AN ANALYSIS OF THE EFFECTS OF PUBLIC SCHOOL QUALITY ON HOUSE PRICES IN DURHAM, NORTH CAROLINA

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Abstract

Incorporating public school quality into the hedonic model of housing prices provides insight into parents' preferences for higher quality public schools. A cross-border analysis controls for neighborhood effects by assigning each home to a discrete neighborhood around a school boundary and then limiting the regressions to only those houses within increasingly narrow ranges (2000 feet, 1500 feet, 1000 feet) around the boundary. The analysis shows that homebuyers are willing pay more for better schools, with the highest effects at the elementary and middle school level. For a 10% increase in test scores, home buyers pay an 11% premium at the elementary and middle school levels and a 5% premium at the high school level. No previous school quality studies have focused on Durham, NC, and this new dataset, created from publically available sources, will serve as the foundation for on-going analysis into the relationship between the price of homes and the quality of public schools.

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I. INTRODUCTION:

At the heart of the lively and ongoing national debate regarding the quality of education is the role public schools play in shaping communities and neighborhoods by influencing where residents choose to live. Because public schools are, by law, free to attend and required to not discriminate when admitting students, school quality cannot be directly communicated through open market prices signals. But when buying a home, families also buy the right to attend the local public school, and they pay for that right in the price of the home, leading to the capitalization of school quality in housing prices. The implicit (hedonic) value of school quality, as shown in housing prices will be the focus of this study, using Durham, North Carolina as the case study.

Durham's public schools have played an important role in the city's history in a number of ways, but this study will focus on how the schools influence where residents choose to live and which homes to buy. In the decades following the forced desegregation of Durham's public schools in the 1960's, middle- and upper-class residents began moving to the Durham County Schools (largely suburban and exurban), which had the effect of making Durham City Schools (mostly inner city) generally poorer and more predominantly African-American. In 1992, the City and County schools were merged to form the unified Durham Public Schools. Currently in 2009, Durham Public Schools consists of 23 traditional elementary schools (plus 7 magnets, and 3 year-round), five traditional middle schools (plus 2 magnet, DSA and Shepard; and 2 year-round, Rogers-Herr and Chewning), and five high schools (plus 1 magnet, DSA). For the sake of comparability, I limited the analysis to only those traditional schools which draw from discrete attendance zones. Because the alternative schools allow some Durham residents to separate their housing and schooling decisions, those house prices will not pick up school quality, biasing my results towards zero. See Appendix for maps of school zones at the elementary, middle, and high school levels.

II. OBJECTIVES:

The general objective of this study is to investigate how the quality of Durham's public schools is capitalized in housing prices. First, the study will investigate whether or not Durham residents pay more to live in particular attendance zones, controlling for all other housing and neighborhood attributes by using a boundary fixed effects analysis. Specifically, the study will:

- Measure the value that Durham home owners placed on the school assignments (see Appendix for maps of school assignment zones) in 2003 and 2008 to determine whether or not home buyers paid more to locate in certain school zones.
- Investigate if home buyers pay more for different levels of school quality. How do they assess school quality? How do they prioritize elementary, middle, and high school assignments?

III. LITERATURE REVIEW

Most of the literature on the capitalization of school quality in housing prices builds on the work of Charles Tiebout. In 1956, Tiebout presented what came to be known simply as the "Tiebout model," which laid the groundwork for decades of empirical research on housing prices, and preferences for local public goods (LPGs) such as public education. The chief feature of the Tiebout model is that people choose where to live much like they choose any other good, by maximizing their preferences. More specifically, in picking where to live, consumers choose the community which offers them the best combination of LPGs and taxes to satisfy their preferences. Several conclusions are drawn from Tiebout's model. The most relevant conclusion for policy makers and school reform advocates is that under the Tiebout model, the most efficient outcome is for individuals to self-sort into homogenous communities with residents of equal income who demand equal levels of school expenditure.

The No Child Left Behind Act of 2001 renewed debate over questions of what it means for a school to be excellent, how to measure that excellence, and how to make a school improve. But the literature over the last half century shows that although economists have tried various techniques to measure the quality of a school, they have not yet reached a consensus view of which metric is best. Wallace Oates (1969 and 1973) worked from the Tiebout model and used per-pupil spending as the primary metric in assessing the quality of the local public schools. Later, Rosen and Fullerton (1977) and Nechyba (2003) criticized using school expenditure as a metric, because it measures the inputs not the outputs. Others (Ridker and Henning, 1967; Linneman, 1980) have used school reputation – as obtained from surveys – as the metric of school quality, because the *perceived* quality (rather than objective quality) of a school reflects how potential home buyers would estimate the value of the local school.

Any attempts at measuring objective school quality will be challenged by heterogeneity in consumer's preferences. Different parents may place relatively more importance on test scores while others care about more teacher-pupil ratio while others care more about racial composition. Although rational consumers should only care about output (marginal benefit on each student's education), prospective homebuyers will most likely judge a school based on the most observable characteristics (inputs may be more easily observed than outputs).

Standardized test scores as an alternative metric have become more practical since the passing of No Child Left Behind, which mandates yearly testing using statewide standardized examinations and makes those tests scores more easily accessible to the public. But test scores, Crone (2006) argues, are also insufficient evidence of school quality because each child's native ability and family background also influence test scores. The ideal metric would be marginal gains on standardized achievement (Hanushek, 1986; Hayes and Taylor, 1996), but because marginal gains are very difficult to accurately measure in real life, parents have to rely on proxies to best assess the quality of a school before attending.

Omitted variable bias is the central statistical challenge of measuring the effects of school quality on home prices because school quality will tend to be highly correlated with other attributes of a neighborhood. Black (1999) developed a technique to limit the data set (using data gathered from Massachusetts) to only include houses that were near the boundaries of school attendance zones within school districts, becoming one of the first to use boundary fixed effects to control for neighborhood characteristics. Since Black's work, boundary fixed effects have become a common technique for controlling for neighborhood effects (Bayer, Ferreira, and McMillan, 2003 and 2004; Kane, Staiger, and Reigg, 2005). Bayer, Ferreira, and McMillan (2003 and 2004) developed a general equilibrium model that incorporated long-run Tiebout demographic sorting into a predictive model of housing prices. Kane (2005) follows on Black's work, conducting a boundary fixed effects analysis in the Charlotte-Mecklenburg School district. Analyses that do not control for neighborhood effects and other indirect effects will overstate, by up to four times, the effects of school quality on housing prices (Black, 1999).

IV. CREATING THE DATASET

Developing the master dataset, though conceptually straightforward, required a certain level of creativity and perseverance. The information I intended to gather was simple. For each house in Durham County, I wanted to know its fair market value, any observable characteristics which affect house prices, which school attendance zones it was in (for elementary, middle, and high school levels), and the distance to the border of the school attendance zone (again, for each school level). I gathered datasets from several sources, including the Durham Tax Assessors Office and Durham Public Schools. I then worked with various GIS shapefiles provided by Duke University's GIS data services.

In the GIS 2008 parcels layer, each parcel in Durham County was represented as a 2-dimensional polygon. I converted each of those parcels into a centroid, which represents the x,y coordinate located in the center of the parcel. I then laid the school attendance zone maps on top of the 2008 parcels, and assigned to each parcel the appropriate elementary, middle, and high school variables (using the join function). In that process, 22 parcels (out of the original 101487) were dropped because the centroids fell outside of Durham County. These are parcels that cross the Durham county line into an adjacent county, and therefore I couldn't confidently assign them to a Durham Public School.

Measuring the distance from each parcel to the nearest attendance zone boundary was the most computationally intensive process. Again, the process was simple in theory but tedious in practice. The software package used, ArcMap, contains a function in the proximity analysis toolset, called "Near". In ArcMap 9.2, the Near function can measure distances between points and lines, but not points and polygons. Because the attendance zones are polygons and the parcels are points, ArcMap 9.2 couldn't directly perform the necessary calculations. Out of necessity, I developed a workaround technique to approximate the distance from each parcel to the boundary line, using the distance to the nearest house in an adjacent attendance zone as a proxy for the distance to the attendance zone boundary (see Appendix for illustration).

For the high schools, I created a layer for each high school attendance zone (Jordan, Hillside, Southern, Riverside, and Northern) and a corresponding layer for the adjacent zones (JordanNOT, HillsideNOT, SouthernNOT, RiversideNOT, and NorthernNOT). I then ran a Near analysis for each attendance zone to the adjacent zones (eg input field "Jordan" with near field "JordanNOT"). The analysis added an attribute, called "neardist" which displayed the distance, measured in feet, to the nearest parcel in an adjacent attendance zone. I exported each layer into its own ShapeFile. Then I used StatTransfer to convert each ShapeFile into a Stata-readable .DTA file. I then appended each .DTA to each other, producing three .DTA files: elem_appended.dta, mid_appended.dta, and high_appended.dta. These Stata files were merged into one dataset, based on the common id for parcel number. My Stata dataset now had, for each unique parcel, the high school, middle school, and elementary school data. I converted that Stata file to a .dbf and then, going back to ArcGIS, I joined the .dbf with my parcel .shp file. Now I had a single .shp file with all relevant school data in it (for mapping purposes). I then exported the .shp file to Stata. In Stata, I dropped any duplicate observations, using the unique id for parcel number, using the command "duplicates drop parecnumber, force". 602 duplicate observations were deleted. Now I had a Stata file (dist.dta) with all school data and a unique identifier for each 2008 parcel. Using this, I merged (dist.dta) with the 2008.dta tax file, on the unique identifier, using the command "merge parcenumber using dist.dta, unique sort". I repeated that merge with the 2003.dta tax file. Now I had two Stata files (2008 and 2003), each with a unique observation for each parcel and including all school information. Then I simply appended the 2003.dta to the 2008.dta file. Now I had a single master dataset, Durham_Master.dta, which included all 2003 and 2008 data with all school information and tax information. I dropped any observations which appeared in only one of the datasets (9560 observations were dropped). I created a variable "pricedif" by calculating the change in price from 2003 to 2008 in house value.

In ArcGIS, I created a new attribute for each house that identifies the nearest school boundary. I had to do this manually by drawing polygons around each of the borders. There are five main borders at the high school level, seven at the middle school level, and 45 at the elementary school level.

V. MEASURING SCHOOL QUALITY IN DURHAM PUBLIC SCHOOLS

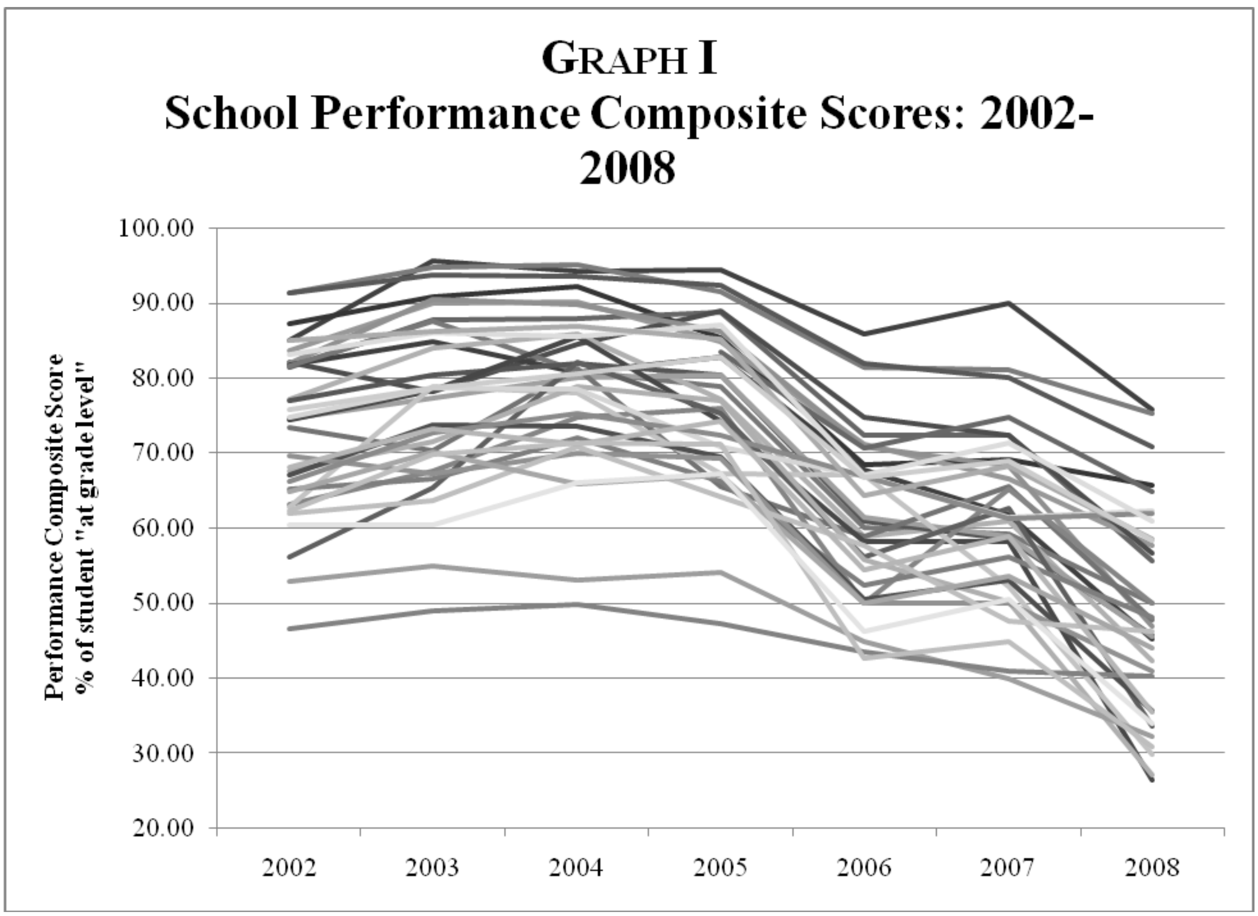
To measure school quality, I used the NC Department of Education's standardized metric: the school performance composite score. The performance composite score measures the percentage of students in the school with test scores at or above Achievement Level III, which is often referred to as "at grade level." See Appendix for full description of how the Department of Education measures performance composites. Performance composite scores were gathered from 2002 through 2008. For each school, I calculated the average score over the time period and I calculated the average annual rate of change. Interestingly, every school in the Durham Public School system worsened on the performance composite score, meaning that each year a lower percentage of students in Durham Public Schools performed at grade level. As a whole, Durham Public Schools (including all schools and the elementary, middle, and high school levels), dropped annually by an average of 4.5% on the performance composite score during the 2002-2008 time period. The fact that every school decreased over the six years suggests that there may have been systematic changes across the district in how tests are being administered and graded.

1. TABLE

PERFORMANCE COMPOSITE SCORE SUMMARY STATISTICS

Variable	Mean	Std. Dev.	Min	Max
eschoolavg[1]	70.6709	8.618126	56.6	88.7
mschoolavg[1]	63.36267	7.870023	55	77.2
hschoolavg[1]	58.5827	10.37195	45.3	70.5
eschoolchg[2]	-4.95152	1.178346	-7.56	-1.7
mschoolchg[2]	-4.44361	0.947079	-6.18	-3.05
hschoolchg[2]	-2.52748	0.868441	-3.56	-1.48

[1]The _schoolavg variables measure the district-wide performance composite score at each school level.
[2] The _schoolchg variables measure the average rate of change in performance composite score from 2002 to 2008.



2. Table

PERFORMANCE COMPOSITE SCORES[1]

SUMMARY STATISTICS FROM 2002-2008

School	Average	Annual Rate of Change
Mangum Elementary	88.7	-1.70
Easley Elementary	87.2	-3.18
Little River Elementary	86.3	-3.58
Hillandale Elementary	79.8	-4.70
Hope Valley Elementary	78.0	-4.43
Southwest Elementary	77.7	-5.14
Forest View Elementary	76.7	-3.50
Eno Valley Elementary	76.3	-6.02
Creekside Elementary	73.5	-5.17
Parkwood Elementary	72.1	-6.03
Club Boulevard Elementary	71.2	-6.16
Holt Elementary	69.4	-6.34
Oak Grove Elementary	69.3	-5.67
Merrick-Moore Elementary	68.3	-5.11
Lakewood Elementary	66.1	-3.90
Fayetteville Street Elementary	65.0	-7.56
W G Pearson Elementary	63.8	-2.48
C C Spaulding Elementary	62.2	-5.84
Eastway Elementary	61.6	-3.54
Y E Smith Elementary	61.2	-6.68
Bethesda Elementary	61.0	-3.27
Glenn Elementary	60.5	-5.68
E K Powe Elementary	59.6	-5.04
George L Carrington Middle	77.2	-4.07
James E Shepard Middle	76.3	-4.93
Brogden Middle	73.1	-3.05
Lowe's Grove Middle	62.2	-5.09
Sherwood Githens Middle	59.4	-3.99
Neal Middle	56.1	-6.18
Chewning Middle	55.0	-4.26
C E Jordan High	70.5	-2.96
Riverside High	68.0	-1.58
Northern High	58.8	-3.32
Southern High	47.4	-3.56
Hillside High	45.3	-1.48

[1] Performance Composite Score is calculated as the percentage of the test scores in the school at or above Achievement Level III (often referred to as at grade level or proficient). See appendix for full explanation of how Composite Score is calculated. Data was collected from the NC Department of Public Instruction, accessible at: http://abcs.ncpublicschools.org

[2] Annual rate of change is measured as the average change in performance composite score over the period of 2002 to 2008.

3. TABLE

SUMMARY STATISTICS

	Full Sample		Year 2003		Year 2008	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
price[a]	162894.0000	113465.9000	145011.10	92238.62	180776.9	128847.4
lnprice	11.8386	0.5636	11.74	0.5365694	11.93831	0.5723146
hneardis[b]	6022.8360	5881.3390	6022.84	5881.366	6022.836	5881.366
mneardis[b]	4908.0800	4329.7280	4908.08	4329.748	4908.08	4329.748
eneardis[b]	2850.5850	3457.2700	2850.59	3457.286	2850.585	3457.286
mapacres[d]	0.4921	0.9121	0.49	0.8614863	0.4921043	0.9599862
age	41.9740	112.1314	41.70	108.4421	42.24949	115.7035
finishedarea	1395.0610	532.4322	1383.13	518.8383	1406.997	545.4312
hvacfootage	879.2834	1036.6860	1.85	0.7853454	1756.715	780.8054
bathrooms	2.4379	0.9769	3.08	0.7555249	1.792543	0.7107174
hscoreavg[c]	58.5827	10.3720	58.58	10.372	58.5827	10.372
mscoreavg[c]	63.3627	7.8700	63.36	7.870059	63.36267	7.870059
escoreavg[c]	70.6709	8.6181	70.67	8.618166	70.6709	8.618166
N	107,950		53,975		53,976	

[a] Price is equivalent to the total assessed value of the property, as reported by the Durham County Tax Assessors Office

[b] The _neardis variables measure the distance, in feet, to the nearest attendance zone boundary (**h**igh, **m**iddle, and **e**lementary)

[c] The _scoreavg variable measure the average Performance Composite Score from 2002-2008 at the assigned school

[d] mapacres measures the total number of acres on the plot of land

VI. RESULTS

First, I performed a simple OLS regression, clustering on "id" with robust standard errors. I created dummy variables for each of the five high schools to compare the relative prices on each school. The basic relationship I wanted to explore is as follows:

(1) $\ln(\text{price}) = \beta_0 + X'\delta + Z'\alpha$,

where the vector X includes housing characteristics and the vector Z include dummies for the schools. The vectors X and Z are represented as follows:

(2) $X = \beta_1\text{mapacres} + \beta_2\text{finishedarea} + \beta_3\text{age} + \beta_4\text{hvacfootage} + \beta_5\text{bathrooms} + \beta_6\text{fireplace} + \beta_7\text{basement} + \beta_8\text{garage}$

(3) $Z_{HS} = \gamma_1\text{HSNorthern} + \gamma_2\text{HSRiverside} + \gamma_3\text{HSSouthern} + \gamma_4\text{HSHillside}$

In each regression, I left out the dummy variable for the highest performing school. For example, at the high school level, I omitted Jordan High School so the coefficients on the high school dummy variables are all in reference to Jordan High School, the highest performing high school in Durham. At the middle school level, coefficients are relative to Carrington and at the elementary level, coefficients are relative to Mangum. At each school level, I ran the regression 4 times, first including all parcels, then limiting the regression to parcels within 2000 feet, 1500 feet, and finally 1000 feet of the nearest high school attendance zone. In Stata, I used variations of the command:

```
regress  lnprice mapacres finishedarea age hvacfootage bathrooms fireplace basement
garage HSNorthern HSRiverside HSSouthern HSHillside , cluster (id) robust
```

4. TABLE
HS DUMMY OLS RESULTS
ROBUST STANDARD ERRORS
DEPENDENT VARIABLE = LN (PRICE)

Distance from HS boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
mapacres	0.0596	0.0067***	0.1100	0.0193***	0.1079	0.0229***	0.1008	0.0247***
finishedarea	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***
age	-0.0006	0.0000***	-0.0008	0.0001***	-0.0008	0.0001***	-0.0010	0.0002***
hvacfootage	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***
bathrooms	0.1678	0.0046***	0.1796	0.0041***	0.1786	0.0049***	0.1784	0.0063***
fireplace	0.1613	0.0027***	0.1872	0.0058***	0.1788	0.0071***	0.1861	0.0090***
basement	0.3078	0.0033***	0.3607	0.0065***	0.3880	0.0079***	0.4276	0.0107***
garage	0.2705	0.0040***	0.3221	0.0093***	0.3674	0.0115***	0.4258	0.0162***
HSNorthern	-0.1794	0.0046***	-0.1671	0.0089***	-0.1612	0.0105***	-0.1433	0.0135***
HSRiverside	-0.0339	0.0041***	0.0134	0.0101	0.0094	0.0119	0.0319	0.0146
HSSouthern	-0.2145	0.0044***	-0.2453	0.0106***	-0.2600	0.0123***	-0.2805	0.0159***
HSHillside	-0.1257	0.0039***	-0.0308	0.0081***	-0.0400	0.0094***	-0.0354	0.0119**
_cons	10.7889	0.0110	10.5529	0.0153	10.5488	0.0175	10.524	0.0243
N	107,950		25,524		18,112		10,904	
R^2	0.7048		0.7155		0.726		0.7468	

* Indicates p-value is less than 0.05; ** indicates p-value is less than 0.01; *** indicates p-value is less than 0.001

5. Table
MS Dummy OLS Results
Robust Standard Errors
Dependent Variable = ln (price)

Distance from MS boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
mapacres	0.0593	0.0066***	0.0735	0.0124***	0.0670	0.0124***	0.0609	0.0133***
finishedarea	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***	0.0002	0.0000***
age	-0.0006	0.0000***	-0.0007	0.0001***	-0.0007	0.0001***	-0.0007	0.0001***
hvacfootage	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***
bathrooms	0.1678	0.0046***	0.1550	0.0119***	0.1469	0.0152***	0.1518	0.0208***
fireplace	0.1572	0.0027***	0.1543	0.0052***	0.1661	0.0061***	0.1779	0.0076***
basement	0.3103	0.0033***	0.3674	0.0078***	0.3845	0.0097***	0.3869	0.0131***
garage	0.2771	0.0040***	0.3459	0.0112***	0.3649	0.0139***	0.3785	0.0197***
MSBrogden	0.0878	0.0045***	0.0265	0.0085**	-0.0178	0.0099	-0.0685	0.0125***
MSChewning	-0.1443	0.0045***	-0.2199	0.0080***	-0.2407	0.0092***	-0.2812	0.0115***
MSGithens	0.0699	0.0042***	-0.0405	0.0082***	-0.0479	0.0092***	-0.0859	0.0116***
MSLowesGrove	-0.0288	0.0038***	-0.0621	0.0078***	-0.0822	0.0092***	-0.1222	0.0116***
MSNeal	-0.1212	0.0037***	-0.3028	0.0091***	-0.3487	0.0107***	-0.4346	0.0136***
_cons	10.6919	0.0101	10.7117	0.0233	10.7531	0.0293***	10.7665	0.0384
N	107,950		31,174		22,306		13,210	
R^2	0.7065		0.6760		0.6746		0.6712	

* Indicates p-value is less than 0.05; ** indicates p-value is less than 0.01; *** indicates p-value is less than 0.001

6. TABLE
ES DUMMY OLS RESULTS
ROBUST STANDARD ERRORS
DEPENDENT VARIABLE = LN (PRICE)

Distance from ES boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
mapacres	0.0409	0.0030***	0.0613	0.0040***	0.0611	0.0043***	0.0592	0.0048***
finishedarea	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***	0.0003	0.0000***
age	-0.0006	0.0000***	-0.0006	0.0000***	-0.0006	0.0000***	-0.0006	0.0000***
hvacfootage	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***	0.0002	0.0000***
bathrooms	0.1328	0.0039***	0.1254	0.0062***	0.1227	0.0068***	0.1116	0.0090***
fireplace	0.1393	0.0023***	0.1574	0.0032***	0.1555	0.0036***	0.1616	0.0045***
basement	0.2615	0.0027***	0.2574	0.0039***	0.2597	0.0043***	0.2672	0.0055***
garage	0.1938	0.0033***	0.1544	0.0050***	0.1573	0.0058***	0.1629	0.0075***
ESBethesda	-0.2662	0.0102***	-0.3120	0.0175***	-0.3292	0.0206***	-0.3823	0.0268***
ESEastway	-0.5620	0.0125***	-0.4830	0.0177***	-0.4678	0.0203***	-0.5027	0.0262***
ESEasley	-0.0957	0.0097***	-0.0428	0.0160**	-0.0544	0.0186**	-0.0728	0.0244**
ESEnoValley	-0.1464	0.0097***	-0.1311	0.0161***	-0.1357	0.0186***	-0.1640	0.0244***
ESCCSpauld~g	-0.3600	0.0143***	-0.2860	0.0192***	-0.2882	0.0216***	-0.3326	0.0276***
ESCreekside	0.0925	0.0099***	0.1358	0.0164***	0.1359	0.0190***	0.1079	0.0246***
ESEKPowe	0.0047	0.0116	0.0396	0.0182*	0.0148	0.0212	-0.0909	0.0281**
ESFayettev~e	-0.3739	0.0105***	-0.2926	0.0162***	-0.2788	0.0185***	-0.3056	0.0242***
ESForestView	0.1398	0.0104***	0.2333	0.0196***	0.1952	0.0239***	0.1439	0.0324***
ESGlenn	-0.2183	0.0101***	-0.1318	0.0162***	-0.1267	0.0188***	-0.1526	0.0246***
ESHillandale	-0.0130	0.0100	-0.0392	0.0174	-0.0554	0.0198**	-0.1066	0.0256***
ESHolt	-0.1233	0.0101***	-0.0617	0.0167***	-0.0470	0.0193*	-0.0614	0.0247*
ESHopeValley	0.1015	0.0099***	0.1451	0.0159***	0.1479	0.0185***	0.1273	0.0242***
ESLakewood	-0.0940	0.0121***	-0.0318	0.0179	-0.0313	0.0205	-0.0812	0.0269**
ESLittleRi~r	0.0008	0.0099	0.0016	0.0166	-0.0073	0.0197	-0.0332	0.0261
ESMerrickM~e	-0.2188	0.0099***	-0.1421	0.0160***	-0.1382	0.0185***	-0.1503	0.0244***
ESOakGrove	-0.1607	0.0094***	-0.1104	0.0160***	-0.0941	0.0185***	-0.1065	0.0243***
ESParkwood	-0.0182	0.0094	0.0769	0.0162***	0.0624	0.0190**	0.0308	0.0250
ESSouthwest	-0.0151	0.0104	0.0412	0.0163*	0.0213	0.0190	-0.0223	0.0248
ESWGPearson	-0.6712	0.0145***	-0.5960	0.0190***	-0.5897	0.0210***	-0.6180	0.0262***
ESYESmith	-0.6188	0.0133***	-0.5464	0.0184***	-0.5260	0.0209***	-0.5833	0.0273***
_cons	10.9480	0.0134	10.8667	0.0210	10.8591	0.0232	10.8878	0.0305
N	107,950		57,150		43,886		28,200	
R^2	0.7649		0.7593		0.7572		0.7573	

* Indicates p-value is less than 0.05; ** indicates p-value is less than 0.01; *** indicates p-value is less than 0.001

Because the results show that parents do pay more for certain schools, I wanted to investigate why they value certain schools more and see if the performance composite scores could serve as a useful proxy for school quality. To produce more generalizable results, I wanted to explore the particular features of the schools to try to distill what exactly home buyers were buying when they paid more to live in a certain school zone. I also wanted to look at how the elementary and middle school zones compared to the high school zones. At each level (elementary, middle, and high), I ran four regressions at varying distances to the boundary. I was most interested in looking at the effect on the coefficient of _schoolavg, which measures the average composite performance score from 2002 to 2008. The score measures the percentage of the test scores in the school at or above Achievement Level III.[2]

7. TABLE
HIGH SCHOOL COMPOSITE SCORES OLS RESULTS
ROBUST STANDARD ERRORS
DEPENDENT VARIABLE = LN (PRICE)

Distance from HS boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
finishedarea	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000
mapacres	0.0529	0.0049	0.1057	0.0168	0.1044	0.0200	0.1011	0.0228
hvacfootage	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000
bathrooms	0.1705	0.0046	0.1891	0.0042	0.1882	0.0050	0.1858	0.0066
fireplace	0.1676	0.0027	0.1970	0.0059	0.1887	0.0071	0.1943	0.0091
basement	0.3147	0.0033	0.3890	0.0064	0.4187	0.0078	0.4578	0.0107
age	-0.0006	0.0000	-0.0008	0.0001	-0.0008	0.0001	-0.0010	0.0002
garage	0.2731	0.0041	0.3601	0.0093	0.4073	0.0114	0.4655	0.0162
hschoolavg	0.0061	0.0001	0.0041	0.0003	0.0046	0.0003	0.0050	0.0004
_cons	10.3183	0.0104	10.2095	0.0190	10.1714	0.0226	10.1371	0.0314
N	107,950		25,524		18,112		10,904	
R^2	0.6972		0.7000		0.7123		0.7335	

Note: all P values are less than 0.000

[2] See appendix for full explanation of how Composite Score is calculated.

8. TABLE

MIDDLE SCHOOL COMPOSITE SCORES OLS RESULTS

ROBUST STANDARD ERRORS

DEPENDENT VARIABLE = LN (PRICE)

Distance from MS boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
finishedarea	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0002	0.0000
mapacres	0.0515	0.0044	0.0641	0.0094	0.0600	0.0098	0.0578	0.0116
hvacfootage	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000
bathrooms	0.1732	0.0047	0.1634	0.0123	0.1569	0.0159	0.1613	0.0217
fireplace	0.1752	0.0027	0.1603	0.0053	0.1716	0.0062	0.1817	0.0077
basement	0.3218	0.0034	0.3958	0.0082	0.4159	0.0105	0.4216	0.0139
age	-0.0006	0.0000	-0.0007	0.0001	-0.0007	0.0001	-0.0007	0.0001
garage	0.2700	0.0042	0.3838	0.0119	0.4088	0.0151	0.4305	0.0211
mschoolavg	0.0052	0.0001	0.0107	0.0003	0.0106	0.0003	0.0117	0.0004
_cons	10.3136	0.0134	9.9143	0.0295	9.9418	0.0366	9.8456	0.0469
N	107,950		31,174		22,306		13,210	
R^2	0.6903		0.6618		0.6575		0.6519	

Note: all P values are less than 0.000

9. TABLE

ELEMENTARY SCHOOL COMPOSITE SCORES OLS RESULTS

ROBUST STANDARD ERRORS

DEPENDENT VARIABLE = LN (PRICE)

Distance from ES boundary:	(1) Full Sample		(2) 2000 feet		(3) 1500 feet		(4) 1000 feet	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
finishedarea	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000	0.0003	0.0000
mapacres	0.0421	0.0027	0.0620	0.0037	0.0641	0.0042	0.0650	0.0052
hvacfootage	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000	0.0002	0.0000
bathrooms	0.1610	0.0045	0.1518	0.0074	0.1455	0.0079	0.1296	0.0103
fireplace	0.1749	0.0027	0.1900	0.0037	0.1862	0.0042	0.1933	0.0052
basement	0.3052	0.0032	0.3148	0.0047	0.3172	0.0051	0.3254	0.0065
age	-0.0005	0.0000	-0.0006	0.0000	-0.0006	0.0000	-0.0006	0.0000
garage	0.2374	0.0040	0.2240	0.0062	0.2305	0.0070	0.2410	0.0090
eschoolavg	0.0073	0.0002	0.0094	0.0003	0.0096	0.0003	0.0116	0.0004
_cons	10.1755	0.0125	9.9814	0.0171	9.9644	0.0190	9.8352	0.0240
N	107,950		57,150		43,886		28,200	
R^2	0.6960		0.6822		0.6821		0.6835	

Note: all P values are less than 0.000

10. TABLE
JORDAN-HILLSIDE BORDER ANALYSIS
WITHOUT ELEMENTARY SCHOOL SCORES
ROBUST STANDARD ERRORS
DEPENDENT VARIABLE = LN (PRICE)

Distance from	(1)				(2)			
Jordan-Hillside	All parcels in border region				1500 feet			
boundary:	Coef.	S.E.	t	P>|t|	Coef.	S.E.	t	P>|t|
mapacres	0.0515	0.0111	4.6300	0.0000	0.0911	0.0285	3.1900	0.0010
finishedarea	0.0003	0.0000	31.7300	0.0000	0.0002	0.0000	26.9000	0.0000
age	-0.0007	0.0001	-7.1600	0.0000	-0.0008	0.0002	-3.9900	0.0000
hvacfootage	0.0002	0.0000	21.3700	0.0000	0.0002	0.0000	16.0600	0.0000
bathrooms	0.1668	0.0109	15.2400	0.0000	0.1998	0.0082	24.4500	0.0000
fireplace	0.1912	0.0056	34.2900	0.0000	0.1549	0.0132	11.7700	0.0000
basement	0.2833	0.0071	40.1300	0.0000	0.4168	0.0126	32.9800	0.0000
garage	0.2668	0.0073	36.3900	0.0000	0.4557	0.0184	24.7900	0.0000
HSJordan	0.0843	0.0052	16.2900	0.0000	0.0283	0.0096	2.9300	0.0030
_cons	10.7440	0.0230	468.0700	0.0000	10.5906	0.0252	419.5300	0.0000
N	30,630				7,556			
R^2	0.6891				0.7269			

Note: The P-values are less than 0.05 on all coefficients

11. TABLE
JORDAN-HILLSIDE BORDER ANALYSIS
WITH ELEMENTARY SCHOOL SCORES
ROBUST STANDARD ERRORS
DEPENDENT VARIABLE = LN (PRICE)

Distance from	(1)				(2)			
Jordan-Hillside	All parcels in border region				1500 feet			
boundary:	Coef.	S.E.	t	P>|t|	Coef.	S.E.	t	P>|t|
mapacres	0.0479	0.0094	5.0800	0.0000	0.0770	0.0213	3.6200	0.0000
finishedarea	0.0003	0.0000	41.2800	0.0000	0.0002	0.0000	34.5600	0.0000
age	-0.0006	0.0001	-8.0700	0.0000	-0.0007	0.0002	-4.5300	0.0000
hvacfootage	0.0001	0.0000	25.9500	0.0000	0.0002	0.0000	22.1500	0.0000
bathrooms	0.1300	0.0088	14.8300	0.0000	0.1495	0.0064	23.4500	0.0000
fireplace	0.1652	0.0048	34.1700	0.0000	0.1500	0.0112	13.3400	0.0000
basement	0.2401	0.0055	43.9100	0.0000	0.2922	0.0106	27.4800	0.0000
garage	0.1914	0.0059	32.6800	0.0000	0.2102	0.0143	14.7500	0.0000
eschoolavg	0.0258	0.0005	48.7900	0.0000	0.0331	0.0010	33.8800	0.0000
HSJordan	0.0123	0.0050	2.4700	0.0130	-0.0203	0.0080	-2.5500	0.0110
_cons	9.0203	0.0328	275.2100	0.0000	8.4208	0.0660	127.6300	0.0000
N	30,630				7,556			
R^2	0.7549				0.8080			

Note: The P-values are less than 0.05 on all coefficients

VII. ANALYSIS & CONCLUSION

The results show that parents do pay more to live in areas with better schools. By limiting the analysis to increasingly narrow ranges around the school zone boundaries, general neighborhood effects which change gradually can be separated from the schooling effects which change discontinuously at the boundaries.

Dummy variables for each school helped illustrate how much parents pay for each school. Tables 4, 5, and 6 show persistent differences in prices, as seen in the statistically significant coefficients on the dummy variables. By looking at performance composite scores, I have shown in Tables 7, 8, and 9 that home buyers pay more for schools with higher test scores, at all school levels. The marginal effect of composite scores on home prices (controlling for neighborhood effects) is seen in the coefficient on _schoolavg in the 4^{th} regression on Tables 7, 8, and 9. The effect of elementary performance composite scores was the largest, where a 10% increase in elementary school scores leads to an 11% increase in housing prices. At the middle school level, a 10% increase in school scores leads to a 11% increase in housing prices. And at the high school level, a 10% increase in school scores leads to a 5% increase in housing prices. In Durham, the mean house value is $162,894, so a 10% increase in housing value would be approximately $16,000 at the mean. A 5% increase would be $8,000. These results are statistically significant at the $p = 0.01$ level, even when controlling for boundary effects and limited the samples to 1000 feet of a border.

Because parents can also choose to send their children to private school, the premium parents pay for a house in a better school district should, theoretically, be equal to the price they would pay in tuition over their child's lifetime to attend an equally good private school (assuming one existed). As a point of comparison and as a possible measure of the opportunity cost, tuition is approximately $10,000 at the Montessori Childrens House of Durham and $6000 at the Immaculata Catholic School.

Any econometric analysis must be very sensitive to omitted variable bias, which is the main challenge to overcome when incorporating public school quality into the hedonic price model. Careless analyses can easily confuse "good schools" with "good neighborhoods" and attribute higher prices to the better schools.

Tables 10 and 11 illustrate the challenges of omitted variable bias in this econometric analysis. By looking only at those houses in the region surrounding the Jordan-Hillside border, it appears initially from regression 1 in Table 10 that homebuyers pay an 8% premium to live on the Jordan side of the border. This result is significant at a $p = 0.0001$ level. To test that conclusion more robustly, I limited the regression to look only those houses with 1500 feet of the border. The relationship persists, though the magnitude and significance both decrease, from 8% to 2% and from $p=0.0001$ to $p = 0.01$, respectively. Table 11 runs the same regression, but incorporates elementary school composite scores. In regression 1 of Table 11, the premium homebuyers pay on Jordan is 1.2%, and that effect is significant at the $p=0.01$ level. But limiting the sample to the houses within 1500 feet of the border shows a reversal in the effects: homebuyers actually seem to pay more to live on the Hillside side of the border (in all other regressions, Jordan homes held a premium). The Jordan-Hillside border runs along several elementary school borders, some of which have significant differences in composite scores. The results of Table 11 show that variation in elementary school quality (which parents prioritize more than high school quality) may lead to counter-intuitive price differentials at high school borders.

I end with Tables 10 and 11 because they highlight one of the most important conclusions of this thesis: the success of the econometric techniques used will determine the extent to which all relevant variables can be incorporated into the model explicitly or implicitly through border effects. Omitted Variable Bias continues to be the largest challenge – both in econometrics and public policy – for studying the effects of variation in school quality.

VIII. FURTHER QUESTIONS

A number of questions regarding the effects of school quality on housing prices remain. The central challenge continues to be that school characteristics are often unobservable and any observable characteristics tend to be highly correlated with a number of characteristics of the neighborhood which homebuyers also care about. Further analyses could incorporate some or all of the following techniques for more fully separating school and neighborhood effects.

- Incorporate US Census data at the block level to develop a more refined and detailed picture of each neighborhood. Important features would include crime rates, racial composition, age demographics, and income. Because parents of school-aged children should be the only home-buyers concerned with school quality, it's important to know for each neighborhood the percentage of households that have children who would be eligible to attend the public schools. Racial composition of a neighborhood may also influence home buyers' decisions, with some parents preferring a diverse neighborhood while others choose a more homogeneous area.
- Bring in more data on each school, in addition to the performance composite score, to see what (in addition to test scores) parents care about. The Department of Education releases an annual report card on each school which includes a

variety of interesting statistics, including school size, teacher-pupil ratio, crimes per 100 students, average percentage of students who attend school each day, percentage of "economically disadvantaged" students, and so on. Because parents will have to make trade-offs between different schools with different characteristics, it would be interesting to see a more refined picture of how parents prioritize the various qualities of a school.

- Develop more sophisticated border techniques to better isolate smaller "micro-neighborhoods" which more completely control for neighborhood effects and can test whether observed housing and neighborhood characteristics change discontinuously at the boundary.

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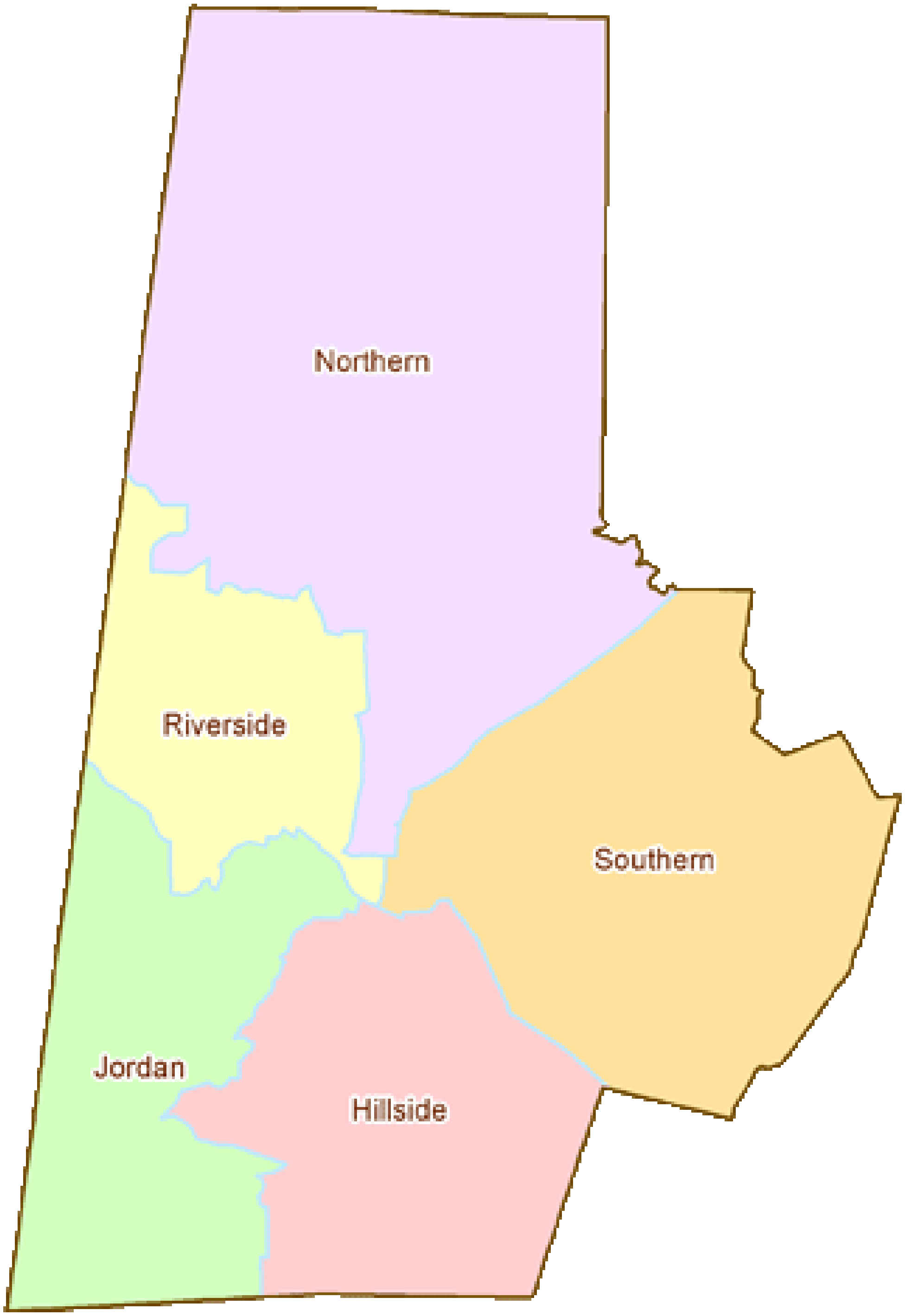
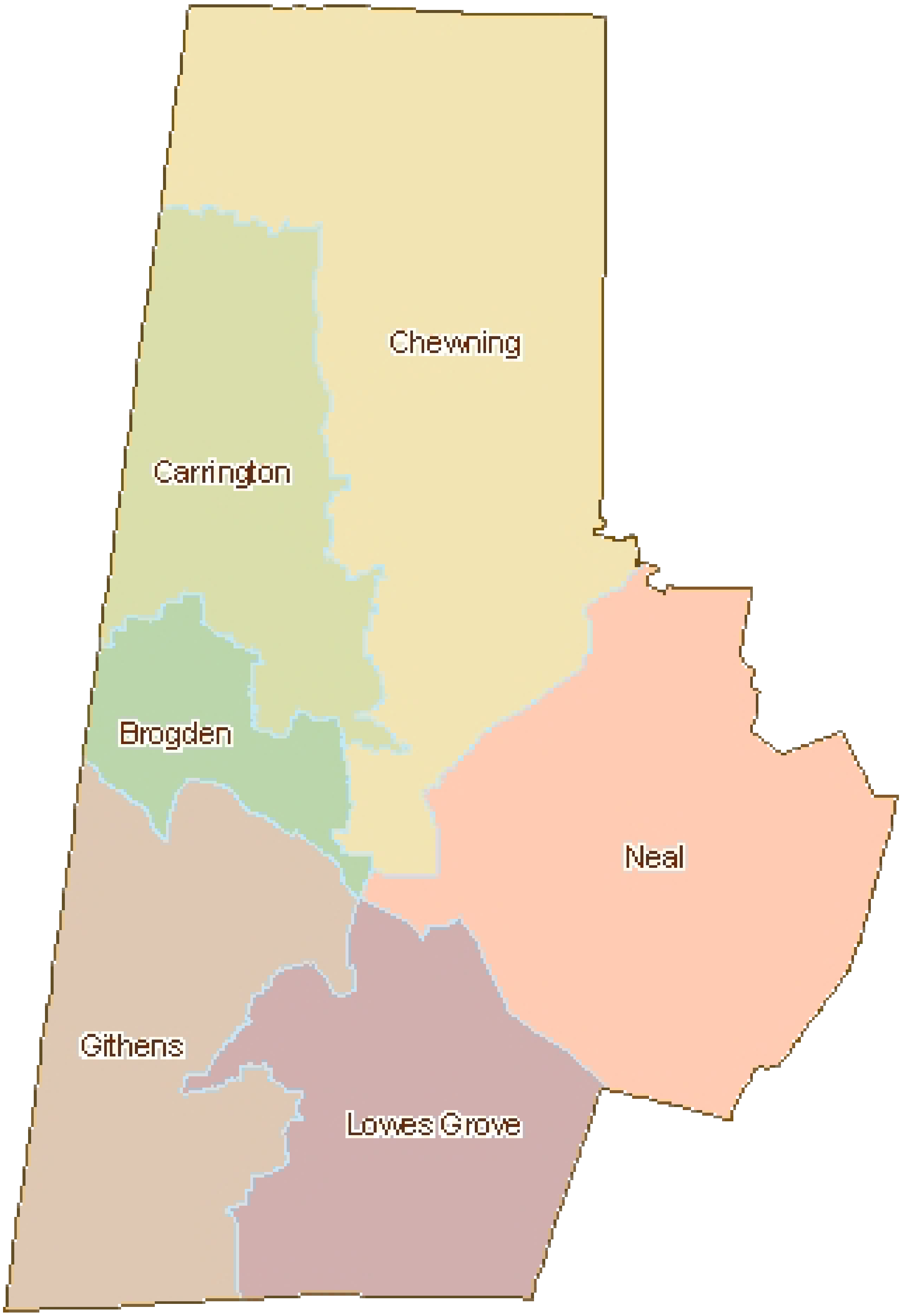
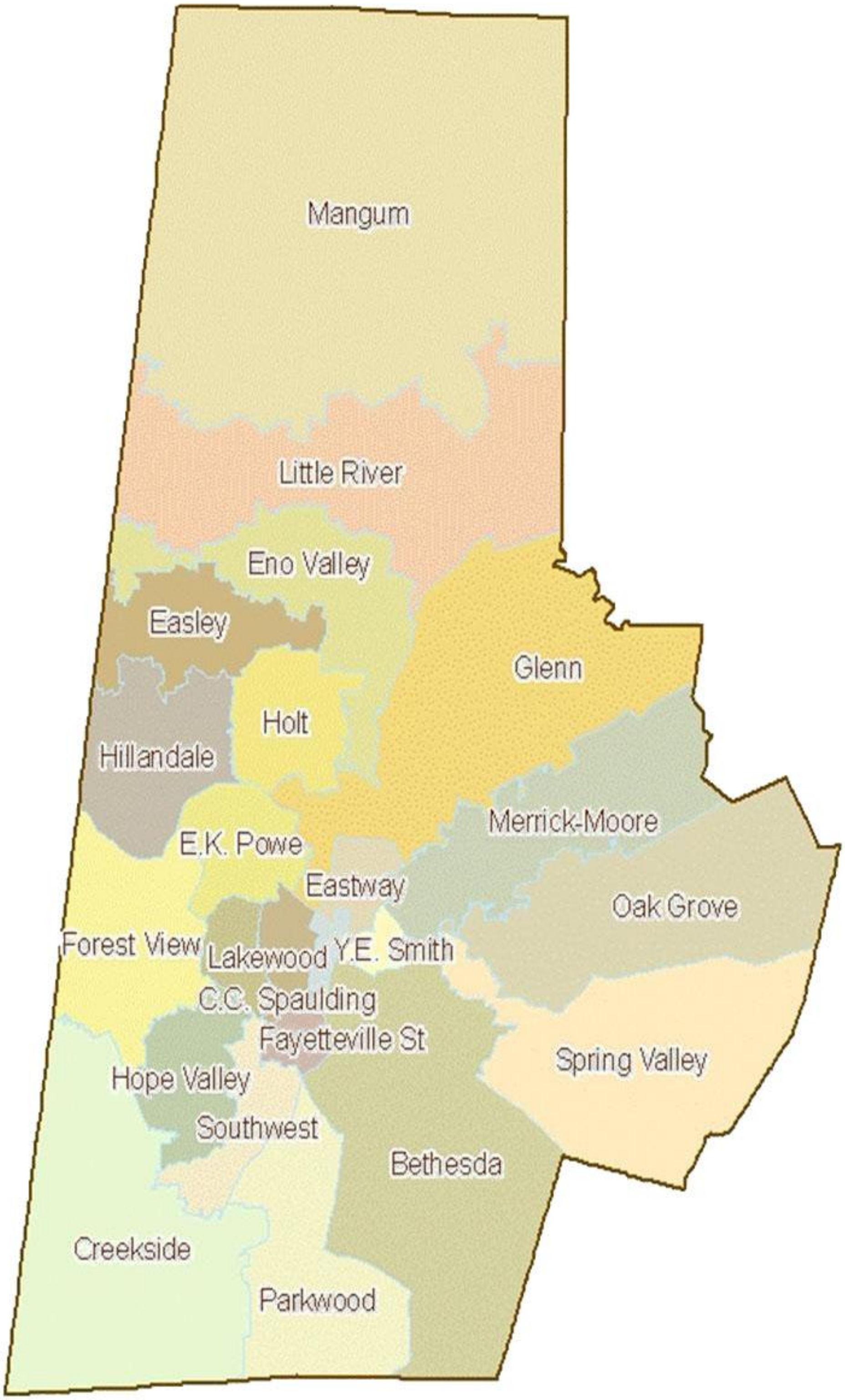
Appendix



High Schools in DPS



Middle Schools in DPS



Elementary Schools in DPS

Accessed from:
http://www.ncpublicschools.org/docs/accountability/reporting/abc/2006-07/composite.pdf

Computing Performance Composite 2006-07

Performance Composite = the percentage of the test scores in the school at or above Achievement Level III (often referred to as at grade level or proficient).

To determine the performance composite for a school with only grades below 8:

1) Count the number of test scores for students who are enrolled in the grade or subject for which they were tested (i.e. third grade EOG scores for third graders in membership in the school on the first day of spring testing).
2) count the number of writing test scores for students enrolled in the appropriate grade (i.e. fourth grade writing test scores for students who are fourth graders)
3) The total from steps 1 and 2 above is the denominator.
4) Using the number of proficient scores that were included in step 2 above, run a confidence interval analysis (by writing grade level separately) to determine the upper limit of the confidence range. This is the percent proficient for writing.
5) Convert the percent proficient calculated in 4 above by multiplying by the number from 2 above.
6) Count the number of proficient EOG (or its alternate) and EOC (or its alternate) scores included in 1 above.
7) Add 5 above to 6 above, this is the numerator.
8) Divide the numerator by the denominator and multiply by 100 to get the percent proficient (performance composite).

To determine the performance composite for a school with grade 9 or above: (inclusive of schools with grades below 9)

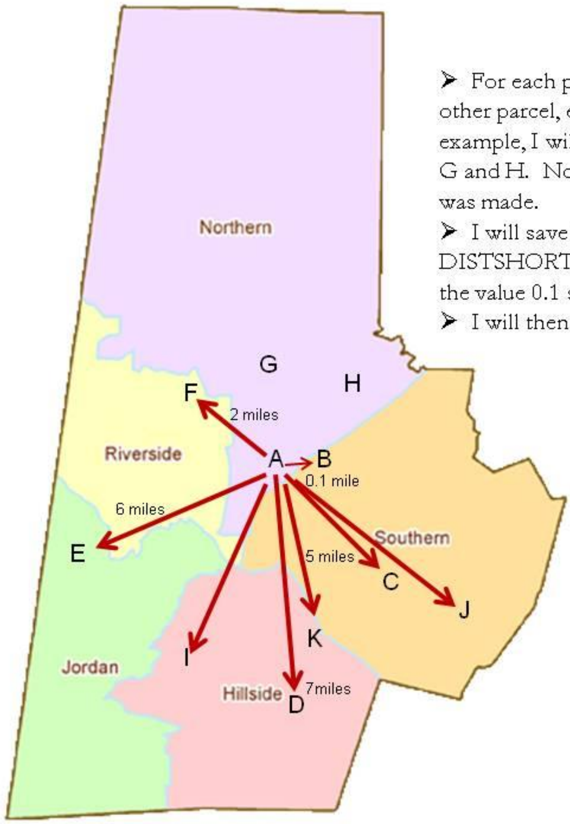
1) count the number of test scores for students who are enrolled in the grade or subject for which they were tested for which they were tested (i.e. English I scores for students in the fall semester long course on the first day of fall testing).
2) count the number of writing test scores for students enrolled in the appropriate grade (i.e. tenth grade writing test scores for students who are tenth graders)
3) count the number of summer school EOC scores credited to the school (from the previous summer)

a. Or Algebra I scores for students who took the Algebra I test prior to 9th grade (only if the school has no grades below 9) and are in membership in 9th grade on the first day of spring testing.

4) The total from steps 1, 2 and 3 above is part of the denominator.

a. Add to them the number of 8th grade students on the first day of spring testing who are not using the NCAAP nor are eligible for the LEP first year in US schools reading test exemption (if the school has an 8th grade).

5) Using the number of proficient scores that were included in step 2 above, run a confidence interval analysis (by writing grade level separately) to determine the upper limit of the confidence range. This is the percent proficient for writing.
6) Convert the percent proficient calculated in 5 above by multiplying by the number from 2 above.
7) Count the number of proficient EOG (or its alternate) or EOC (or its alternate) scores included in 1 and 3 above.
8) Count the number of 8th grade students on the first day of spring testing who have a passing score on the computer skills exam in their record.
9) Add 6 above to 7 above and 8 above, this is the numerator.
10) Divide the numerator by the denominator and multiply by 100 to get the percent proficient (performance composite).



- For each parcel, I will calculate the straight-line distance to every other parcel, excluding parcels that are in the same zone. For example, I will calculate distance from A to all other parcels, except G and H. Note that AG and AH return "na" because no calculation was made.
- I will save the shortest distance (in bold) as a new variable DISTSHORTEST in the dataset. In this example, parcel A will have the value 0.1 stored under the variable DISTSHORTEST.
- I will then repeat for all parcels.

Vector	Distance (miles)
AB	**0.1**
AC	5
AD	7
AE	6
AF	2
AG	na
AH	na
AI	5
AJ	7
AK	3

- Each parcel will now have a value for the variable DISTSHORTEST.
- Regressions can now be run, limiting the dataset to only those parcels which are located near zone boundaries by requiring DISTSHORTEST $< X$, where X represents the maximum distance to the zone boundary.

Parcel	HS Zone	Vector	DISTSHORTEST
A	Northern	AB	0.1
B	Southern	BA	0.1
C	Southern	CK	1.2
D	Hillside	DC	2.7
E	Jordan	EI	2.3
F	Riverside	FG	0.6
G	Hillside	GF	0.6
H	Northern	HB	0.8
I	Hillside	IE	2.3
J	Southern	JK	1.4
K	Hillside	KC	1.2

Illustration of techniques used to create dataset.

2007-08 **C E Jordan High**

Education First
NC SCHOOL
REPORT CARDS

C E Jordan High

Richard Webber, Principal
6806 Garrett Road
Durham, NC 27707 5699
(919) 560-3912

Grades 9-12
Regular School
Traditional Calendar

Durham Public Schools

HIGH STUDENT PERFORMANCE

Performance of Students in Each Course on the ABCs End-of-Course Tests

Percentage of Students' Scores At or Above Grade Level

	English I	Algebra I	Algebra II	Geometry	Biology	Chemistry	Physical Science	Physics	Civics & Econ.	US History
Our School	74.2%	48.2%	46.6%	43.2%	67.8%	75.8%	17.9%	71.4%	67.7%	76.1%
District	61.1%	52.3%	45.2%	45.4%	59.7%	55.7%	32.6%	78.0%	54.8%	55.7%
State	73.1%	69.0%	67.2%	67.9%	68.0%	71.8%	58.4%	81.5%	68.5%	66.5%

N/A = Fewer than five students

SCHOOL PROFILE

School Size

The total number of students in this school and the average number of students in schools with similar grade ranges at the district and state levels.

OUR SCHOOL	DISTRICT	STATE
1,849	864	854

Average Course Size

The average number of students enrolled in the the courses listed at the time of testing.

	OUR SCHOOL	DISTRICT	STATE
English I	12	16	17
Algebra I	18	20	19
Algebra II	27	19	19
Geometry	24	17	19
Biology	25	17	17
Chemistry	24	19	18
Physical Science	21	15	17
Physics	19	13	14
Civics & Econ.	24	18	18
US History	24	19	18

Performance of Each Student Group on the ABCs End-of-Course Tests

Percentage of Passing Scores on the End-of-Course Tests Grouped by Gender, Ethnicity, and Other Factors.

	Male	Female	White	Black	Hispanic	Amer. Indian	Asian Pacific Islander	Multi-Racial	E.D.	N.E.D.	L.E.P.	Migrant Students	Students with Disabilities
Our School	59.0%	62.2%	81.0%	43.2%	43.8%	83.3%	65.6%	80.5%	37.9%	66.2%	42.5%	N/A	31.6%
# of tests taken	2,002	1,972	1,581	1,587	365	6	250	185	829	3,172	226	0	275
District	53.2%	53.1%	78.2%	39.7%	45.2%	64.1%	71.1%	81.9%	36.7%	61.1%	34.8%	N/A	28.7%
State	68.8%	68.2%	78.5%	48.6%	59.1%	58.6%	80.6%	71.9%	53.6%	76.0%	45.4%	40.2%	39.5%

E.D. = Economically Disadvantaged   N.E.D. = Not Economically Disadvantaged   L.E.P. = Limited English Proficiency
N/A = Fewer than five students

School Attendance

The average percentage of students who attend school daily.

Our School	96%
District	95%
State	95%

To learn more about federal No Child Left Behind (NCLB) requirements, visit **http://www.ncpublicschools.org/nclb/**

For information about the ABCs of Public Education and Adequately Yearly Progress (AYP), visit **http://www.ncpublicschools.org/accountability/**

Example of DPS School Report Card

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SAFE, ORDERLY AND CARING SCHOOLS

School Safety

The number of acts of crime or violence reported below includes all acts occurring in school, at a bus stop, on a school bus, on school grounds, or during off-campus, school-sponsored activities.

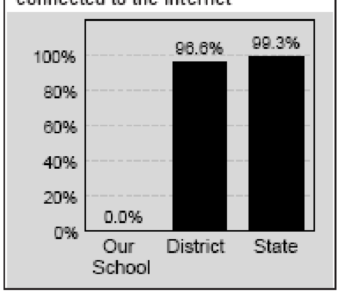
Out of 1,849 students in our school, there were a total of 35 act[s] of crime or violence.

The number of acts of crime or violence reported per 100 students:

OUR SCHOOL	2
DISTRICT	1
STATE	1

Access to Technology

Percentage of classrooms connected to the Internet



Keeping you informed

More information about your school is available on the NC School Report Cards website at: **http://www.ncreportcards.org**

HIGH STUDENT PERFORMANCE, CONTINUED

School Performance

Each year, schools in North Carolina may receive several designations based on their performance on the state's ABCs tests. These designations are awarded on the basis of the percentage of students performing at grade level and on whether students have learned as much as they are expected to learn in one year. The designations earned by your school are displayed below, followed by a brief description of each designation.

Our School's Designation(s): School of Progress, Expected Growth

DESIGNATION	PERFORMANCE: STUDENTS PERFORMING AT GRADE LEVEL	GROWTH: LEARNING ACHIEVED IN ONE YEAR			PERCENT OF SCHOOLS WITH DESIGNATION	
		High Growth	Expected Growth	Expected Growth Not Achieved	DISTRICT	STATE
HONOR SCHOOL OF EXCELLENCE	At least 90% of students at grade level and the school made adequate yearly progress (AYP)				0%	2%
SCHOOL OF EXCELLENCE	At least 90% of students at grade level				0%	1%
SCHOOL OF DISTINCTION	At least 80% of students at grade level				0%	9%
SCHOOL OF PROGRESS	At least 60% of students at grade level		✓		43%	26%
NO RECOGNITION	60 to 100% of students at grade level				14%	37%
PRIORITY SCHOOL	50 to 60% of students at grade level, OR Less than 50% of students at grade level				14%	18%
LOW PERFORMING	Less than 50% of students at grade level				29%	7%

Adequate Yearly Progress (AYP) Results

North Carolina has set target goals that schools must meet to make Adequate Yearly Progress (AYP) under the federal No Child Left Behind (NCLB).

Our school did not make adequate yearly progress.

Our school met 18 out of 22 AYP targets.

In any group where the percentage of students at a grade level is greater than 95% or less than 5%, the actual values may not be displayed because of federal privacy regulations. In these cases the results will be shown as >95% or <5% for the group.

QUALITY TEACHERS

	Total Number of Classroom Teachers*	Fully Licensed Teachers	Classes Taught by Highly Qualified Teachers	Teachers with Advanced Degrees	National Board Certified Teachers*	Years of Teaching Experience			Teacher Turnover Rate
						0–3 years	4–10 years	10+ years	
Our School	121	87%	100%	36%	13	33%	29%	38%	19%
District	58	86%	97%	32%	7	35%	25%	40%	22%
State	61	89%	96%	25%	8	23%	26%	52%	14%

* The total number of teachers in this school and the average number of teachers in schools with similar grade ranges at the district and state level.

Public Schools of North Carolina
State Board of Education | Department of Public Instruction

Example of DPS School Report Card