Urban Influences on Oklahoma Agricultural Land Values

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Information is based on thesis research completed in 2007 but findings are still valuable.

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Compared to residential properties or other development, agricultural land requires fewer public services, contributes to storm water management, and provides wildlife habitat. Houses near open space often sell at a higher price. Because urban sprawl is a concern, many communities have implemented zoning and tax exemptions for agricultural use. Farmland preservation programs have developed through which local governments or private organizations buy the land development rights. But, urban sprawl also has potential benefits and many communities have policies that inadvertently encourage sprawl. This article summarizes research analyzing the effect of urban proximity on Oklahoma agricultural land values.

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-251, Farm and Non-farm Influences on Agricultural Land Prices; and
- AGEC-253, Oklahoma Agricultural Crop Versus Pasture land Values

Historically, research finds that population and income are consistently the two most important factors in explaining the effect of urban proximity on agricultural land values. We use Oklahoma rural land sale prices from 1971 to 2005 and test for a preference shift toward living further from the city center. We also test whether urban sprawl may be increasing over time beyond what would be expected from increases in population and income. Using data for the entire state allows us to test hypotheses about why the effect of urban proximity varies across communities and time.

Theory

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

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

The returns can be from agricultural uses, recreational uses, exurban development (conversion to low-density residential use), or from the option to convert to urban uses. Past research has typically found that distances to urban areas influenced agricultural land values with values declining as distance increased. Previous studies have included variables such as distance to closest city with a terminal market, distances to major cities or metropolitan areas, adjacency to metropolitan counties, travel distance on major road networks or travel times. Our research is unique because it uses parcel data rather than county-level data as has been done elsewhere. Geographic information systems (GIS) that are now available made it possible for us to measure distances from a specific parcel to a specific city.

Given enough distance from an urban area, parcels may be valued for agricultural uses only. Here, we estimate the distance where the urban influence on agricultural land values disappears, which is essentially when the agricultural land price is the state average price of land not near one of the twelve cities considered. The parameters of the urban effect are assumed to depend on the population and real income of the nearest city.

Data

The data include sales prices of Oklahoma agricultural land for the time period of 1971 to 2005. Only land sales prices within 100 miles of one of twelve urban centers were used. The urban centers were those towns with the largest population, including eleven towns in Oklahoma (Lawton, Oklahoma City and metropolitan, Tulsa and metropolitan, Ardmore, Bartlesville, Duncan, Enid, Muskogee, Ponca City, Shawnee, and Stillwater) and one in Arkansas (Fort Smith) (Figure 1). These cities were selected because there was a natural gap between the population of Duncan and the next largest city. Distances were measured from the center of the parcel's section to the nearest urban center using the most direct route along a network road system. The dataset for the entire state of Oklahoma included 52,700 observations of which 43,399 were usable. To focus on agricultural land, observations used were limited to those with prices above $150/acre, and those below $10,000/acre. Descriptive statistics for variables used in the model are listed in Table 1 and statistics for the twelve cities are listed in Table 2.

Table 1. Descriptive Statistics.

Variable	*Units*	*Mean*	*SD*	*Min*	*Max*
Log sales price (LPERACRE)	$/acre	6.3	0.58	5.01	9.21
Parcel size	Acres	180.2	453.90	1.00	36,364.00
20-40 acres	%	11.3			
40-80 acres	%	25.2			
80-160 acres	%	39.8			
160-640 acres	%	17.9			
>640 acres	%	2.5			
Crop land	%	29.2	37.50	0.00	100.00
Irrigated acres	%	0.8	8.10	0.00	100.00
Pasture acres	%	65.5	39.00	0.00	100.00
Timber acres	%	2.9	11.80	0.00	100.00
RAIN	Inches	37.5	6.58	23.80	53.60
DEER	deer/100 acres	0.13	0.13	0.00	0.84
Distance	miles	41.10	21.78	1.10	100.00
Population	thousands	198.20	301.10	36.70	1,142.39
$\sqrt{\text{Population}}$	tens	36.81	25.03	19.16	106.88
Real Income	$1,000/person	19.58	3.85	9.59	30.64

Results

As expected, irrigated cropland was the most valuable land type followed by crop, pasture, and timber. Price per acre decreased as tract size increased with the greatest reduction in the largest tracts, which was consistent with past research. The per-acre premiums for the smallest parcels were substantial. The translated results indicated that the price per acre of parcels in the largest category was only 34.6% of the price of parcels in the smallest categories. The premium for smaller parcels was likely due to greater demand for exurban use.

Larger recreational values as measured by deer density were reflected in land prices, evidence of a premium for quality of deer hunting. Evaluation of land price relative to deer density indicated that recreation was important, but certainly not dominant. Rainfall had the expected positive influence and reflected both the greater agricultural use value and greater exurban use value of higher rainfall areas.

Further analysis indicated:

- The size of the urban effect was influenced more by population than per capita real income or time.
- Real income was the main reason for increases in distance to the end of the urban effect.
- Preferences to live farther from the city center were no more than would be expected due to increased population and income.
- Population density increased as population increased. Thus, the effect of urban proximity on agricultural land values did not expand as fast as the urban area itself did when population increased.

Figure 2 shows the distance to the end of the urban influence on agricultural land values for the two largest cities and two representative smaller cities. The 10 smaller cities are similar in population and so plots for their values are similar to those for Stillwater and Ponca City. Ponca City is chosen to represent cities such as Duncan and Bartlesville whose economies are heavily dependent on the oil industry. Stillwater is chosen to represent the other cities that have more diversified economies. Oklahoma City and Tulsa have the largest multipliers and largest distances due to having substantially larger populations than the other cities. Oklahoma City and Tulsa show consistent growth in the distance of their urban effect, which is due to growth in their population and income. The economy of Ponca City is closely tied to the oil industry and so the distance of its urban effect reflects the oil boom and bust in the early 1980s. Stillwater shows much less variation over time.

Figure 3 shows the urban center multipliers. When the multiplier equals one, there is no urban effect on the price of agricultural land values. An urban center multiplier of two means that the price of agricultural land at the urban center

Table 2. Descriptive Statistics for the Twelve Cities Considered.

Metropolitan or or Micropolitan Area	*Population (thousands)*	*Real Income ($1,000/person)*	*Smallest Distance to urban center (miles)*
Ardmore	52	15.16	1.1
Bartlesville	48	20.29	2.0
Duncan	42	14.90	3.0
Enid	59	16.97	2.4
Fort Smith, AR	241	14.31	4.4
Lawton	114	14.96	1.3
Muskogee	68	13.58	2.9
Okla. City	988	17.73	6.8
Ponca City	48	17.26	2.0
Shawnee	60	13.91	1.7
Stillwater	63	13.69	2.1
Tulsa	776	19.03	8.1

Note: Population and income are averages across the years 1971-2005 weighted by the number of observations in the dataset each year.
Source: U.S. Department of Commerce, Bureau of Economic Analysis. http://www.bea.gov/bea/regional. Accessed February, 2007.

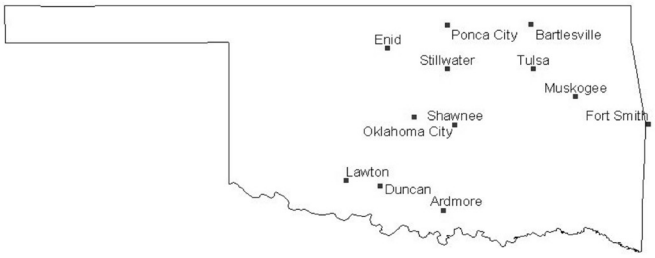

Figure 1. Map of urban centers.

would be twice that for a similar parcel outside of any urban center. A parcel half from the urban center to the edge of the urban effect would have a price 1.5 times higher than at the edge. Note that actual land in the city center would be much more than double the price of land outside the influence of the city. Because we have no observations of agricultural land in the city centers, the linearity of the urban effect only applies to the parcels on the edges of cities that we observe. Also, parcels inside cities would have already incurred the cost of converting to urban uses.

The multiplier decreases as the distance from the city increases and so no agricultural land will have a multiplier as large as any number in Figure 3. In recent years, Oklahoma City has a multiplier around six and the impact extends 42 miles (Figure 2). A parcel of land halfway from the center city (21 miles) would be expected to have a price three times that of similar agricultural land outside the influence of any of the twelve cities considered.

The multipliers in Figure 3 showed a gradual increase over time, which indicates that the value of exurban use or the option for conversion to urban use is increasing relative to agricultural and recreation uses. The multipliers for some cities vary minimally over time, because these cities had little change in population and real income.

Conclusion

Studies done elsewhere determined that greater distances to major cities decreased price per acre for agricultural land. This study finds similar results when Oklahoma agricultural land sales prices per acre are examined using distances to the center of the twelve cities with the largest population. The size and distance of the effect of urban proximity on agricultural land values was allowed to vary across city and time. Population and real income for the twelve urban areas were used to explain the changes in the urban effect across city and time. There were large differences across cities, but only small changes across time.

The distance where urban influence ends for agricultural land in Oklahoma has increased slightly over time due to increased population and real income. But, the evidence does not indicate a shift in tastes and preferences toward living farther from the city center. Real income has the most effect on the distance of the urban effect, while population has the most influence on the strength of the effect. Although Oklahoma is less populated than many other states, the urban influence on agricultural land values is strong.

References

Guiling, Pamela, B. Wade Brorsen, Damona Doye. "Effect of Urban Proximity on Agricultural Land Values." Land Economics. AGEC-251.

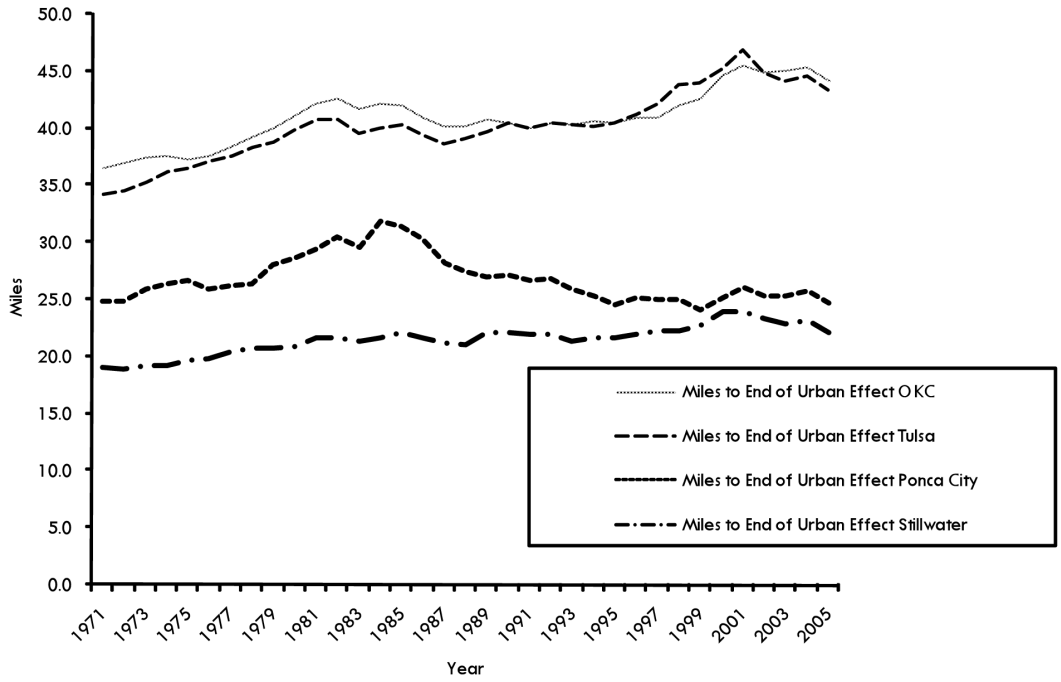

Figure 2. Distance to the end of the urban effect.

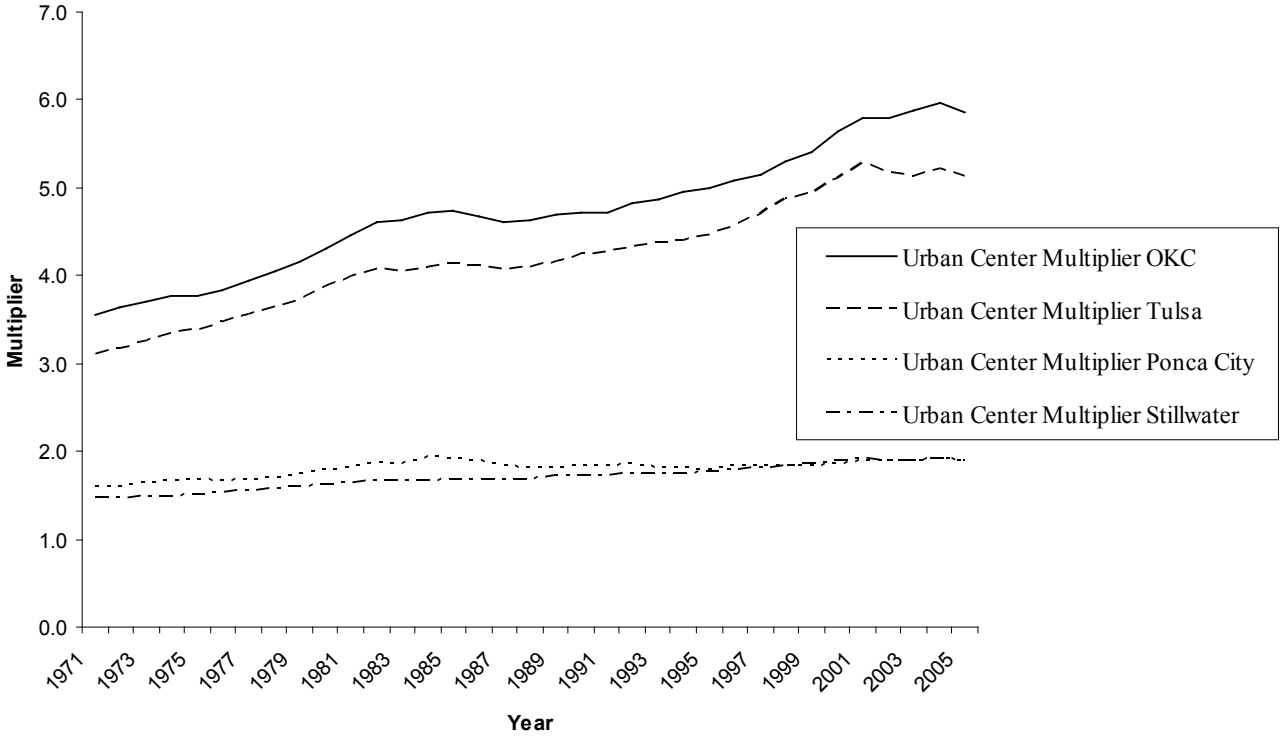

Figure 3. Urban center multipliers.

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