012431	0.2606510	0.1271735	0.0100458	285553.7
N. Plains	0.0683554	0.0685231	0.5885639	0.1910921	0.0834655	3719013.9
Northeast	0.1786155	0.2025413	0.3731667	0.2243398	0.0213367	42689.0
N. Central	0.2663521	0.1991401	0.3820430	0.1384050	0.0140598	710007.9
S. Plains	0.0738577	0.1061974	0.3637109	0.4140184	0.0422156	4467588.8

wheat regions: southeast: AL, GA, NC, SC, TN, VA
far west: AZ, CA, ID, NV, OR, UT, WA
delta states: AR, LA, MS
northern plains: MN, MT, ND, SD, WY
northeast: DE, MD, NJ, NY, PA, WV
north central: IL, IN, IA, KY, MI, MO, OH, WI
southern plains: CO, KS, NE, NM, OK, TX;

Annex 2

Variable Descriptions, Equation Form, and Estimation Results

Variable Descriptions:

**FPSBUS is a vector of state level shares of flex land planted to soybeans where ** represents the crop code: corn (CO), cotton (CT), rice (RI), and sorghum (SG).

**FPPCUS is a vector of state level shares of flex land planted to other program crops where ** represents the crop code.

**FPBCUS is a vector of state level shares of flex land planted to the base crop where ** represents the crop code.

**FPIDUS is a vector of state level shares of flex land idled where ** represents the crop code.

**NRUS is a vector of state level expected net returns ratios of the base crop versus a competing crop where ** represents the crop code.

**PARUS is a vector of state level farm program participation rates for the base crop where ** represents the crop code.

**ARP is the vector of ARP rates for the base crop **.

**CP@@ is a vector formed by the crop planting progress in state @@ for the base crop ** and zeroes for all other states.

INT@@ is a vector of indicator variables for the state @@.

Equation Form:

The complete system structure will be shown for the rice estimation. The system structure for the other crops follows this pattern. For all of the systems, net returns parameters are labeled b11-b41, participation rate parameters are labeled c11-c41, state planting progress parameters are labeled d11-r41 (depending upon the number of states included in the estimation), ARP rate parameters are labeled s11-s41, and state indicator parameters are labeled t11-ag41 (depending upon the number of states included in the estimation).

```
RIFPSBUS = A1+B11*(RINRUS)+C11*(PARUS)+D11*(RICPAR)+E11*(RICPCA)
           +F11*(RICPLA)+G11*(RICPMS)+H11*(RICPTX)+S11*(RIARP)
           +T11*(INTAR)+U11*(INTCA)+V11*(INTLA)+W11*(INTMS)
RIFPPCUS = A2+B21*(RINRUS)+C21*(PARUS)+D21*(RICPAR)+E21*(RICPCA)
           +F21*(RICPLA)+G21*(RICPMS)+H21*(RICPTX)+S21*(RIARP)
           +T21*(INTAR)+U21*(INTCA)+V21*(INTLA)+W21*(INTMS)
RIFPBCUS = A3+B31*(RINRUS)+C31*(PARUS)+D31*(RICPAR)+E31*(RICPCA)
           +F31*(RICPLA)+G31*(RICPMS)+H31*(RICPTX)+S31*(RIARP)
           +T31*(INTAR)+U31*(INTCA)+V31*(INTLA)+W31*(INTMS)
RIFPIDUS = A4+B41*(RINRUS)+C41*(PARUS)+D41*(RICPAR)+E41*(RICPCA)
           +F41*(RICPLA)+G41*(RICPMS)+H41*(RICPTX)+S41*(RIARP)
           +T41*(INTAR)+U41*(INTCA)+V41*(INTLA)+W41*(INTMS)
```

Estimation Results:

Equation	Model DF	Error DF	R-Square
COFPSBUS	33	72	0.8555
COFPPCUS	33	72	0.9079
COFPBCUS	33	72	0.8926
COFPIDUS	33	72	0.6733
CTFPSBUS	31	67	0.6512
CTFPPCUS	31	67	0.8434
CTFPBCUS	31	67	0.8995
CTFPIDUS	31	67	0.7348
RIFPSBUS	13	22	0.8698
RIFPPCUS	13	22	0.9060
RIFPBCUS	13	22	0.9076
RIFPIDUS	13	22	0.9492
SGFPSBUS	27	57	0.7656
SGFPPCUS	27	57	0.9008
SGFPBCUS	27	57	0.7736
SGFPIDUS	27	57	0.6563

Nonlinear SUR Parameter Estimates for Rice

Parameter		Estimate	'T' Ratio	Parameter		Estimate	'T' Ratio
Net	B11	-0.147997	-3.81	LA	F11	-0.144858	-2.26
Return	B21	-0.00842888	-1.15		F21	0.010064	0.83
	B31	0.041034	2.08		F31	-0.012619	-0.39
	B41	0.147070	4.55		F41	0.165245	3.10
Part.	C11	-0.230232	-0.31	MS	G11	0.058524	1.64
Rate	C21	0.015838	0.11		G21	0.00521593	0.77
	C31	0.647912	1.71		G31	-0.026316	-1.45
	C41	-0.205587	-0.33		G41	-0.020346	-0.69
Plant.	D11	-0.00989258	-0.30	TX	H11	-0.065095	-1.28
Prog.	D21	0.00396087	0.64		H21	0.021316	2.22
AR	D31	-0.00758706	-0.46		H31	0.00479005	0.19
	D41	0.017753	0.65		H41	0.097888	2.32
CA	E11	-0.062222	-1.95	ARP	S11	-0.047183	-1.73
	E21	0.018322	3.04	Rate	S21	-0.00177678	-0.34
	E31	-0.013893	-0.86		S31	-0.00712058	-0.51
	E41	0.162959	6.15		S41	0.054449	2.39

Nonlinear SUR Parameter Estimates for Corn

Parameter		Estimate	'T' Ratio	Parameter		Estimate	'T' Ratio
Net	B11	0.00394618	0.40	IL	K11	0.014097	0.93
Return	B21	-0.00332382	-0.51		K21	0.00306959	0.31
	B31	-0.013634	-1.14		K31	-0.013522	-0.74
	B41	0.00664512	0.51		K41	-0.00281875	-0.14
Part.	C11	-0.199023	-1.52	IN	L11	0.020292	1.34
Rate	C21	0.059208	0.69		L21	0.00255097	0.26
	C31	-0.227091	-1.43		L31	-0.014609	-0.80
	C41	0.443933	2.58		L41	-0.00770652	-0.39
Plant.	D11	-0.037336	-2.46	IA	M11	0.031544	2.11
Prog.	D21	0.00563050	0.56		M21	0.00202079	0.21
CO	D31	-0.00447890	-0.24		M31	-0.018418	-1.02
	D41	0.018063	0.91		M41	-0.013638	-0.70
KS	E11	-0.00188766	-0.11	MI	N11	-0.00124974	-0.08
	E21	0.00961082	0.87		N21	0.00419559	0.42
	E31	-0.00653340	-0.32		N31	-0.00522629	-0.29
	E41	0.00421863	0.19		N41	0.00355949	0.18
NE	F11	0.014341	0.95	MN	O11	0.056880	3.79
	F21	0.00484790	0.49		O21	0.00503253	0.51
	F31	-0.00700705	-0.38		O31	-0.042495	-2.35
	F41	-0.010155	-0.51		O41	-0.022540	-1.15
SD	G11	0.025266	1.69	MO	P11	0.046210	2.77
	G21	0.012756	1.30		P21	0.00680955	0.62
	G31	-0.028258	-1.57		P31	-0.037023	-1.84
	G41	-0.00289777	-0.15		P41	-0.010377	-0.48
GA	H11	0.00862995	0.17	OH	Q11	0.033908	2.23
	H21	-0.037443	-1.09		Q21	0.00464567	0.47
	H31	-0.038055	-0.60		Q31	0.00810913	0.44
	H41	0.106358	1.55		Q41	-0.044186	-2.22
KY	I11	0.010514	0.69	WI	R11	0.016845	1.11
	I21	0.00174635	0.17		R21	0.016547	1.66
	I31	-0.012642	-0.69		R31	-0.039896	-2.18
	I41	0.010118	0.51		R41	0.014864	0.75
NC	J11	0.00953403	0.55	ARP	S11	0.015055	0.64
	J21	-0.00131800	-0.12	Rate	S21	0.011824	0.76
	J31	-0.00583743	-0.28		S31	0.041470	1.45
	J41	0.00608677	0.27		S41	-0.083886	-2.70

Nonlinear SUR Parameter Estimates for Cotton

Parameter		Estimate	'T' Ratio	Parameter		Estimate	'T' Ratio
Net	B11	-0.022359	-2.26	AR	J11	0.013494	0.87
Return	B21	-0.00034439	-0.05		J21	0.00122187	0.12
	B31	-0.00095345	-0.06		J31	0.00093344	0.04
	B41	0.012292	0.79		J41	-0.013520	-0.55
Part.	C11	0.041265	0.45	LA	K11	0.00625736	0.41
Rate	C21	-0.022828	-0.38		K21	0.00596418	0.60
	C31	0.272768	1.91		K31	-0.023094	-0.98
	C41	-0.425982	-2.91		K41	0.013280	0.55
Plant.	D11	-0.020305	-1.27	MS	L11	0.020167	1.35
Prog.	D21	0.010971	1.06		L21	0.00496072	0.51
AL	D31	-0.025605	-1.04		L31	-0.00771905	-0.33
	D41	0.036802	1.46		L41	-0.014395	-0.61
GA	E11	-0.012290	-0.78	MO	M11	0.010488	0.68
	E21	0.00791918	0.77		M21	0.00504222	0.50
	E31	-0.025781	-1.06		M31	-0.010646	-0.44
	E41	0.037464	1.50		M41	-0.00437001	-0.18
NC	F11	-0.00096813	-0.06	TN	N11	0.00375443	0.26
	F21	0.00436202	0.43		N21	0.00132695	0.14
	F31	-0.00363203	-0.15		N31	-0.00821303	-0.37
	F41	0.00205659	0.08		N41	0.00298954	0.13
SC	G11	0.00771564	0.49	NM	O11	-0.049884	-3.07
	G21	0.00181279	0.18		O21	0.044897	4.24
	G31	-0.00999725	-0.41		O31	-0.018305	-0.73
	G41	0.00355563	0.14		O41	0.050734	1.97
AZ	H11	-0.050286	-2.08	OK	P11	-0.089878	-5.75
	H21	0.047491	3.02		P21	0.013324	1.31
	H31	-0.00735963	-0.20		P31	-0.00553932	-0.23
	H41	0.071334	1.86		P41	0.081964	3.31
CA	I11	-0.042487	-2.34	TX	Q11	-0.021694	-0.94
	I21	0.047400	4.01		Q21	0.033702	2.25
	I31	-0.030666	-1.09		Q31	-0.048204	-1.36
	I41	-0.00291242	-0.10		Q41	0.044819	1.23
				ARP	S11	-0.106196	-4.44
				Rate	S21	0.031302	2.01
					S31	0.117315	3.17
					S41	0.00570750	0.15

Nonlinear SUR Parameter Estimates for Sorghum

Parameter		Estimate	'T' Ratio	Parameter		Estimate	'T' Ratio
Net	B11	-0.044029	-1.62	MO	J11	0.00877084	0.33
Return	B21	-0.00165738	-0.15		J21	-0.00459353	-0.44
	B31	0.00506202	0.27		J31	0.00320264	0.18
	B41	0.029712	1.00		J41	-0.00721400	-0.25
Part.	C11	0.00547402	0.18	NE	K11	-0.012112	-0.44
Rate	C21	-0.00030926	-0.03		K21	0.00696056	0.63
	C31	-0.014938	-0.70		K31	0.015081	0.80
	C41	0.012619	0.37		K41	-0.00228232	-0.07
Plant.	D11	0.00727238	0.18	NM	L11	-0.067348	-2.12
Prog.	D21	-0.015035	-0.93		L21	0.010864	0.86
AR	D31	0.00576118	0.21		L31	-0.028096	-1.29
	D41	0.00704471	0.16		L41	0.055778	1.59
CO	E11	-0.079270	-2.51	OK	M11	-0.078151	-2.71
	E21	0.00598869	0.48		M21	0.00840239	0.73
	E31	-0.015857	-0.74		M31	-0.017832	-0.91
	E41	0.100081	2.88		M41	0.107018	3.37
IL	F11	0.013600	0.53	SD	N11	-0.032793	-1.34
	F21	-0.00808084	-0.80		N21	0.00580963	0.60
	F31	0.018931	1.08		N31	0.00981943	0.59
	F41	-0.021574	-0.76		N41	0.032396	1.21
KS	G11	-0.028130	-0.99	TX	O11	-0.061417	-0.49
	G21	0.00647159	0.57		O21	0.056414	1.13
	G31	-0.010390	-0.53		O31	-0.032254	-0.38
	G41	0.044892	1.43		O41	0.154823	1.12
LA	H11	-0.00568765	-0.15	ARP	S11	0.086712	3.50
	H21	-0.00984780	-0.65	Rate	S21	-0.017074	-1.74
	H31	-0.020785	-0.80		S31	0.042371	2.50
	H41	0.047284	1.13		S41	-0.146007	-5.35
MS	I11	0.046709	1.15				
	I21	-0.038704	-2.39				
	I31	-0.017833	-0.64				
	I41	0.018670	0.42				