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A FURTHER NOTE ON SCHOOLS AND HOUSING VALUES

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This paper provides further evidence on the relationship between public schools and housing values. Drawing on data from the Los Angeles and San Francisco areas, the paper presents estimates of an Oates-type model of community housing values. Included in the model are measures of both student achievement and racial composition. The quality of public schooling, as measured by reading achievement, is found to be a strong, statistically significant determinant of community housing values, independent of student racial mix or socioeconomic background. Estimates of the model suggest that changes in achievement scores have substantial impacts on community housing values.

This paper further examines the relationship between public schools and housing values. Its purpose is to try to separate the effects of quality schools from the influences of student racial composition which also may influence value and the demand for housing. This issue is important to an understanding of the "white flight" phenomenon as well as to any assessment of the likely effects on the demand for urban housing of efforts to upgrade urban public schools.

A number of past studies of housing values have looked at the influence of schools (see, for example, Edel and Sclar [5], Gustely [9], Harrison and Rubinfeld [10], Kain and Quigley [15], Li and Brown [16], and Oates [17]). Such studies usually have measured the quality of schools either by expenditures per student or achievement scores. Most have found that the quality of local public schools has a significant, positive impact on value, although some (for example, Edel and Sclar [5] and Gustely [9]) have reported that school quality when measured by per pupil expenditures may have an effect that is insignificant and even negative.

The racial composition of local schools also has been studied as a factor affecting residential location and housing values (Clotfelter [2]

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and Gill [7]). These studies have shown generally that housing values are negatively related to increases in the percentage of minority students in neighborhood schools. And they have added support to Coleman's [4] thesis that school desegregation contributes to white flight.

Three studies of which I am aware have examined both the academic quality and the racial composition of neighborhood schools (Grether and Mieszkowski [8], Jud and Watts [13], and Vandell and Zerbst [22]). Grether and Mieszkowski used data on individual housing sales in the greater New Haven area. They found the influence of school quality as measured by percentile reading scores to be a significant determinant of value. They further reported that student racial composition as measured by the percent of white children in primary school had no influence on housing values.

At the time Grether and Mieszkowski conducted their study, there was little or no busing for desegregation in the New Haven area. Jud and Watts, however, used data from Charlotte, North Carolina reflecting housing sales in 1977. During this period, the Charlotte schools had been under court-ordered desegregation for about six years. Their findings, nevertheless, were very similar to those of Grether and Meiszkowski. School quality as measured by reading achievement scores was found to be a very significant determinant of value, while student racial composition was found to be less important and statistically not significant when included in the same regression equation as the school quality variable.

Vandell and Zerbst used data on individual housing sales drawn from the Highland Park area of Dallas during the 1970s, when the Dallas schools were undergoing court-ordered school desegregation. Part of their sample was included in the Dallas city school district and part in the Highland Park district. They reported that housing value was negatively related to the percentage of black students in the neighborhood public school and positively related to location in the Highland Park school district. They interpreted this latter result as reflecting a premium for higher quality schools. They further reported that this premium had tended to rise over time, while the negative effect of black enrollment had tended to wane following the initiation of an integration plan.

The present paper provides further evidence of the impact of school quality and student racial composition, based on a sample of aggregation housing values in suburban communities in the Los Angeles and San Francisco areas. It finds that the quality of local public schools, as measured by student achievement scores, affects the price of housing, independent of school racial composition. A 4% increase in achievement is found to be associated with a 2 to 3%

increase in property values. The negative effect of student racial composition is found to be reduced substantially when school quality is included along with the racial variable in the estimated model of housing values.

SCHOOLS AND HOUSING VALUES

In any study of housing values, theory offers only a partial guide as to exactly what variables should be included or the functional form of the model. In this study, the decision was made to employ the variables and functional specification used by Oates [17] in his pathbreaking study of schools and property tax capitalization. This decision was made to facilitate comparison of the results reported here with those of Oates and numerous others who have reported findings based on an Oates-type model. The choice of the particular functional form used here is discussed by Oates at length. It can be noted, however, that none of the basic conclusions of the analysis were altered when other functional specifications were used.

Oates measured school quality by per pupil expenditures on education. However, following the example of Rosen and Fullerton [20], reading achievement scores are used in place of expenditures in the model reported here. The model also includes two other variables not used by Oates: 1) student racial composition in the public schools and, 2) the racial make-up of the community. These variables are introduced into the model to control for racial effects, both in the schools and the community at large.

The basic model that was estimated was:

$$V = \theta_0 + \theta_1 \ln SC + \theta_2 \ln MIN + \theta_3 \ln T + \theta_4 \ln D + \theta_5 Y + \theta_6 P + \theta_7 R + \theta_8 N + \theta_9 W + u \quad (1)$$

where,

V = median value of owner-occupied housing in thousands of dollars;
SC = district mean reading score in third grade;
MIN = average percentage of minority students in third grade;
T = effective tax rate;
D = distance to downtown;
Y = median household income in thousands of dollars;
P = percentage of the population below poverty;
R = median number of rooms per home;
N = fraction of housing stock built more than ten years ago;
W = percent white in the community population; and
u = random error term.

TABLE 1

Determinants of Median Housing Values

	Los Angeles		San Francisco	
	(I)	(II)	(I)	(II)
lnSC	63.39	---	−123.73	---
	(3.03)		(3.48)	
lnMIN	9.29	−14.78	1.36	−10.87
	(2.55)	(4.56)	(0.24)	(2.26)
lnI	−12.69	−13.65	−23.96	−25.08
	(2.32)	(2.42)	(3.71)	(3.56)
lnD	−9.48	−9.70	−1.01	−6.61
	(3.99)	(3.96)	(0.24)	(1.58)
Y	3.52	3.84	1.79	1.84
	(9.33)	(10.30)	(2.86)	(2.69)
P	−0.09	−0.02	−1.03	−1.41
	(0.29)	(0.72)	(1.18)	(1.49)
R	−5.76	−6.06	10.48	13.47
	(1.62)	(1.66)	(1.20)	(1.42)
N	−0.07	−5.67	11.50	16.63
	(0.73)	(0.59)	(0.70)	(0.93)
W	−0.22	−0.09	−0.23	−0.24
	(1.40)	(0.57)	(0.93)	(0.89)
Constant	−198.37	156.88	−648.11	84.52
	(1.63)	(4.88)	(2.94)	(1.22)
R^2	0.81	0.80	0.87	0.84
n	138	138	67	67

Note: Numbers in parentheses are t-values. Variables are defined in the text.

The model was estimated using 1980 data for 138 communities in the Los Angeles area and 67 communities in the San Francisco Bay area. A complete list of the communities included in the two samples along with a list of variables and their means and standard deviations is provided in Tables A.1 and A.2.

The estimated parameters of equation (1) are shown in Table 1 for both Los Angeles and San Francisco. Ignoring for the moment the school-related variables, most of the estimated coefficients have the expected signs, with the exception of the rooms variable in the Los Angeles equations and the age variable in the San Francisco equations. Median property values appear to increase with proximity to the central city and the incomes of area inhabitants. Property values decline with increases in the effective rate of taxation.[1]

The quality of public schooling as measured by the reading achievement scores of third grade pupils is a strong and statistically significant determinant of community housing values. In Los Angeles, the elasticity of housing values with respect to the quality of public schools (evaluated at the point of means) is 0.7. In San Francisco, the elasticity is 1.3.

The percentage of minority students in the public schools generally is negatively associated with property values. This result accords with the findings of Coleman. However, the negative impact of minority enrollment appears to be much stronger when the school quality variable is omitted from the estimated equations [see column (II) in Table 1]. Both the absolute values of the racial coefficients and their t-values rise when school quality is not included. This result supports the findings reported by Jud and Watts. It suggests that the negative effect of race alone is overstated in previous studies that have not controlled for the quality of schooling.

The racial composition of the community was not found to be a statistically significant determinant of values in any of the equations shown in Table 1, and the signs of the estimated coefficients were contrary to expectations. This may indicate that race is relatively unimportant once the socioeconomic class of community residents and the racial character of the schools have been considered; however, the evidence here is not strong and more work needs to be done before a conclusion is accepted on this issue.

There may be some reason to be suspicious of results presented in Table 1. A case can be made for the argument that the positive association between school quality and median housing values stems from a dependence of school quality on property values (rather than the reverse). Wealthier residents may be able to purchase better schools: Also, higher property values are positively correlated with the socioeconomic class of community residents, and the work of Coleman [3] and Jenks [12], of course, suggests that socioeconomic background is the principal determinant of student achievement.

Oates employed two-stage least squares (TSLS) to deal with the simultaneous-equation bias in his model, and was able to show that better schools, when measured by per capita spending on education,

[1] Following Oates' procedure for calculating the degree of tax capitalization but assuming a discount rate of 10% and a useful life of 40 years, the degree of property tax capitalization can be calculated by using the estimated coefficients on the tax variable in Table 1. The estimates shown in column (I) reveal that capitalization is about 53% complete in the Los Angeles area and 88% complete in communities around San Francisco. Oates reported a tax capitalization rate of about 66%, based on his sample of 53 New Jersey communities in 1960.

were capitalized into higher community property values. Using a similar statistical procedure, Rosen and Fullerton [20] reestimated Oates' model, replacing per pupil expenditures on education with the grade-level performance of fourth-grade students on standardized tests of reading and mathematics. They again found that better schools were capitalized into higher property values, and they reported that the explanatory power of Oates' model was substantially improved by the substitution of per pupil expenditures by student achievement.

Unfortunately, as Pollakowski [18] has pointed out, there are difficulties with the use of TSLS in the aggregate models estimated by Oates and Rosen and Fullerton. This is because in order to correctly employ TSLS in a model of this type, one must find instrumental variables which affect the quality of public education, but not property values. Pollakowski asserts that it is difficult to conceive of instruments that satisfy this criterion.

It is possible, however, to develop a procedure to estimate the impact of public schools on housing values independent of the socioeconomic class of district residents. (A similar procedure was employed by Ihlanfeldt and Jackson [11] in their study of property tax capitalization.) Following Oates, assume that average property values can be viewed as a linear combination of structural and neighborhood attributes:

$$V = F(X\theta) \tag{2}$$

Among the X_i's, include all the variables in equation (1) except school quality — that is, use the estimates of equation (1) shown in column (II) of Table 1. This assumes that any variations in school quality not associated with the socioeconomic class of area residents are random and can be incorporated in the error term.

The set of predicted values ($\hat{V}$) from equation (2) comprises the hypothetical distribution of housing values that would exist in the absence of any differences in school quality which are not based on socioeconomic background or race.

Next, using the set of predicted values, estimate the relationship between student achievement and housing values. This relationship reveals the influence of socioeconomic background on average student achievement.

$$\ln SC_i = B_0 + B_1\hat{V}_i + \Phi_i \tag{3}$$

The set of residuals (R1nSC) obtained from equation (3) represents the random differences in school quality not associated with student background. Using this set of residuals, it is then possible to estimate the impact of the random differences in school quality on average property values. That is,

$$V_i - \hat{V}_i = \gamma_0 + \gamma_1 R1nSC_i + \Phi_i \tag{4}$$

Measurement error in $1nSC_i$ is incorporated into the residual of equation (3). Thus, $R1nSC_i$ is measured with error in equation (4). Because $R1nSC_i$ is measured with error, $\hat{\gamma}_1$ will be biased and inconsistent. However, $\hat{\gamma}_1$ will have the same sign and be closer to zero than if R1nSC had not been measured with error (see Theil [21], pp. 608-9). Thus, $\hat{\gamma}_1$ may be interpreted as a lower bound estimate of the impact of school quality, independent of student background, on residential housing values.

The estimates of equation (4) were as follows (t-values are shown in parenthesis; however, because of the measurement error in $R1nSC_i$ they must be considered only as approximations):

Los Angeles

$$V_i - \hat{V}_i = \underset{(0.00)}{0.00} + \underset{(2.10)}{31.55} R1nSC_i \qquad R^2 = 0.04 \qquad F = 4.41 \qquad N = 138 \tag{5}$$

San Francisco

$$V_i - \hat{V}_i = \underset{(0.00)}{0.00} + \underset{(2.69)}{71.79} R1nSC_i \qquad R^2 = 0.10 \qquad F = 7.26 \qquad N = 67 \tag{6}$$

These results indicate that community-wide housing values in the Los Angeles and San Francisco areas are influenced by the quality of public education available to community residents independent of student racial mix or socioeconomic background.

In the Los Angeles area, the average district-wide reading score of third-graders was 255, with a standard deviation of 34. The mean value of the logs of the average district scores was 5.53, with a standard deviation of 0.14 (see, Table A.1). (It should be noted that the compactness of the distribution is because it contains district average scores, not scores of individual students.) The regression estimates shown above suggest that if the average district could raise its average score by just one-third of a standard deviation above what would be expected based on the racial composition and socioeconomic class of community residents, average housing values in the district would rise by an average of $1,472 (0.14/3 x 31.55), or about 1.6%. For the typical Los Angeles district, this would amount to an increase in its average reading score of 11.3 points, or a percentage rise of 4.4%.

For the San Francisco area the regression estimates indicate that an increase in average district reading score of one-third of a standard deviation would raise the average value of housing there by $2,872

(0.12/3 x 71.79), or about 2.7% An increase in average reading score of one-third of a standard deviation would represent a percentage rise of about 3.9% for the typical district in the San Francisco area.

SUMMARY AND EVALUATION

This study suggests that student achievement has a significant effect on housing values. This effect appears to be independent of student racial mix or socioeconomic background. Accordingly, it indicates that policies designed to upgrade urban schools may increase the demand for housing and help stem the outmigration of middle-class families (both white and black), which is currently a matter of serious public concern (see, Jud [14]).

Two questions are at issue in evaluating the policy relevance of this work. First, are achievement scores a valid measure of school quality? And second, can achievement levels be affected by educators and educational policy?

In answer to the first question, I believe that reading achievement scores are a reasonable measure of the quality of local schools as perceived, rightly or wrongly, by individual home buyers. The results presented here suggest that parents who are concerned with school quality are attracted to residential areas where school achievement scores are high.

Regarding the second question, there has been wide disagreement over precisely what school inputs affect student achievement and school quality. The Coleman report [3] adopted the rather pessimistic view that inputs to education have little affect once account is taken of the socioeconomic class of students. More recently, a growing number of educational researchers have reported evidence that schools and teachers can significantly affect achievement (see, Purkey and Smith [19]). The consensus of these studies has been that some schools are better than others at fostering student achievement because some teachers and administrators are more effective. There also is evidence that effective schools are possible even in low-income neighborhoods (Edmonds [6], Armor [1]). The renewed interest in quality education evident at local school board meetings and state houses across the country strongly suggests that many connected with public education have come to believe that better schools can make a difference.

REFERENCES

[1] D.J. Armor, G. Sumner and V. M. Thompson. *Analysis of the School Preferred Reading Program in Selected Los Angeles Minority Schools.* R-2007-LAUSD. Rand Corporation, 1976.

[2] C.T. Clotfelter. The Effects of School Desegregation on Housing Prices. *Review of Economics and Statistics* 57(4):446-51, 1975.

[3] J.S. Coleman, E.Q. Campbell, C.J. Hobson, J.R. McPartland, A.M. Mood, F.D. Weinfeld and R. L. York. *Equality of Educational Opportunity* 2 001s. U.S. Government Printing Office, 1966.

[4] J.S. Coleman, S.D. Kelly and J.A. Moore. *Recent Trends in School Integration, 1968-73.* Paper 772-03-01. The Urban Institute, 1975.

[5] M. Edel and E. Sclar. Taxes, Spending, and Property Values: Supply Adjustments in a Tiebout-Oates Model. *Journal of Political Economy* 82(5):941-954, 1974.

[6] R. Edmonds. Effective Schools for the Urban Poor. *Educational Leadership* 37(1):15-24, 1979.

[7] H.L. Gill. Changes in City and Suburban House Prices during a Period of Expected School Desegregation. *Southern Economic Journal* 50(1):169-84, 1983.

[8] D.M. Grether and P. Mieszkowski. Determinants of Real Estate Values. *Journal Urban Economics* 1(2):127-146, 1974.

[9] R.D. Gustely. Local Taxes, Expenditures, and Urban Housing: A Reassessment of the Evidence. *Southern Economic Journal* 42(4):659-665, 1976.

[10] D. Harrison and D.L. Rubinfeld. Hedonic Housing Prices and the Demand for Clean Air. *Journal of Environmental Economics and Management* 5(1):81-102, 1978.

[11] K.R. Ihlanfeldt and J.D. Jackson. Systematic Assessment Error and Intrajurisdiction Property Tax Capitalization. *Southern Economic Journal* 49(2):417-27, 1982.

[12] C. Jenks, *et al. Inequality: A Reassessment of the Effect of Family and Schooling in America.* Basic Books, 1972.

[13] G.D. Jud and J.M. Watts. Schools and Housing Values. *Land Economics* 57(3):459-70, 1981.

[14] G.D. Jud. Public Schools and Urban Development. *Journal of the American Planning Association* 51(1): 74-83, 1985.

[15] J.F. Kain and J.M. Quigley. Measuring the Value of Housing Quality. *Journal of the American Statistical Association* 65,330:532-46, 1970.

[16] M.M. Li and H.J. Brown. Micro-Neighborhood Externalities and Hedonic Housing Prices. *Land Economics* 56(2):125-41, 1970.

[17] E. Oates. The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis. *Journal of Political Economy* 77(6):957-71, 1969.

[18] H.O. Pollakowski. The Effects of Property Taxes and Local Public Spending on Property Values: A Comment and Further Results. *Journal of Political Economy* 81(4):994-1003, 1973.

[19] S.C. Purkey and M.S. Smith. Synthesis of Research on Effective Schools. *Educational Leadership* 40(4):64-9, 1982.

[20] H.S. Rosen and D.J. Fullerton. A Note on Local Tax Rates, Public Benefit Levels, and Property Values. *Journal of Political Economy* 85(2):433-40, 1977.

[21] H. Theil. *Principles of Econometrics.* John Wiley & Sons, 1971.

[22] K.D. Vandell and R.H. Zerbst. School Desegregation and Housing Values: An Application of Ridge Regression. *AREUEA Journal* 12(2):109-135, 1984.

TABLE A.1

Table of Means and Standard Deviations

	Los Angeles (n = 138)		San Francisco (n = 67)	
Variable*	$\bar{X}$	S.D.	$\bar{X}$	S.D.
V	93.57	35.49	106.56	39.02
1nSC	5.53	0.14	5.61	0.12
SC	254.89	34.31	274.49	31.86
1nMIN	3.36	0.77	3.14	0.79
1nT	1.24	0.28	1.16	0.35
1nD	3.11	0.79	3.30	0.71
Y	21.20	8.15	23.09	9.33
P	7.93	6.12	5.98	3.83
R	5.68	0.71	5.99	0.65
N	0.71	0.21	0.72	0.17
W	80.28	14.82	81.18	14.68

* The variables SC, MIN, and T were obtained from the California Assessment Program, *Profile of School District Performance,* 1977-80. The variable D was calculated by the author from Rand McNally maps of the Los Angeles and San Francisco areas. The variables Y, P, R, N, and W were taken from Bureau of the Census, *Census of Population and Housing,* 1980.

TABLE A.2

List of Suburban Communities

LOS ANGELES AREA

Los Angeles County: Alhambra City, Altadena, Arcadia, Artesia, Azusa City, Baldwin Park, Bell City, Bellflower City, Bell Gardens, Beverly Hills, Burbank City, Carson City, Cerritos City, Commerce, Compton, Covina, Cuduhy, Culver City, Diamond Bar, Downey City, Duarte City, El Monte, El Segundo, Gardena, Glendale, Glendora, Hacienda Heights, Hawaiian Gardens, Hawthorne City, Hermosa Beach, Huntington Park, Inglewood City, La Canada-Flintridge, La Crescenta-Montrose, La Mirada, Lancaster, La Puenta, Lawndale, Lennox, Long Beach, Los Angeles, Lynwood, Manhatten Beach, Monrovia, Montebello, Monterey Park, Newhall, Norwalk, Palmdale, Palos Verdes Estates City, Paramount, Pasadena, Pico Rivera, Pomona, Rancho Pales Verdes, Redondo Beach, Rowland Heights, San Dimas, San Gabriel, San Marino, Santa Fe-Springs City, Santa Monica City, South El Monte, South Gate, South Pasadena, South Whittier, Temple City, Torrance City, Walnut City, Walnut Park, West Covina, West Whittier-Los Nietos, Whittier City.

Orange County: Anaheim, Brea City, Costa Mesa, Cypress City, Dana Point, El Toro, Fountain Valley, Fullerton, Garden Grove, Huntington Beach, Irvine City, Laguna Beach, Laguna Hills, Laguna Niguel, La Habra, La Palma, Los Alamitos, Mission Viejo, Newport Beach, Orange City, Placentia, San Clemente, San Juan Capistrano, Santa Ana, Seal Beach, Stanton, Tustin City, Tustin Foothills, Westminster, Yorba Linda.

Ventura County: Camarillo, Oxnard, Port Hueneme, Ventura City, Santa Paula, Simi Valley, Thousand Oaks.

Riverside County: Banning City, Corona, East Hemet, Hemet City, Indio City, Norco City, Palm Desert, Palm Springs City, Riverside City, Sunnymead.

San Bernardino County: Apply Valley, Barstow, Big Bear, Bloomington, Chino City, Colton City, Fontana City, Hesperia, Highland, Montclair, Ontario, Rancho Cucamonga, Redlands, Rialto City, San Bernardino, Upland, Victorville, Yucaipa.

SAN FRANCISCO AREA

Alameda County: Alameda, Albany, Berkeley, Castro Valley, Dublin, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont City, Pleasanton City, San Lenardo, San Lorenzo, Union City.

Contro Costa County: Antioch, Danville, El Cerrito, El Sobrante, Lafayette, Martinez, Moraga Town City, Orinda, Pinole City, Pittsburg, Richmond City, San Pablo, San Ramon, Walnut Creek.

San Francisco County: San Francisco.

San Mateo County: Belmont City, Burlingame City, Daly City, East Palo Alto, Hillsborough, Menlo Park, Millbrace City, Pacifica City, Redwood City, San Bruno, San Caslos City, San Mateo City, South San Francisco.

San Jouquin County: Lodi City, Manteca, Stockton City, Tracy City.

Stanislaus County: Ceres City, Modesto City, Turlock City.

Santa Cruz County: Live Oak, Santa Cruz, Watsonville.

Santa Clara County: Alum Rock, Campbell, Cupertino, Gilroy City, Los Altos, Los Gatos, Milpitas, Morgan Hill, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale.