Pricing the Homebuyer's Proximity to Open Land

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While there is a substantial literature showing amenity value accruing to properties abutting various types of open space, there is less showing the relative value of these amenities on properties that do not abut, but are close to, the open space in question. This study looking at property transaction finds that the value of lake frontage far exceeds that on farms or other open spaces, but while farms transmit a positive amenity value to properties nearby, properties nearby but not on lakes experience a disamenity. We find limited evidence for positive amenity value on golf course and outlot frontage.

INTRODUCTION

One of the great demographic shifts of the post-war period in most developed countries is the urbanization and subsequent sub-urbanization of the population. Suburban life has come with (or from) a growing comfort with a longer commute to employment centers. This has arguably led to the 'exurb', a term coined by Spectorsky (1955) and expanded and formalized by Daniels (1999). While the suburbs are typically immediately adjacent to a metropolitan area, the exurbs are typically composed of either small neighborhoods in otherwise agricultural areas or relatively small towns and villages which are relatively close to a metropolitan area but still separated from the ring of historic suburbs by at least a few miles of agricultural land. The challenges created by both suburban and exurban growth have been debated and documented in the economic planning literature for nearly as long. There is no doubt that encroachment on agricultural land has been profound. For example, Yang (2003) used satellite imagery to examine urban territorial growth in the Atlanta metro area from 1973 to 1999, concluding that a population increase of 96% was associated with an urban territorial expansion of 247%.

While the economics of land conversion are well worthy of study, the primary interest of this paper is the question of how citizens value proximity to open spaces such as parks, outlots, golf courses, institutions (such as a school), a farm, or even a significant body of water. To the extent suburbs and particularly exurbs have easier access to or more frontage on such open spaces than in urban centers, a positive valuation on such proximity would have a number of implications.

First, it would drive encroachment on the very land providing the positive externality. Second, to the extent that such valuations would be reflected in property values, they would also feed through to property taxes and thus be relevant in any sort of fiscal optimization a suburban or exurban community might engage in. Third, it would be interesting to know if different sorts of open spaces offer different positive externalities that really are reflected in property values as well as whether immediate adjacency to the open space is necessary or if it is sufficient to be 'close enough'.

We address this question by using a hedonic model of residential real estate pricing to put a price on the amenity value of living next to open spaces in the exurban community of Muskego, Wisconsin. Our results suggest that not only do lakes and farms do have amenity value for fronting properties, and for lakes more so than farms, but they also present an externality value to properties that are nearby but not fronting these open spaces. While in the case of farmland this externality value is positive for this community, it is strongly negative for being near a lake and the externality travels farther in the case of lakes than in the case of farmland. We have mixed results for frontage on golf courses and commercial outlots, but fail to find any amenity or disamenity value for parks, institutions, or even high-tension power lines.

LITERATURE

Through the use of revealed preference methodology, hedonic analysis deduces the price of a particular non-separable attribute from the differences in total price of a between products with differing attributes. Residential real estate has attributes for the structure, such as square footage and number of bedrooms or bathrooms or whether or not there is central air conditioning, as well as attributes for the location of the property, such as proximity to transportation conduits or a lake or perhaps a factory emitting noxious gasses or, of particular interest to this paper, open spaces of various sorts. Many of these attributes are not marketed independently and so do not have an overt market price; rather, only the bundle of the whole property is traded and its price reflects only the whole bundle. However, heterogeneity between properties and the prices they trade at permits the opportunity to examine relationships between differences in attributes and differences in price and thereby infer the value of a particular attribute, essentially hypothesizing that homeowners maximize their net utility by trading changes in price for changes in housing attributes. This method might be questionable if price differences reflected changes in supply as well as differences in demand for different attributes. However, at any given time, there exists a distribution over space of the supplies of these attributes and since the housing stock alters only slowly over time, the attributes can reasonably be treated as perfectly inelastic in supply (Brown and Pollakowski, 1977). While the concept of hedonic pricing analysis begins prior to the Great Depression (Waugh, 1928), it evolved quickly following the work of Grillches (1971), Lancaster (1971), and Rosen (1974). Econometrically, the implicit prices of attributes are estimated by a reduced-form multivariate regression model with total price as the dependent variable and various attributes (physical as well as those of near-by amenities) as the independent variables.

There are a number of studies exploring amenity value in this manner. Kashian et al (2006) is one of many studies looking at the amenity value of a lake which generally find a positive and significant impact of lake frontage on home price but no impact on the price of properties which are otherwise close by, but without actual lake frontage. A great deal of the research on farmland and open space amenity value is summarized in Bergstrom and Ready (2007) and in McConnel and Walls (2005). More specifically, in regards to living adjacent to farmland, Roe et al (2004)

find a positive value to the location of the home relative to its being adjacent to farmland. However, Smith et al (2002), Paterson and Boyle (2002), and Kopits, et al (2007) finds no such impact while Johnston et al (2001) find a negative impact. Results here could potentially be quite sensitive to the nature of the farmland. A farm using very intensive techniques could generate a lot of negative externalities such as animal or chemical odors or large amounts of dust, while other sorts of farms might offer more in the way of picturesque vistas and the feeling of being 'close to nature'. Weicher and Zerst (1973) showed that housing next to parks commanded a price premium. Thorsnes (2002) suggests that properties adjoining forests are worth more, and Hobden et al (2004) finds similarly for adjacency to green spaces in general. In regards to general open space and its impact on home values, Johnston et al (2001) and Geoghegan (2002) found a positive and significant relationship. As later reaffirmed in our paper, Kopits et al (2007) finds that 10% increase in subdivision open space results in a 0.1% increase in the average house value. However that paper also found that sales prices of waterfront houses are found to be 30 percent higher than prices of other houses.

This study adds to this literature by including many of the amenities above and in particular breaking down the 'open spaces' into different sorts which permits an assessment of relative amenity values. Further, we are also able to account for not only the value of direct frontage on a per-foot basis, but also whether or not 'close enough' is actually close enough to derive some amenity value from these open spaces; that is, whether amenity value of an open space or lake accrues to properties which are merely nearby and not adjacent.

DATA, VARIABLE, AND MODEL

We study residential property sales in the community of Muskego, WI. Muskego, formerly a farming community with a recreation pull due to three lakes in it, has evolved into an exurb. The 36 square-mile city has a population of 22,817. Of the approximately 22,000 acres in the city, 3,000 acres are lake surface and about 5,200 acres are currently farmed with the rest being some combination of residential, institutional (i.e., schools and churches), commercial outlots, a golf course, and space set aside for high-tension electrical lines.

A residential property's value relationship with open space is the key locational characteristic of interest. It is of course important to include characteristics that have long been included in the housing price literature such as square footage, number of bedrooms and bathrooms, and existence of a basement and we follow Brown and Pollakowski (1977) and Palmquist (1984) in that regard. As Muskego has several lakes and it is fairly well established that a lakefront property commands a price premium, it is necessary to account for that. We also include measures of immediate interest, being proximity to open spaces and we discriminate between various sorts of open space. Our proximity measures include not just adjacency, but also distance from the open space in an attempt to sort out how far the amenity externality travels. Further, our adjacency measure is linear feet of frontage on the amenity in question except for the case of high-tension power lines which is simply an adjacency dummy variable.

As mentioned previously, we use a hedonic analysis to estimate the marginal valuation of these externalities. In so doing, a number of assumptions need to be stated. First, the value of residential property is assumed to be a function of specific measurable housing and other attributes. Second, general attributes such as amenities applying to the entire region of the state apply to all properties under analysis equally. Third, we assert that one identifiable difference between the valuations of properties in Muskego is the unique location attributes offered whether

these attributes were lake frontage or open space or farmland attributes. It is also necessary to assume that relative demand for particular attributes is static. Otherwise, an increase in demand for a particular attribute which should increase its "price" coinciding with a general decrease in demand for other attributes would tend to be netted out as far as impact on the observable price for the bundle of attributes.

In all cases, the dependent variable is the log of the inflation-adjusted sales price. The sales price data and the hedonic descriptive statistics come from the City of Muskego (WI) Assessor's Office database. The assessor's database includes entries for 1,285 sales of detached residential houses between 2002 and 2008 (inclusive). The variable names and descriptive statistics are presented in Table 1. The distance and frontage measures were determined through examination of plat maps in the assessor's office. In all cases, there was no change in the existence of the externalities in the time frame examined (i.e., all farms stayed farms, etc.). The sales were taken as 'arms length' transactions and were obtained through the Multiple Listing Service. Thus, our sample is limited to those residential properties traded on the market in the relevant time frame.

TABLE 1:
DESCRIPTIVE STATISTICS

Age of Home at Sale	Mean	Std. Deviation	N
Total Number of Room	28.040	33.412	1285
Number of Bedrooms	6.522	1.267	1285
Number of Bathrooms	3.260	0.640	1285
Square Feet	2.014	0.654	1285
Has a Basement	0.942	0.233	1285
Frontage On Little Muskego	69.346	37.723	65
Frontage On Big Muskego	148.147	201.373	19
Frontage On Lake Denoon	80.813	41.134	12
Frontage Adjacent to a Farm	339.553	296.920	47
Frontage Adjacent to a Park	95.850	43.213	20
Frontage Adjacent to an Outlot	145.500	89.371	170
Frontage Adjacent to a Golf Course	97.118	35.208	17
Frontage Adjacent to an Institution	121.700	30.548	20
Adjacent to High Tension Power Lines	0.021	0.143	27
Within 500 Feet of a Farm	300.459	130.224	192
Within 1000 Feet of a Farm	750.292	144.299	472
Within 500 Feet of a Golf Course	228.267	117.552	61
Within 1000 Feet of a Golf Course	749.175	167.844	4
Within 500 Feet on an Institution	297.922	129.190	205
Within 1000 Feet of an Institution	721.540	141.497	268
Within 500 Feet of a Park	308.892	132.298	182
Within 1000 Feet of a Park	749.168	145.712	342
Within 500 Feet of an Outlot	257.822	131.132	616
Within 1000 Feet of an Outlot	695.365	139.417	277
Within 500 Feet of Little Muskego Lake	251.270	141.924	271

Within 1000 Feet of Little Muskego Lake	743.921	146.294	245
Within 500 Feet of Big Muskego Lake	314.394	116.661	82
Within 1000 Feet of Big Muskego Lake	787.423	132.482	82
Within 500 Feet of Lake Denoon	296.664	123.351	33
Within 1000 Feet of Lake Denoon	698.132	144.717	34

We run two estimations. All estimations are by OLS with heteroskedastic-consistent robust standard errors with the results presented in Table 2. Both use as independent variables the age of the home at sale; the total number of rooms; the number of bedrooms; the number of bathrooms; the square footage of the home; the square of the square footage to account for increasing or diminishing returns to size; the existence of a basement the size of which is not included in house size as a dummy variable with no basement being the excluded state; the linear feet of frontage on each of the three lakes Big Muskego, Little Muskego, and Denoon (footfront*); the linear feet of frontage on a farm, commercial outlot, park, or institution (church or school); and whether the property abuts a high-tension power line as a dummy variable.

TABLE 2

		R^2 = .3981			R^2 = .4158	
Dependent Var = ln(salesprice)		F(16,1264) = 60.19			F(34,1246) = 32.42	
Indep. Var.	Coef	Std Err	t	Coef	Std Err	t
Constant	11.31	0.26308	43.02	11.424	0.2659	42.96
Age at sale	-0.00123	0.00235	-0.53	-0.00115	0.00229	-0.5
#Rooms	**-0.03763**	**0.01906**	**-1.97**	**-0.03449**	**0.01946**	**-1.77**
Bedrooms	-0.00836	0.02168	-0.39	-0.0059	0.02215	-0.27
Bathrooms	0.07307	0.04878	1.5	0.07062	0.04846	1.46
SqFt	**0.00062**	**0.000204**	**3.05**	**0.00058**	**0.00021**	**2.76**
SqFt^2	**-6.79E-08**	**3.99E-08**	**-1.7**	-6.28E-08	4.11E-08	-1.53
Basement	**0.21059**	**0.05766**	**3.65**	**0.18999**	**0.05664**	**3.35**
footfrontLittleL	**0.00534**	**0.00075**	**7.12**	**0.00458**	**0.00077**	**5.95**
footfrontBigL	**0.00143**	**0.00035**	**4.1**	**0.00146**	**0.00059**	**2.45**
footfrontDenoon	**0.00652**	**0.00164**	**3.98**	**0.00616**	**0.0016**	**3.85**
footfrontFarm	**0.00034**	**0.00017**	**1.97**	**0.00035**	**0.00019**	**1.88**
footfrontGolfCourse	**0.00087**	**0.00046**	**1.89**	0.00038	0.00047	0.82
footfrontInstritutions	0.00062	0.00065	0.95	0.00066	0.00064	1.04
footfrontOutlot	**0.00032**	**0.00018**	**1.76**	0.0003	0.00018	1.62
footfrontPark	-0.0003	0.0011	-0.28	-0.0004	0.00117	-0.34
HighTension	-0.06823	0.08688	-0.79	-0.05242	0.09109	-0.58
NearestLittleL~500				**-0.13685**	**0.03403**	**-4.02**
NearestBigL~500				**-0.14439**	**0.06134**	**-2.35**
NearestDenoonL~500				-0.10895	0.06921	-1.57
NearestAnyFarm~500				**0.05743**	**0.03034**	**1.89**

NearestGolf~500	-0.04193	0.06247	-0.67
NearestAnyInst~500	0.01924	0.03087	0.62
NearestAnyOutlot~500	0.01057	0.03148	0.34
NearestAnyPark~500	-0.00173	0.03279	-0.05
NearestHighTen~500	0.00877	0.03801	0.23
NearestLittle~1000	**-0.07497**	**0.02998**	**-2.5**
NearestBig~1000	**-0.13343**	**0.06064**	**-2.2**
NearestDenoon~1000	-0.16747	0.10583	-1.58
NearestAnyFarm~1000	-0.0124	0.02462	-0.5
NearestGolf~1000	0.17733	0.18597	0.95
NearestAnyInstitution~1000	0.00573	0.02907	0.2
NearestAnyOutlot~1000	0.01393	0.03335	0.42
NearestAnyPark~1000	0.03813	0.02858	1.33
NearestHighTen~1000	-0.00939	0.03732	-0.25

The first regression includes the variables above. The second regression adds measures of distance to the various amenities. These measures are dummy variables with Nearest(*)~500 having a value of 1 if the nearest instance of the amenity is within 500 feet and zero otherwise, and Nearest(*)~1000 having a value of 1 if the nearest instance of that amenity is within a range of 501 to 1000 feet from the property and zero otherwise. The value for both of these dummies is 0 for properties with immediate frontage on the amenity; the amenity value for these properties is captured in the frontage variable. It is possible for a property to be within 1000 feet of multiple amenities, except the lakes which are more than 2000 feet from each-other. Our prior expectations are that most housing characteristics should have a positive coefficient, reflecting the assumption that a house with more square footage or more bedrooms or more bathrooms should command a higher price. We expect the frontage on a lake to have a positive impact on property value consistent with findings in other studies. We form no particular expectations on value of frontage on parks or golf courses or institutions; while a positive spillover from the amenity is certainly possible, it is also possible that the amenity attracts users from elsewhere and the associated traffic and such could form something of a nuisance from the perspective of a property owner right next to the amenity. The exception here is high-tension power lines, which we would expect to be thought of as a detriment, if at all. We are even more hesitant to form a priori expectations of the spillovers from amenities that are merely nearby and not abutting the property. They will be positive if the property owner is a user of the amenity, but if the spillover does not travel that far then traffic and bother from other users might constitute a negative externality.

RESULTS

Let us first focus on the estimation excluding 'nearness' variables. Among the housing characteristics themselves, only the variables related to the number of rooms and house size are significant. It is probable that the number of rooms is being traded off against their size given the other independent variables, in particular overall square footage. Given house size and other

characteristics, a house with fewer larger rooms gives more value than one with more, smaller rooms. While the magnitude of the coefficient on the number of bathrooms suggests that it is more valuable to have an additional bathroom than to have one fewer room in the house, there is insufficient confidence in the estimate to make many assertions. The coefficient on overall house size in square feet is reassuringly positive, while the coefficient on the square of size is negative consistent with diminishing returns to square footage. The addition of a basement has a strongly positive impact on house price, again not surprising as the square footage variable does not include basement space and thus the existence of a basement should have much the same impact as a larger house.

Looking at the amenity variables, we find the reassuring result that lakefront footage has a positive impact on property value. Frontage on a farm, on a golf course, and on an outlot also have a positive impact on property value. The coefficients for frontage on a an institution are positive, and those for a park and high-tension power lines negative, but none of them significant for the Muskego community.

Going back to the variables that are significant (farms, golf courses, and outlots), the hedonic value of being next to these amenities is roughly an order of magnitude less than that for the lakes on a per-foot basis. Another way to think about the magnitude of these coefficients is to compare them to the value of a larger house. On that measure, each linear foot of frontage on a farm has about half of the same hedonic value as a square foot of house space. If we suppose a frontage of 60 feet on a farm, that adds about as much value then as a quarter of a 12’x10’ room. Frontage on a golf course would then be worth perhaps a third more than a square foot, so the same 60 feet of frontage on a golf course would be worth about as much as two thirds of a 12'x10' room. For frontage on a lake however, we would need to compare a linear foot of frontage on a lake to tens of square feet of house. 60 feet of frontage on a either Little Muskego Lake or Denoon Lake would be worth about as much as an extra 600 square feet of house which is a lot of house...five of our 12'x10' rooms. Frontage on Big Muskego Lake is significantly less valuable than frontage on the other lakes, but by less than an order of magnitude...only 2 more of our baseline rooms. This is due to the fact that Big Muskego is significantly shallower than the other lakes which results in less recreational value.

When we add measures allowing properties to be ‘near enough’, we find that the coefficients for many variables do not change much except for the ordinary consequences to significance from adding more independent variables. We do find that confidence of the estimate on outlot frontage drops enough to fall below the 90% confidence level while the estimate on golf course frontage drops far more in significance. We also lose significance on the square of square footage.

The coefficients for frontage on lakes and farmland do not change in magnitude or significance. It appears that part of the amenity value of farmland also accrues to properties within 500 feet. A simple comparison with the coefficient on foot frontage on a farm suggests that just being within 500 feet of a farm is worth as much as having 164 feet of frontage on a farm. There is also an impact of being close to a lake, but in the case of lakes this effect is apparently negative. This negative externality appears to extend to properties not just within 500 feet of the lake, but also to properties within the next 500 feet after that. The coefficient on this dummy is negative for all three lakes and only not significant for Denoon. It may be that in the case of Big Muskego and Little Muskego, being too close is something of a nuisance, perhaps due to the traffic from lake-users coming from farther away. The magnitude of this externality seems to diminish with distance for Little Muskego, being a little more than half as large in the

501-1000 foot range than for properties in the 0-500 foot range. This does not appear to be the case for Big Muskego, with only a slight decrease in the magnitude of the negative externality.

CONCLUDING REMARKS

The hedonic pricing literature now has a good number of studies showing the amenity value of property frontage on farmland. The open questions, however, is how does that value compare to the value of other amenities such as parks or lakes, and does the amenity value travel beyond the properties immediately adjacent to the amenity? Similar to other studies, we show that farmland and lakes both have amenity value to abutting properties, but this value is far higher for lakes than for farmland. However, while the farmland amenity value also travels to properties that are within 500 feet (basically within a city block of the farm), this is not the case for properties near but not adjacent to a lake. In fact, the opposite seems to be the case; being close to a lake but not on it has a negative impact on housing value. Other than these however, we cannot claim to find much value put on open spaces per se. Farmland and lakes seem to have clear amenity results, but we have inconsistent results for golf courses and outlots, while parks and other institutions seem to matter not at all.

One challenge presented in work specific to one area is the argument that the results are drawn from one particular exurb in south-eastern Wisconsin. Additional studies on other communities would assist in producing more confidence in these results. While this community is very rich in that it offers many different types of amenity space to compare, it has had its own particular pattern of expansion which may correspond with property values in ways that we are not able to account for.

REFERENCES

Bergstrom, J. C. and Ready, R. C. (2009). What Have We Learned from Over Twenty Years of Farmland Amenity Valuation Research in North America? Review of Agricultural Economics, 31, (1), 21-49

Brown, G. M. and Pollakowski, H. O. (1977). Economic Value of Shoreline. The Review of Economics and Statistics, 59, (3), 231-249.

Daniels, T. L. (1997). Where Does Cluster Zoning Fit in Farmland Protection? Journal of the American Planning Association, 63, (1), 129-137.

Daniels, T. L. (1999). When City and Country Collide: Managing Growth in the Metropolitan Fringe. Washington, DC: Island Press.

Geohegan, J. (2002). The Value of Open Spaces in Residential Land Use. Land Use Policy. 19 (1), 19-98.

Griliches, Z. Ed., Price Indexes and Quality Change. Cambridge, MA: Harvard University Press.

Hobden, D. W. (2004). Green space borders—a tangible benefit? Evidence from four neighborhoods in Surrey, British Columbia, 1980–2001. Land Use Policy, 21, (2), 129-138.

Irwin, E. G. (2002). The Effects of Open Space on Residential Property Values. Land Economics,78, (4), 465-480.

Johnston, R. J. et al. (2001). Estimating Amenity Benefits of Costal Farmland. Growth and Change, 32, (3), 305-325.

Kopits, E. et al. (2007). The Trade-Off Between Private Lots and Open Space in Subdivisions at the Urban-Rural Fringe. American Journal of Agricultural Economics, 89, (5), 1191-97

Lancaster, K. J. (1971). Consumer Demand: A New Approach. New York, NY: Columbia University Press.

McConnell, V. and Walls, M. (2005). The Value of Open Space: Evidence from Studies of Nonmarket Benefits. Washington, D.C: .Resources for the Future.

Palmquist, R. B. (1984). Estimating the Demand for the Characteristics of Housing. The Review of Economics and Statistics, 66, (3), 394-404.

Paterson, R. W. and K. J. Boyle. (2002). Out of Sight, Out of Mind? Using GIS to Incorporate Visibility in Hedonic Property Value Models. Land Economics, 78, (3), 417-25

Roe, B. et al. (2004). The Effects of Farmland, Farmland Preservation, and Other Neighborhood Amenities on Housing Values and Residential Growth. Land Economics, 80, (1), 55-75.

Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. Journal of Political Economy, 82, (1), 34-55.

Smith, V. K. et al. (2002). Treating Open Space as an Urban Amenity. Resource and Energy Economics 24: 107–29.

Spectorsky, A. C. (1955). The Exurbanites. With Drawings By Robert Osborn. Philadelphia, PA: Lippincott.

Thorsnes, P. (2002). The Value of a Suburban Forest Preserve: Estimates from Sales of Vacant Residential Building Lots. Land Economics, 78, (3), 426–41.

Waugh, F. V. (1928). Quality factors influencing vegetable prices. Journal of Farm Economics, 10, (1), 185–196.

Weicher, J. and Zerbst, R. (1973). The externalities of neighborhood parks: an empirical investigation. Land Economics, 49, (1), 99–105.

Yang, X. (2002). Satellite Monitoring of Urban Spatial Growth in the Atlanta Metropolitan Area. Photogrammetric Engineering & Remote Sensing, 6.8, (7), 725-734.