FARMLAND VALUES AND URBANIZATION

By Douglas E. Morris[1]

Urbanization affects agriculture in two ways. It reduces the cropland base and it increases the value of the remaining farmland on the urban fringe. Of these two facets, the actual loss in agricultural production capacity has been the main issue to date (*7*, *5*, *12*, *13*).[2] The other facet, how urbanization affects farmland values and food production costs, has been largely ignored and it is the issue addressed here.

- Estimates of the effect of urbanization on farmland values and eventually food prices are presented. These estimates, which reveal a strong positive relationship between urbanization and farmland values, are used to construct elasticities of farmland value related to population density for the 10 farm production regions in the 48 contiguous States. These elasticities are generally elastic; thus the author examines the issue of including a land charge in commodity cost of production budgets that could eventually be used as a basis for loan rates.

- Keywords: Farmland value, urbanization, elasticity, cost production.

Nationally, the loss of agricultural land so far to urban uses has had little net effect on the total supply of cropland. Irrigation, clearing, and drainage in some areas have more or less offset losses in other areas. Should these offsets fail to occur, price pressures on land could result from the reduced quantity and possibly changing quality of land. However, I address a different and less well-understood relationship between urbanization and farmland values.

In a specific county, for example, urbanization affects contiguous farmland supplies *in that county* and it can drive up farmland values through local opportunity costs for nonfarm uses. To the extent that a significant share of farm production occurs close to urban areas, there can be important implications for farmland values, the cost of agricultural production, and prices received by farmers for farm products.

The results of the following analysis may be used by policymakers to assess the impact on average farmland values as a county becomes increasingly urbanized. The degree to which urbanization affects farmland values has important implications for such policies as farmland assessment acts and purchase of development rights. For instance, land acquisition, transfer, and taxation are materially affected by the magnitude of farmland value. As such value is "pushed up" by nonagricultural forces, important changes in land tenure and land use may well occur. One area not directly addressed here is the land price spiral that occurs when farmers bid up the price of land in anticipation of a future income stream (see *9* for information).

THE MODEL

Farmland value is hypothesized in the model used here to be a function of the impact of urbanization after differences in agricultural value associated with productivity have been adjusted for.

The following functional form was specified:

$$FV = \beta_0 + \beta_1 D_{70} + \beta_2 D_{\Delta} + \beta_3 S + \beta_4 A + u \qquad (1)$$

where

FV	=	average farmland value per acre in 1969
D_{70}	=	population per square mile (density) in 1970
D_{Δ}	=	percentage change in density, 1960-70
S	=	average agricultural sales per acre in 1969
A	=	average farm size in 1969
u	=	random disturbance

D_{70} and D_{Δ} are proxies for urbanization. The inclusion of D_{Δ} allows the change in population density for each county to enter the model, so the effects of urbanization are not based on purely cross-sectional, static data. It is expected, *a priori*, that D_{70} and D_{Δ} will have estimated coefficients that are positive in sign. The proxy for agricultural value is S, the value of agricultural sales per acre. Farm size, A, is included to correct for the impact of average tract size on the per acre value. The coefficient for S is expected to be posi-

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[2] Italicized numbers in parentheses refer to items in References at the end of this article.

tive as agricultural sales should have a positive impact on farmland value, an expectation supported by Hammill (*4*). A negative coefficient for A is expected, a contention supported by Clonts (*2*), Bovard and Hushak (*1*), and Lindsay and Willis (*6*).

The unit of observation is the county. Counties were grouped into the 10 farm production regions (commonly used by USDA) of the 48 contiguous States. Counties with less than 5 percent of total land area in farms were omitted. Farmland value per acre, value of agricultural sales per acre, and farm size are all county averages from the *1969 Census of Agriculture* (*10*). Density (population per square mile in 1970) and percentage change in density from 1960 to 1970 are from the *County and City Data Book*, 1972 (*11*).

Farmland value (FV) as reported in the *Census of Agriculture* is the subjective value of farmland provided by the farm owner at the time of the census. A landowner would be expected to incorporate the results of recent sales of nearby land into the estimate; hence, both agricultural and urbanization (if present) values may be contained in the estimate. The value of buildings is included in FV as well as land value. This is not expected to be a severe problem since (1) FV is expressed per acre, (2) the farm production regions delineate similar types of agriculture, and (3) buildings are also included in cost of production budgets. Further, when FV is determined mainly by urbanization, the "salvage" value of the existing buildings is probably minimal. The proxy for agricultural value (S) is admittedly gross. Operations such as feedlots, poultry production, and nurseries are included even though sales from such enterprises are not closely related to land productivity. Hence, the use of S may overstate the agricultural value portion of FV.

THE RESULTS

Equation (1) was estimated for each farm production region and the United States using OLS techniques. For brevity, only the results for the United States (all counties) appear in table 1. The regression coefficients for the farm production regions are used to construct the estimates of elasticity developed in the following section—the major thrust of this article. For the equation presented in table 1, all coefficients have the expected sign and they are statistically significant at the .001 level. The statistical properties are similar for the regional equations. The coefficients of determination (R^2) are generally higher than would be expected from such a model (see *1* and *6*).

Urbanization pressure is not evenly spread throughout a region or even a county. Farmland on the urban fringes necessarily is more strongly affected than farmland farther away. One limitation of using the county as the unit of observation is that the pressure of urbanization is statistically spread over the entire county. County size differences tend to compound this problem. The results reported in table 1 for all counties probably understate the impact of urbanization on farmland values. To correct for this problem, the counties were disaggregated into two groups: Standard Metropolitan Statistical Area (SMSA) counties and non-SMSA counties for each farm production region and the United States.[3] By disaggregation of the

[3] SMSA's are defined at the town level for New England. Thus, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island were omitted from the Northeast for the disaggregated analysis.

Table Regression estimates for equation 1: farmland value per acre in 1969, the dependent variable, is a function of the indicated independent variables

County	Regression coefficients[1]					R^2
	Constant	D_{70}	D_{Δ}	S	A	
All counties n = 2952	108.00	[2]0.41 (0.01)	[2]2.36 (0.14)	[2]1.95 (0.05)	[2]-0.004 (0.0008)	0.68
SMSA counties n = 406	55.45	[2]0.34 (0.02)	[2]6.24 (0.58)	[2]2.28 (0.16)	[3]-0.03 (0.02)	0.69
Non-SMSA counties n = 2487	100.84	[2]1.00 (0.03)	[2]0.64 (0.11)	[2]1.65 (0.04)	[2]-0.003 (0.0006)	0.62

Note: See text for definitions.

[1] The numbers in parentheses are the standard errors of the regression coefficients. [2] Significant at the α = .001 level. [3] Significant at the α = .05 level.

observations into two more nearly homogeneous groups as to level of urbanization pressure for the SMSA counties and agricultural pressure for the non-SMSA counties, the problem of underestimation should be lessened. The problem of county size differences among farm production regions still remains.

The estimated coefficients of Equation (1) for SMSA and non-SMSA counties appear in table 1. The most notable difference between the aggregated and disaggregated results is the magnitude of the coefficients for density change. This difference is even more pronounced for the regional SMSA equations ranging from 1.57 (Mountain) to 16.86 (Pacific). Overall, the aggregated and disaggregated analyses support the hypothesized relation between farmland value and both urbanization and agricultural value.

Table 2—Density elasticity of farmland value by farm production region and the United States

Region[2]	Elasticities[1]		
	All counties	SMSA counties	Non-SMSA counties
United States	1.05	1.67	0.47
Northeast[3]	2.92	2.56	3.25
Lake States	0.97	0.91	0.65
Corn Belt	1.25	1.51	0.37
Northern Plains	0.48	1.51	0.16
Appalachian	1.62	2.24	1.17
Southeast	0.95	1.53	0.62
Delta	0.51	1.77	0.49
Southern Plains	0.95	1.36	0.38
Mountain	0.59	1.15	0.51
Pacific	1.93	2.86	0.74

[1] Elasticities calculated at data means. [2] Northeast: Maine, New Hampshire, Vermont, Connecticut, Rhode Island, Massachusetts, New York, New Jersey, Pennsylvania, Delaware, Maryland. Lake States: Minnesota, Michigan, Wisconsin. Corn Belt: Ohio, Indiana, Illinois, Iowa, Missouri. Northern Plains: North Dakota, South Dakota, Nebraska, Kansas. Appalachian: West Virginia, Virginia, North Carolina, Kentucky, Tennessee. Southeast: Alabama, Georgia, Florida, South Carolina. Delta: Arkansas, Louisiana, Mississippi. Southern Plains: Oklahoma, Texas. Mountain: Arizona, New Mexico, Nevada, Utah, Colorado, Idaho, Montana, Wyoming. Pacific: Washington, Oregon, California. United States: 48 contiguous States. [3] See text footnote 2.

DENSITY ELASTICITY OF FARMLAND VALUE

Given the estimated coefficients in table 1, the responsiveness of farmland value to changes in density can be calculated in the form of an elasticity. The *density elasticity of farmland value* is derived as follows:

Given:

$$FV = f(D_{70}, D_{\Delta}, S, A) \qquad (2)$$

$$D_{\Delta} = g(D_{60}, D_{70}) \qquad (3)$$

Then:

$$\epsilon = \frac{dFV}{dD_{70}} \cdot \frac{D_{70}}{FV}$$

$$= \left[\frac{\partial FV}{\partial D_{70}} + \frac{\partial FV}{\partial D_{\Delta}} \cdot \frac{\partial D_{\Delta}}{\partial D_{70}}\right] \cdot \frac{D_{70}}{FV} \qquad (4)$$

From (1) and (4):

$$\epsilon = \left[\beta_1 + \beta_2 \frac{100}{D_{60}}\right] \cdot \frac{D_{70}}{FV} \qquad (5)$$

Elasticities (table 2) were calculated from Equation (5) using the estimated coefficients in table 1 and the unreported estimates for the farm production regions. The elasticities based on all counties are elastic for the Northeast, Corn Belt, Appalachian, and Pacific regions, while for the Lake States, Southeast, and Southern Plains, they are nearly unitary. The remaining regions (Northern Plains, Delta, and Mountain) are inelastic. For the United States, the elasticity is close to unitary (ϵ=1.05). For instance, a 1-percent increase in density in the agriculturally important Corn Belt would result in a 1.25-percent increase in farmland value. In the Northeast, a similar increase in density is associated with nearly a 3-percent increase in farmland value. Except possibly for the heavily urbanized Northeast, the elasticities appear to be surprisingly high.

The elasticities based on the coefficients from the SMSA counties are quite elastic, excepting the Lake States (ϵ = .91). As expected, the elasticities are generally lower for the non-SMSA counties. These estimates of the responsiveness of farmland value to density changes are quite revealing and have important policy ramifications for many land related issues.

IMPLICATIONS

The extent that urbanization can affect commodity production costs depends upon the proportion of production under urban influence and the importance of land charges in costs of production. In 1969, 16.8 percent of the corn, 15.4 percent of the soybeans, and 22.3 percent of all cotton were produced in SMSA counties. In the Corn Belt, 19.6 percent of the corn, 18.7 percent of soybeans, and 23.4 percent of the wheat were grown within SMSA counties. In the recent USDA report on costs of production, two methods are used to estimate land charges for the crop budgets; current value and acquisition value (*3*). Based on corn budgets in 1977, for example, land allocation (current value) comprises 38 percent of production costs, whereas land allocation (acquisition value) comprises 30 percent of production costs. These estimates of land values are composites reflecting share rents, cash rents, and current and acquisition costs of owner-operated land. Land comprises a large portion of production costs for corn, most of which is produced in the Corn Belt. Thus, a corn cost-of-production spiral could result largely from population growth in this region ($\epsilon = 1.25$ based on all counties or $\epsilon = 1.51$ based on SMSA counties), should corn loan rates be based on cost-of-production estimates. Similar spirals could occur for other commodities, such as soybeans, wheat, and cotton.

Urbanization can and does inflate the cost of agricultural lands, a cost which ultimately must be paid. Urbanization processes which force land prices upward seem also to be forcing up food and fiber production costs and eventually raising prices to consumers. Results of this research demonstrate the need to link natural resource policy and agricultural commodity policy legislation. Land use planning to control the location of increases in population density can be an important tool in farm and food price legislation as well.

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