Effects of Zoning on Residential Option Value

By

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Abstract Knowing more precisely how zoning affects housing value would allow policy-makers to improve long-term policy decisions. Previous studies have concluded that local zoning regulations affect residential option value. These studies, however, do not specify the magnitude of the effect for varying zoning types. This study quantifies zoning's effect on residential option value for specific types of zoning using a hedonic regression model of housing prices. The study utilizes information on housing characteristics and sales prices for a cross-section of houses in Monongalia County, West Virginia. The research develops two models to differentiate between zoning effects on developed versus undeveloped properties. The research finds that R1 and R1a zoning regulations – the most common types of residential zoning in Monongalia County – significantly impact housing value.

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I. Introduction

Housing value plays an important role in the economy. Housing constitutes the major form of wealth for low and middle class households. People seeking loans to finance a business or property improvements often take out a mortgage or home equity loan, offering their home as collateral. This is an extremely important use of one's housing value since these capital investments likely produce net positive long-term effects allowing the economy to grow more quickly. Moreover, governments tax (property taxes) housing value, usually at the local level, to finance public services.

Land use zoning may impact housing value. This government policy restricts property to a narrow range of uses or specific use. Once land is zoned, the owner must obtain permits to alter the property. Government generally grants these permits only for "legitimate uses" of the land. When governments zone land, they may change the supply of land for that particular use. For example, before a zoning ordinance is enacted 200 lots of land may be available for rental housing, but afterwards a city may only allow 100 lots of land to be used for rental housing. As a result, the price of rental housing would likely increase since zoning has reduced the supply of available lots by 50 percent. The new zoning may also decrease the allowed use of the permitted rental properties. For example, initially any number of people may have been able to live in these properties, but zoning might allow a maximum of only three adults to live in an apartment. This limitation on use may decrease the property's value. The change in property value due to zoning is known as option value. This externality may or may not be positive. To account for changes in option value, good government must know specifically how and by what magnitude land use zoning affects the option value of property.

This research examines whether zoning affects the value of residential property. To address this issue, I apply a hedonic regression model to the housing and land markets in Monongalia County, WV. The study will consider differentiation of zoning's effect between different residential zones. It will add to current knowledge about this topic and will help government choose zoning options more carefully in the future.

The relationship between land use patterns and property value is studied often due to the increasing need for urban planning. My study will follow a model similar to previous researchers. I will, however, add new independent variables that may better account for location influences and use different housing characteristic criteria. I will also find the effect of different zoning types on residential property option value. In short, my study will be more specific, which should yield more precise applications to land use planning in the future.

II. Literature Review

Zoning

Some effects of zoning have been previously studied. When local government mandates land use zoning, many homes and businesses substitute more complex structures (i.e. taller buildings) for increased land use since the supply has changed. Phillips and Goodstein (2000) estimated the change in mean housing price changes in Portland, Oregon due to implementation of the Urban Growth Boundary (UGB), a type of zoning that restricts land use beyond a geographic range. They compared Portland's housing prices to prices in other major cities around the country and found that the UGB has likely imposed upward pressure on prices, but their results indicate a modest impact. The downfall of this estimate may be that their data compared very different cities without accounting for other variables such as historical

significance. Grissom and Wang (1991) found rental properties to negatively affect the sales price of nearby single-family residences, thus indicating that zoning land for multiple-family occupancy may decrease a city's average property values. Interestingly, Turnbull (1991) showed that zoning alters development paths in growing cities so that development temporarily stops in some places while leap-frog development occurs in others, disrupting normal growth in both cases.

Hedonic Modeling and Zoning

A hedonic model relates the price or value of an asset to its bundle of non-separable component characteristics. The starting point is that the total market value of an asset must be the sum of the market values of its component characteristics. In a hedonic regression, the estimated coefficient of each characteristic reveals the change in the value of the asset for a one unit change in the characteristic, all else equal. Thus, it reveals the implicit price (unit value) of the characteristic. For example, the value of a house relies upon certain characteristics such as the building area, number of bathrooms, and number of bedrooms. One cannot effectively separate each of these variables since you cannot sell them individually in the real world (i.e. you cannot sell one bathroom, one bedroom, or one square foot of the building). Using a hedonic regression, we can estimate how much each unit of each characteristic contributes to the value of a house.

Some important literature uses hedonic modeling to explore zoning's effects. Using a regression model that tabulated results based on housing survey characteristics in a Houston suburb, Groves and Helland (2000) found that zoning negatively affects the option value of property when its best use is commercial and it is zoned residential. They also concluded that zoning positively affects the option value of property when its best use is residential and it is

zoned residential. Although the suburb may not be especially representative of the population of cities due to boundary effects (Houston exerting pressure on prices in one way or another), the research still yielded valuable findings. Glaeser and Gyourko (2002) used a hedonic model to discover that high housing prices in densely populated areas such as New York City and California indicate an increased likelihood that zoning will affect the price of housing. This makes high-priced housing value more susceptible to zoning regulations.

All of the previously mentioned articles indicated that zoning may have a price-increasing effect on housing if the government uses supply-side regulation without paying attention to individual housing characteristics. On the other hand, a price-decreasing effect may appear if government uses regulation that pays attention to individual characteristics. While zoning may affect property prices negatively in the short-run, the long-run effect is not clear. The effects found by Turnbull (1991) and by Glaeser and Gyourko (2002) may vanish over time.

III. The Model

To evaluate the effect of zoning on residential property value, one must consider the effects of many different variables. Location characteristics are relevant in analyzing housing prices. Proximity to employment, recreation, roads, shopping centers, and many other agglomerations should increase the price of residential property as long as they do not produce negative externalities, in which case they should lower the value of the property. Public policy constraints and subsidies that include all types of land-use regulation and taxes will affect the value of one's property by increasing or decreasing the incentive to own it. One must also consider the influence of public good provision and the presence of amenities. They create desirability differences between pieces of property, thus creating differences in market value.

The models developed below were applied to Monongalia County, WV. Analysis was conducted on a cross-sectional basis, with Morgantown, Star City, and Westover being the only districts in Monongalia County having any land use zoning legislation.

The research considers two separate models to study zoning, one for developed residential property, the other for undeveloped property. For each model, the dependent variable is the natural log of total property value. Table 1 shows definitions for all variables. The residential property model is:

Log(Value) = f(R1, R1a, R2, R3, Star City, Westover, Union District, log(Land Area), Age, Agesq, log(Building Area), log(Bathrooms), Basement, Poor Condition, Excellent Condition, Tax Rate, Distance) (1)

The undeveloped property model is:

Log(Value) = f(R1, R1a, R2, R3, Star City, Westover, Union District, log(Land Area), Tax Rate, Distance) (2)

As suggested in earlier sections of this paper, all zoning variables (R1, R1a, R2, and R3) are expected to change the value of residential property relative to leaving it unzoned. When a property lies within Star City or Westover, a decrease in residential value may occur relative to property in Morgantown due to decreased amenities available for public consumption in those municipalities. On the other hand, if a property is in the Union District, which entirely contains a high-valued amenity, Cheat Lake, an increase in residential value may occur relative to other unincorporated areas. An increase in either land area or building area should increase the value of residential property, but the effect will decrease as either variable grows larger. The same effect is expected for an increase in the number of bathrooms. Age is a special variable. As a building's age increases, the value of the property is expected to decrease to a certain point, after which age becomes a valued amenity to prospective buyers. Hence, a quadratic form of the age variable was used to simulate its effects on residential property value. An increase in tax rate

should decrease the value of the property since a higher tax burden will be capitalized into a lower price of housing (i.e., potential buyers would be willing to pay less in the face of higher taxes, all else equal). An increase in distance should also decrease the value of residential property due to relatively greater demand for property nearer to the central city (Morgantown), all else equal.

IV. Data

Official data used by the Monongalia County Assessor's Office was obtained[1]. The data set includes the entire population of residential and business property in Monongalia County, nearly 68,000 observations. Only residential property (Class II) is used in the analysis and any observation with missing data was eliminated. For the first model, the sample includes only those residential properties with a building (developed). For the second model, the sample includes only those residential properties which have no building (undeveloped). The first sample contains 17,123 observations while the second contains 14,926.

The Monongalia County data included all important variables except for zoning, tax rate, and distance. I used a combination of housing address, zoning maps, and the neighborhood variables included in the data to find the current zoning for each address. Tax policy effects were accounted for by observing which district each address was in and inputting the current tax levy rate. The research accounted for distance by including dummy variables for location in each district and computing an average distance from downtown Morgantown for each district location using mapping software and observed concentrations of population.

Table 2 shows descriptive statistics for the variables used in the study. The majority of both developed and undeveloped residential property in Monongalia County was unzoned. Of

1 The Assessor's data was provided by SpecPrint, Inc. of Timonium, Maryland. The Monongalia County Assessor's Office contracts out to SpecPrint, Inc.

the zoned property, the majority was zoned as type R1a. Older areas tend to be more densely developed, thus giving reason for them to be zoned R1a. Newer developed properties should tend to be zoned any of the other three types of zoning. Land area in square feet was greater for undeveloped property. Undeveloped lots may be resized so that they are smaller as they become more developed over time. Distance from Morgantown Corporation was greater for undeveloped property due to normal centralized patterns of property development.

V. Results

Table 3 shows the regression results for the first model (developed property). All coefficients are significant at the one percent level with the exception of Basement (which was significant at the five percent level) and R2 and Star City which are not significant even at the ten percent level. The model R-Square is 0.75.

Since the R2 zoning is most like unzoned areas, which allows the most diverse use of the property, its statistical insignificance is not surprising. R1 zoning, with a parameter estimate of 0.49, had a greater impact on housing value than did the other zoning types. A 49 percent increase in total value occurs when developed property is zoned R1. Most residential properties in zoned areas (Morgantown, Star City, and Westover districts) are zoned R1a. R1a had the second largest effect on housing price with a 30.7 percent increase in total value. Since properties zoned R1 or R1a are normally larger in lot size compared with R2 and R3 properties, it makes sense that zoning has a stronger effect.

Unzoned properties in the Union District, which includes Cheat Lake, were significantly more valuable than those that lie in other unzoned districts. Interestingly, the tax rate for this model is nearly unitary elastic (a 1 percent increase in tax rate decreases the value of the property

by 1 percent)[2]. Unitary elasticity of the tax rate confirms our assumption that the tax rate is capitalized in the value of the property. Signs for the other variables in the model are as expected.

Table 4 shows regression results for undeveloped property. All variables except for R2, R3, and Star City are significant at the 1 percent level. R3 is significant at the 10 percent level while R2 and Star City are not. The R-Square estimate for the second model is .1560.

R1a zoning significantly lowers the value of undeveloped properties. A 10.1 percent drop in total value occurs when undeveloped property is zoned R1a. Perhaps this effect occurs because R1a zoning does not restrict the use of undeveloped property sufficiently. For R1 zoning, which is more restrictive, owners may feel that the restrictions protect their property from encroachment. Since R1a zoning lacks the protective properties of R1 zoning, R1a properties may have lower demand. Undeveloped property zoned R1 experiences an average 36.1 percent increase in total value. Perhaps demand for undeveloped properties in zoned areas of Monongalia County is concentrated in developing R1 type properties. R3 zoning increases the value of undeveloped properties by 22.15 percent. R2 zoning did not significantly differ from unzoned properties. Once again, the tax rate has a nearly unitary elastic effect on residential value[3].

[2] For example, when the tax rate mean (1.17 %) increases by 1 percent to 2.17 percent, the price of housing decreases by nearly the same percent (2.17 x -.4688 = -1.0173%).
[3] For example, when the tax rate mean (1.17 %) increases by 1 percent to 2.17 percent, the price of housing decreases by nearly the same percent (2.17 x -.4130 = -0.8962%).

VI. Conclusion

According to the results and following from the hypothesis, zoning does affect residential property value. R1 zoning, which is more restrictive than other types of zoning, tends to have the largest effect on residential property value in both the developed and undeveloped cases. In the developed case, all significant zoning options affect the value of residential property positively, raising their value. In the undeveloped case, the R1a zoning option seems to affect residential property value negatively, decreasing its value, while the R1 option increases its value. Undeveloped properties are more sensitive to zoning because zoning is more restrictive when development of that property is taken into consideration. The effect of zoning on the value of residential property in both cases can be explained on the demand side by restriction of demand to a certain use, which could decrease the value. Zoning may be seen by residents as a protection of their rights while it decreases options for developers. Understandably then, undeveloped property is affected differently than developed property. On the supply side, zoning restricts the supply of residential property according to categories of use, which could raise value. Much consideration needs to be taken into account when public entities zone residential property; the effects could be helpful or disastrous.

In future studies, one needs to account more for the subjectivity of the assessed value of the properties. Each assessor gives his or her professional opinion on the value of the property, but it is only an opinion; a buyer may value the property more or less than the assessor. Moreover, since this study focuses only on property in Monongalia County, West Virginia it may not be applicable to some other areas of the world that are significantly different in their economic characteristics. For example, Monongalia County is economically very different from New York City, NY, Sun City, AZ, and Moscow, Russia. Given more time, the distance for

each property from important locations can also be compiled with the use of GIS making the data more reliable. Moreover, better measures need to be developed to accurately separate the effects of the differentiation of provision of public services within and outside a municipality.

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Table 1. Definitions of Variables.

Value	The total dollar value of the property (building and land) as assessed by county authorities.
R1	Equals 1 if zoned R1, equals 0 otherwise. Primarily a single-family property and includes most of the territory designated for residential use outside of the central business district of Morgantown as well as some areas within it.
R1a	Equals 1 if zoned R1a, equals 0 otherwise. Primarily a single-family property in older areas with lots which do not meet the R1 standards.
R2	Equals 1 if zoned R2, equals 0 otherwise. Primarily a single-family and two-family residence district. Multi-family dwellings are permitted as conditional uses, and requirements for minimum lot size, ground floor area of structures and maximum height of buildings are somewhat less stringent than the requirements of the R1 and R1a districts.
R3	Equals 1 if zoned R3, equals 0 otherwise. Permits all types of residential use, including those parts of the city which are most densely built-up and contain a number of two- and multi-family dwellings. The minimum lot size requirements for dwellings in this District are lower to permit greater population densities close to the business and industrial areas.
Star City	Equals 1 if in Star City, equals 0 otherwise.
Westover	Equals 1 if in Westover, equals 0 otherwise.
Union District	Equals 1 if in Union District, equals 0 otherwise.
Land Area	The property's land area in square feet.
Age	The age of any building included in the property.
Building Area	The area in square feet of all buildings on the property.
Bathrooms	The number of bathrooms on the property.
Basement	Equals 1 if the property contains a basement of any kind, equals 0 Otherwise.
Poor Condition	Equals 1 if structures on the property were labeled by the assessor as being in poor condition, equals 0 otherwise.
Excellent Condition	Equals 1 if structures on the property were labeled by the assessor as being in excellent condition, equals 0 otherwise.
Tax Rate	The tax levy rate for the property (as a percentage of value).
Distance	The distance measured from a central population point in the property's district to a central population point in the City of Morgantown.

Table 2. Descriptive Statistics for All Variables.

Developed Residential Property				
Observations	17,123			
Variable	***Mean***	***Highest Value***	***Lowest Value***	***Value was Yes***
Value	93,441	1,451,900	1,100	(NA)
R1				1,082
R1a				4,476
R2				35
R3				108
Star City				358
Westover				1,062
Union District				3,179
Land Area	276,095	1,876,739,040	175	(NA)
Age	43	304	1	(NA)
Building Area	1,637	25,226	300	(NA)
Bathrooms	1.6	8.2	0.1	(NA)
Basement				14,401
Poor Condition				13
Excellent Condition				180
Tax Rate	1.17	1.35	1.10	(NA)
Distance	6.04	26.26	0.10	(NA)
Undeveloped Residential Property				
Observations	14,926			
Variable	***Mean***	***Highest Value***	***Lowest Value***	***Value was Yes***
Value	11,056	3,602,200	100	(NA)
R1				386
R1a				3,238
R2				73
R3				61
Star City				213
Westover				576
Union District				2,509
Land Area	309,024	2,091,542,091	100	(NA)
Tax Rate	1.9	2.72	1.11	(NA)
Distance	7.9	26.26	0.10	(NA)

Table 3. Parameter Estimates for Developed Residential Property.

Variable	*Parameter Estimate*	*Standard Error*	*t-Value*
R1	0.4934	0.0265	18.56***
R1a	0.3070	0.0250	12.25***
R2	0.0812	0.0627	1.30
R3	0.2215	0.0406	5.45***
Star City	-0.0168	0.0190	-0.88
Westover	-0.1031	0.0122	-8.39***
Union District	0.2037	0.0073	27.79***
Log(Land Area)	0.0406	0.0021	19.32***
Age	-0.0124	0.0002	-47.17***
Agesq	0.0000	0.0000	23.13***
Log(Building Area)	0.8641	0.0083	104.15***
Log(Bathrooms)	0.2486	0.0084	29.30***
Basement	0.0155	0.0072	2.16**
Poor Condition	-0.6989	0.0972	-7.19***
Excellent Condition	0.1449	0.0257	5.64***
Tax Rate	-0.4688	0.1124	-4.17***
Distance	-0.0161	0.0007	-22.60***
F-Value	2971.74		
R-Square	0.7471		
Adjusted R-Square	0.7468		

*** *Significant at the one percent level.*
** *Significant at the five percent level.*
* *Significant at the ten percent level.*

Table 4. Parameter Estimates for Undeveloped Residential Property.

Variable	*Parameter Estimate*	*Standard Error*	*t-Value*
R1	0.3610	0.0218	16.52***
R1a	-0.1010	0.0149	-6.74***
R2	-0.0136	0.0389	-0.35
R3	-0.0831	0.0314	-2.65***
Star City	0.0088	0.0315	0.28
Westover	-0.1802	0.0189	-9.51***
Union District	0.5267	0.0124	42.45***
Log(Land Area)	0.5410	0.0019	28.56***
Tax Rate	-0.4130	0.0142	-28.98***
Distance	-0.220	0.0011	-19.56***
F-Value	275.68		
R-Square	0.1560		
Adjusted R-Square	0.1557		

*** *Significant at the one percent level.*
** *Significant at the five percent level.*
* *Significant at the ten percent level.*