The Relationship Between Residential Property Sale Price and Distance from Public Schools in the Oshkosh Region

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Background:

Property owners of all types, whether single family residence, or multi-unit apartment complexes continually monitor a diverse array of factors influencing property values. Some of these factors the owners may have direct influence over, for example general maintenance and upkeep of said property, while for other factors, the owners may have little or indirect, to no control. For example, if the city decides to install tasteful old-fashioned lamp-posts and curbside trees, this could well increase a property value simply by adding aesthetic appeal and general community continuity.

Another example of a factor that might influence property values, and that an owner would at best have only indirect influence over, is in the property's proximity to schools. It would seem to intuitive that the closer a property is to a school, the more desirable the property would be to families with children served by these schools. This increase in desirability could well result in increased value of the property relative to similar properties at greater distances to the school. While these arguments may have intuitive appeal, one might question whether this supposition can be demonstrated or if it is really just a statement of perception, with no evidence to back it. The question of what a property is worth is well known to be a multi-variate problem. With multivariate problems such as this, it could well be the case that some factors that seem important on the surface get relegated to having little to no tangible impact in the presence of many other (apparently more important) factors.

Performing a quick search on the internet, one can find real estate sites that suggest proximity to schools is a factor to consider when choosing a house, but we found no research to back up the claim that this might be an important factor in the sale price of a home. Given that the Oshkosh Area School District (OASD) and its Board of Education (BOE) is considering changing some of the district attendance boundaries and closing some schools, the relative proximity to schools of a large number of properties in the Oshkosh area would be increased. Because of this, we sought to estimate the relationship between proximity to schools in the OASD and the sale prices of properties recently sold in the area. In addition to finding the estimates, we also wanted to perform a formal test of significance to see if these factors were in fact substantially related and not just an artifact of random chance.

Methods:

To estimate the impact of the proximity to schools on sales prices, we gathered data from multiple sources. First, we obtained all records of residential sales recorded in the Multiple Listing Service (MLS) with a sale date from Jan 1, 2006 to the present time. Next we obtained records of residential sales from the City of Oshkosh Assessor's website at: http://www.ci.oshkosh.wi.us/RES_SALES_BY_ADDRESS.pdf. Next we obtained the official street addresses from each of the schools listed on the OASD website at: http://www.oshkosh.k12.wi.us/schools/. Note for this analysis we used only the 17 elementary schools, 5 middle schools, and 2 high schools. We did not include any of the Charter schools or other alternative learning program locations in this analysis. Finally we submitted all of the addresses from each of the aforementioned sources into a web interface for a program that converts street addresses to decimal point latitude and longitude coordinates. The website used can be found at http://stevemorse.org/jcal/latlonbatch.html.

After merging the MLS sales data along with the city assessor's records we were left with 1094 records from properties in recorded as *City of Oshkosh* or *Town of Algoma*. Note that while these were the only two labels in the municipality fields from the MLS database, careful inspection of the street addresses shows that some of the properties were located in the Townships of Oshkosh and Black Wolf. Of the 1094 records, 1075 had no missing values in any of the variables. These 1075 records were then used in the subsequent analyses.

With the cleaned dataset, we performed a model building exercise to find all of the important predictors of sales price included in the datasets. We employed quantile regression techniques [1] which are commonly used in econometric analyses. These techniques are known to provide consistent estimates of effects yet be robust to the effects of potentially outlying observations. In other words, a single house that might have sold for $4 million dollars will not completely dominate the analysis, where this might be possible

using a classical least-squares general-linear-model approach. We started with the null model, only estimating a median price. Then a stepwise approach was employed to add and subtract predictors from the model using a significance level of $\alpha = .05$ for the threshold to either add or subtract predictors from the model. This resultant model was then used as our baseline model.

Next we utilized the longitude and latitude coordinates to calculate a distance from each of the properties to each of the schools in the OASD. We created three new variables that represented the distance from each property to the closest school for each of the present levels, i.e. elementary, middle, and high schools. We then added to the baseline model these three addition predictors and found their estimates. Finally, we statistically compared the two models to see if adding the distance predictors after incorporating all other significant predictors from the baseline model yielded appreciable gains in the ability to predict the sale price.

Results:

The results of the model building exercise identified the following variables as significant predictors of sale price.

Square Footage:	self evident	
Age:	Ordinal classification variate	
	0	0 to 5 years, not previously lived in
	1	0 to 5 years, previously lived in
	2	6 to 10 years
	3	11 to 15 years
	4	16 to 20 years
	5	21 to 30 years
	6	31 to 50 years
	7	50+ years
Waterfront	0	Not on waterfront
	1	On waterfront

Condo	0	Property is not a condo
	1	Property is a condo
Number of baths	self evident	
Acreage > 0.5	0	Property has ≤ 0.5 acres
	1	Property has > 0.5 acres

Next we fit a model with all of these predictors but also included three additional predictors including distance to closest elementary school, distance to closest middle school, and distance to closest high school (all measured in quarter miles). The quantile regression procedure yielded the following estimates:

Predictor	Estimate
Constant	68669.03
Square Footage	36.68
Age	-7274.01
Waterfront	47540.21
Condo	-26288.09
Number of baths	23569.67
Acreage >0.5	35899.19
Elementary distance	-523.08
Middle distance	-1409.10
High distance	-153.19

Interpretation: The estimates of the model can be interpreted as follows. The expected median sale price for a residential property could be found with these estimates. First we start with the value $68,669.03 for any property. We add to this value $36.68 times the property's square footage. For each increase in age category, the property value is reduced by $7274.01. If a property is on the waterfront, the value is increased by $47,540.21. If the property is a condominium, the value is reduced by $26,288.09. If the property has greater than one half acre, the value is increased by $35,899.19. Finally, the expected

median sale price is reduced by $523.08 for each quarter mile a property is away from the closest elementary school, $1409.10 for middle school, and $153.19 for each quarter mile a property is away from the closest high school.

Next we conducted a formal test of significance to see if these estimates (for the distances away from school) significantly predicted sale price. Using a Wald form of the test, we find a value of the F-statistic of 4.6488 on 3 numerator and 1065 denominator degrees of freedom. This results in a p-value of 0.0031, a statistically significant result.

Conclusions:

This work affirms the perception that there is a significant relationship between a residential property's proximity to public schools and the property's value as predicted by sales prices. Moreover, the relationship for all of the measures, elementary, middle, and high school distances all have a negative relationship, i.e. the further a property is away from the schools, the less value a property might have.

[1] Koenker, R. 2005, *Quantile Regression*, Cambridge University Press, New York, NY