ZONING AND THE VALUE OF URBAN LAND

by Paul K. Asabere and Peter F. Colwell

Government zoning is considered to be either an important tool used by local governments to control the pattern of land use or an irrelevant exercise that merely conforms to market outcomes rather than modifying them. Government zoning might have radically different allocative effects in various communities.

This paper is an empirical study of the allocative effects of government zoning in the community of Champaign-Urbana, Illinois. The central premise that underlies the empirical work is that certain relative prices between land uses indicate indirectly that the allocative results of government zoning are inefficient.

The empirical model here is specified in order to provide for direct estimates of relative land prices across land use zones, as well as to capture the structure of several other hypotheses related to the determinants of urban land prices. Other variables such as location, amenities, and the date of sale are included in conventional ways in the empirical model.

The data are superior in two ways to those used in most other hedonic studies on the impact of zoning. First of all, the sample consists of micro data instead of the usual aggregate data. Secondly, the sample includes only sales of vacant land instead of the usual sales of improved land. Every recorded sale of vacant land (125) in Champaign-Urbana over a two-year period is included.

In order to provide a proper background for the empirical analysis, a brief review of the literature on zoning is presented here.

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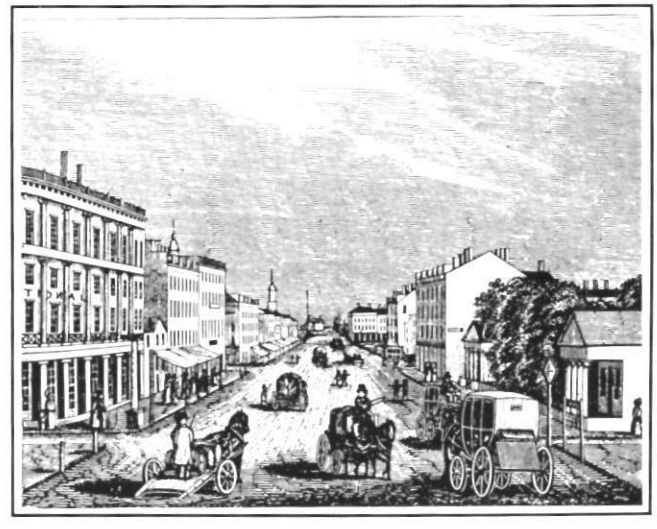

The Zoning Debate

The zoning debate began in North America in the early years of the twentieth century. Land use control laws were accepted rapidly in most urban areas and were defended by the judiciary. This proved sufficient to defeat early opponents, which helped proliferate the laws. The pressures of urban development in the second half of this century have uncovered flaws in a number of areas, promoting renewed rigor on the subject of government zoning (Goldberg and Horwood, 1980).

Empirical evidence on the effects of zoning did not surface until the late 1960s, despite the long history of debate. The volume and quality of the empirical research to date are hardly overpowering, due in part to problems related to the availability of data. Among the notable examples of studies on the effects of government zoning are: Courant (1976); Crecine (1967); Davis and Whinston (1964); Maser, Ricker and Rosett (1977); White (1975); Rueter (1973); Siegan (1972); Stull (1975); and Crone (1983).

There is still no consensus on the effect of zoning on property values. One view holds that it cannot be determined *a priori* whether zoning regulation will modify market outcomes or conform to them. For example, Ohls, Weisberg and White (1974) conclude that it is generally not possible to use *a priori* theory to predict the impact of zoning on aggregate land values in a community, regardless of whether the intent of the zoners is to control externalities or to achieve fiscal goals. Under plausible assumptions, however, they argue that zoning as practiced in the United States probably lowers aggregate land values in the community which is doing the zoning. Some theoretical investigations, however, "sit on the fence" by concluding that zoning may modify market outcomes (see Stull, 1975).

On the other hand, some existing empirical investigations conclude that zoning is effective in modifying market outcomes. Examples of these investigations are: Sagalyn and Sternlieb (1973); Siegan (1972); Crecine et. al. (1967); and Rueter (1973). Rueter, however, finds little likelihood that all the externalities anticipated by zoning ordinances actually arise in urban property markets. As mentioned previously, it is possible that zoning might have allocative effects which are radically different on different communities. The necessary step toward an understanding of the potential effects of zoning on land values is to provide more case studies, especially of areas that are substantially different from the markets already studied.

The Zoning Hypothesis

The type of government zoning considered here is called by various names such as hierarchical zoning, cumulative zoning, and progressively inclusive zoning. As compared to exclusive zoning, floating zoning, etc., this kind of zoning is the most prevalent in the United States.

The rationale behind hierarchical zoning suggests that it restricts the flow of negative externalities from lower to higher land uses in the hierarchy. If this were the only effect of governmental zoning, the value of the highest uses in the hierarchy would be raised as a result of the protection provided by the zoning ordinance *ceteris paribus*. In other words, those who desire to use land for residential purposes, which are usually the highest uses in the hierarchy, are able to choose from land in any zone, but they would be willing to pay more for land in the protected residential zone, holding location and other factors constant. Thus, the externality argument, which provides the rationale for the legal application of police powers to governmental zoning, implies that there should be a premium paid for land zoned for residential purposes.

Governmental zoning, on the other hand, may fulfill other purposes. Special interests both in and out of the government may be able to shape governmental zoning to serve their own ends (see Davis et. al., 1964). A local government may engage in fiscal zoning in order to protect directly its purse and indirectly impoverish neighboring governments.

Planners have their biases, too. Influenced by the almost universal preference for single-family dwellings, they may overallocate land for single-family use. If planners are ideologically at odds with the expansion of business activity on the local level, they will have little trouble finding political allies.

The owners of land currently zoned for commercial and industrial use prefer to limit its supply. These owners may be joined in their efforts to restrict supply by owners of residential land who fear the effects of negative externalities.

Thus, zoning may not only increase efficiency by separating incompatible land uses and reducing the flow of negative externalities, but it may also create inefficiency by distorting the supply of land to the various uses. The nature of hierarchical zoning causes such distortions to be asymmetric. It can only overallocate land to the highest uses and underallocate land to the lowest ones. The reverse situation of underallocating land to the highest uses and overallocating land to the lowest ones is impossible. Thus, where supply effects from governmental zoning exist, there would be a tendency for residential land values to be depressed and commercial land values to be increased by the zoning. It is necessary to recall that the externality argument suggests that a premium would be paid for residential land. Therefore, any net effect of residential zoning on land value indicates whether zoning operates primarily to improve the allocation of land or to misallocate it. If the partial effect of commercial zoning increases land value, then this would indicate misallocation at the low end of the zoning hierarchy.

University, Others Affect Planning Processes

The presence of the University of Illinois and other major public employers seems to imbue the planning processes in Champaign-Urbana with a greater sense of the need to protect the single-family use from competition with lower uses, and with a greater distaste for the lower uses than would exist in communities which are more entrepreneurial in nature.

It is hypothesized that land in Champaign-Urbana is overallocated to single-family and underallocated to commercial uses. An empirical test of this hypothesis would be to see whether the partial effect of single-family zoning is to lower the price below that for intermediate uses and the partial effect of commercial zoning is to raise the price of commercial land above that for intermediate uses.

The structure of equation (1) directly reveals these relative prices.

$$SP_i = m\, e\, \beta_2 COMM_i + \beta_3 SRES_i \qquad (1)$$

where:

SP_i = the selling price of vacant lot i,

$COMM_i$ = a dummy variable assigning 1 if lot i is zoned commercial and 0 otherwise,

$SRES_i$ = a dummy variable assigning 1 if lot i is zoned single-family residential and 0 otherwise,

e = a natural constant, 2.718281. . ., and the base of natural logarithms, and

m = everything else that affects selling price.

The antilog of the parameter β_2 is the ratio of the price of commercially zoned land to the price of land with neither commercial nor single-family zoning (i.e., almost entirely multi-family zoning). In a similar way the antilog of the parameter β_3 is the ratio of the price of land zoned as single-family to the price of land with neither commercial nor single-family zoning. The relative price of commercial to single-family zoned land is the antilog of $\beta_2 - \beta_3$. The hypothesis is that β_2 is positive and β_3 is negative.

In order that the partial effects of zoning may be detected, the explanatory variables described in the following section are included.

Lot area: It is also hypothesized that, holding relative lot area constant, selling price increases at a decreasing rate as absolute lot area increases. Of course, this means that the unit price of land decreases as lot area increases. At first glance one might think that this kind of price pattern cannot persist because arbitrage consisting of further subdivision of lots would eliminate the unit price differentials. However, this pattern must persist because it reflects unit cost differentials.

The total costs of providing a lot with street access and utilities, as well as surveying and platting costs, increase at a decreasing rate as lot area increases. So while there is an increment to value as a result of subdividing land over a wide range of lot areas, this increment, which is called plattage, is equal to the increment in subdivision costs in equilibrium (see Colwell et. al., 1976).

Location: In addition to the zoning and lot area variables, it is important to include location variables. The theory of urban economics tells us that different land use zones would have different values in the absence of government zoning so the effect of government zoning can only be measured while holding location constant. Five location variables are utilized here: distance to a center of economic activity and dummy variables for cul-de-sac, growth path, corner lot, and busy street. Three of these variables (cul-de-sac, corner lot, and busy street) could be classified as amenity-nonamenity variables rather than location variables.

The first of these variables is distance to the center of activity. For Champaign-Urbana, which is a typical campus town, the north end of the University of Illinois "quad" is the center of activity. The university serves as the principal regional employer and the main nightlife area; the campus town at the north end of the quad serves some commercial functions. The downtowns (CBDs) for Champaign and Urbana are not used explicitly as proxies for the centers of activity, due to their relative decline in importance in recent years as well as the development of peripheral shopping centers. However, it should be noted that the north end of the quad is on a line approximately halfway between the two CBDs, and therefore may act as the centroid of the existing activity.

The second location variable measures the impact that cul-de-sac location has on land value. The inclusion of this variable is based on a belief that the cul-de-sac plays three main roles. First of all, it allows for flexibility in the arrangement and orientation of the homes, and, thus, provides for more variety in spatial arrangements. Secondly, the cul-de-sac reduces pedestrian, bicycle, and automobile traffic, which reduces noise and dirt and increases security. Finally, neighbors around a cul-de-sac may be more socially integrated than those located on traditional gridiron patterns, since the cul-de-sac neighborhood is well-defined and small.

These factors promote club formation and cohesion as well as the resulting public goods production (e.g., manicured lawns, freshly painted facades, and help when needed). Based on such attributes, location on a cul-de-sac should have a positive impact on the selling price, although it is not expected to affect nonresidential properties. This differential effect is captured by using an interaction term which is found by multiplying the cul-de-sac dummy by a dummy for all residential properties.

The third location variable is intended to pick up the impact of being in the path of rapid growth. Most developments south of Kirby/Florida Avenue appear to be post-1960, and most of the post-1960 developments appear to be south of Kirby/Florida Avenue. Thus, the growth path variable is a dummy that indicates whether the lot is north or south of this street.

The fourth location variable captures the effect of corner location on land value. Corner location should have a positive effect on selling price for a wide variety of land uses. Corner lots provide greater separation between dwelling units for single-family residential property. For commercial and multi-family residential uses the exposure and access provided by corner lots are desirable features. Corner location is probably preferred by both residential and commercial land users. The corner location variable used in this study is a dummy that indicates whether or not the lot is located on a corner.

The fifth and final location variable is a dummy for high traffic volume streets. It is hypothesized that location on a busy street has a positive impact on most properties except for single-family residential properties where high-traffic locations are not desirable. Commercial activity favors location on busy streets because of the visibility and high potential for attracting customers who pass by the property. An interaction variable is used to capture the effect of higher traffic on properties other than single-family residential properties. This is formed by multiplying the high-traffic dummy by a dummy for properties which are not single-family residential.

Time of sale: It is hypothesized that during the sample period, 1977 and 1978, land appreciated in value at a rate which was relatively constant and that the selling

price of lot i depends on its time of sale in an exponential fashion.

The Model

All the hypotheses developed above were brought together into the following equation:

$$SP_i = \beta_0 LOT_i^{\beta_1} \exp[\beta_2 COMM_i + \beta_3 SRES_i + \beta_4 QUAD_i + \beta_5 (CdeS_i * ARES) + \beta_6 GRTH_i + \beta_7 CORN_i + \beta_8 (HTRF_i * NSRES_i) + \beta_9 MOS] \quad (2)$$

where:

SP_i = selling price of vacant lot i,

LOT_{ij} = area of vacant lot i in thousands of square feet,

$SRES_i$ = a dummy variable assigning 1 if lot i is in a single-family residential zone and 0 for all other zones (e.g., multi-family and commercial),

$COMM_i$ = a dummy variable assigning 1 if lot i is located in a commercial zone and 0 for all other zones (e.g., multi-family and single-family),

$QUAD_i$ = distance in miles of lot i from the north end of the "quad" of the University of Illinois,

$CdeS_i$ = a dummy variable assigning 1 if lot i is on a cul-de-sac and 0 if it is not located on a cul-de-sac,

ARES = a dummy variable assigning 1 if lot i is located in any of the residential zones and 0 for location in a nonresidential zone,

$GRTH_i$ = a dummy variable assigning 1 if lot i is located in the growth path south of Kirby/Florida Avenue and 0 if it is located north of it,

$CORN_i$ = a dummy variable assigning 1 if lot i is a corner lot and 0 if it is not,

$HTRF_i$ = a dummy variable assigning 1 if lot i is located on a street with an average daily traffic volume of 5,000 or more and 0 for less than 5,000,

$NSRES_i$ = a dummy variable assigning 1 if lot i is in an other than single-family residential zone and 0 for all other zones,

MOS_i = the month of sale of lot i.

The sample data consist of all recorded sales of vacant lots in the cities of Champaign and Urbana during the years 1977 and 1978. The selling price data were obtained from transfer tax and deed records, whereas the lot size data were obtained from platbooks. Zoning information for the city of Urbana came from the Champaign County Regional Planning Commission, whereas zoning information for Champaign came from the Champaign City Planning Office.

The model was estimated by taking natural logarithms of both sides of equation (2) and utilizing Ordinary Least Squares. The results of the estimation are as follows:

$$\begin{aligned} \ln SP_i = {} & \underset{(5.938)}{2.040} + \underset{(4.095)}{0.389}\ \ln LOT_i + \underset{(2.304)}{0.602}\ COM \\ & \underset{(-4.634)}{-0.793}\ SRES_i - \underset{(-1.717)}{0.151}\ QUAD_i + \underset{(2.163)}{0.362}(CdeS_i * ARES) \\ & + \underset{(2.036)}{0.223}\ GRTH_i - \underset{(1.577)}{0.224}\ CORN_i + \\ & \underset{(1.535)}{0.494}(NSRES_i * HTRF_i) + \underset{(0.942)}{0.011}\ MOS_i \end{aligned} \quad (3)$$

(t ratios in parentheses; d.f. = 114)

The adjusted coefficient of determination is 0.38. (A correlation matrix for the explanatory variables is shown in Table 1.) The coefficients on the $\ln LOT_i$, $COMM_i$, $SRES_i$, $QUAD_i$, $CdeS_i$*ARES, $GRTH_i$ are significantly different from zero at the 90 percent level of confidence. The coefficients on the $CORN_i$ and $NSRES_i$*$HTRF_i$ dummy variables are significantly positive (one-tail) at the 90 percent level of confidence.

The estimated coefficients on the zoning variables strongly suggest that governmental zoning is allocatively inefficient in Champaign-Urbana. The dummy variable $COMM_i$ (commercial zoning) proved to have a substantial positive impact on land values. By subtracting one from the antilog of the coefficient on $COMM_i$, commercial zoning appears to add 83 percent to value. On the other hand, the dummy variable $SRES_i$ (single-family residential zoning) proved to have a substantial negative impact on land value. Subtracting the antilog of the coefficient on $SRES_i$ from unity indicates that single-family residential zoning causes a 55 percent decline in value. The coefficient on the commercial zoning dummy variable is significantly positive at the 95 percent level of confidence, while the coefficient on the single-family zoning dummy variable is significantly negative at 99 percent level of confidence. According to the theory presented earlier, these results indicate that land in Champaign-Urbana is overallocated to single-family residential and underallocated to commercial.

The plattage hypothesis was borne out by the estimation. The coefficient on LOT_i is significantly greater than 0 and less than 1 at the 99 percent level of confidence.

The five variables having to do with location worked as hypothesized. In equation (3), land value is shown to be a negative exponential function of distance from the University of Illinois quad. The land value gradient was estimated to be .151. Location in the path of most urban growth and location on a corner lot proved to increase land price by 25 percent each. Location on a high traffic street was estimated to increase the value of land zoned (except for single-family property) by 64 percent.

The monthly rate of appreciation was estimated to be 1.1 percent which is equivalent to an annual rate of 13.2

percent. This annual rate is close to the 15.6 percent rate estimated by Colwell and Sirmans (1978) for the period 1969 to 1975. However the coefficient here does not differ significantly from zero, whereas it does in the Colwell and Sirmans paper. The main reason for this difference is that as the urban bid-rent function shifts upward over time, the price of peripheral land in transition from agricultural to urban uses is determined by the agricultural land price and not by the height of the bid-rent function. Most vacant lot sales tend to be more or less peripheral. Thus the coefficient on the month of sale variable is more indicative of the experience of agricultural land prices than urban land prices. There is independent evidence that suggests that agricultural land prices were relatively stable over the study period, whereas they increased dramatically over the earlier period.

constituents in a community like Champaign-Urbana may be attempting to foster single-family residential activity by protecting it from the competition of lower uses. Or, planners may be trying to maximize land value. Still another possible explanation is that the planning processes are too chaotic to be goal-oriented. Regardless of the motives of the planners, it is quite likely that government zoning is misallocating land in Champaign-Urbana.

The empirical study also reveals the effects of a number of control variables on land value. Lot size is among the more important of these variables. The selling price of land increases at a decreasing rate as absolute lot area increases. Without this feature built into the model, one land use type might appear to have a higher (or lower) price than another just because typical lot size is lower (or higher). A cul-de-sac variable had positive effects on the price of land zoned for residential use.

The primary intent of the location variables included in the model were to determine the desirability of sites for commercial purposes. Land values were shown to decline as distance to the University of Illinois quad increases. Location in the path of most urban growth and corner location had positive impacts on value. Finally, location on a busy street proved to have a positive impact on the price of land zoned for uses other than single-family.

TABLE

Variable Correlation Matrix

	$CORN_i$	$CdeS_i$*ARES	$SKIRBY_i$	MOS_i	$QUAD_i$	1n LOT_i	$SRES_i$	$COMM_i$
$CdeS*ARES_i$	0.09793							
$SKIRBY_i$	−0.07945	0.13504						
MOS_i	0.00973	−0.09917	0.15706					
$QUAD_i$	−0.29716	0.00242	0.32423	0.06040				
1n LOT_i	0.04246	−0.04050	−0.15561	−0.02365	0.12471			
$SRES_i$	0.02910	0.28529	−0.01922	−0.15380	0.15061	0.00516		
$COMM_i$	0.08342	−0.17508	−0.02177	0.08494	−0.17934	−0.02250	−0.53313	
$NSRES_i$*$HTRF_i$	0.13474	−0.03088	−0.05668	−0.12089	−0.19376	−0.07249	−0.13725	0.07317

Conclusions

Relative land prices can signal certain resource allocation problems caused by government zoning. This empirical study of land values in Champaign-Urbana suggests that local government zoning is overallocating land to the highest uses and underallocating land to the lowest ones. This conclusion is based on the finding that the price of land zoned for single-family use is less than the price for multi-family which is, in turn, less than the price for commercial.

One explanation for this may be that planners and their

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