What Can A Kansas Farmer Afford to Pay to Rent Cropland?*

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Abstract

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Five years of continuous annual data are used to measure the marginal value product of cropland (return to land) on approximately 100 Kansas farms. Determinants of the marginal value product are investigated using regression.

What Can A Kansas Farmer Afford to Pay to Rent Cropland?

In 1999, Kansas Farmers paid $529 million of net rent to non-farm landlords (KS Dept. of Ag. and NASS). For Kansas Farm Management Association farms in 1999, 92% of the farms rented land (Langemeier and Delano, not dateda). The 1997 U.S. Census indicated that 40% of U.S. farms rented or leased land and 41% of the land in farms was rented or leased. For oilseed and grain farming, 55% of U.S. farms rented or leased land, and 52% of the land in farms was rented or leased. Therefore, information about what farmers can afford to pay to rent cropland and procedures for estimating the value of land in individual farm operations is relevant for a large portion of U.S. farmers, especially those who produce major field crops. Such information is also useful for landowners who wish to rent land to farmers, and to policy makers who are concerned about land resources and farm profitability.

The purpose of this research was to investigate how much a farmer could afford to pay for rented cropland. The three objectives were: (1) to measure the marginal value product (MVP) of cropland for a sample of Kansas farms, (2) to measure the annual variability of the MVP for cropland under the Federal Agriculture Improvement and Reform Act of 1996, and (3) to examine the relationship between MVP of cropland and farm characteristics such as farm size, machinery management, and crop diversity and/or specialization.

Related Literature

According to Ibendahl, Trimble, and Isaacs, recent drops in gross income from lower commodity prices have not lowered cash rental rates. The authors explain that future price expectations and machinery management concerns may be driving the unresponsive cash rental rates. In our model, we include commodity price and a machinery quality variable to help explain what might be driving the MVP of cropland.

Rister et al. argue that the Federal Agricultural Improvement and Reform Act of 1996 (FAIR) has substantially changed the way landowners of the Texas rice belt lease their cropland. They concluded that higher rental rates are justified because of opportunity costs associated with leasing the cropland to a rice tenant, since landowners have the freedom to produce other crops under FAIR. Higher rental rates sought by the landowner may lead to higher volatility within the observed rental rates.

Burton and Abderrezak found expected farm profits to be positively related to increases in farm size and the amount of leased intermediate and long-term assets. Specifically, a large positive relationship exists between the degree of non-ownership of real estate and machinery, and expected farm profits. This relationship indicates that a farm, which leases cropland and machinery at levels above average, would observe higher expected profits.

Garcia, Sonka, and Yoo, found no economic efficiency differences between moderate (< 700 acres) and large farm (> 700 acres) sizes. In contrast, Nivens and Kastens found increased profits associated with increasing farm size. Coinciding with Burton and Abderrezak, Garcia, Sonka, and Yoo also concluded that increased short run profitability resulted as the number of acres rented increases. This research will examine the impact on the MVP of cropland caused by several independent variables including farm size, and the percent of acres rented.

Procedures and Data

Measuring the MVP of Cropland

Farm enterprise data are extremely scarce. A strong point of this research was the use of actual farm enterprise data from the Kansas Management, Analysis and Research in 105 counties (K-MAR-105) data set. We focused on the eighteen counties that comprise the North Central Kansas Farm Management Association. The data consisted of the financial records 103 farms that met the standards for inclusion in the enterprise Profit-Link Analyses (an annual publication from Kansas State University Research and Extension) each year from 1995 to 1999.

What farmers can afford to pay for rented cropland, is measured for individual farms at the margin by calculating the MVP as a weighted average of returns to land for the annual mix of five major crops (wheat, milo, corn, soybeans, and alfalfa). Returns to land are defined as gross crop revenue less total variable costs and all fixed costs except land. Gross crop revenue includes crop sales, government payments, and crop insurance indemnity payments. The MVP for the farm was calculated using the MVP of each crop weighted by the acres of the crop divided by the total acres of the five major crops.

Because the K-MAR-105 data include only the operator's share of income and expenses, the data were adjusted to include the landlord's share for gross income, fertilizer expense, herbicide/insecticide expense, conservation expense, and seed expense. Thus each farm was treated as though the operator owned it. Procedures for calculating the MVP of cropland follow.

Addition of the Landlord's Share to K-MAR-105 Enterprise Revenue Data

First, the percent of production that represents the landlord's share must be computed and added into the operator's share of production. Equation 1 represents the operator's percentage of total crop production, including both owned and rented production (Farm percent). Thus, the landlord's share of total farm production is equal to (1- Farm percent).

$$(1) \qquad \text{Farm percent} = \left(\frac{\text{operator's crop production}}{\text{total rented production} + \text{owned production}} \right)$$

In this formula, operator's crop production represents the amount of the crop kept by the producer for both rented and owned acres, total (operator's plus landlord's) rented production is the total production on rented acres, and owned production is the total (operator) production on owned acres.

To account for the landlord's gross income on crop share rented acres, Equation 2 was used to estimate total gross farm income per crop acre (Langemeier, 1976).

$$(2) \qquad \text{Gross Income} = \left(\frac{\text{Operator's gross crop income}}{\text{Farm percent}} \right)$$

Operator's gross crop income is the total dollar value earned by the operator on rented and owned crop acres in a given year, and farm percent is explained above. This procedure was also used to make adjustments for the expected landlord's share of government payments and crop insurance income.

Addition of the Landlord's Share to K-MAR-105 Enterprise Expense Data

K-MAR-105 enterprise costs data do not include the landlord's share of any shared expenses. The landlord's share of expenses was added to the operator's costs using calculated percentages of the landlord's share from a recent survey of crop producers in North Central Kansas (Tsoodle and Wilson). Tsoodle and Wilson report percentages for three separate crop sharing arrangements, as well as the average expense percentages paid by the landlord under each crop share arrangement. The landlord's shares of expenses (fertilizer, herbicide/insecticide, seed, and conservation) were derived for wheat, milo, soybeans, corn, and alfalfa. The expected landlord's share of an expense is equal to the summed percent of expense paid by the landlord multiplied by the crop share arrangement percentage.

Since adequate data to distinguish between chemical and application costs were not available, we assumed the application costs would be included in the total bill to the operator and were included in the adjustment for chemical costs. If the operators apply their own chemicals, then the application costs will be reported under machinery expenses. The same procedure was used for fertilizer and fertilizer application. The landlord's share was added to the reported fertilizer, herbicides/insecticides, seed, and conservation expenses. Additionally, because data to separate herbicide and insecticide were not available within the KMAR data set, herbicide percentages from Tsoodle and Wilson were used in landlord's expense share calculations for all crops except alfalfa. For alfalfa, the insecticide percentage from Tsoodle and Wilson was used to calculate the landlord's share of expense. Equation 3 was used to add the landlord's share of the different costs to the operator's share to arrive at the total costs per acre.

$$(3) \quad \text{Gross Expense} = \left(\left(\left(\frac{\text{oper. prod. exp.}}{(\text{Farm percent})} \right) - \text{oper. prod. exp.} \right) * \frac{\text{landlord's share of exp.}}{\text{landlord's share of crop}} \right) + \text{oper. prod. exp.}$$

Operator's production expense is equal to the amount the producer paid for a given expense for a certain crop for rented and owned crop acres in a given year, and farm percent and landlord's share of crop are as previously defined.

Calculation of Interest on Variable Expenses

Variable production expense included the costs of hired labor, machinery repairs, seed, fertilizer, machinery hired, fees, fuel, storage, personal property tax, farm utilities, herbicide/insecticide, conservation, farm auto, and crop insurance. Interest on variable costs was computed by multiplying three-fourths of the sum of the variable costs by an interest rate of 8% (Langemeier and DeLano, not datedb).

Fixed Costs

The fixed costs that were included to compute returns to land were: 1) management charge, 2) machinery depreciation, 3) farm insurance (not including crop insurance), 4) unpaid operator labor, and 5) a calculated interest charge. The management charge per acre is defined as four percent times the gross farm income per acre from the five crops.

Depreciation reported in the K-MAR-105 data series is market depreciation as opposed to a tax depreciation, and should be representative of the cost of farming. It is primarily depreciation on machinery. Depreciation on buildings is included, but the value is small enough to be insignificant.

The interest charge represents an opportunity charge on farm machinery. Machinery value for each crop is equal to machinery depreciation multiplied by ten. The interest charge calculation is as follows for a given farm in a given year for all five crops:

(4) Interest charge/acre = 8% * Machinery value/ Total crop acres

where machinery value is the sum of the total value for each of the five crops.

Unpaid operator labor represents the value of unpaid labor on the farm. This value is directly reported in the KMAR data set within the fixed costs category.

Marginal Value Product Calculation

The marginal value product (MVP) of cropland is a weighted average of the different crops planted each year. The marginal value product equals the sum of each enterprise's net income multiplied by the acres of each respective crop divided by the total number of acres for the entire farm. The MVP formula is as follows for a given farm in a given year:

$$\text{(5)} \qquad \text{MVP}_{jt} = \frac{\sum_i \text{Net income}_{ijt} * \text{crop acres}_{ijt}}{\text{Total Crop Acres}_{jt}}$$

where *i* represents crop (alfalfa, corn, milo, wheat, soybeans), *j* represents farm, and *t* represents year (1995-1999).

Regression Analysis

This section discusses data processing to produce independent variables and the two models that were used in the regression analysis.

Data Handling to Produce Independent Variables

Depreciation, machinery repairs, hired labor, unpaid operator labor, crop income (revenue), and crop production were all converted to per acre values. After those conversions, several additional variables were created for use in the regression analysis. The first variable created was Labor. This variable is the sum of unpaid operator labor per acre and hired labor per acre. Output price per unit (Price) was the next variable to be created, and is computed as crop income divided by crop production. Since both are on a per acre basis, the result would be a $/unit of production. Mach1 was created to measure machine quality and is calculated as the ratio of machinery depreciation-to-machinery repairs. The machinery depreciation-to-labor ratio is represented by Mach2.

The variable Rentpct represents the percent of all crop acres that were rented by a farm in a given year. The variable Rentpct2 is equal to percent of acres rented squared. This variable is included to allow the impact of renting land, if there is one, to be nonlinear. Finally, a year dummy variable was created for 1995 through 1999, with 1999 serving as the default year. All variables are computed for each farm in each year for all five crops individually. Total crop acres (TCA) represents the sum of all five crops for a given farm in a given year. The variable TCA2 is equal to total crop acres squared. These variables are included to determine the impact farm size has on the returns to land.

Normalized Data

When necessary, independent variables are normalized to allow for cross crop comparisons. With data normalization, it is possible to compare an acre of wheat with an acre of milo in terms of relative productivity. Because both are computed relative to their means, the comparison of which crop is producing more is relative to the average. Machinery depreciation, machinery repairs, total labor, crop production, machinery hired, output price, machinery depreciation-to-labor ratio, and machinery depreciation-to-machinery repairs ratio were normalized. They were normalized as a percent difference from the average according to

$$\text{(6)} \qquad \grave{e}_{it} = \left(\left[\frac{Y_{ijt}}{\overline{Y_{it}}} \right] - 1 \right) * 100$$

where Y_{ijt} is the observed value for a specific farm for a specific crop in a given year, $\overline{Y_{it}}$ represents the average value for all farms for the same crop in the same year, and 2_{it} is the normalized value for the variable *y* of the i^{th} enterprise in year *t*.

Relative Variable Indexes

Using the normalized values computed in Equation 6 and the percent of each farm's total enterprise acres that were used in the production of a specific crop, relative variable indexes were computed for crop yield (Yield)**,** machinery depreciation (Deprec), machinery repairs (repair), machinery depreciation-to-machinery repairs ratio (Mach1), machinery depreciation-to-labor ratio (Mach2), machinery hired (Machir), and the sum of unpaid and hired labor (Labor). The normalized values were weighted by their respective crop's percent of total farm acres and then summed to compute the index value. For example, the relative yield index is equal to the normalized alfalfa production times percent of acres in alfalfa (ALFpct) plus normalized soybean production times percent of acres in soybeans (SOYpct) plus the normalized wheat production times percent of acres in wheat (WHTpct) plus the normalized milo production times percent of acres in milo

(MILpct) plus the normalized value of corn production times percent of acres in corn (CRNpct). The following example depicts the relative yield:

(7) $$\text{Relative Yield Index}_{jt} = \sum_{i=1}^{5} \left\{ è * \left(\frac{A_{ijt}}{TCA_{jt}} \right) \right\}$$

where *i* represents one of the five crops (alfalfa, corn, milo, wheat, soybeans), *j* represents an individual farm, *t* represents a year (1995-1999), and A represents the percent of acres in a crop on a farm in a year.

Diversification

A Herfindahl type index was used as an indication of crop diversity for each farm. The index is computed as $H = \Sigma S_i^2$, where S_i is equal to one enterprise's share of the total crop mix, and in this application is computed by summing the squared value of the ALFpct, SOYpct, WHTpct, MILpct, and CRNpct variables (Tirole). The variable DIV represents the index value within the regression. A value of one indicates complete specialization, or no diversification.

Conceptual Model

For this research we assume that each producer is a rational, profit-maximizing producer. Our producer believes that the amount he or she could pay for an additional acre of rented cropland is determined by factors such as farm size, average crop yield, diversification, quality of machinery, machinery usage relative to labor usage, crop prices received, crop rotations, and management ability.

Regression Model I

In model I, all independent variables are included in the model individually,

(8)
$$\begin{aligned}\mathbf{MVP} = {} & \hat{a}_0 + \hat{a}_1 \text{TCA} + \hat{a}_2 \text{TCA}^2 + \hat{a}_3 \text{Yield} + \hat{a}_4 \text{Div} + \hat{a}_5 \text{Deprec} \\ & + \hat{a}_6 \text{Repair} + \hat{a}_7 \text{Price} + \hat{a}_8 \text{Labor} + \hat{a}_9 \text{Rentpct} + \hat{a}_{10} \text{Rentpct}^2 \\ & + \hat{a}_{11} \text{Machir} + \hat{a}_{12} \text{y95} + \hat{a}_{13} \text{y96} + \hat{a}_{14} \text{y97} + \hat{a}_{15} \text{y98} + \hat{a}_{16} \text{ALFpct} \\ & + \hat{a}_{17} \text{SOYpct} + \hat{a}_{18} \text{MILpct} + \hat{a}_{19} \text{CRNpct}\end{aligned}$$

The following signs on independent variables were hypothesized. Total crop acres are expected to be positive, assuming economies of scale exist. Total crop acres squared is expected to be negative, indicating diminishing returns to an increase in total crop acres. Crop yield is expected to be positive. Because higher levels of the diversification variable Div indicate higher levels of specialization, Div is expected to be positive. Higher levels of specialization are expected to result in higher profitability. The signs for machinery depreciation, machinery repairs, and labor are difficult to forecast. To the extent that a producer can "trade-off" these variables, they cannot be signed a priori. A producer who is not mechanically inclined may manage his or her farm with higher machinery depreciation but lower machinery repairs and labor. On the other hand, a mechanically inclined producer may manage his or her farm with low machinery depreciation, and higher machinery repairs and labor. Thus, these variables may or may not influence the MVP of cropland. Crop (output) price is expected to be positive. A higher price relative to the average indicates higher revenues, and an increased ability to pay more for rented cropland. We have no sign expectation on percent of rented acres. Percent of rented acres squared is included to allow the impact of renting land, if there is one, to be nonlinear. The sign on machinery hired is expected to be negative or positive. Returning to the "trade-off" argument, a producer may trade-off between hiring machinery and owning machinery. Since the percent of acres planted to wheat is the default variable, the signs on all of the crop percent variables will be determined by how profitable they are relative to wheat. All variable descriptions are given in Table 1.

Regression Model II

In model II, two ratios were used in place of machinery repairs, machinery depreciation, and labor. The first ratio, machinery depreciation divided by machinery repairs, was included to measure machinery quality. The second ratio, machinery depreciation divided by the sum of unpaid and hired labor was included to measure the capitol-to-labor ratio. Model II is shown in Equation 9.

$$
\begin{aligned}
\mathbf{MVP} = {} & \hat{a}_0 + \hat{a}_1 \mathrm{TCA} + \hat{a}_2 \mathrm{TCA}^2 + \hat{a}_3 \mathrm{Yield} + \hat{a}_4 \mathrm{Div} + \hat{a}_5 \mathrm{Deprec/Repair} \\
& + \hat{a}_6 \mathrm{Price} + \hat{a}_7 \mathrm{Deprec/Labor} + \hat{a}_8 \mathrm{Rentpct} + \hat{a}_9 \mathrm{Rentpct}^2 \\
& + \hat{a}_{10} \mathrm{Machir} + \hat{a}_{11} \mathrm{y95} + \hat{a}_{12} \mathrm{y96} + \hat{a}_{13} \mathrm{y97} + \hat{a}_{14} \mathrm{y98} + \hat{a}_{15} \mathrm{ALFpct} \\
& + \hat{a}_{16} \mathrm{SOYpct} + \hat{a}_{17} \mathrm{MILpct} + \hat{a}_{18} \mathrm{CRNpct}
\end{aligned} \tag{9}
$$

Hypothesized signs are the same for variables included in both models. We have no sign expectations on the ratios of machinery depreciation to machinery repairs and machinery depreciation to labor. As stated previously, producers who employ different management strategies could “trade-off” between these variables. Thus, these variables may or may not influence the MVP of cropland.

Results

MVP of Cropland

Table 2 reports the MVP summary statistics by crop and year. From 1995 to 1999, the average whole farm MVP of cropland ranged from a low of $57.31 in 1998 to a high of $115.70 in 1996. During this same time the annual whole farm standard deviation ranged from $30.22 to $43.53. The coefficient of variation ranged from a low of 35.3% (1997) to a high of 65.8% (1998) indicating considerable variability from year to year relative to the mean. For the entire five-year period, the average whole farm MVP of cropland was $76.99 an acre, with a standard deviation of $43.27 an acre. Nine of the eleven counties in the North Central Crop Reporting District (NCCRD) are also in the North Central Farm Management Association. So NCCRD cash rental rates may provide a perspective on the MVP of cropland. According to the Kansas Agriculture Statistics Service (KASS), the average cash rental rates for the NCCRD from 1995 to 1999 was $37.70 an acre. This is substantially lower than our reported MVP mean of $76.99 an acre. The average reported by KASS is only representative of cash rents paid, where our average represents all types of leases that affected the data set. Also, the actual value paid is not always representative of the actual dollar amount that could be paid for an additional acre of rented cropland, at least not in the short run.

The computed whole-farm MVPs of cropland values are quite variable. Likely, this variability is due to weather variability as well as general market conditions. However, given the large variability that occurs within a given year, it is also indicative of highly variable management abilities across producers. Another possible cause of the large range is varying land qualities. Land quality is not accounted for in the K-MAR-105 data set.

Regression Analysis

Ordinary least squares regression is used to examine the relationship between MVP of cropland and farm characteristics such as farm size, machinery management, and diversity and/or specialization. Summary statistics of all variables included in Models I and II are reported in Table 3.

Regression Model I

Of the nineteen variables, thirteen were statistically significant at the 5% level (Table 4). The independent variables explained 72% of the variability in the dependant variable (i.e., R^2= 0.72). The root mean square error is $23.39/acre.

The signs were not as expected on total crop acres and total crop acres squared. The sign on the TCA variable is negative and TCA^2 is positive indicating that MVP decreases at a decreasing rate for most of our data's range. Once farm size reaches 1882 acres, MVP increases as farm size increases.

The crop mix variables suggest that MVP increased by $0.59, $0.52, and $0.43 per acre by increasing acres of corn, soybeans, and alfalfa, respectively, 1% relative to wheat acres. Percent of acres planted to milo was not statistically significant. Based on the above stated results, relative to wheat, corn production was the most profitable crop in North Central Kansas during 1995-1999. Soybeans and alfalfa follow corn.

With regard to the indexed variables, the interpretations are as follows. The average of the indexes should be zero, so interpretation would be from the average. If the yield index variable increases by one percent above the average, then the MVP of cropland will increase by $1.30 an acre. In other words, those producers that had yields 1% higher than average, *ceteris paribus*, could pay $1.30 more per acre to rent cropland. A decrease of $0.11, $0.22, and $0.15 per acre in the MVP of cropland will be observed, if machinery depreciation, machinery repairs, and labor, respectively, are 1% above average. When the output prices are 1% above average, the MVP of cropland increases by $1.13 an acre. If machinery hired is 1% above average, then the MVP of cropland will decrease by $0.02 an acre. The percent of rented land, the percent of rented land squared, and the diversification variables are not significantly different from zero.

Only years 1996 and 1997 were statistically different from zero. Years 1995 and 1998 are no different than the default year of 1999. Producing in 1996 relative to 1999 would increase the MVP of cropland by $57.13 an acre, and producing in 1997 relative to 1999 would yield an increase in the MVP of cropland of $24.86 an acre. Both of these results indicate much higher revenues per acre for farms in 1996 and 1997 relative to 1999. This could be due to high corn and soybean prices in those years, along with high government payments and high yields.

<u>Regression Model II</u>

Only six of the eighteen variables were statistically significant at the 5% level (Table 5). The R^2 value of 0.58 indicates a weaker goodness of fit (in-sample) than Model I. The root mean square error of Model II is $28.03/acre, which also suggests a worse in-sample predictive ability relative to Model I. Significance of Yield and Price in Model II confirm their importance in determining the MVP of cropland. Significance of y96 and y97 confirm that 1996 and 1997 were significantly more profitable than other years. Lack of significance of Mach1 (machinery depreciation divided by machinery repairs) suggests that farm profitability may be achieved with both costly new machinery and low repair costs, or less costly machinery and high repair costs. Significance and the negative regression coefficient of Mach2 (machinery depreciation divided by the sum of unpaid and hired labor) indicates that substitution of machinery for labor is not profitable. An F-test was conducted to compare the two models. The calculated F-statistic was 245.02, which is greater than the critical value (5% level) of 3.84, so we reject the null hypothesis of the models being equivalent, Model I is the better model.

Summary

The MVP of cropland was measured for 103 farms located in North Central Kansas from 1995 to 1999, and proved to be highly variable. All of the observations occurred under the Federal Agriculture Improvement and Reform Act of 1996 (FAIR). Clearly profitability is highly variable under FAIR, further research is needed to determine whether profitability under FAIR is more or less variable than profitability under previous farm programs. It is believed that the majority of the variability resulted from differing levels of management ability and weather changes. A model that considered machinery depreciation, machinery repairs, and labor was better than a model that expressed the machinery and labor variables as ratios. The independent variables explained 72% of the variability in the MVP of cropland. Significant variables included total crop acres, total crop acres squared, percent of acres planted to alfalfa, percent of acres planted to soybeans, percent of acres planted to corn, crop yield, machinery depreciation, machinery repairs, total labor, commodity price, machinery hired, year 1996, and year 1997. A notable observation is the signs on the total crop acres (TCA) and total crop acres squared (TCA^2) variables. The sign was negative for TCA and positive for TCA^2, which is the opposite of our hypothesis. However for farms over 1882 acres, MVP increased as farm size increases. A second model considered machinery depreciation divided by machinery repairs and machinery depreciation divided by total labor. The first model did a significantly better job of explaining the MVP of cropland. However, the second model confirmed that 1996 and 1997 were the most profitable years and that commodity price and crop yields significantly affect the MVP of cropland. It also indicated that substitution of machinery for labor would decrease the MVP of cropland.

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Table 1. Variable Descriptions

Variable	Name	Units
TCA	Total crop acres	Acres
TCA2	Total crop acres squared	Acres
ALFpct	Percent of total acres planted in alfalfa[a]	%
SOYpct	Percent of total acres planted in soybeans	%
MILpct	Percent of total acres planted in milo	%
CRNpct	Percent of total acres planted in corn	%
Yield	Crop production	Indexed value with mean 0
Deprec	Machinery depreciation	Indexed value with mean 0
Mach1	Machinery depreciation to machinery repairs ratio	Indexed value with mean 0
Mach2	Machinery depreciation to labor ratio	Indexed value with mean 0
Repair	Machinery repairs	Indexed value with mean 0
Labor	Sum of unpaid and hired labor	Indexed value with mean 0
Price	Output (crop) price	Indexed value with mean 0
Machir	Machinery hired	Indexed value with mean 0
Rentpct	Percent of total acres rented	%
Rentpct2	Percent of total acres rented squared	%
Div	Diversification	Indexed value ranging to 1, where one is complete specialization
y95	Dummy variable for 1995[b]	0 or 1
y96	Dummy variable for 1996	0 or 1
y97	Dummy variable for 1997	0 or 1
y98	Dummy variable for 1998	0 or 1

[a]Percent of total acres planted to wheat was not included so the percentages did not sum to 100.
[b]The default year was 1999.

Table 2. The Marginal Value Product of Cropland

	# of Obs	Average	Minimum	Maximum	Standard Deviation
1995					
Alfalfa	54	$85.87	($71.40)	$400.79	$91.67
Soybeans	41	$74.41	($75.23)	$207.85	$57.57
Wheat	96	$36.99	($28.95)	$125.96	$33.66
Milo	88	$102.50	($120.11)	$269.40	$63.83
Corn	10	$81.58	($54.35)	$192.73	$86.59
Whole Farm	289	$63.45	($13.84)	$178.00	$34.78
1996					
Alfalfa	47	$137.31	$574.91	($63.08)	$104.26
Soybeans	45	$161.74	$312.57	($1.35)	$67.75
Wheat	94	$110.37	$288.58	($35.96)	$53.76
Milo	96	$105.50	$273.38	($4.61)	$51.06
Corn	15	$146.09	$366.32	($68.76)	$106.07
Whole Farm	297	$115.70	$23.75	$226.48	$43.53
1997					
Alfalfa	53	$132.95	($24.40)	$366.82	$89.20
Soybeans	49	$109.83	($54.45)	$235.60	$64.52
Wheat	93	$85.81	($58.78)	$156.86	$35.00
Milo	97	$59.33	($89.90)	$167.91	$42.53
Corn	15	$45.63	($46.65)	$147.22	$51.47
Whole Farm	307	$85.72	$12.59	$163.29	$30.22
1998					
Alfalfa	58	$127.05	($104.80)	$328.82	$90.16
Soybeans	54	$61.23	($139.70)	$157.81	$62.64
Wheat	92	$56.89	($99.32)	$166.13	$38.23
Milo	94	$34.56	($187.92)	$141.90	$49.87
Corn	20	$52.45	($132.26)	$148.51	$68.55
Whole Farm	318	$57.31	($45.42)	$161.44	$37.69
1999					
Alfalfa	59	$112.59	($33.55)	$319.26	$71.26
Soybeans	65	$76.29	($71.37)	$190.00	$49.29
Wheat	95	$61.64	($69.06)	$183.69	$40.58
Milo	88	$37.19	($112.01)	$149.99	$46.64
Corn	21	$28.95	($40.41)	$117.05	$50.77
Whole Farm	328	$62.78	($66.04)	$183.69	$40.34
1995-1999					
Alfalfa	271	$118.63	($104.80)	$574.91	$90.44
Soybeans	251	$94.39	($139.70)	$312.57	$69.17
Wheat	499	$70.33	($99.32)	$288.58	$48.00
Milo	460	$67.87	($187.92)	$273.38	$59.43
Corn	80	$66.03	($132.26)	$366.32	$82.18
Whole Farm	515	$76.99	($66.04)	$226.48	$43.27

Table 3: Variable Summary Statistics

Variable	N	Mean	Std Dev	Minimum	Maximum
MVP	515	76.99	43.2729	-66.04	226.48
TCA	515	816.23	460.9935	72.9	2639.60
TCA2	515	878335.80	1049238	5314.41	6967488
ALFpct	515	6.54	11.5563	0	85.27
SOYpct	515	7.92	10.7797	0	53.84
WHTpct	515	57.53	20.6691	0	100
MILpct	515	26.07	14.6852	0	100
CRNpct	515	1.93	6.1372	0	41.72
Yield	515	0.03	22.2380	-72.63	64.47
Deprec	515	28.04	94.5833	-99.51	770.10
Repair	515	-0.58	48.1239	-93.95	304.82
Mach1	515	0.83	135.5978	-99.24	1665.58
Mach2	515	-2.04	78.2365	-99.61	461.02
Labor	515	0.80	48.4856	-85.29	283.83
Price	515	-0.09	17.7728	-32.97	90.48
Machir	515	-2.38	160.3951	-100	1022.12
Rentpct	515	69.27	26.8871	0	100
Rentpct2	515	5520.15	3258.74	0	10000
Div	515	0.50	0.1676	0.22	1
y95	515	0.20	0.4003	0	1
y96	515	0.20	0.4003	0	1
y97	515	0.20	0.4003	0	1
y98	515	0.20	0.4003	0	1

Table 4. Results of Regression Model I

Variable	Parameter Estimates	Stand error	t-value	p-value
Intercept	64.69	11.13	5.82	0.0001
TCA	-0.04	0.01	-5.26	0.0001
TCA2	0.00	0.00	3.41	0.0007
ALFpct	0.43	0.11	3.80	0.0002
SOYpct	0.52	0.13	4.04	0.0001
MILpct	-0.05	0.09	-0.54	0.5872
CRNpct	0.59	0.21	2.75	0.0062
Yield	1.30	0.06	23.23	0.0001
Deprec	-0.11	0.01	-8.12	0.0001
Repair	-0.22	0.02	-9.78	0.0001
Labor	-0.15	0.03	-5.71	0.0001
Price	1.12	0.07	15.33	0.0001
Machir	-0.02	0.01	-3.69	0.0002
Rentpct	0.23	0.17	1.36	0.1743
Rentpct2	-0.00	0.00	-0.68	0.4960
Div	13.80	10.18	1.36	0.1756
y95	2.66	3.32	0.80	0.4242
y96	57.13	3.33	17.14	0.0001
y97	24.86	3.30	7.53	0.0001
y98	-2.85	3.27	-0.87	0.3851

Table 5. Results of Regression Model II

Variable	Parameter Estimates	Stand error	t-value	p-value
Intercept	53.80	13.17	4.08	0.0001
TCA	-0.02	0.01	-1.62	0.1054
TCA2	0.00	0.00	0.80	0.4266
ALFpct	0.08	0.13	0.56	0.5725
SOYpct	0.48	0.15	3.12	0.0019*
MILpct	-0.05	0.11	-0.43	0.6675
CRNpct	-0.13	0.23	-0.55	0.5819
Yield	1.18	0.07	17.86	0.0001*
Mach1	-0.00	0.01	-0.14	0.8897
Mach2	-0.04	0.02	-2.00	0.0462
Price	1.24	0.09	14.12	0.0001*
Machir	-0.01	0.01	-1.17	0.2421
Rentpct	0.14	0.21	0.65	0.5132
Rentpct2	-0.00	0.00	-0.36	0.7162
Div	15.58	12.19	1.28	0.2020
y95	2.24	3.97	0.56	0.5736
y96	57.07	3.99	14.30	0.0001*
y97	25.39	3.95	6.42	0.0001*
y98	-2.55	3.93	-0.65	0.5170

*This variable was significant in both models.