Good School Districts: How Are Public Elementary Schools Affecting the Value of Your Home?

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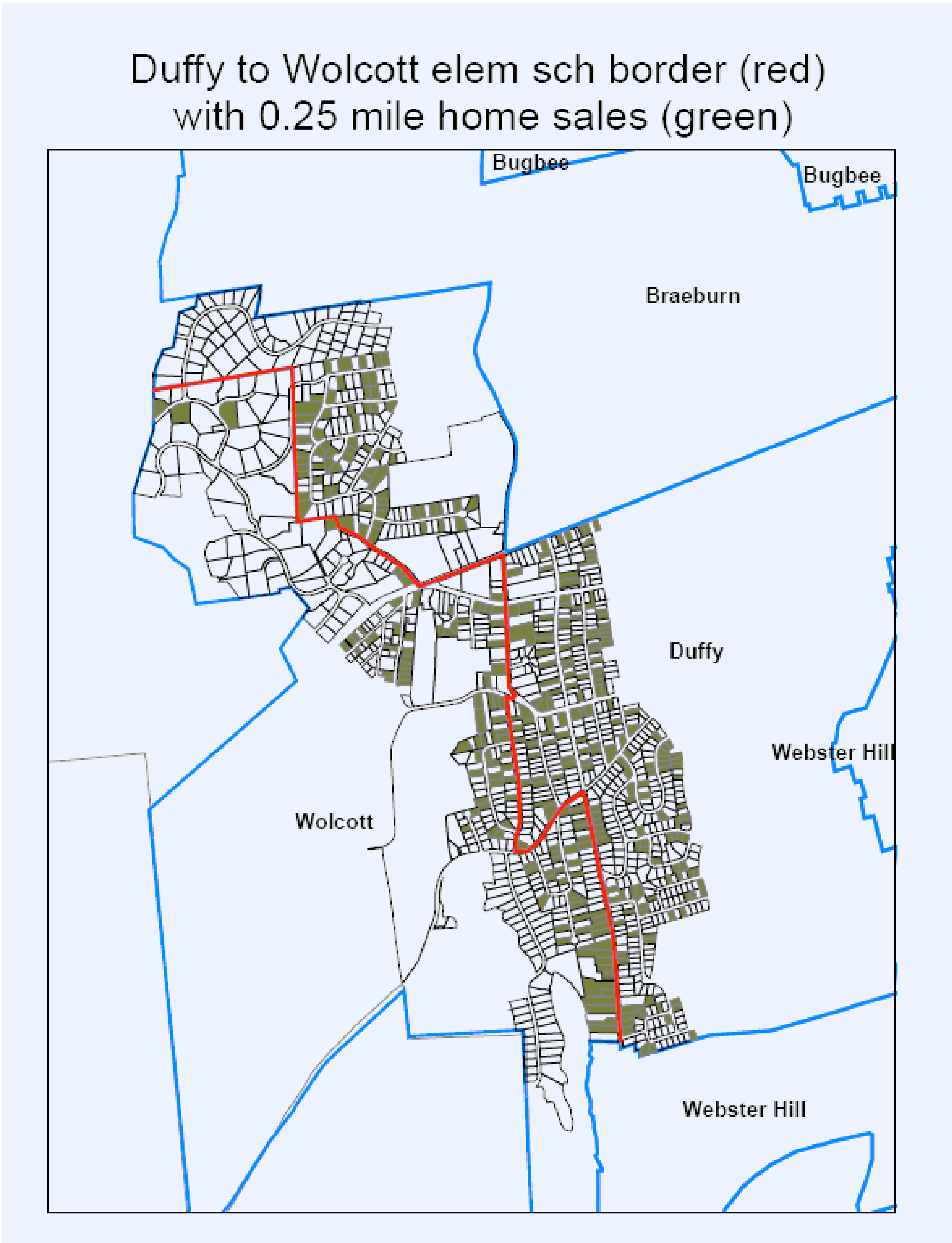
Education has become an increasingly interesting topic in the field of Economics. With more and more emphasis being placed on education throughout the country, economists have begun to analyze the effect that a good school system can have on local economies. Local communities benefit from a good school system, shown clearly in the housing market. In theory, the higher the quality of the school system, the higher the prices of houses in that school district will be. This study explores how the Connecticut Mastery Test (CMT) scores of West Hartford fourth grade students, in reading and mathematics, will affect the price of the homes within their respective elementary school districts.

*** School quality does have a significant and positive impact on housing prices:**

When the houses are .35 miles from the Duffy-Wolcott school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.96 percent increase in housing prices or a price of approximately $13,935.04 at the mean (the mean house price is $236,639.49).

When the houses are .25 miles from the Duffy-Wolcott school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.06 percent increase in housing prices or a price of approximately $11,958.66 at the mean (the mean house price is $236,361.37).


Duffy to Wolcott elem sch border (red)
with 0.25 mile home sales (green)
Bugbee
Bugbee
Braeburn
Duffy
Webster Hill
Wolcott
Webster Hill

Descriptive Statistics for Distance set at .25 miles for Duffy-Wolcott

NUMBER OF OBSERVATIONS: 277				
	Mean	Std Dev	Minimum	Maximum
HOUSEP	236361.37184	74787.03912	75000.00000	720600.00000
TEST	101.25693	3.52463	93.32460	104.55700
BED	3.33213	0.81526	2.00000	7.00000
BATH	2.55235	0.73842	1.00000	5.00000
LOTSIZE	141.60625	64.39900	0.000	511.7000
INTSF	19.87632	5.88557	10.56000	58.38000

Interpretations of a 5% Test Score Increase for Duffy-Wolcott

	.35 miles from the boundary	.25 miles from the boundary	.15 miles from the boundary
Coefficient of test score	.0117548	.00999335	Insignificant at this distance
Percent Change in housing price as a result of a 5 % change in test score	5.96%	5.06%	-
Dollar Change in housing price (at the mean house price)	$13,9535.04	$11,958.66	-

When the houses are .35 miles from the Duffy-Wolcott school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.96 percent increase in housing prices or a price of approximately $13,935.04 at the mean (the mean house price is $236,639.49).

When the houses are .25 miles from the Duffy-Wolcott school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.06 percent increase in housing prices or a price of approximately $11,958.66 at the mean (the mean house price is $236,361.37)

Conclusion

This study was inspired by Sandra Black's article, "Do Better Schools Matter? Parental Valuation of Elementary Education" which analyzed the effects of school systems on house prices. In her study, she used three different categories of variables: school quality characteristics, housing characteristics, and neighborhood characteristics. Since this model was isolated to one town (West Hartford), school quality characteristics were limited to only test scores, given that per-pupil expenditure and student-teacher ratio are constant throughout the town of West Hartford. By creating a comparison where homes are clustered around each other, but are in two different school districts, it is possible to control for neighborhood characteristics and focus primarily on the impact of the school quality on house prices. This study adopted the following housing characteristics used in Black's study: age of the house, bedrooms, bathrooms, internal square footage, and lot size.

Houses at three different distances, .15 miles, .25 miles, and .35 miles from the Duffy-Wolcott elementary school boundary were used. Within these distances, real estate sales data were collected from the West Hartford Property Records Database[1] from 1998 to 2004. Connecticut Mastery Test (CMT) scores for the school systems were collected. After the organization of the data, the first regression was run; certain estimation problems arose. One problem was that the age of the house, which was used in Black's study, turned out to be insignificant. There was just not enough variation in the age of houses in the sample for age to be significant. Another problem that was revealed through the Park Test was that heteroscedasticity existed in the model. House price was heteroscedastic with respect to internal square footage (INTSF), bedrooms (BED), and lot size (LOTSIZE). To estimate the final model, a robust regression was run to correct for the problem of heteroscedasticity.

After running the robust regression, the final model showed that the school quality characteristic (TEST) had the largest impact on the price of the house. When a sample was taken at the .35 mile distance from the school district boundary, it was shown that every one percentage point increase in the test score above the average score for West Hartford elementary schools increased the price of a house by 1.2027 percent or $2,846 (similar results were found at the other distances as well). In fact, when the houses are .35 miles from the school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.96 percent increase in housing prices or a price of approximately $13,935.04 at the mean (the mean house price is $236,639.49). Also, when the houses are .25 miles from the school boundary, a 5 percentage point increase in the test score above the average score for West Hartford elementary schools, is associated with a 5.06 percent increase in housing prices or a price of approximately $11,958.66 at the mean (the mean house price

[1] Information was provided by Jack Dougherty and Jeff Roller

is $236,361.37). Therefore, it was concluded that school quality does in fact affect the price of a house.

SUMMARY APPENDIX

Population Relationship

$$LNHOUSEP = \beta_0 + \beta_{TEST} * TEST + \beta_{BED} * BED + \beta_{BATH} * BATH + \beta_{BATHSQ} * BATHSQ +$$

$$\beta_{LOTSIZE} * LOTSIZE + \beta_{INTSF} * INTSF + \varepsilon$$

Dependent Variable:

LNHOUSEP: The log of the price of the house (2000 dollars).

Independent Variables:

School Quality Characteristic

TEST: Connecticut Mastery Test (CMT) scores in reading and mathematics in the school district where the house is located, measured in indexed points. Both the reading and math scores are indexed in comparison to the other 10 elementary schools in the town. The two indexes are then averaged and indexed again in comparison to the other 10 elementary schools in the town. (The process of indexing takes away discrepancies over generations in the test scores).

$\beta_{TEST} > 0$; It is expected that the higher the CMT test score, the higher the quality of the public school. Since this study's hypothesis is that better school districts will result in higher priced houses, the better the test score -a measure of the quality of the school- the higher the price of the house, holding all other independent variables constant.

House Characteristics

BED: The number of bedrooms in the house.

$\beta_{BED} > 0$; It is expected that the more bedrooms a house has, the more valuable the house will be, holding all other independent variables constant. Bedrooms are positively correlated with the value of a house.

BATH & BATHSQ: The number of bathrooms in the house.

$\beta_{BATH} > 0$; $\beta_{BATHSQ} < 0$; It is known that for houses with a small number of bathrooms, differences in the number of bathrooms will affect house price. As the number of bathrooms increase the price of the house will increase as well. However, it is expected that at a certain point, house prices will start to decrease as the number of bathrooms increase, holding all other independent variables constant. This is because once a house has a certain large number of bathrooms, additional bathrooms become somewhat impractical and therefore house prices will decrease. To account for this characteristic the quadratic functional form needs to be used.

LOTSIZE: The size of the property (in square feet).

$\beta_{LOTSIZE} > 0$; It is expected that the larger the lot that a house is located on, the more valuable the house will be, holding all other independent variables constant.

INTSF: The internal square footage of the house (in thousands of square feet).

$\beta_{INTSF} > 0$; It is expected that the larger the internal square footage of a house, the more valuable the house will be, holding all other independent variables constant.

AGE & AGESQ: The number of years since the house has been built.

$\beta_{AGE} < 0$; $\beta_{AGESQ} > 0$; It is expected that the older a house is, the greater the possibility that damage has occurred from seasonal weathering and various other hardships that a house may endure. Therefore, the older a house is, the less valuable the house will be, holding all other independent variables constant. However, at a certain point an increase in age will start to make the house price increase, holding all other independent variables constant. This is because many people place high value on homes that are considered historic. Considering the effect that age can have on the price of a house, the quadratic functional form needs to be used.

Table 31: Robust Coefficients and t-statistics for Duffy-Wolcott

(t-Statistics are in parentheses)
Dependent Variable = ln(HOUSEP)

Adjusted R^2	.618436	.601201	.597883
F-statistic	95.8164	70.3463	45.8530
Durbin-Watson statistic	1.69758	1.39473	1.27859

Independent Variable	All Houses (.35 miles)	.25 Miles from Boundary	.15 Miles from Boundary
Test (TEST)	.0117548 **(3.63260)**	.00999335 **(2.86072)**	.00389185 (1.01255)
Bedrooms (BED)	-.290922E-02 (-.167916)	.018401 (1.01571)	.860422E-03 (.040162)
Bathrooms (BATH)	.183047 **(2.19051)**	.219606 **(3.17417)**	.229800 **(3.60446)**
Bathrooms Squared (BATHSQ)	-.017669 (-1.08655)	-.025668 **(-1.78526)**	-.024622 (1.9146)
Lot Size (LOTSIZE)	.514561E-03 **(2.15009)**	.462786E-03 **(1.76674)**	.297274E-03 (.987038)
Internal Square Footage (INTSF)	.0283588 **(9.19192)**	.0264067 **(9.08321)**	.0282162 **(10.3492)**

ii. <u>Interpretation of Coefficients for Duffy-Wolcott</u>

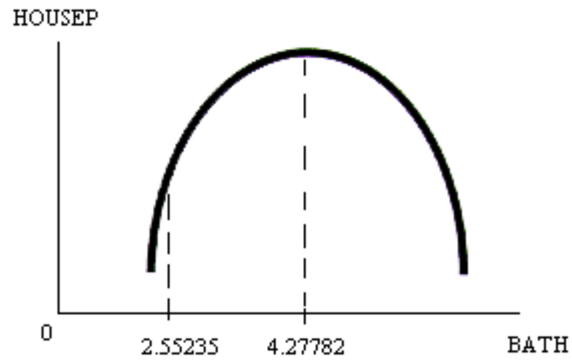
<u>Distance set at .25 miles</u>

$\hat{\beta}_{\text{TEST=}}$ .00999335

For every one percentage point increase in the test score above the average score for West Hartford elementary schools, the price of the house will increase by .999335 percent or by $2,362, holding all other independent variables constant.

$\hat{\beta}_{\text{BED=}}$ .018401

For every one bedroom increase in the house, the price of the house will increase by 1.8401 percent or by $4,349, holding all other independent variables constant.



Derivative = $\beta_{BATH} + 2\,\beta_{BATH} * BATH$
Set Derivative = 0 to find point at which House Price starts to increase

$\beta_{BATH} + 2\,\beta_{BATHSQ} * BATH = 0$
BATH = 4.27782

$\hat{\beta}_{BATH=}$ .219606
$\hat{\beta}_{BATHSQ=}$ -.025668

For every one bathroom squared increase in the house beyond the mean value of 2.55235 bathrooms, there will be an 8.86% or a $20,936.54 increase in the price of the house, until the maximum number of bathrooms (4.27782) is reached, holding all other independent variables constant.

$\hat{\beta}_{LOTSIZE=\,.}$ .000462786

For every one hundred square foot increase in the lot size, the price of the house will increase by .0462786 percent or by $109, holding all other independent variables constant.

$\hat{\beta}_{\text{INTSF=}\,.}$ .0264067

For every one hundred internal square foot increase in the house, the price of the house will increase by 2.64067 percent or by $6,241, holding all other independent variables constant.