Magnet Schools and the Differential Impact of School Quality on Residential Property Values

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Abstract. **Previous research has concluded that public school quality is capitalized into local house prices. This result is reasonable if residents are assigned to local schools and have no freedom of school choice. The magnet school concept gives parents some degree of freedom of choice for schools within a local school district. The availability of magnet schools should thus reduce the capitalized value of school quality within a school district. This hypothesis is tested using data from Wake County (Raleigh), North Carolina. The results show that school levels where the magnet program has been most extensively implemented have lower capitalized values.**

Introduction

Measurement of the effect of school quality on residential property values has received increased attention in recent years [3, 4, 5, 6]. The general conclusion of the studies is that school quality does have a positive effect on residential property values; that is, school quality is capitalized into residential property values. This is the finding both when school quality has been compared between school districts [3, 5], and when school quality has been compared between different schools within the same district [4, 6]. In some of the studies, this relationship has been used to estimate the willingness of residential property owners to pay for improved school quality [6].

A relatively recent development in American public education is the magnet school concept at the local school district. Magnet schools offer specialized academic programs in fields such as science, language, communications and the arts. Enrollment in magnet schools is open to students district wide. Thus magnet schools create a degree of freedom of choice for parents of school children in a local school district. In school districts with magnet schools, parents have the option of sending their children to the assigned local school or of seeking admission to a magnet school.[1]

The institution of a magnet school program in a local school district has a potential major implication for the capitalization of school quality *within* the district. To the extent that magnet schools give parents freedom of choice among many schools within the local district (as compared to being limited to an assigned school), the magnet school program should reduce the capitalized value of school quality of assigned (neighborhood) schools

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on the district's residential property values. Other aspects of magnet schools have been studied (see [2]), but the impact of magnet schools on property values has not been examined.

The purpose of this paper is to present a test of this hypothesis by estimating the capitalized value of school quality in a local school district where a magnet program has been instituted. Furthermore, in the local district studied, the magnet program has been instituted unevenly in the three school levels (elementary, middle, secondary). This provides an opportunity to analyze and compare the capitalized value at different school levels.

The plan of the paper is as follows. The next section presents the empirical model and discusses the database. One advantage of the study is the rich set of house characteristics provided in the database, which allows for a degree of control of house characteristics unmatched in previous studies. The omitted variable problem, common in some hedonic studies of residential property values, should be minimal. The third section presents and discusses the empirical results. Concluding comments are made in the final section.

Empirical Model and Data

A standard first-stage hedonic model is employed to isolate the effect of school quality on residential property values:

$$P = \beta_0 + \beta_1 H + \beta_2 SD + \beta_3 N + \beta_4 SQ, \quad (1)$$

where P is house sales price, H is a set of house characteristics, SD is a set of subdivision characteristics, N is a set of neighborhood characteristics, SQ is a set of school quality and composition characteristics, and β_0, β_1, β_2, β_3 and β_4 are sets of parameters to be estimated.

The database is a sample of 598 new house sales which occurred in Wake County (Raleigh), North Carolina during 1987. The houses were located in all parts of the county. Data on the sales were collected by Falls Research, Inc., of Raleigh, North Carolina. Data on the house characteristics of the observations are more extensive than in many previous housing hedonic studies, including the presence of such characteristics as ceramic tubs, hardwood floors, and wallpapering. Subdivision characteristics include the presence or absence of such features as a golf course and a pool and tennis courts, in addition to the location of the subdivision vis-a-vis the two major centers of economic activity in the area, downtown Raleigh and Research Triangle Park.[2] Neighborhood characteristics for 1987 are taken from National Planning Data Corporation for census tract measures such as demographic characteristics (age distribution; percent non-white) and median household income, and from Wake County for the combined municipal and county tax rate applicable to the house. Descriptive statistics for the house, subdivision and neighborhood characteristics are given in Exhibit 1.

School standardized test scores are used as the measure of school quality, as has been done in other comparable studies. Standardized test scores for the 1986–87 school year were available for the county-wide local school district (Wake County Public School System) for each elementary and middle school grade and for different types of standardized tests (language, reading and math). At the elementary and middle school level the standardized test is the California Achievement Test (CAT), and the SAT (Scholastic Aptitude Test) is the standardized test for high schools.

Exhibit 1
Descriptive Statistics

Variable	Variable Name	Mean	Standard Deviation	Minimum	Maximum
House characteristics:					
Sale Price	*PRICE*	$120,457	$44,713	$47,000	$293,500
Number of bedrooms	*BEDRM*	3.16	0.56	1	5
Number of baths	*BATHS*	2.00	0.31	1	4
Number of half-baths	*HFBATHS*	0.68	0.47	0	2
Number of stories	*STORIES*	1.68	0.42	1	3
Presence of a single car garage	*SINGAR*	15.21%	35.95%	0	1
Presence of a double car garage	*DBLGAR*	27.76%	44.82%	0	1
Square footage	*SQFT*	1832	523	746	3900
Presence of a microwave	*MICROW*	22.24%	41.62%	0	1
Presence of a disposal	*DISPOSAL*	90.97%	28.69%	0	1
Presence of a refrigerator	*REFRIG*	2.68%	16.15%	0	1
Presence of a ceramic tub	*CERAMIC*	42.14%	49.42%	0	1
Presence of tile surrounding bath	*TILE*	47.99%	50.00%	0	1
Presence hardwood floors in entry	*HFENTRY*	57.86%	49.42%	0	1
Presence hrdwd flrs in dining room	*HFDIN*	33.95%	47.39%	0	1
Presence hrdwd flrs in living room	*HFLIVE*	22.51%	41.80%	0	1
Presence hrdwd flrs in kitchen	*HFKITCH*	5.69%	23.18%	0	1
Presence of wallpaper in kitchen	*WPKITCH*	80.94%	39.31%	0	1
Presence of crown molding	*CROWNMLD*	68.52%	46.48%	0	1
Presence of chair rail molding	*CHAIRMLD*	54.85%	49.81%	0	1
Presence of Apollo heating system	*APOLLO*	7.02%	25.58%	0	1
Presence of a masonry fireplace	*MASONRY*	50.33%	50.04%	0	1
Presence of an insert (prefab) fireplace	*INSERT*	45.15%	49.81%	0	1
Presence of a porch	*PORCH*	2.17%	14.59%	0	1
Presence of a deck	*DECK*	78.76%	40.93%	0	1
Presence of a brick exterior	*BRICK*	29.32%	45.61%	0	1
Presence of an outside storage unit	*STORAGE*	69.56%	46.05%	0	1
Presence of cable TV service	*CABLETV*	70.74%	45.53%	0	1
Presence of available natural gas service	*GAS*	60.20%	48.99%	0	1
Presence of ceiling fan	*FAN*	2.01%	14.02%	0	1
Presence of a special bathtub (garden, whirlpool, hot, or jacuzzi tub)	*FANCYTUB*	16.05%	36.74%	0	1
Presence of high ceilings (vaulted, cathedral, or 9-ft ceilings)	*HICEIL*	5.52%	22.85%	0	1
Presence of skylights	*SKYLITE*	6.02%	23.81%	0	1
Presence of a wet bar	*WETBAR*	2.51%	15.65%	0	1
Subdivision characteristics					
Presence of a lake	*LAKE*	16.05	36.74%	0	1
Presence of tennis courts	*TENNIS*	39.46%	48.92%	0	1
Presence of a pool	*POOL*	47.33%	49.91%	0	1
Presence of a club house	*CLUBHSE*	23.91%	42.69%	0	1
Presence of golf facilities	*GOLF*	4.18%	20.03%	0	1
Distance of subdivision from downtown Raleigh	*DISTRAL*	8.91 miles	3.76 mi.	2.00 mi.	22.50 mi.
Distance of subdivision from Research Triangle Park	*DISTRTP*	13.61 miles	6.86 mi.	3.30 mi.	37.50 mi.

Exhibit 1
(continued)

Variable	Variable Name	Mean	Standard Deviation	Minimum	Maximum
Neighborhood characteristics					
Combined municipal and county property tax rate, 1987 ($ per $100 of value)	*TAXRATE*	$0.88	$0.32	$0.59	$1.28
Median household income in census tract, 1987	*INCOME*	$38,802	$13,594	$20,805	$72,105
Percent of population in census tract over age 65, 1987	*POP>65*	7.14%	2.98%	2.80%	25.30%
Percent of population in census tract under age 18, 1987	*POP<18*	26.40%	2.84%	15.20%	31.30%
Percent of population in census tract, non-white, 1987	*POPNW*	16.33%	12.77%	2.10%	97.50%
School quality and composition characteristics					
Elementary school, average CAT percentile score, grades 1–5 reading, language, math.	*ELTEST*	70.38	10.21	45.50	86.64
Middle school, average CAT percentile score, grades 6, 7, 8 reading, language, math.	*MITEST*	65.41	11.64	46.44	79.44
High school, average SAT score	*HITEST*	895.61	50.57	737.00	978.00
Elem. school, % non-white	*ELNW*	29.28%	10.92%	14.00%	60.00%
Middle school, % non-white	*MINW*	27.94%	9.29%	12.00%	45.00%
High school, % non-white	*HINW*	25.12%	9.60%	13.00%	44.00%

Sources: Falls Research, Inc., National Planning Data Corp., Wake County (N.C.) Government, Wake County Public School System.

Previous studies have used standardized test scores for one grade as the measure of school quality. There seems no particular reason, other than data availability, to choose one grade over another. High correlations between grade scores in individual schools prevent including all grade scores simultaneously as independent variables. A reasonable approach seems to be to use an average of the individual grade scores as the school quality variable. Since each house is assigned to an elementary (grades 1–5), middle (grades 6, 7, 8), and high (9–12) school, the elementary school average standardized test score (averaged over all grades and all tests), middle school average standardized test score (averaged over all grades and all tests), and high school average SAT score (no individual grade scores are available at the high school level) are used as the school quality variables. Correlation among the school test score variables is relatively low (the highest bivariate correlation is 0.45 between the elementary school average test score and the middle school average test score).

Previous studies have also included the racial composition in the public school as an additional control variable. The non-white percent of the student body in each of the three assigned schools is also included in the analysis. Descriptive statistics for all the school quality variables are given in Exhibit 1.

In 1974 the Wake County Public School System introduced a magnet school program. In the 1986–87 school year, academic magnet programs were functioning at seventeen of forty-nine elementary schools (35%), four of fifteen middle schools (27%) and one of twelve high schools (8%).[3] Magnet schools have specialized courses in a wide range of fields, including the arts, sciences, languages and applied fields. Any child, regardless of residential location in the county, can apply for admission to any of the magnet schools, and consideration is given on a time-of-application basis. Magnet school test scores are higher than non-magnet school test scores at the middle and high school levels. Magnet schools break the link between local school quality and residential property values. Since the magnet program is most extensive at the elementary school level and least extensive at the high school level, we hypothesize that the capitalized effect of school quality is smallest for the elementary school level, next smallest for the middle school level, and largest for the high school level.

Empirical Results

The hedonic housing equation is estimated using a semilog functional form for comparability with other studies. However, other functional forms gave similar results.

A high degree of correlation between bedrooms and square footage, between hardwood floors in the dining room and hardwood floors in the living room, between crown molding and chair rail molding, and between subdivision tennis courts and a subdivision pool prevented all of these variables from being entered. Consequently, bedrooms, hardwood floors in the living room, crown molding, and subdivision pool were omitted from the analysis.

The parameter estimates and levels of statistical significance for the hedonic equation are given in Exhibit 2. The extensive set of house, subdivision, neighborhood and school

Exhibit 2
Results of Hedonic Housing Price Equation Estimation

Dependent variable: Log of house sales price			
Explanatory Variable		Parameter Estimate	*t*-value
House characteristics			
	Intercept	10.0851***	53.674
BATHS	Baths	0.0621***	4.067
HFBATHS	Half baths	0.0358**	2.432
STORIES	Stories	0.0166	1.026
SINGAR	Single car garage	0.0691***	5.318
DBLGAR	Double car garage	0.1003***	7.187
SQFT	Square footage	0.0003***	19.296
MICROW	Microwave	0.0037	0.205
DISPOSAL	Disposal	−0.0199	−1.021
REFRIG	Refrigerator	−0.0407	−1.249
CERAMIC	Ceramic tub	0.0524***	3.178
TILE	Tile surrounding bath	0.1279***	7.463
HFENTRY	Hardwood floors, entry	0.0261**	2.122
HFDIN	Hardwood floor, dining and living rooms	0.0141	0.952
HFKITCH	Hardwood floors, kitchen	−0.0110	−0.528
WPKITCH	Kitchen wallpaper	0.0177	1.034

Exhibit 2
(continued)

Dependent variable: log of house sales price

Explanatory Variable		Parameter Estimate	*t*-value
CHAIRMLD	Chair rail and crown molding	0.0119	0.908
APOLLO	Apollo heating system	−0.0587***	−3.036
MASONRY	Masonry fireplace	−0.0026	−0.195
INSERT	Insert (prefab) fireplace	−0.0188	−1.432
DECK	Deck	0.0856***	5.698
PORCH	Porch	−0.0467	−1.357
BRICK	Brick exterior	0.0242**	2.055
STORAGE	Outside storage unit	−0.0036	−0.284
CABLETV	Cable TV service available	−0.0344***	−2.571
GAS	Nat'l gas service available	0.0825***	6.022
FAN	Ceiling fan	0.0935***	2.519
FANCYTUB	Special bathtub	0.0202	1.243
HICEIL	High ceilings	0.0361	1.221
SKYLITE	Skylights	−0.0070	−0.252
WETBAR	Wet bar	0.0083	0.201
Subdivision characteristics			
LAKE	Lake	0.0222	1.264
TENNIS	Tennis courts and pool	0.0049	0.367
CLUBHSE	Clubhouse	−0.0488***	−2.954
GOLF	Golf course	0.0859***	3.115
DISTRAL	Distance (miles) from downtown Raleigh	−0.0051**	−2.295
DISTRTP	Distance (miles) from RTP	0.0015	0.983
Neighborhood characteristics			
TAXRATE	Combined municipal and county property tax rate	−0.0012	−0.059
INCOME	Median household income (1000s) in census tract, 1987	0.0015***	2.567
POP>65	Percent population over age 65 in census tract, 1987	0.0143***	6.507
POP<18	Percent population under age 18 in census tract, 1987	0.0096***	4.662
POPNW	Percent population non-white in census tract, 1987	−0.0005	−0.964
School Quality and Composition Characteristics			
ELTEST	Average elementary school CAT score	−0.0004	−0.471
MITEST	Average middle school CAT score	0.0019***	2.442
HITEST	Average high school SAT score	0.0002	1.357
ELNW	Non-white percent elementary school	−0.0008	−0.859
MINW	Non-white percent, middle school	−0.0022*	−1.704
HINW	Non-white percent, high school	−0.0004	−0.455

$n = 598$
$R^2 = 0.93$
F-value = 148.262***
***significant at 0.01 level, two-tail test
**significant at 0.05 level, two-tail test
*significant at 0.10 level, two-tail test

Source: statistical analysis by the author

quality characteristics results in a very high degree of explanatory power of the hedonic equation. This should mean increased confidence in the parameter estimates of the school quality variables.

House, Neighborhood, and Subdivision Characteristics

Although the focus in this study is on the differential capitalized effects of school quality, brief comments are first made about the estimated effects of some of the other explanatory variables.

Interesting results are found for heating systems. Heating by natural gas is less costly in North Carolina than heating by the major alternative, an electric heat pump. These savings are apparently capitalized into the price of a new house to the extent of an 8% price premium. Apollo heating is a new steam heating system that is advertised to be less costly than the conventional electric heat pump. However, the results here indicate that, perhaps because of consumer uncertainty associated with a new product, the Apollo heating system carries a price discount.

New houses with brick exteriors carry a 2% price premium. This is much less than the 8% premium found by Bajic [1] in a study of Toronto houses and less than the 4% premium found by Grether and Miezkowski [4] in a study of New Haven, Connecticut, houses. The price premiums estimated for TILE and for FAN appear to be very high. It is likely that these variables are capturing the effects of other correlated characteristics not measured in the data.

The presence of golf facilities in the subdivision carries a price premium, whereas no statistically significant price effect is related to availability of tennis courts, and a price discount is related to the presence of a clubhouse. The results indicate that the Raleigh/Wake County market is monocentric, with price discounts related to distance from downtown Raleigh, but not from Research Triangle Park.

Consistent with other studies, new house prices are higher, ceteris paribus, in neighborhoods with higher median income, which probably reflects the positive externalities that new homebuyers associate with such neighborhoods. No statistically significant effect on new house prices is found for the percentage of non-white residents in the neighborhood (census tract). This is consistent with the finding of other studies which include both neighborhood racial composition and school racial composition as separate explanatory variables [5].

The property tax rate has no effect on new house prices. First, it should be remembered that the school district in the study is countywide, thus differences in the combined municipal-county property tax rate within Wake County are not related to public school financing. The finding apparently indicates buyers of new homes associate differences in property taxes in Wake County with differences in public service levels.

School Quality and Composition Characteristics

The findings for the school quality variables are interesting and potentially important for public school administrators, developers, and residential property owners. At the elementary school level, where the magnet school program has been most extensively implemented, neighborhood school average CAT scores and racial composition are not associated with new house prices. In contrast, at the middle school level where only four of

fifteen schools have magnet programs, neighborhood school average CAT scores are positively and significantly associated with new house prices, and the non-white percentage in the schools is negatively and significantly associated with differences in new house prices. Thus, the comparative findings between elementary and middle schools are consistent with the hypothesis that the magnet school program, by increasing freedom of choice, results in a reduced capitalized value of school quality.[4]

High school SAT scores are positively related to new house prices, but not at a statistically acceptable level, and high school racial composition is not related to new house prices.[5] However, the variation in high school SAT scores is much less than the variation in CAT scores at the elementary and middle levels. The coefficient of variation of *HITEST* is only 5.6 compared to coefficients of variation of 14.5 and 17.8 for *ELTEST* and *MITEST*

Exhibit 3
Parameter Estimates for Individual Grade and Test Scores

Variable	Parameter Estimate	*t*-value
Elementary school		
1st grade reading test	0.0010	1.557
1st grade math test	0.0011	1.897*
2nd grade reading test	0.0020	2.455***
2nd grade language test	−0.0009	−1.129
2nd grade math test	0.0013	2.021**
3rd grade reading test	−0.0012	−1.797*
3rd grade language test	−0.0003	−0.432
3rd grade math test	−0.0004	−0.736
4th grade reading test	−0.0009	−1.698*
4th grade language test	−0.0008	−1.702*
4th grade math test	−0.0009	−1.947**
5th grade reading test	−0.0008	−1.216
5th grade language test	−0.0006	−1.047
5th grade math test	−0.0025	−4.832***
Middle School		
6th grade reading test	0.0010	1.294
6th grade language test	0.0009	1.254
6th grade math test	0.0007	1.263
7th grade reading test	0.0011	1.747*
7th grade language test	0.0011	1.686*
7th grade math test	0.0008	1.606*
8th grade reading test	0.0032	3.486***
8th grade language test	0.0025	3.022***
8th grade math test	0.0020	3.504***
High School		
SAT, verbal	0.0001	0.255
SAT, math	0.0001	0.353
SAT, total	0.0001	0.311

***significant at the 0.01 level, two-tail test
**significant at the 0.05 level, two-tail test
*significant at the 0.10 level, two-tail test

Source: statistical analysis by the author

respectively. So, since high school quality varies less than middle school quality, it seems reasonable that the capitalized value of high school quality is less than the capitalized value of middle school quality. Furthermore, all elementary and middle school students take the CAT tests, whereas 70% of high school students in Wake County take the SAT. Thus, SAT scores may be a less reliable measure of school quality at the high school level.

Quantitatively, the result for the middle school quality measure (a 0.2% increase in new house price for each percentile point increase in CAT scores) is within the range found in other studies using a similar measure. Grether and Miezkowski [4] found a 0.2% price premium associated with a percentile point increase in reading scores, and Gabriel [3] found a 0.8% price premium associated with a percentile point increase in 6th grade CAT scores.

In order to further identify differential effects of school quality, the hedonic housing equation was rerun separately for each individual grade level test score and the associated racial composition measure. That is, each rerun equation had only one grade level test score included and all others excluded. Exhibit 3 shows only the parameter estimates and significance levels for the test score variables resulting from this analysis. The results are consistent with the aggregate analysis. At the elementary level only three of fourteen parameter estimates are positive and statistically significant, whereas at the middle school level six of nine parameter estimates are positive and statistically significant. None of the high school test scores are statistically significant.

Conclusions

What have we learned from this study? First, the results support the conclusions of earlier studies that school quality does matter in the housing market. When houses are assigned to schools, houses assigned to better quality schools have that quality capitalized into their value.

Magnet schools provide a degree of freedom of choice to parents of school age children in a local school district, and as such, we would expect the implementation of magnet schools to reduce the intra-district capitalized value of school quality. The findings of this study are consistent with this hypothesis. The school level (elementary schools) in the study area in which magnet schools had been most extensively implemented had the lowest capitalized value; in fact, the capitalized value was zero. Of course, inter-district capitalization could still be present.

This finding has implications for the recommendation, from some quarters, for movement to greater choice for parents in public school assignment. One fallout from such a move would be the reduced capitalization of intra-district variation in school quality. Therefore, at the local level, freedom of choice in school assignments will likely be opposed by developers and residential property owners in neighborhoods where the quality of assigned schools is higher.

Notes

[1]There are many potential rationales for the magnet school concept. One is that magnet schools provide economies of scale in the provision of specialized programs. Another reason is that magnet schools can help local school districts achieve acceptable levels of racial balance in schools. For example, by putting magnet programs in schools with traditionally high percentages of non-white students, white students may voluntarily enroll in such schools and bring the racial balance to more acceptable levels.

[2]One reviewer suggested including distance to the nearest magnet school as an additional explanatory variable. This was not done for two reasons. First, the magnet schools are scattered about the county, so variation in this distance measure would be small. Second, public transportation is provided for children attending magnet schools, so the family's commuting costs are not affected by distance from a magnet school.

[3]These numbers may overstate the perception by many parents of magnet school availability at the middle school level. Fifty percent (2 of 4) of the magnet middle schools are located in low income, inner city neighborhoods, whereas only 29% (5 of 17) of the magnet elementary schools are located in such neighborhoods.

[4]School quality, as measured by standardized test scores, can be influenced by social and economic characteristics of the neighborhood, such as average income and racial composition. However, neighborhood income, neighborhood racial composition, and racial composition of the school are included as independent variables in the hedonic equation. The parameter estimates on the test score variables are the independent effects of these variables on house price holding constant the included social and economic characteristics.

[5]*HITEST* is statistically significant at the 10% level using a one-tail test.

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