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Econ 345

Durham Paper: Externalities of Public Parks

Introduction and Economic Theory:

Milton Friedman rationalizes the provision of public parks for two reasons; charging users for use of the service is inefficient because the high costs associated with collection and non-users also experience externalities from the park. Parks create positive, external benefits for non-users as they enjoy the park's scenery rather than use of services such as tennis courts, grills, park benches, and baseball fields, which are reserved for users. Non-users can be broken down into two main groups, the first group consists of passer-byers and the second are those who live within sight of the park who can experience the positive externalities of the scenery from their own property.[1] The positive externalities are hard to measure for the passer-byers, so from this point on, non-users will refer only to homeowners who live nearby the park and experience externalities associated with it.

The following paper focuses on quantification of the externalities of parks for both users and non-users. As stated above, non-users receive positive externalities due to the scenery of the park, so abutters to the park are those that benefit. The supply of such sites is fixed, therefore, families that value the aesthetics of a park have to bid for the land and subsequently increase the demand for the land. The difference in price between an abutter's property and a property away from the park site should be a quantitative representation of the value of the externalities of the park. If the price difference deviates from the value of the externalities, families will choose to either sell or purchase properties and dive down or up, respectively, the price of those properties. No one will move when the residential price differences match, making the price differences an accurate representation of the value of the externalities.[2]

Aside from the ability to quantify the resulting positive or negative externalities of parks on homeowners, various attributes of individual parks make it easier to formulate a hypothesis about the park's potential externalities. While the scenery of the park is a positive externality of living near a park is the scenery it provides, different aspects of certain parks

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[1] Weigher and Zerbst (1973); these are basic principles established in their paper which measured externalities of neighborhood parks, similar to the Rockwood Park, which is the basis of my study
[2] Julius Margolis (1968), he applied this theory to neighborhoods abutting park property opposed to individual homes, but the theory still applies here

can yield negative externalities. Parks with baseball fields typically result in negative externalities, and, consequently, a decrease in surrounding home values. Residents feel it creates a loss of privacy and, in some cases, potential danger to property from stray baseballs. Highly used parks create traffic, noise pollution, litter, and more strangers in the area, which can depress the value of surrounding homes. Also, parks with high walls or parks that are set extremely far back can attract people at night who partake in legal or illegal activities, possibly creating a feeling of an unsafe environment for surrounding homeowners.

Rockwood Park is specifically used in this study. The park is located far away from main roads and is settled nicely between a few surrounding neighborhoods. The main traffic comes from families with small children using the smaller and larger playgrounds during the day. No baseball fields are located inside the park and only a small basketball court, set further back in the park, could possibly field a sports team, thereby increasing noise pollution for small periods of time. The park has a few grills, picnic benches, and a small shelter near the picnic area. It does not exhibit and excess of the qualities that typically drive down the value of surrounding homes and provides good scenery for abutting homeowners. Therefore, Rockwood Park is believed to be a positive asset to the surrounding neighborhoods, subsequently increasing the value of abutter's homes.

Abutters are not the only ones to experience benefits from living near a park. Studies have focused on determining the range of positive externalities for users living close to a park or open space. One study[3] in Portland, Oregon, focused on the change in real estate values for homes near open spaces. The authors concluded that home values rise $2,262 (1990 dollars) if they are located within 1500 ft. - a five-minute walk at a pace of five feet per second - of a public park. The five-minute walk radius has also been used in neighborhood planning models, see Kelbaugh (1989), as a calculated distance where people believe they benefit from living close to a park. Some other studies, Alexander (1977), suggest that park use declines when people live more than a three-minute walk away from the park, but this study will use a five-minute walk radius to determine potential vicinity benefits because it is more represented in the literature.

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[3] Bolitzer and Netusil (2000)

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Although Alexander's three-minute walk boundary is not used in this study, he helps supply evidence that familiarity of roads surrounding a park increases the externalities of the park.[4] He argues that small neighborhood parks, similar to the size of Rockwood Park, have increased positive externalities for homeowners if they are along roads that families use most often when commuting around their neighborhood. Several outlet roads from the surrounding neighborhoods run parallel to the outskirts of the park, therefore the set of data points in this study will not be dissimilar due to externalities associated with familiarity.

One important aspect of the walking radius is the network of streets that surrounds the park. The rent gradient gridiron plan[5] illustrates how walking distance to a center point, the park in this example, and the distribution of its benefits cannot be shown as a circle around the park, but rather through cost contours related to the network of streets surrounding the park. Also, travel distance is typically subject to traffic congestion on certain roads, but because the radius in this study is concerned with walking distance only, the model does not take into account street traffic, only distance on the road between a homeowner's lot and the park. Figures 1.1 through 1.4 clarify these assumptions. Therefore, instead of using the assigned 1500 ft. as an absolute walking distance from the park, the 5-minute walk radius is calculated through walking distance on well-traveled streets surrounding the park.

The Model

The goal of the study is to isolate the value of the externalities of Rockwood Park on the surrounding homeowners through differences in land value. The data for each of the park's abutters as well as properties within the five-minute walking radius was collected and merged into a dataset. Then, selected homes that shared qualities with those within the five-minute walking radius were added to the data set. Properties with pools or other unique qualities were omitted from the dataset because there was not a significant amount of observations for those properties to warrant adding a dummy. Estimated property values were collected from Zillow.com and were used in lieu of sale price, when they were available,

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[4] Alexander (1977)
[5] Yinger (1993)

to keep make sure the data set was not misrepresented due to sales within families or to family friends at a price below market value.

All properties were picked so that they were significantly far enough away from Route 15-501 that negative externalities of congestion and noise associated with living on or near the road were not apparent in the data set. Similarly, closeness to the road means each of the properties experiences positive externalities of living near shopping centers and places to eat that are evenly distributed throughout the properties, therefore having no effect on the model. Properties were selected in each of the neighborhoods around the park so the five-minute walk would be on roads that were familiar exit points for the surrounding main roads. These choices ensured there would be no misrepresentation of the five-minute walk due to unfamiliarity with the walking route.

In order to isolate the park's effects on the change in home values, the data set also includes a variety of other factors affecting the price of the properties. From Zillow.com, statistics were collected about the number of bedrooms, number of bathrooms, size of the yard (lot size minus home size) in square feet, and age of the house.

Results

Ordinary Least Square (OLS) regressions are used to determine the effect of Rockwood Park on the surrounding home values. The first regression performed on the data aims at determining the positive externalities of the park for abutters in comparison to all properties without a clear view of the park. The control and dummy variables for abutters to the park are regressed on the price of individual homes, taken from Zillow.com. The results show that homeowners living directly next to the park experience an increase in home value of $26,195 (95% Confidence Interval), while holding constant for each of the control variables.[6] The nominal increase in home value represents a 12.66% increase over the average land value of $206,961.

In addition to the proximity to the park, the number of baths, size of yard, and age of the house showed significant, positive correlations on home value. The number of

[6] Shown in Figure 2

bedrooms showed no correlation with home value. The positive correlation for the number of baths and age of the house can be supported by amenities and less need for repairs in newer homes, respectively. The lack of correlation for the number of bedrooms is most likely due to the difficulty of reporting the data for homeowners because bedrooms can easily be changed to rooms with other primary functions and vice versa. The very significant (t-stat = 5.83), positive coefficient for the size of the yard shows that homeowners in this area place a large amount of value on available yard space. This is intuitive when one considers that homeowners who chose to live near a park typically value yard space, even those outside of the five-minute radius.

Although this regression showed the value added of the park for those next to it, the model does not differentiate between the positive externalities accrued by users and non-users. The data set used for the first regression, the full data set, includes homes that abut the park, are within a five-minute walking radius of the park, and are outside the five-minute radius. In order to isolate the benefits to non-users, the second regression excludes all properties outside the walking radius so that all property value increases can be attributed to homes that directly enjoy the scenery of the park as well as those who are free to use it without having to travel on the streets.

The goal of the second model[7] is to separate the benefits of non-users from users. All people within the five-minute walking radius experience positive externalities of living near a park, but by regressing with the dummy variable representing, the model shows if the non-user externalities are evident in the housing market. As Figure 3 shows, homeowners living next to the park do not experience any positive externalities over those within the walking radius. The lack of a significant correlation is most likely due to the similarities of the backyards of all people within the walking radius. Most of the homeowners have larger backyards with views of trees on the outskirts of their respective properties, reducing the desire to purchase a home closer to the park for the scenery.

[7] Shown in Figure 3

The third and fourth models[8] aim to justify the increase in home values due to the externalities of the park for abutters and those living within the five-minute walking radius. The first of these two models includes data without the abutters; it aims at offering evidence that the five-minute walking radius provides positive externalities illuminated in the housing market. The model includes a dummy variable for all homes within the walking radius and shows that a significant, positive coefficient of $33,468 exists for homes within the radius. The subsequent (fourth) model removes all data for homes in the walking radius except those that abut the park and reuses the abutter dummy variable. This model again shows a significant, positive coefficient for abutters of $39,372, slightly higher than those within the radius. The difference of $5,904 leads to the possible conclusion that living closer within the five-minute radius provides increased benefits, but, as the second model suggests, this is not the case.

Conclusion

The set of four regression models used in this study supports the idea of positive externalities from parks for homes within a five-minute walking radius of a park. Although the models do not reveal the positive externalities for non-users, in line with previously discussed literature, small differences in home values between models three and four hint at these positive externalities. The study shows how quiet parks, such as Rockwood, provide increases in home values, but further studies are required to determine the effects of different types of parks on the surrounding area. Literature suggests that baseball parks provide negative externalities, such as noise pollution and unwanted congestion, so further models could separate park abutters between living on the quiet and noisy side of a park with a baseball field.

Continuing with the trend of possible future research, now that the positive externalities of parks such as Rockwood have been established, the next step for this study would be to investigate the value the park has to the city through increased tax returns. Many studies suggest compiled by Crompton (2001) suggest the gain in property taxes for communities would pay for the costs of building and maintaining public parks. Analysis of

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[8] Shown in Figures 4 and 5

more parks and the property tax increases are strong candidates for future research. Durham may have the potential to benefit from constructing parks at minimal to zero cost in the long run.

Appendix

In order to assure the results of higher priced homes next to the park was not a product of choosing more upscale properties next to the park than away from it, correlation tests were perform with STATA between the independent, dependent, and control variables.[9] The correlation test results show no large correlation between any of the control variables and the abutter dummy variable.

[9] Shown in Figure 6

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Figure 1:

Figure 1.1

Iso-transportation cost contour in a generic gridiron plan. In this model, travel distance is the only component of transportation cost.

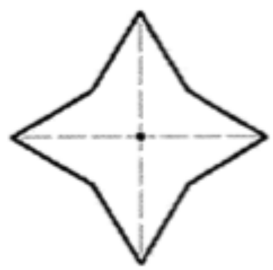

Figure 1.2

Transportation cost contours with varying arterial speeds. In the illustration, cardinal streets leading from the central point have higher travel speeds than secondary roads.

Figure 1.3

Transportation cost contours with constant travel speed and a bias in favor of straight paths. Complex paths increase the perceived travel distance and travel cost. The form of the model resembles Illus. 2, but the meaning is different.

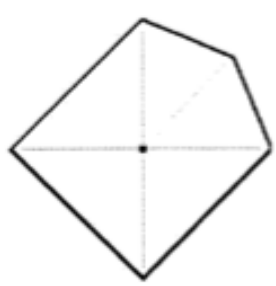

Figure 1.4

Transportation cost contour with gridiron and one diagonal boulevard. Travel distance is the only variable in this model.

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Figure 2:

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. regress price abutter beds bath sizeofyard yearsold
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Source	SS	df	MS
Model	1.5835e+11	5	3.1670e+10
Residual	1.2292e+11	66	1.8625e+09
Total	2.8127e+11	71	3.9616e+09

Number of obs =	72
F(5, 66) =	17.00
Prob > F =	0.0000
R-squared =	0.5630
Adj R-squared =	0.5299
Root MSE =	43156

price	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
abutter	26194.89	12225.08	2.14	0.036	1786.724	50603.06
beds	136.8913	8606.071	0.02	0.987	-17045.68	17319.47
bath	37243.88	11222.55	3.32	0.001	14837.35	59650.42
sizeofyard	1.068417	.1992409	5.36	0.000	.6706201	1.466215
yearsold	540.9019	234.8837	2.30	0.024	71.94157	1009.862
_cons	87329.64	27153.05	3.22	0.002	33116.82	141542.5

Figure 3:

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. regress price abutter beds bath yearsold sizeofyard
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Source	SS	df	MS
Model	1.2847e+11	5	2.5694e+10
Residual	7.7203e+10	40	1.9301e+09
Total	2.0567e+11	45	4.5705e+09

Number of obs =	46
F(5, 40) =	13.31
Prob > F =	0.0000
R-squared =	0.6246
Adj R-squared =	0.5777
Root MSE =	43933

price	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
abutter	4002.995	14461.44	0.28	0.783	-25224.67	33230.66
beds	3587.527	10851.17	0.33	0.743	-18343.5	25518.55
bath	54322.76	15332.96	3.54	0.001	23333.68	85311.83
yearsold	594.4557	312.0109	1.91	0.064	-36.14175	1225.053
sizeofyard	.9728325	.21065	4.62	0.000	.547093	1.398572
_cons	54477.99	42975.67	1.27	0.212	-32379.09	141335.1

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Figure 4:

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. regress price minradius beds bath sizeofyard yearsold

      Source |       SS       df       MS              Number of obs =      53
-------------+------------------------------           F(  5,    47) =    4.06
       Model |  2.7739e+10     5  5.5479e+09           Prob > F      =  0.0038
    Residual |  6.4236e+10    47  1.3667e+09           R-squared     =  0.3016
-------------+------------------------------           Adj R-squared =  0.2273
       Total |  9.1975e+10    52  1.7688e+09           Root MSE      =   36969

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       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   minradius |   33468.23   10362.83     3.23   0.002     12620.92    54315.55
        beds |   9139.161   10247.37     0.89   0.377    -11475.89    29754.21
        bath |   21180.07   12834.78     1.65   0.106    -4640.184    47000.32
  sizeofyard |  -1.252942   1.441953    -0.87   0.389    -4.153776    1.647893
   yearsold  |    353.871   285.0986     1.24   0.221    -219.6735    927.4154
       _cons |   119078.4    28002.2     4.25   0.000     62745.26    175411.6
------------------------------------------------------------------------------
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Figure 5:

```
. regress price abutter beds bath sizeofyard yearsold

      Source |       SS       df       MS              Number of obs =      45
-------------+------------------------------           F(  5,    39) =   22.19
       Model |  1.7718e+11     5  3.5435e+10           Prob > F      =  0.0000
    Residual |  6.2287e+10    39  1.5971e+09           R-squared     =  0.7399
-------------+------------------------------           Adj R-squared =  0.7065
       Total |  2.3946e+11    44  5.4423e+09           Root MSE      =   39964

------------------------------------------------------------------------------
       price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     abutter |    39372.7   12724.68     3.09   0.004      13634.6     65110.8
        beds |  -934.8714   9304.978    -0.10   0.920    -19755.97    17886.22
        bath |   45645.45   12697.47     3.59   0.001      19962.4    71328.51
  sizeofyard |   1.085212   .1860366     5.83   0.000      .708918    1.461507
    yearsold |   859.2466   254.6071     3.37   0.002     344.2552    1374.238
       _cons |   42413.04   29790.17     1.42   0.162    -17843.27    102669.4
------------------------------------------------------------------------------
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Figure 6:

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. pwcorr price abutter beds bath yearsold sizeofyard
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	price	abutter	beds	bath	yearsold	sizeof~d
price	1.0000					
abutter	0.3986	1.0000				
beds	0.3189	0.1723	1.0000			
bath	0.5075	0.2784	0.6487	1.0000		
yearsold	0.1081	0.0027	-0.1745	-0.2206	1.0000	
sizeofyard	0.6035	0.2364	0.1653	0.2674	-0.0053	1.0000

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