Farm and Non-farm Influences on Agricultural Land Prices

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Analysis of agricultural land prices is important because rates of change are not uniform across geographic areas and prices are affected by different factors in different geographic regions. Agricultural factors such as soil productivity, land improvements, tract size, cash rents, government payments, interest rates, and farm income are common variables in analyzing the impact of agricultural returns on agricultural land values. The importance of non-agricultural influences has also long been recognized. Non-agricultural or non-income producing activities, deer density, recreational income from agricultural uses, acres of elk habitat, hunting lease rates and recreational income have been found to be influential in studies in other states and regions. To measure the impact of urban influences, variables such as population density, population growth, per capita income, and distance to urban areas are used in research.

Although it is widely recognized that Oklahoma agricultural land prices are increasing, the relative importance of factors contributing to the increases – returns to agriculture, recreation, conversion to commercial or residential use – is less well known. This study analyzes the impact of these factors on recent Oklahoma agricultural land prices, both pasture and cropland. This article is one in a series of articles highlighting recent research on factors impacting Oklahoma agricultural land values. Other articles include:

- AGEC-250, The Environment for Oklahoma Agricultural Land Values, Past and Present;
- AGEC-252, Urban Influences on Oklahoma Agricultural Land Values; and
- AGEC-253, Oklahoma Agricultural Crop Versus Pasture land Values.

Model

Economic theory suggests that the value of land is derived from the net present value of future returns. Most authors use the capitalization formula to explain the price of land. The capitalization formula is:

(1) agricultural land value = returns/discount rate.

Here, we use hedonic modeling to explain agricultural land values with potential returns deriving from agricultural, recreational, and urban influences. The model incorporates agricultural influences through land characteristics, namely land use percentages, cropland, irrigated cropland timber, water waste, recreation, cattle prices, crop returns, and rainfall. County deer harvest and recreational income are included to account for the impact of recreational returns on land value. Population density, population growth, and per-capita income are used to account for the urban effect. The explanatory variables are listed in Table 1 with descriptive statistics.

The multi-level data set used here includes both county-level data and parcel characteristics. The data used are from 2001 to 2005. More detail on the data can be found in AGEC-250, "The Environment for Oklahoma Agricultural Land Values, Past and Present." The full data set plus two subsets of the data are used to estimate three models: all tracts, tracts with fewer than eighty acres, and tracts with eighty or more acres. Data from Tulsa and Oklahoma counties are excluded due to the urban influence. A maximum of $3,000 per acre is specified to exclude observations presumed to be non-agricultural tracts and to focus on the impact of factors on agricultural tracts. A minimum of $150 per acre is specified because extremely low prices may represent transactions among related individuals below market value. The SAS PROC MIXED procedure is used to estimate the models.

Results

The regression results are presented in Table 2. Past research generally finds that price per acre decreases with tract size as smaller acreages have more potential buyers and appeal to small, part-time and hobby farmers. As Table 2 shows, our results are consistent with earlier studies, as per acre land prices decrease with tract size. Since the coefficient on the acres squared term is positive, the rate of decrease slows as tract size increases.

The coefficient for irrigated farmland has the expected positive sign, indicating a price premium relative to dryland. Most timber land in Oklahoma is not lumber quality and can support few cattle or deer so its lower value relative to other land use is expected. Similarly, wasteland has a net per-acre discount relative to the average land value. The percent of recreation and water are significant only for the largest tract sizes, but there are few observations with these primary land uses.

Rain is used as a proxy for yield potential so higher rainfall areas are expected to have higher land values. As expected, the coefficient for rainfall is positive and significant.

The interaction variable with crop returns on cropland price shows the strongest influence when tract sizes are greater than eighty acres. The interaction variable with cattle prices shows that pasture prices rise when cattle prices rise on both small and large tracts.

The deer harvest parameter is positive and significant for all tract sizes, and the coefficient is largest on small tract sizes. Likewise, the coefficient for recreational income is significant for all the data sets with a relatively greater impact on prices for mall tracts.

Consistent with other studies, the urban variables of per capita, income, population density, and population growth, have positive coefficients (and they are significant in all cases).

Graphs of cropland and pasture land price per acre for all parcels are shown in Figure 1, while graphs for parcels greater than or equal to eighty acres are in Figure 2 and graphs for parcels less than eighty acres are in Figure 3. Cropland prices are obtained by setting the percentage of cropland (PCROP) to one and setting all other variables to their statewide mean for each year. The crop and pasture land prices are then plotted over the five-year period for each of the three data sets (Figures 1, 2, and 3).

In all figures, pasture prices rise relative to cropland, and in 2005 pasture was worth more than cropland. On small tracts, cropland is less valued relative to pasture. Many of the small tracts are likely purchased for exurban use, where pasture is generally preferred. These results demonstrate that similarity in pasture and cropland prices is not due simply to more pasture tracts being in highly populated areas. Larger tract sizes are presumed to be used primarily for agricultural purposes; the per-acre prices for these tracts are lower than the other two data sets and more in line with agricultural use value. (Note that even for the larger tract sizes, the land prices are considerably higher using transaction data than the more widely used USDA survey data.)

The elasticities are shown in Table 3. The larger elasticities for agricultural and urban influences implies that the market response is larger for these factors relative to recreational influences. The highest elasticity is 0.99 for cattle prices followed by 0.69 for rainfall, the proxy for agricultural productivity. The deer harvest elasticity is only 0.10, just below the population density estimate. Recreational income and crop returns have elasticities near zero.

Conclusion

Land values are important not only to lenders, appraisers and realtors but also investors, agricultural producers, and people purchasing land for recreational uses. This study determines the relative impacts of agricultural, recreational, and urban conversion on Oklahoma land values. Agricultural factors are the most important, followed by urban variables, and then recreational variables. The urban influence is shown by the positive and significant coefficients for per-capita income, population density, and population growth. Deer harvest and recreational income variables are included to capture the recreational impact on land values. Although recreational income is insignificant, the positive and significant coefficients on the deer harvest variable support the idea that recreational uses are an important component of land values.

Tract size affects how the land will be used and how the land is valued. Residential or recreational uses often demand smaller sizes where an agricultural producer looking to expand might prefer a larger tract size. The deer harvest has a larger effect on small tract sizes, and pasture is preferred to cropland in small tracts. Our study indicates that recreational, urban effects, and other non-farm use are important in explaining agricultural land values. But, it also shows that agricultural value remains a primary influence on Oklahoma land values.

Table 1. Variable Names and Descriptive Statistics.

Variable	*Units*	*Mean*	*SD*	*Min*	*Max*
Land sales price (PERACRE)	$/a	848.49	486.91	150.0[a]	3000.0[a]
Total deeded acres (ACRES)	a	230.72	652.9	2.0	14,384.0
Crop acres (PCROP)	%	22.1	0.356	0	100.0
Irrigated crop acres (PIRRIG)	%	0.8	0.078	0	100.0
Timber acres (PTIMBER)	%	12.1	0.244	0	100.0
Waste acres (PWASTE)	%	0.3	0.021	0	44.0
Recreation acres (PRECREATION)	%	0.0067	0.006	0	50.0
Water acres (PWATER)	%	0.07	0.016	0	100.0
Deer harvest/county acres (DEER)	deer/a	0.002	0.001	8.9E-5	0.008
Per capita income/county (INCOME)	$/person	22,068.04	2,785.84	15,664.0	31,170.0
Average county rainfall (RAIN)	inches	38.28	7.42	17.2	53.6
Recreation income (RECINCOME)	$1,000/a	0.003	0.009	0	0.07
Crop returns (dryland) (RETC)	$/a	85.76	41.63	-24.63	214.79
Cattle prices	$/cwt	102.17	9.8	91.33	120.82
Population density (POPDENSITY)	#/a	0.058	0.056	0.002	0.64
Population growth (POPGROWTH)	%	0.046	1.2	-4.87	14.11

[a]Minimum and maximum price per acre specified to eliminate outliers.

Table 2. Estimates of the Regression Model with Variables Representing Recreational and Urban Conversion Uses.

Dependent variable: Land price per acre

Variable	All acres	>= 80 acres	< 80 acres
INTERCEPT	-978.76***	-578.89***	85.23
	(81.88)	(67.10)	(180.87)
PCROP	732.79***	653.44***	528.04***
	(48.46)	(38.53)	(109.29)
PIRRIG	1,297.17***	1,162.09***	1,011.17***
	(74.86)	(57.88)	(211.97)
PTIMBER	470.77***	378.95***	287.40***
	(45.04)	(36.72)	(94.57)
PWASTE	-332.26	-249.66	-299.13
	(220.05)	(170.29)	(418.41)
PRECREATION	1,055.18	1,260.03**	687.27
	(767.84)	(567.65)	(870.22)
PWATER	599.37**	743.77***	-170.80
	(276.54)	(218.92)	(794.30)
RAIN	15.23***	11.84***	7.732***
	(0.88)	(0.78)	(1.70)
RETCI	0.464*	0.790***	0.331
	(0.238)	(0.186)	(0.581)
CATTLEPI	8.22***	6.62***	5.91***
	(0.41)	(0.33)	(0.88)
DEER	34,185***	33,985***	38,596***
	(4,479)	(4,043)	(7,654)
RECINCOME	200.18***	185.18***	340.61***
	(39.73)	(35.74)	(64.80)
INCOME	0.0153***	0.0047***	0.0303***
	(0.0022)	(0.0018)	(0.0042)
POPDENSITY	2,569.64***	2,465.56***	1,884.72***
	(93.47)	(87.23)	(144.92)
POPGROWTH	4,005.46***	2,739.27***	6,508.80***
	(409.01)	(327.22)	(959.23)
ACRES/100	-27.77***	-13.51***	-1721.54***
	(1.53)	(1.17)	(218.24)
(ACRES/100)**2	0.2250***	0.106***	747.58***
	(0.016)	(0.012)	(206.32)
YEAR 2001	-141.14***	-153.66***	-169.95***
	(16.48)	(13.70)	(31.96)
YEAR 2002	-109.48***	-127.51***	-134.91***
	(16.20)	(13.49)	(31.57)
YEAR 2003	-29.90**	-81.20***	-55.34*
	(16.13)	(13.35)	(32.48)
YEAR 2004	-6.26	-27.91**	-41.41
	(15.13)	(12.74)	(28.70)
R2	0.38	0.42	0.41

Note: Asterisks denote significance levels: *** 1% probability, ** 5% probability, * 10% probability

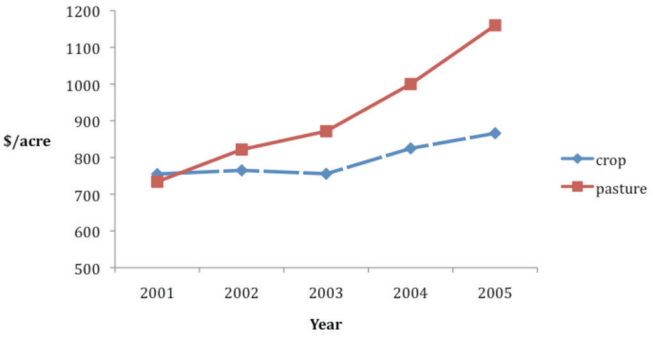

Figure 1. Cropland and pasture land price per acre for all parcels.

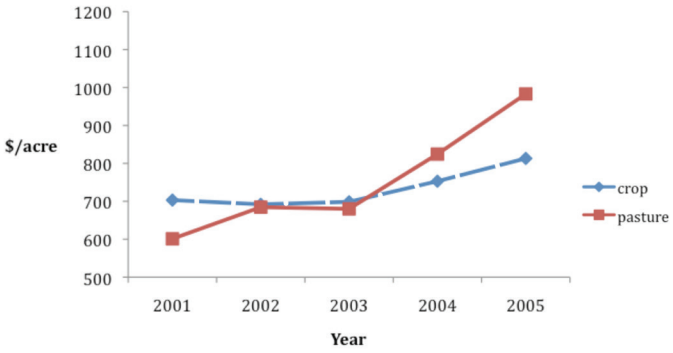

Figure 2. Cropland and pasture land price per acre for parcels greater than or equal to eighty acres.

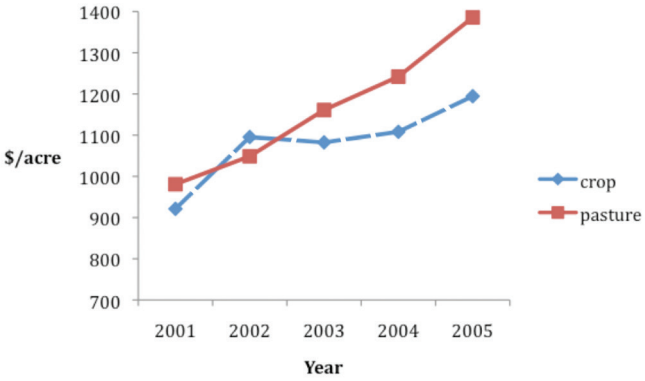

Figure 3. Cropland and pasture land price per acre for parcels less than eighty acres.

Table 3. Elasticities for the Effects of Characteristics on Oklahoma Land Prices.

Variable	*Elasticity*
Cattle prices on pasture prices[a]	0.99
Rainfall	0.69
Per capita income	0.40
Population density	0.17
Deer harvest	0.10
Crop returns on cropland prices	0.05
Recreational income	0.02
Population growth	0.0022

[a] The elasticity is computed as the coefficient times average cattle price and then divided by average price per acre.

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