DETERMINANTS OF LAND VALUES

AT THE URBAN-RURAL FRINGE

by

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June, 1972

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The objective of this study is to estimate the impact of urban

influences on land values at the urban-rural fringe. The urban-rural

fringe includes land along the boundaries of the city, in the suburbs,

and in unincorporated areas near the city. The study area is Franklin

County, Ohio in which the city of Columbus is located. The results are

based on a sample of 59 undeveloped land transactions during 1971.

Land Markets at the Urban-Rural Fringe

A major portion of the growth in metropolitan areas has occurred at

the urban-rural fringe. This has occurred as a result of people moving outward

from the congestion of central cities, the natural population growth of

metropolitan areas, and migration to urban areas from rural communities. The

1970 Census of Population shows that 13 out of the 25 largest cities had

decreases in population between 1960 and 1970 [6, p. 147]. At the same time,

24 out of the 25 largest metropolitan areas had increases in population

[6, p. 154]. This growth at the urban-rural fringe has caused substantial

shifts in land use and increases in land values. Clawson places metropolitan

growth in perspective and describes some of the problems it has generated.

"Once upon a time, a city was rather sharply and clearly
set off from its surrounding countryside; indeed, many older
cities had walls around them, as a defense against attackers.
In peaceful times, a few people would build homes outside
the walls, to escape the crowding within, but in time of war
they scurried back inside. Such cities were economic
entities where manufacturing, trade, and business were located
as well as residences, churches, and schools. They were also
legal or political entities. For some hundreds of years,
many European cities were city-states, that looked after
their own defense, minted their own coinage, and conducted their
affairs like a self-governing state. A hundred years ago or
so, American cities were also distinct physical, economic,
and political entities, sharply and clearly set off from
their hinterland.

All of this has changed in recent decades. Today, there
is rarely a sharp clean line between the developed city and
the unbuilt-upon rural countryside; instead, some suburbs or
subdivisions are usually located well out into the country,
sometimes several miles from one another and from the city
center where many of the residents are employed. The legal
or political city has often expanded its boundaries, but
rarely fast enough to keep up with the spread of the physical
city. Increasingly, the old legal or political city is
surrounded by other smaller cities or towns, politically
separate, or by unincorporated areas typically governed as part

of a county. The discrepancy between the physical-economic
city on the one hand, and the legal-political city on the
other, is serious and growing larger,"[1, p. 31].

These changes have generated a number of problems for the agri-
cultural use of land near the urban-rural fringe. This land is assessed
at a high rate for property tax purposes compared to its agricultural
income capability. Although some farmers obtain capital gains benefits
by holding land, other farmers are forced to sell their land because of
the inability to finance the costs of high property taxes.

Previous Research

Much of the previous research on land values has been concerned with
estimating the impact of various characteristics of land on its agricultural
use value. [1/] A number of these studies have included some urban
characteristics. Schuh and Scharlach [5] incorporated population density
and distance from Chicago in their cross-sectional analysis of the value
of land and buildings per acre by county in Indiana. The population
density of the county was positively related to land values, while distance
from Chicago was negatively related. Hammill [4] incorporated the variable,
population of SMSA divided by distance of SMSA from the county, in her
cross-sectional analysis of farm real estate values in Minnesota counties.
The SMSA had to be within 200 miles of the county to be included; the ratios
of this variable were summed for all SMSA's within 200 miles of a county to
obtain a measure of the total urban influence on land values in a county.
The variable was positively related to land values.

Although the research provides useful background, it does not
lead very far in determining factors that influence land values at the
urban-rural fringe. The role of factors such as location with respect
to the city and a major highway, size of parcel, zoning, and property
taxes in the land market is not fully understood. Clonts [2], in his
study of land values in Prince William County, Virginia, on the periphery
of Washington, D. C., investigates several of these factors. His results
showed that radial mileage to urban periphery and distance to urban
access highway had negative effects on land values for all types of land.
Size of parcel had a positive effect on residential lot prices, but a
negative effect on agricultural, forest and idle land values. Road
conditions had a positive influence on land values, slope of land a
negative effect.

The Study Area and Data Sources

Franklin County, Ohio is one of the fastest growing population
areas in Ohio. Population increased by 22 per cent between 1960 and
1970 from 682,962 to 833,249. At the same time, the State of Ohio had
a 9.7 per cent increase. The city of Columbus increased from 471,316
people in 1960 to 540,025 in 1970, a 14.6 per cent increase. The
Columbus metropolitan area increased by 21 per cent from 754,885 in 1960
to 916,228 in 1970. Other cities in Ohio had decreases in population:
Akron by 5 per cent, Cleveland by 14 per cent, and Cincinnati by 10
per cent. The respective metropolitan areas increased by 12, 8, and
9 per cent. Suburban areas in Franklin County had substantial increases
in population between 1960 and 1970. Gahanna increased by 356 per cent
from 2,717 to 12,400, Upper Arlington by 58 per cent from 24,486 to 38,630,
and Westerville by 79 per cent from 7,011 to 12,530 [6, pp. 147-212].

The sample consists of 59 observations on undeveloped land trans-
actions in Franklin County during 1971. Undeveloped land is land which
is either in agricultural use or is idle at the time of the sale. [2/]
Sales caused by death were excluded because of the forced nature of
these sales. Family transfers and other non-open market sales were also
excluded. Sales of developed land were excluded because the value of
developed land includes the costs of preparing the land for urban uses. [3/]

The raw data came from three sources. The total sale value, the
size, and the zoning of each parcel were obtained from sales records
maintained by the State Board of Tax Appeals. The exact location of each
property was determined at the Franklin County Engineers Office, from
which were determined the distance from the property to City Hall, the
distance to an access highway, and the location of the property in
Columbus, in an incorporated suburb, or unincorporated township area.
The annual property tax on each property, the taxable value of land,
and the taxable value of buildings were obtained at the County Auditor's
office. Property in Franklin County is taxed at 40 per cent of its
assessed value. [4/] Information on slope, drainage, and other physical
characteristics would have required on-sight inspection of each property,
which was beyond the resources available for this study. However, physical
characteristics of land in Franklin County are quite uniform; slope and
drainage problems are minor relative to urban uses.

Some of the characteristics of the land sales in the sample are
presented in Table 1. The average sale value per acre is $21,764 with a
range of $621 to $103,584. Of particular interest are the figures for the
ratio of taxable value to sale value. Franklin County property was
last assessed in 1969. Subsequent adjustments may have been made by

Table 1

Characteristics of the Sample Land Sales, Franklin County, Ohio, 1971

	Number of Sales	Simple Mean	Standard Deviation	Range
Sale Value/Acre ($)	59	21,763.51	25,948.07	621.18-103,583.94
Location:				
Columbus	18	38,258.54	32,948.29	5,491.15-102,923.00
Suburban	9	20,861.75	31,704.67	2,028.82-103,583.94
Unincorporated	32	12,738.87	12,755.34	621.18- 50,000.00
Zoning:				
Agricultural	3	7,621.16	10,113.98	993.08- 19,262.52
Residential	37	16,795.69	18,062.04	621.18- 84,000.00
Commercial	19	33,671.02	35,664.32	2,028.82-103,583.94
Taxable Value / Sale Value	59	0.26	0.18	0.02-1.08
Property Taxes ($) / Acres	59	230.02·	314.03	11.14-1,416.04
Acres per Sale	59	8.52	14.80	0.26-85.68
Distance from:				
City Hall (Miles)	59	7.95	2.87	2.10-13.30
Highway (Miles)	59	1.00	1.05	0.00- 5.00

the County Auditor. The average of the taxable-sale value ratio for the sample is 26 per cent, with a range of 2 to 108 per cent. Only three pieces of property have ratios in excess of 40 per cent, all of which are zoned residential and are located in unincorporated areas. While sale value and taxable value have a simple correlation coefficient of 0.91, the correlation between sale value per acre and the taxable-sale value ratio is -0.14.

Statistical Analysis

The model used for the statistical analysis of land values is

$$Y_i = a + \Sigma b_j X_j + e,$$

where Y_i is a measure of land value per acre, the X_j are the characteristics of the land, and e is the random component. The model is a linear additive model.

Conceptually, the model is a demand function for land. Each seller offers a piece of property with a predetermined bundle of characteristics, i.e., size, location, zoning, etc. A transaction occurs when the seller is satisfied that he has found the highest bidder. [5/] The locus of highest bids for land with varying characteristics traces the demand function.

Two measures of value per acre are used:

$$Y_1 = \frac{\text{sale value}}{\text{acres}}$$

$$Y_2 = Y_1 - 2.5 \frac{\text{(Taxable value of buildings)}}{\text{acres}}$$

Since the primary concern of this study is undeveloped land values, Y_2 was developed in an attempt to obtain a measure of land value only. The reliability of this measure is questionable with the variation in taxable-

sale value ratios for the sample; it does provide a set of alternative results.

The independent or predetermined characteristics of land (X_j) used in the analysis are:

Size = acres in the parcel

Location = a three-way variable using two dummy variables with land in unincorporated areas as the control group.

    Columbus = 1, land located within the city limits of Columbus

              0, otherwise

    Suburban = 1, land located within one of the incorporated suburban areas

              0, otherwise

Zoning = a three-way variable using two dummy variables with land zoned residential as the control group.

    Commercial = 1, land zoned commercial or for multiple unit dwellings

              0, otherwise

    Agricultural = 1, land zoned agricultural

              0, otherwise

Dist. Highway = the distance in miles from the property to an access highway. Access highways are major city streets, state or U. S. highways, or Interstate highways.

Dist. City Hall = the distance in miles from the property to the Columbus City Hall. This was used rather than the distance from the Columbus city limits because of the great irregularities of the city limits.

$\dfrac{\text{Property Tax}}{\text{Sale Value}}$ X 100 = the property tax rate based on market value i.e., the "real" tax rate.

$\dfrac{\text{Property Tax}}{\text{Taxable Value}}$ X 100 = the property tax rate based on taxable value.

$\dfrac{\text{Property Tax}}{\text{Acres}}$ = the per acre taxes on the property.

$\dfrac{\text{Taxable Value}}{\text{Sale Value}}$ X 100 = the taxable value as a per cent of market value.

Under the assumption that these characteristics of land offered for sale are predetermined to potential buyers of land, the relationship can be estimated by ordinary least squares. The results of the analysis are presented in Table 2. Equation 1 with Y_1 as dependent variable and equation 4 with Y_2 dependent are considered "best" results. Adjusted R^2 was maximum for these equations. No coefficient exceeded its standard error when additional variables were added.

In equation 1, an increase in size of parcel by one acre decreases the value of the property by an estimated $352 per acre. Location within Columbus relative to an unincorporated area is worth almost $21,000 per acre, the most significant variable in the equation. Location in an incorporated suburb is worth about $12,000 per acre. Land zoned commercial sells for about $7,600 more than residential land, a value which appears small. There are three reasons which partially explain the relatively large values of location and small values of commercial zoning. First, it may be progressively less costly to have land zoned commercial as it is located in an unincorporated area, a suburb, or Columbus, respectively. Second, the increase in value from obtaining commercial zoning may decline as land is located in an unincorporated area, a suburb, or Columbus. The eleven observations on commercial land

Table 2

Results of the Regression Analysis Used to Explain Variations

in Undeveloped Land Sale Values per Acre, Franklin County, Ohio, 1971[a]

Variable [b]	Equation				
	1	2	3	4	5
Dependent	Y_1	Y_1	Y_1	Y_2	Y_2
Intercept	18,945.5* (106.6)	11,485.6* (30.94)	12,787.0* (36.91)	12,240.8* (89.25)	6,452.4* (24.26)
Size	-351.8*** (1.667)	-349.7*** (1.593)	-364.0** (1.679)	-246.6*** (1.515)	-268.2*** (1.612)
Location Columbus	20,700.1* (2.807)	21,984.8* (2.823)	21,404.3* (2.774)	18,070.6* (3.176)	18,314.9* (3.092)
Suburban	12,023.8*** (1.348)	11,158.4 (1.189)	10,637.9 (1.125)	10,267.6*** (1.491)	8,271.8 (1.139)
Zoned Commercial	7,636.6 (1.073)	8,504.7 (1.161)	8,261.5 (1.133)	6,724.8 (1.225)	7,242.8 (1.294)
Dist. Highway	-4,801.3*** (1.636)	-5,144.9*** (1.663)	-4,903.6*** (1.639)	-4,301.5** (1.899)	-4,337.8** (1.889)
Dist. City Hall		730.5 (0.626)	790.5 (0.660)		894.0 (0.972)
$\dfrac{\text{Property Tax}}{\text{Sale Value}}$ X 100			-1,026.2 (0.044)		-831.8 (0.464)
$\dfrac{\text{Taxable Value}}{\text{Sale Value}}$ X 100		54.4 (0.280)			
R^2	0.289	0.297	0.296	0.334	0.347
Adjusted R^2	0.222	0.200	0.199	0.271	0.257
F	4.314*	3.072*	3.056*	5.315*	3.866*

a/ t values in parentheses

b/ Dependent variables: Y_1 = total sale value/acre

Y_2 = Y_1 -2.5 (Taxable value of buildings/acre)

Significance levels, two-tail t and F
  * = .05 level: t = 2.007, F = 2.28
 ** = .10 level: t = 1.675
*** = .20 level: t = 1.299

in Columbus have a mean value of $35,955 per acre, while the seven

observations on residential land have a mean value of $41,879. The

respective figures for land in suburbs and unincorporated areas combined

are $30,531 for eight observations and $10,641 for 33 observations

including three zoned agricultural. Land zoned agricultural is combined

with residential because there are only three observations. Finally,

not only does the service and tax structure vary among the three locations,

but Columbus controls significant parts of the service structure. For

example, it controls the water supply. Water at regular city rates is

generally available on land in Columbus; in the suburbs water is

available but the rate must be negotiated. In unincorporated areas,

city water may be refused; a strong incentive for some property owners,

e.g., developers, to annex their land to Columbus.

An increase of one mile from a major access highway decreases the

value of property by $4,800 per acre. The results of equation 4 are

consistent with the results of equation 1. The coefficients are corre-

spondingly smaller because Y_2 does not include the estimated value of

buildings.

Distance from city hall has a positive coefficient, but the

coefficient never exceeds its standard error in equations 2, 3, 5, and

other equations not reported. The coefficient is expected to be negative,

but three factors may explain the positive but insignificant coefficients.

First, all observations come from Franklin County, so distance does not

have the broad variation it has in Schuh and Scharlach [5] or Hammill [4].

Second, with the range of distances from city hall in this sample, there

may be increases in value with increasing distance from the congestion of

the central city. Finally, there are three major trade centers in the
fringe areas of the metropolitan area. While central Columbus is the major
center for some services. e.g., financial, the three trade centers are the
major retail centers. In future work, a distance variable which measures
from the nearest of these four centers is planned. Also, location with
respect to quadrant of the city will be added; development appears to be
most rapid in the northwest and least rapid in the southwest quadrants
of Columbus.

None of the tax variables improved the results. The property tax-
sale value (equations 3 and 5) and property tax-taxable value (not
reported) tax rates both have negative but insignificant coefficients.
Property tax per acre (not reported) has a positive significant coefficient,
but this indicates that high taxes per acre are caused by high land values
and not vice versa as is assumed in this analysis. The taxable-sale
value variable has a positive but not significant coefficient (equation 2).
The positive coefficient is consistent because the higher the current
taxable-sale value ratio, the less can the ratio increase in the future.

Overall, the property tax structure appears to have little impact
on land values. Although current property taxes have some effect on the
costs of holding land, a cost very significant to farmers, the current
value of the land and its taxes are very small compared to the future
value of and tax rates on this land after it has been developed for
urban use.

Summary and Conclusions

This study uses 59 observations on undeveloped land sales in Franklin
County, Ohio during 1971 to estimate the impact of urban factors on land

values at the urban-rural fringe. Franklin County includes the cit Columbus. The factors used in the analysis are: size of parcel; location in Columbus, a suburb, or an unincorporated area; whether land is zoned commercial, residential, or agricultural; distance fr major access highway; distance from the Columbus city hall; three m of property tax rates; and the taxable-sale value ratio.

The location variable has the greatest significance. Land loc in Columbus is $21,000 per acre more valuable than land in unincorp areas, and in suburbs $12,000 per acre more valuable. Distance fro access highway is also important; each increase of one mile causes estimated decrease of $4,800 per acre in value. Based on these est owners of undeveloped land have substantial incentives to encourage incorporation of their land into a suburb or Columbus, and highway improvements near their property.

Each increase of one acre in size of the property sold decreas its value by an estimated $250 to $350 per acre. An owner of 40 ac of land could increase its selling price by $5,000 to $7,000 per ac by selling two tracts of 20 acres. Commercial zoning increases the of land by $6,700 to $8,500 per acre. The impacts of other variabl land values have no statistical significance in this sample.

In conclusion these results should be viewed as preliminary. are based on a relatively small sample and the explanatory power of equations, although statistically significant, is small at about 30 cent of the total variation in land values. Further, new questions been generated which need to be incorporated into this analysis. F

and expansion of the sample both within Franklin County and to include

land sales outside of Franklin County within a 25 mile radius of

Columbus, and 2) application of these results to an analysis of alternatives

for assessing and financing property taxes on agricultural land at the

urban-rural fringe. [6/]

Footnotes

* The authors are indebted to E. T. Shaudys for detailed comments on the operation of the land market in Franklin County. Helpful comments have been received from T. F. Glover, F. J. Hitzhusen, F. E. Walker, and W. A. Wayt. The authors are fully responsible for the contents of the paper.

1/ See Schuh and Scharlach [5] for reference to and discussion of this literature.

2/ Many of the parcels in the sample include buildings, some of which are houses. The extent to which this land has access to urban services, such as city sewer and water lines, is unknown, but is hopefully accounted for by the location variables.

3/ An example of developed land is land which has been divided into lots for residential housing with streets, sewers, and other utilities already installed.

4/ Taxable value refers to the value on which property taxes are based. Assessed value is the estimate of true value, and taxable value is 40 per cent of assessed value.

5/ In some cases the seller might not accept the highest bid. This is not of concern here, however, since the sample consists of actual transactions.

6/ See Hady [3] for a recent discussion of these alternatives.

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