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MULTI-PEAKED URBAN LAND VALUES: CITY OF AKRON CASE[1]

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ABSTRACT. Using 1977 data for the City of Akron, this paper examines the spatial relationships between assessed land value and selected variables, including distance from the Central Business District (CBD). A simple correlation analysis demonstrates a very weak inverse relationship between land value and distance. The inverse relationship between commercial land value and distance is only relatively stronger than other relationships, while in the case of residential land value, the relationship is positive. The results from a stepwise multiple regression also suggest that distance from CBD cannot predict urban land value. Land use category, intensity of use, and lot size were identified as important variables influencing land value, but not strong predictors. While analyzing the residuals from regression, the study demonstrated marked regional differences in the relationships and confirmed them through separate sectoral analysis. Suburbanization and the development of multiple centers led to significant changes in the distance — land value relationship, producing a multi-peaked land value surface with higher residential land values in the periphery.

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INTRODUCTION

Classical theories of land economics assert that accessibility of sites with respect to different land uses distributed throughout a city is the most important basis of urban land value differences (Alonso 1968). Although variations in aesthetic qualities and geological characteristics would account for some value differences, if there were no differences in accessibility among sites, all land would have essentially the same locational value. Based on the notion that the CBD contains the point of minimum aggregate travel, accessibility within an urban land market is at maximum at the CBD; and hence, assuming a competitive market and homogeneous sites, land values are expected to be higher in this central area. Theorists argue that as distance from the CBD increases, accessibility decreases causing decline in land value (Haig 1926, Alonso 1960, Hoyt 1960, Seyfried 1963, Mills 1969).

During the past few decades, the interests of the competitive forces in the land market and the increasing need for planning and zoning have warranted intensive study of spatial distribution of land values in urban areas. The postulated inverse relationship between land value and distance from the CBD has been generally verified in past studies. The works by Hoyt (1933) on Chicago, Illinois, and Knos (1968) on Topeka, Kansas, are classic examples of empirical studies that emphasized the centrality of land value. Similar relationships have also been discovered in some Third World cities (Withington et al. 1975, Khan 1976, Noble et al. 1979).

However, the Central Business District is but one, albeit the largest, of a number of commercial areas in a city. If land values are higher towards the peak land value intersection (PLVI) of the CBD, they should also rise towards the other commercial areas. Berry (1963) illustrated this idea

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through the so-called "circus tent" diagram that depicts a major land value peak in the CBD and smaller peaks in outlying retail centers. Empirical evidences given by Knos (1968) and Downing (1973) also support this contention. It follows that locations of smaller commercial and transportation centers would restructure land values in a city.

In the American urban scene, the automobile has brought about a revolution in the land uses: declining rate of growth of retail business in the CBD; increased concentration of office, management, and finance-related land uses in the CBD; greatly increased pace of suburbanization with high class residences moving outwards from the central parts of the city; and establishment of peripheral and suburban shopping complexes. The revolution has increased traffic congestion and parking problems in the CBD, while many suburban areas, became more accessible because of the newly constructed highways. As a consequence, it might be expected that the inverse relationship between land values and distance from the peak land value intersection (PLVI) would tend to weaken with the passage of time. Yeates (1965) examined this in the Chicago area at decennial intervals from 1910 to 1960. This study substantiated the hypothesis that land values decline with distance from the CBD for the whole city at each time period. This study also noted continuous decline in the strength of the association between the 2 variables. Further, it indicated that in Chicago there is an upward trend of land values at the periphery. This change of land value in one American city is perhaps not unique and, in the future, the trend might become more pronounced. Although the existence of such a trend in American cities is indirectly supported by recent literature on suburbanization (Guest 1975), no study of urban land values specifically designed to reinforce Yeates' (1965) findings is known to the authors. Similar trends have also been observed in other westernized countries, for example, South Africa (Boaden and Hart 1975). This paper, presented 15 years after Yeates' (1965) Chicago study, will re-examine these relationships.

METHODS AND MATERIALS

This paper will test the strength of a hypothesized inverse relationship between land value and distance from the PLVI in a mid-sized American city—Akron, Ohio. Three hypotheses are proposed: (1) land values will tend to decline with increasing distance from the CBD, but the degree of association between the 2 variables will be very insignificant; (2) the inverse relationship between commercial land value and distance will be relatively stronger; and (3) residential land value, when considered separately, will not show a distance-decay function at all.

A related objective is to analyze the spatial pattern of land values in Akron in relation to the general land use situation, and to identify the major determinants of land value in the city. We will also examine whether the relationships between land value and other selected variables are homogeneous throughout the city, or whether they show marked regional/sectoral differences.

This study is based on assessed land value data of the city of Akron for 1977. Relevant land value and other related data were collected for a sample of 508 individual lots distributed throughout the city of Akron. We superimposed a grid on a map of Akron, assigned consecutive numbers to the grid intersecting points falling within the city limits, and randomly selected 20% of these points. Next, the actual lots corresponding to these random sample points were identified, and data were collected from the Summit County Land Records Office, forming the basic data units for the study. Per acre values of land, improvements including buildings, and combined values (land plus improvement values) for the sample lots were then computed from the respective per lot values. The assessed values in these 3 categories were obtained from the records in the Summit County Land Records Office in Akron. In Ohio, property is assessed at 35% of its fair market value, and hence, the use of unadjusted assessed values in this paper implies understating values by 65%. This will not influence the paper's statistics, but caution should be exerted interpreting the absolute values where they are discussed. Absolute lot sizes (in acres), and the straight line distance (in miles) from the PLVI in the CBD were selected as other variables for this study. The PLVI is, simply, the central point in the highest valued lot in the city.

Initial analysis of the land value pattern in Akron was accomplished through a visual comparison of the generalized land use map of the city (fig. 1) and the corresponding land value map (fig. 2). The 3-dimensional statistical surface of land value

(fig. 3) added to the precision of this analysis. We computed Pearson's Product Moment Correlation coefficients to test the proposed hypotheses, and to discern the nature and strength of mutual association between the selected variables, particularly between land value and distance. In order to identify the major determinants of land value in Akron, a stepwise multiple regression was also run with per acre land value as the response (criterion) variable, and lot size, building value, and distance from the CBD as predictor sets.

From the initial examination of the land value maps and the residuals from regression, marked regional/sectoral differences were noted. The city was then divided arbitrarily into 4 sectors (fig. 1); including at least one major thoroughfare radiating from the CBD as a criterion for sectoral delimitation. The multiple regression model was then applied in each sector.

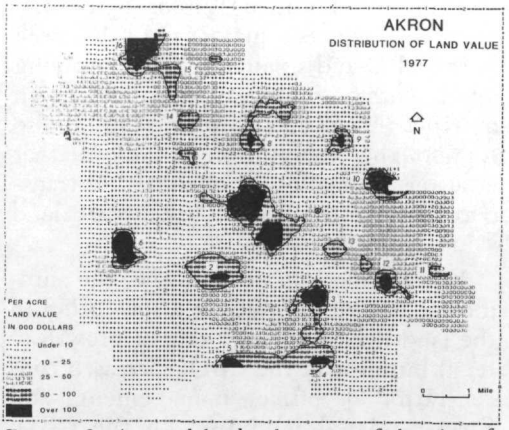

FIGURE 2. Assessed land value map of the city of Akron, 1977, based on field survey and Summit County Land Records. No. 1 indicates the location of CBD.

RESULTS

From a visual examination of the land value maps (figs. 2 and 3), it is apparent that the spatial distribution of land values in Akron is quite irregular. The CBD is still the peak land value zone of the city, however, a number of very prominent peaks are also found outside the CBD. Very high ($100,000 and over per acre) and high ($50,000-100,000 per acre) land values contoured in figure 2 are associated with the CBD (No. 1 in the map), which still contains the highest peak. Lesser peaks having similar high value (over $50,000 per acre) are associated with the commercial ribbon in area No. 8; with an L-shaped ribbon (Nos. 3, 4, and 5), having 3 peaks and containing 2 closely located shopping centers (Arlington Plaza and

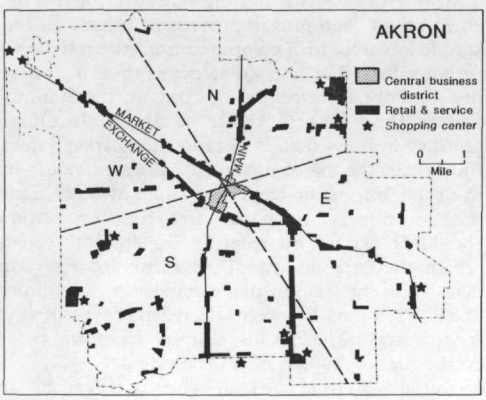

FIGURE 1. City of Akron with 4 sectoral divisions from the CBD (Central Business District). N = North, E = East, S = South, and W = West.

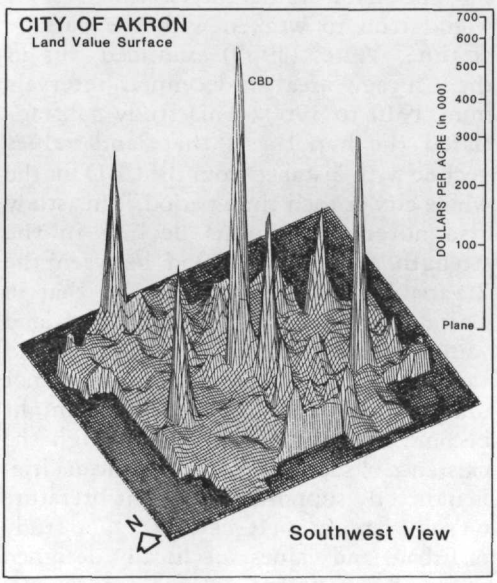

FIGURE 3. Three dimensional statistical surface of the assessed land value, city of Akron, 1977, viewed from the southwest.

Akron Square); with a commercial ribbon and light industry development in areas 11, 12, and 13 paralleling Market Street, a major arterial; and with important street intersections (Nos. 6, 9, and 10), where commercial activities predominate. Two high income residential areas (Nos. 14 and 15) and an area of mixed commercial and residential uses at a cross-roads location in the Cuyahoga Valley (No. 16) also show similar high value peaks. In addition, the near-CBD manufacturing and commercial area (No. 2) and a few other scattered pockets have smaller land value peaks. In general, the lesser peaks are located along the major business thoroughfares of the city, at intersections, near the outlying shopping complexes, and in the more attractive residential areas (fig. 1). These high values are widely scattered throughout the city, providing a multi-peaked surface of land value (fig. 3). Areas which have considerable amounts of vacant land, such as the southwestern part of the city, generally exhibit low land values.

The simple correlation coefficient between land value and distance reflects the hypothesized negative relationship (−0.07), although the strength of the association is negligible, and is not statistically significant even at the 0.10 level. The relationship between commercial land value and distance is slightly stronger (−0.26), and the coefficient is significant at the 0.01 level, validating our second hypothesis. Residential land values were found to increase with distance from the CBD, the correlation coefficient being only 0.23, but still significant at the 0.01 level. This result suggests that peripheral lands are more attractive for residential purposes when compared with land in the middle or central parts of the city. The research substantiates all 3 hypotheses of this study. Relatively stronger correlations between land value, building value, and the total value are not unexpected; reflecting the fact that higher valued land is generally more intensively used. Although the correlations between lot size and the other variables are not strong, the signs of the coefficients are quite logical, so that with increasing size of commercial or residential lots, per acre value of land and improvements tend to decrease.

A series of stepwise multiple regressions was run with land value as the response variable, and building value, lot size, and distance as the predictor set, first for the city as a whole and then for each of its 4 sectors (E, S, W, and N) (table 1). For the entire city, the coefficient of multiple correlation was found to be 0.47, which is not high, but still significant at the 0.01 level. However, the hypothesized set of predictor variables explained only about 22.5% of the variation in land value in Akron. And almost the entire amount of this explained variation is the contribution of one variable, building value.

The multiple correlation coefficients in the North ($R = 0.45$), South ($R = 0.60$), East ($R = 0.38$), and West ($R = 0.88$) sectors of the city vary considerably, but they are all significant at the 0.01 level. The amount of variation explained by the model also differs widely between the sectors, ranging from 14.3% in the East sector to nearly 77% in the West sector. In all the sectors, as in the city as a whole, building value is the predominant explanatory variable, while lot size and distance have very insignificant roles in the regression model.

A similar series of regression analyses was carried out for the residential and commercial lots in the sample (table 1). The findings are generally similar to the total sample. Major discrepancies are found only in the West (W) sector. In the residential land value analysis, distance becomes the most important variable, followed by building values; the existence of several very high income residential areas near the periphery in this sector may account for this discrepancy. The commercial land value analysis for the sector shows that lot size is the predominant variable, and building value is not significant at all. It may be recalled that when all land

TABLE 1

Results from stepwise regression for the city of Akron as a whole and by sectors.

	Sector-N R^2	Sector-S R^2	Sector-E R^2	Sector-W R^2	City R^2
All Land Value	n=101	n=113	n=171	n=123	n=508
Bldg. value[$]	0.191	0.337	0.093	0.764	0.221
Distance	0.013	0.009	0.047	0.003	0.002
Lot size	0.001	0.010	0.003		0.001
All Variables	0.205	0.356	0.143	0.767	0.225
Multiple R*	0.45	0.60	0.38	0.88	0.47
Residential Land Value	n=66	n=57	n=125	n=96	n=344
Bldg. value[$]	0.250	0.370	0.385	0.104	0.294
Distance	0.024	0.007	0.011	0.215	0.039
Lot size	0.030	0.003	0.007	0.018	0.005
All Variables	0.304	0.379	0.403	0.337	0.337
Mean Land Value (in dollars)	21924.20	20044.87	26455.81	23319.58	23648.87
Mean Lot Size (in acres)	0.5	0.3	0.3	0.4	0.4
Multiple R*	0.55	0.61	0.63	0.58	0.58
Commercial Land Value	n=26	n=36	n=34	n=11	n=107
Bldg. value[$]	0.137	0.413	0.034		0.176
Distance	0.004	0.001	0.148	0.002	0.051
Lot size	0.045	0.019	0.005	0.315	0.001
All Variables	0.186	0.433	0.188	0.317	0.228
Mean Land Value (in dollars)	42135.07	72089.36	103445.26	35130.53	70974.80
Mean Lot Size (in acres)	9.2	2.8	1.6	14.7	5.2
Multiple R*	0.43	0.66	0.43	0.56	0.47

*All the R values are significant at the .01 level
[$]Value of buildings and improvements

uses were considered, building value entered the equation as the predominant explanatory variable in this sector. Another discrepancy is that in the commercial land value analysis in the East (E) sector, distance has assumed the role of the most important explanatory variable in the equation.

DISCUSSION

The following conclusions may be drawn from the present study.

1. The spatial distribution of land values in Akron is quite irregular. Although the maximum values are still located in the CBD, a number of other high value peaks occur in the city. These peaks correspond with the intersections of major business throughfares and the locations of large shopping centers.

2. An inverse relationship was found between land value and distance from the PLVI in the CBD, but the strength of the relationship is statistically insignificant. Thus, a progressively declining and weakened relationship, found by Yeates in Chicago of 1960, seems to have matured in Akron by 1977 to a stage where statistical significance had disappeared. In the future, this relationship is expected to weaken even further.

3. The inverse relationship between distance and commercial land value is relatively stronger compared to other relationships, but the absence of a strong

correlation reflects the influence of peripheral and suburban shopping complexes.

4. Residential land values gradually increase away from the city center. Higher residential land values near the periphery of Akron, an industrial city with a stagnant downtown, are indicative of what has happened in many American cities. The effects of suburbanization and modern shopping complexes located in the outskirts of the city are reflected in the positive association between residential land value and distance from the CBD. Moreover, these 2 factors seem to have contributed heavily to the development of a pronounced multi-peaked surface of land values in contemporary American cities.

5. Among the selected set of independent variables, value of buildings and improvements is the most important determinant of land value in Akron. Since this variable is an indicator of the intensity of land use, this finding is not surprising.

6. An expected inverse relationship between lot size and distance was discovered, but lot size itself was not an important determinant of land value in Akron.

7. Marked regional/sectoral differences in the pattern of land value were observed in Akron. This reflects the differential growth pattern of the city, and the regional/sectoral variations in land use characteristics.

The present study demonstrates a very weak inverse relationship between land value and distance from the PLVI in the CBD. The regression results also suggest that physical distance, even though a common surrogate for accessibility, is no longer a strong predictor of urban land value. The multiple regression model used in this study, however, did not prove satisfactory in eliciting the major determinants of land value in the city of Akron. Inclusion of more appropriate variables as predictors and the use of "dummy" and interaction variables in conjunction with the sectors or zones of the city would probably make the regression model more useful. Nonetheless, the statistical insignificance of the distance/land value relationship illustrates that the American city, as exemplified by Akron, may have entered a phase in history characterized by multiple peaks of land value and higher values for residential uses in the periphery.

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