Public Parks, Housing Values, and

Fiscal Flexibility

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Abstract: This research seeks to analyze local financing options for the construction and operation of park and recreational facilities in West Virginia. En route to accomplishing this objective, we perform an hedonic estimates of park and recreational amenities in Charleston and Huntington, in order to evaluate welfare gains associated with these amenities. We find that the presence of a park increases home values within a census tract by roughly $2,600. A fitness facility or trail increases median home value in a census tract by between $10,600 and $11, 060 depending upon model specification. The total welfare gains of the two park systems we analyze total roughly $280 million in property value enhancements. This, in turn generates roughly $980,000 annually in incremental property tax revenues. This suggests that tax increment financing may be a viable revenue source for construction and operation of these types of recreational facilities.

1. Introduction

A number of relatively recent publications have associated proximity to parks and other recreational facilities with housing values through the estimation of hedonic pricing models (Vaugghn, 1981; Palmquist, 1992; Espey and Owusu-Edusai, 2001; Lutzenhiser and Netusil, 2000; and Geohegan, 2002). Not surprisingly, homes with ready access to such facilities are generally more valuable when other price-determining attributes are accounted for. Within the current analysis we offer two additional examples that illustrate this linkage. As importantly, we extend these illustrations to consider the implications that altered property values may have on the ability to finance future park developments.

The remainder of this manuscript is organized in the following fashion – Section 2 provides a description of the communities on which the study is based. Section 3 describes available data, empirical model specification and estimation issues. Empirical results and their policy implication are provided in Section 4, while Section 5 contains a few concluding remarks.

2. The Study Communities

During 2002 and 2003, Marshall University's Center for Business and Economic Research prepared Recovery Action Plans (RAP's) for the cities of Charleston and Huntington, West Virginia. [1] Demographically and economically, the two communities are very similar. Both have populations of approximately 50,000. Both have predominantly white, working class populations. And both have faced significant fiscal challenges within recent years.

[1] A Recovery Action Plan is a comprehensive analysis of park amenities, activities, resources and local demand that is performed in five year increments in order to qualify parks for a suite of federal construction funding.

Each RAP includes a thorough inventory of all park and recreational facilities. In compiling these inventories, the study team used global positioning system (GPS) measurements to precisely locate each facility. This, in turn, made it possible to integrate facility attributes with census data describing demographic and economic characteristics.

3. Data and Model Estimation

The hedonic pricing approach introduced by Rosen [1974] is a well developed method of estimating implicit prices of characteristics on a heterogeneous good. Amenity estimates using the hedonic pricing models have been applied to recreation areas and parks (Vaughn, 1981; Palmquist, 1992; Espey and Owusu-Edusai, 2001; and Geohegan, 2002). Concerns regarding hedonic pricing models have focused on functional form (Blomquist and Worley, 1981), specification (Mcmillen and McDonald, 1989), data inaccuracy (Dombrow, 1997) and sample efficacy (Schultz and King, 2001). The latter paper addresses the aggregation issues regarding open space amenities. This is of particular concern to us since we are both estimating implicit prices for park and recreation amenities as well as employing Census data that is regionally aggregated. Schultz and King find that “aggregation of land-use data by alternative levels of census geography does not appear to seriously affect the overall quality of marginal implicit prices estimates for open-space amenities” (2001, pg. 250). The authors also note the cost and availability restrictions on geographically coded micro-data sets employing actual transactions data (Multi-Listing Service (MLS) or Tax Assessment data). These findings largely motivate our ability to conduct this analysis since within our sampled area geocoded MLS and assessor data are unavailable.

The data we employ for park characteristics were collected as part of the regional park RAP studies. Each park was individually geocoded using GPS technology and portrayed on a Mercator projection of West Virginia. Assignment of each park to a Census tract was performed manually. This process largely removes from concern expressed by Schultz and King [2001] that aggregation to the Census tract may miss the conterminous effects of park and recreational areas since the Census designations are largely bounded by public infrastructure such as roads. This problem may also be addressed through the use of corrections for spatial autocorrelation.

The dependent variable is the median home value for each Census block within the region serviced by the two Park and Recreation Districts. Notably, unlike many other studies of urban amenities, both park districts serve rural, as well as urban, areas. This is due both to the steep urbanization gradient in both regions as well as the increasingly centralized fiscal situation in West Virginia. Simply, over the past three decades the park systems for both of these cities have been tasked to provide amenities to rural areas as well as the cities the Districts were originally formed to service. The regressors we employ are common to the hedonic pricing models and serve primarily as control variables in this estimation.

The park facilities data presented earlier were employed as presence dummies in this estimation with only a few adjustments. We aggregated sports specific recreational facilities (e.g. baseball, soccer and basketball) as well as running and fitness facilities.

The basic hedonic model then takes the form:

$$\begin{aligned}\text{MEDHHVALUE} = {} & \exists_1 + \exists_2(\text{MEDNUMROOMS}) + \exists_3(\text{AVGHHSIZE}) + \exists_4(\text{HHAGE}) + \\ & \exists_5(\text{OCCUPYRATE}) + \exists_6(\text{PCINCOME}) + \exists_7(\text{POPDENS}) + \exists_8(\text{PERLTHS}) + \\ & \exists_9(\text{FITCENTER}) + \exists_{10}(\text{NUMPARK}) + \exists_{11}(\text{PLAYGROUND}) + \exists_{12}(\text{RESTROOM}) + \\ & \exists_{13}(\text{TENNISCRTS}) + \exists_{14}(2) + :\end{aligned}$$

Data definitions and descriptive statistics are reported in Table 1 except.for 2, which is the spatial autocorrelation function and : the normally distributed error term.[2] The spatial autocorrelation function permits a second correction for potential aggregation bias. A spatial autocorrelation function is formally the value of the dependent variable in region *j*, weighted for distance from region *i*, the more aggregated variable. In practice, either the mean of the home value for the contiguous census tracts or some more highly aggregated geographic measure (say county or city) is typically employed. We tested both, finding a better goodness of fit with the county level variable.

Table 1, Descriptive Statistics of Regressors

	Definition	Mean	Maximum	Minimum	Std. Dev.
MEDHHVALUE	Median Home Value	$77,787	$198,000	$31,700	$27,078
MEDNUMROOMS	Median Number of Rooms	5.46	7.50	3.00	0.73
AVGHHSIZE	Average House Size	2.13	4.41	1.36	0.35
HHAGE	Median House Age	42.1	64.0	23.0	11.4
OCCUPRATE	Occupancy Rate	0.91	0.97	0.80	0.03
PCINCOME	Per Capita Income	$18,444	$45,228	$4,312	$6,887
POPDENS	Population Density	2,162	10,218	28	2,374
PERLTHS	Pct. Completing High School	0.22	0.47	0.04	0.10
FITCENTER	0/1 Fitness Center or Trail	0.04	1	0	.203
NUMPARK	Number of Parks	0.75	0	9	1.411
PLAYGROUND	0/1 Playground	0.17	0	1	0.37
RESTROOM	0/1 Restroom	0.15	1	0	0.35
TENNISCRT	0/1 Tennis Court	0.07	1	0	0.26

As with most other applications of the hedonic pricing model establishing a functional form is problematic. Theory provides little direction for this concern, and the literature regarding non-linearities in amenities provides little consistent empirical evidence from which to select a deviation from a linear assumption. In addition to a number of functional form adjustments

[2] An ethnic variables was also available, but was not statistically significant at any reasonable level and so was omitted from the regression. Parameter estimates were not sensitive to this omission, the log likelihood ratio value was 8= 0.09 with a probability of 0.34.

(e.g., log, semi-log) we employed a Box-Cox Transformation and tested for linearity. Specifically, the Box-Cox Transformation provides for a conversion of the dependent variable where the linear form is transformed through the value (MEDHHVALUE^{8} - 1)/ 8. In practice testing through a range of 8 values provides closer approximation of non-linear form. Also, testing against a null of linearity is an alternative method. Employing the standard likelihood ratio test we were unable to reject linearity in this model, a finding that is closely supported by the classic article regarding housing markets and functional form (Cropper, Deck and McConnell, 1988).

We estimated several models that included park characteristics. We were able to reject most characteristics from our set of choices due to small number of observations. Two models were constructed from the basic version presented above, one with, and the other without the spatial component. Results are reported in Table 4.

Table 4, Regression Results, Dependent Variable = MEDHHVALUE, n=93

	Model 1		Model 2	
Variable	Coefficient	t-Statistic	Coefficient	t-Statistic
C	87177.3***	2.547744	-118803	-1.20435
MEDNUMROOMS	152.8475	0.049938	2311.661	0.786236
AVGHHSIZE	-4339.2	-1.23325	-5663.54	-1.62448
HHAGE	-853.401***	-5.62406	-962.489***	-5.92481
OCCUPANCYRATE	-17877.3	-0.40047	-38781.1	-0.8066
PCINCOME	3.086618***	5.549816	2.928026***	5.167956
POPDENS	1.052943	1.280608	1.545098*	1.854746
PERLTHS	-41662.3***	-2.44457	-37557.8***	-2.29596
PERURBAN	-1511.36	-0.34272	-726.302	-0.15835
Fitness Trail	11023.54***	2.834518	10657.52***	2.806544
Park Presence	2591.098***	2.230527	2655.559***	2.52564
Picnic/Playground	-2425.18	-0.82221	-2701.07	-0.95129
Restroom	-662.179	-0.11454	1396.763	0.233481
Tennis Courts	-1410.19	-0.43456	-1876.56	-0.54907
2_{I}			3.146476***	2.002321
Adjusted R-squared	0.87114		0.876213	
Durbin-Watson stat	1.541953		1.621785	

4. Estimation Results and Policy Implications

The overall fit for both models is extraordinarily good with only 13 percent of the variation in median housing prices going unexplained. Of the independent variables designed to capture variations in housing and household characteristics, three are statistically significant. Newer houses are of greater value. Households with greater incomes purchase more expensive homes. And communities with a greater level of educational attainment tend to occupy residences of greater value. These are consistent with all the existing literature regarding hedonic pricing of housing.

Of the variables denoting the presence of recreational facilities, two are statistically significant. The addition of a park to any given census track adds $2,535 dollars to the median value of homes within that track with a 90 percent confidence interval of $2,101 to $3,207. The addition of a jogging or fitness trail contributes $11,059 to the median home value, with a 90 percent confidence interval from $8,658 to $12,654. The estimated marginal impacts of available park and recreation facilities are entirely consistent with those obtained by other researchers.[3] However, past research on this topic has rarely extended marginal effects to estimate the aggregate impact on housing values within an affected community. Welfare impacts are typically measured by integrating the impacts across the demand curve. Assuming that marginal impacts are roughly consistent with average impacts, the parameter estimates provided in Table 4 suggest that, in total, the availability of parks and other recreation facilities contribute nearly $280 million to the value of residential properties in the two communities.[4]

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3 Of particular note is the remarkable proximity of our estimates with those of Lutzenhiser and Netusil (2000) who found natural area park impacts had a $10,648 impact on home prices.

[4] Given that the mean number of facilities within those census tracks where any facility is present is 1.09, this assumption is not unreasonable.

Extending the individual values to derive an aggregate impact has a number of interesting public policy implications. First, it is clear that the development of recreation facilities simultaneously creates wealth for residential owners of nearby property. Theoretically, these residents might, therefore, be asked to contribute to the financing of new recreation projects. However, such a course is likely to prove impractical. A far more tractable approach may involve the use of *tax increment financing* (TIF) to generate funds for new recreational projects. The process is relatively simple. Analysts estimate the degree to which a proposed project will increase property values. It is then a simple matter to calculate the incremental increase in property tax revenues attributable to the project. It is, then, possible to bond against the projected incremental revenue stream in order to raise necessary construction funds.

Again, in the current example, the presence of parks and trails is responsible for $280 in housing values. Based on a weighted average property tax rate of $0.35 per hundred dollars of assessed value, these recreational facilities could be responsible for roughly $980,000 annually if property assessments reflect amenity-related variations in home prices. Had this information been available at the time of construction, these incremental revenues might have been used as a funding source for parks and recreation.

5. Summary and Conclusions

Using census track level data describing housing and household characteristics, in combination with primary data recreation facility, the current analysis successfully measures the relationship between available recreational amenities and housing values in two West Virginia communities. These results suggest that the presence of parks and recreational trails significantly increase housing values. Thus, the process of creating new recreational facilities can also create wealth for residents who live nearby. While it may be impossible for communities to directly recover any of the newly created wealth, the increased hosing values can yield incremental increases in property tax revenue streams that can be used to at least partially fund the project in question through the use of tax increment financing.

6. References

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