Urban Econ Literature Survey

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Which Characteristics of Schools Affect House Prices?

Introduction

When looking for a new home, buyers consider many factors, including neighborhood appearances and demographics, proximity to city centers, safety, property tax rates, and the quality of local school districts and other public services. Specifically, buyers give considerable attention to public school quality and researchers have become increasingly interested in which school attributes are most valuable to home buyers, and hence, influence house prices most strongly. Traditionally, test scores have been used as a good indicator for school quality and have been associated with higher real estate prices; however, the relationship between school characteristics and local home values has been extremely difficult to quantify. The researchers of each of the following papers found unique methods to overcome various data shortcomings.

Downes and Zabel (2), Kane, Riegg, and Staiger (3), and Clapp, Nanda, and Ross (1) all examined the importance of district performance and demographic composition on property values in Chicago from 1997 until 2001, Mecklenburg County, North Carolina from 1994 until 2001, and Connecticut from 1994 until 2004, respectively. For each paper, the researches compiled data from multiple sources in order to eliminate bias from excluded variables and to quantify the effects of specific school attributes on house prices. Although there are similarities and differences in their methods, all three groups of researchers made conclusions largely consistent with one another.

Data Sources

While examining previous work, Downes and Zabel (2) identified two major shortcomings: the lack of controls for intra-jurisdictional variation in schools and for neighborhood quality when trying to determine which school attributes were relevant to home value. In order to combat these, Downes and Zabel (2) combined data from the Chicago Metropolitan Statistical Area (MSA) America Housing Survey (AHS) from 1897 until 1991, the Summary Tape Files (STF) from the 1980 and 1990 Decennial Censuses, and Illinois School Report Cards from 1987-88 until 1991-92. The AHS data include house characteristics and owner reported home information for a random sampling of homes, which eliminate the bias that arises from only using sales data and neighborhood

characteristics that are available in the STF data. Additionally, Downes and Zabel sorted the Census and AHS data by census tracts, nearly homogenous areas of 2,500 to 8,000 occupants, enabling more accurate control over neighborhood variation.

To study the effects of a court-imposed desegregation order to redraw school boundaries in Mecklenburg County, North Carolina, Kane, Riegg, and Staiger (3) faced the same challenge faced by Downes and Zabel (2): distinguishing between the influence of school quality and other contributing factors on house prices. To combat this, they used home sales data from 1994 until 2001 from the county's Property Assessment and Land Record Management Division. Furthermore, data from the tax assessor's office was used to divide Mecklenburg County into 1,048 homogenous neighborhoods, which was combined with demographic information from the 1990 and 2000 Decennial Censuses and census tract information. Information about school boundaries throughout the rearrangement was obtained from the Charlotte Mecklenburg School District (CMS) from 1993 until 2001 and information on individual school performances and demographics was provided by the North Carolina Department of Public Instruction from 1997 though 2001.

Finally, Clapp, Nanda, and Ross (1) studied the influence of school district performance and demographic composition on home values in Connecticut, as well as whether or not the importance of these indicators varies over time. They used data from a sample of home sales from 1994 through 2004 purchased from Banker and Trademan, which was combined with census tract information from the 1990 Decennial Census to control for neighborhood variation as in the previous two studies mentioned. This data also included information to control for house characteristics. To account for the possibility that housing price appreciation or depreciation may vary regionally or by market, Clapp, Nanda, and Ross (1) included separate year and month fixed effects for each of the ten Labor Market Areas (LMAs) in Connecticut. Information on school attributes from 1994 until 2004 was provided by Connecticut public schools.

Methods and Results

For their work in Chicago, Downes and Zabel (2) first examined the correlation between school characteristics and neighborhood values. Many variables were significantly correlated suggesting that excluding neighborhood controls would bias the coefficient estimates for school characteristics when determining their influence on house prices. Next, Downes and Zabel (2) used

multiple regressions, shown in Table 1, with the natural log of the owner estimated home value as the dependent variable to estimate the importance of six measures of school quality for both the district and school level data.

The six district/school quality measurements used were the proportions of African-American students, Hispanic students, limited English proficiency students, and subsidized lunch eligible students, as well as the natural logs of district per pupil expenditures and eighth grade reading tests. A comparison between the coefficients of the pooled regressions (with neighborhood variables included) estimated using the district level and the school level data revealed many biases that can arise from the use of district level data. First, homeowner's sensitivity to the racial composition of the local school was hidden, and second, the effects of both the school cost variables were of a lower magnitude when district level data was used. There was no significant difference on the importance of test scores. After establishing that both neighborhood and intra-jurisdictional variations could not be excluded, the pooled regression with neighborhood variables included for the school level data became their favored regression, shown in the second results column of Table 1. From this specification, Downes and Zabel (2) concluded that both the proportions of African-American and Hispanic students in the local school had significantly negative effects on home values, while the proportion of limited English proficiency students and the natural log of district per pupil expenditures had significantly positive effects on home values. This is consistent with the argument that homeowners and researchers measure school quality differently. The first-difference regression results are similar, which shows that proper controls for neighborhood and house characteristics remove the need to control for temporally stable, unobserved house and neighborhood characteristics. And finally, the value-added regression tests the hypothesis that the relationship between house prices and standardized test scores is temporally stable. Although, they were unable to reject this null hypothesis, Downes and Zabel (2) note that the direction of change of the coefficient estimates is consistent with the expectation that as states have been more conscious of making school performances public, the correlation between housing prices and standardized test scores will strengthen.

Unlike Downes and Zabel (2), Kane, Riegg, and Staiger (3) were able to use the redistricting of schools to their advantage while trying to isolate the effects of school quality on home values. Their empirical strategy was two-fold, focusing first, on housing values near school boundaries

(houses in the same neighborhood assigned to different schools) and second, on house values for homes affected by the court ordered redistricting. To study housing values near school boundaries, Kane, Riegg, and Staiger (3) ran a series of regressions to track the changes in coefficient estimates for elementary school test scores and distance to the elementary school while increasing controls for housing and neighborhood characteristics around each boundary. The natural log of the sales price was the dependent variable in these regressions. Shown in Table 2, all specifications supported the conclusions that mean test scores have a significant positive correlation to property values; however, this impact decreases in magnitude as more controls are added. The distance of a house from its school assignment was found to have a negative relationship with house price, but this relationship became insignificant as more controls for house and neighborhood fixed effects were included. These same specifications were also used for other measures of school quality, including the proportions proficient on the state test and African-American, the median household income, and the "value-added" test score between 1994 and 1999. The proportion of students scoring at the proficient level on the state test and medium income both had significant positive relationships with house prices, as expected, while the proportion of African-American students in the school had a significant negative relationship with house prices. The coefficients for "value-added" were not significantly different from zero in any of the specifications, implying that prospective buyers observe characteristics of potential peers, instead of "value-added" to measure school quality. This is consistent with the finding of Downes and Zabel (2) that homeowners measure school quality differently than researchers do.

Kane, Riegg, and Staiger (3) also examined the relationship between school characteristics and house prices using solely differences in redistricting. As shown in Table 3, all specifications included controls for housing and neighborhood characteristics, as well as fixed effects for every reassignment. The three measures of school quality included were the percent of African-American students, the median household income, and the percent of proficient students on the state test. The percent of African-American students had a significant negative impact on house prices while the average median income and percent proficient had positive effects on house prices at the high school level. At the middle school and elementary school levels, the measured effects were either insignificant or only marginally significant. Both empirical strategies Kane, Riegg, and Staiger (3) confirmed the presence of residential sorting as additional indirect impacts resulted because the population living in any given school boundary is itself a function of the school assignments.

Similarly, Clapp, Nanda, and Ross (1) used three specifications to observe the effects of school attributes using the same dependent variable as Kane, Riegg, and Staiger (3), the natural log of the transaction price. Shown in Table 4, the first results column uses the traditional hedonic regression without controlling for town or census tract effects, the second column presents the regression after controlling for town fixed effects, and the third column after controlling for census tract fixed effects. School attributes included in their study were Math test scores and the fractions of free lunch eligible, non-English speaking, African-American, and Hispanic students. Like the researchers who conducted studies in Chicago and Mecklenburg County, Clapp, Nanda, and Ross (1) found that the effects of school district attributes were sensitive to which specification was used.

The most basic OLS model, controlling only for neighborhood observables, overestimated the effect of test scores on housing prices, and gave coefficient estimates for the effects of the fractions of non-English speaking, African-American, and Hispanic students that were inconsistent with previous findings. As seen before, this regression overestimated the effect of school quality of housing prices. In the second and third columns, the coefficient estimates are not statistically different from one another; however, Clapp, Nanda, and Ross (1) favor the regression that includes census tract fixed effects. This model implies that test scores have a significant positive effect of home values while greater fractions of African-American and Hispanic students have a significant negative effect on home values. These effects are of similar size as the ones measured by Downes and Zabel (2) and Kane, Riegg, and Staiger (3). Clapp, Nanda, and Ross (1) took their study one step further to explore whether or not the effects of key district attributes have changed over time. They found that the effects of the fraction of Hispanic students and test scores are changing over time, becoming less negative and more positive, respectively. This is the type of change that Downes and Zabel (2) suggested, but were unable to confirm statistically.

Conclusion

The three studies surveyed in this review yield many similar conclusions regarding which school attributes influence house prices. First, homebuyers are concerned about changes in the demographic makeup of the local school, in addition to, and sometimes more than, test scores when deciding how much to spend on a home. Second, two sources agreed that prospective homebuyers do not measure school quality in the same value-added way that researchers might. Instead, they rely on many observable factors, such as demographics of their peer groups, to measure school quality.

And third, it would be interesting to see if the way homebuyers measure school quality will change as school performances on standardized tests are made more public. One source was able to confirm that this is the case, while yet another suggested it without providing statistical verification. All of this leads to the question of whether homebuyers actually cared more about certain observable demographic factors or if they just used them as indicators because they were more easily accessed. The decline in the use of certain demographic factors as key indicators may also suggest changing opinions regarding race that would be interesting to explore.

References

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3. Kane, Thomas J., Stephanie K. Riegg, and Douglas O. Staiger. "School quality, neighborhoods, and housing prices." *American Law and Economics Review* 8.2 (2006): 183-212. http://www.dartmouth.edu/~dstaiger/Papers/KaneRieggStaiger%20NBERwp11347.pdf

Appendix

Table 1: Downes and Thomas (2) - Regressions Using School level Data and the Natural Log of Owner Estimated House Value as the dependent Variable

Note: controls for variations house and neighborhood and neighborhoods characteristics were included in this regression but are not pictured below

Regressions Using School-Level Measures of School Quality[1,2]
Dependent Variable: Natural Log of Owner-Estimated House Value (LNVAL)
(Standard Errors in Parentheses)

Independent Variable	Pooled Regression-Neighborhood Variables Excluded	Pooled Regression-Neighborhood Variables Included	First-Differenced Regression	Pooled Regression-Cross-Time Changes
LNTAX	1.2527** (0.3348)	0.7024** (0.3347)	0.3660 (0.6250)	0.6702** (0.2798)
AFRAM	-0.1981** (0.0829)	-0.1663* (0.1012)	-0.5627 (0.3565)	-0.1877** (0.0957)
HISPNA	-0.4002** (0.1462)	-0.3246** (0.1379)	-0.5998 (0.4753)	-0.3340** (0.1309)
LEP	1.2155** (0.2753)	1.0758** (0.2620)	-0.7530 (0.5414)	1.0780** (0.2489)
LOWINC	-0.4129** (0.1059)	-0.0834 (0.1039)	0.3603 (0.2424)	-0.0476 (0.0994)
LNPPEX (LNPPEX91)	0.6651** (0.1405)	0.3889** (0.1427)	0.3968 (0.9009)	0.4551** (0.1608)
LNRDG8 (LNRDG891)	1.6030** (0.3097)	0.7084** (0.3139)	0.8734 (0.7234)	0.7504** (0.2547)
LNPPEX88				0.4056** (0.1680)
LNRDG888				0.4413 (0.3595)
R^2	0.3039	0.4244	0.0294	0.4807
Number of Observations	2126	2126	756	2126

* - Significant at 10 percent level.
** - Significant at 5 percent level.

Table 2: Kane, Riegg, and Staiger (3) – Sensitivity of Regression Estimates to Neighborhood and Housing Characteristic Controls

Table 2. Similar Results using Other Measures of Elementary School Characteristics

Dependent Variable: Ln(Sales Price)	(1)	(2)	(3)	(4)	(5)
Percent Proficient on State Test (/10)	0.122 (0.021)	0.049 (0.016)	0.028 (0.013)	0.016 (0.011)	0.021 (0.010)
Median Household Income in Elem School Zone (/100000)	1.054 (0.208)	0.567 (0.104)	0.448 (0.117)	0.261 (0.122)	0.179 (0.081)
Population Percent Black in Elem School Zone (/100)	-0.753 (0.126)	-0.352 (0.098)	-0.286 (0.091)	-0.264 (0.087)	-0.016 (0.101)
"Value-Added" Test Score '94-'99 (in student-level s.d. units)	0.377 (0.252)	0.043 (0.106)	-0.017 (0.099)	0.052 (0.096)	-0.140 (0.085)
Other Covariates:					
Base Covariates	Yes	Yes	Yes	Yes	Yes
Boundary Fixed Effects		84			
Boundary-by-Neighborhood Fixed Effects			496	496	
2500 Sq. Foot Area Fixed Effects					556
Building Quality Dummies & Block Group Characteristics				Yes	Yes
Observations	23,084	23,084	23,084	23,084	23,084

Table 3: Kane, Riegg, and Staiger (3) – Sensitivity of Housing Prices to Changes of within Neighborhood School Characteristics

Table 5. Housing Prices and Within-Neighborhood Changes in School Characteristics

	School Characteristic:		
Dependent Variable: Ln(Sales price)	School Zone Percent Black	School Zone Median Household Income	School Percent Proficient
	(1)	(2)	(3)
Level of School:			
Elementary school	0.034 (0.066)	0.045 (0.099)	-0.237 (0.140)
Middle school	-0.144 (0.083)	0.083 (0.091)	-0.039 (0.108)
High school	-0.419 (0.074)	0.284 (0.066)	0.184 (0.063)
School Assignment History Fixed Effects?	Yes	Yes	Yes
Observations	89548	89548	87908
R-squared	0.88	0.88	0.88

Table 4: Clapp, Nanda, and Ross (1) – Regressions using District Level Measure of School Quality and Controlling for Different Fixed Effects

Table 3
Housing price OLS and fixed effects models

Controls	OLS	Town FE	Census Tract FE
Math Test Score	0.074	0.014	0.013
	(8.99)	(2.53)	(2.45)
Fraction Student enrolled in Free Lunch program	−0.363	0.049	0.019
	(−6.19)	(0.75)	(0.31)
Fraction Student Non-English Speakers	0.419	0.165	0.085
	(4.93)	(1.24)	(0.79)
Fraction Student African-American	0.279	−0.152	−0.364
	(6.64)	(−0.77)	(−3.81)
Fraction Student Hispanics	0.128	−0.136	−0.308
	(1.22)	(−0.66)	(−1.90)
Effective Property Tax Rate	−0.531	−0.305	−0.299
	(−11.49)	(−8.30)	(−8.69)
R^2	0.702	0.718	0.733
N		349,730	

Note. The dependent variable is the natural log of transactions price, ln P_{ijkt}, of house i in neighborhood j in school district k at time t, t-values are in parentheses, and standard errors are based on town-year clustering.