School Accountability Ratings and Housing Values

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Abstract

We study the housing price impacts of school mean test scores and school accountability ratings, focusing on properties near school assignment boundaries in Mecklenburg County, North Carolina. Similar to Black (1999), we find that differences in school test scores are strongly related to housing values, even among houses within 500 feet of school boundaries. A one student-student level standard deviation difference in average test scores is associated with a 19 percent difference in housing price, after controlling for observed housing characteristics and neighborhood fixed effects. Although school-level test score data had been available in the county, new information was released in 1997 when the state began identifying schools as "low-performing" and singling out schools that had achieved "expected" or "exemplary" ratings on the state's value-added metric (which accounts for students' baseline scores). Unlike Figlio (2002), we find no evidence that new state accountability ratings had any effect on housing prices.

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I. Introduction

Over the last decade, states have constructed elaborate systems for rating the performance of individual schools based on student test scores, and publicly released this information in the form of school "report cards". The federal No Child Left Behind Act of 2001 will accelerate that movement by requiring states to test all students in grades three through eight, publicly report each school's student test performance, and sanction schools when they fail to achieve specific standards. Earlier research has documented the cross-sectional relationship between housing values and student test scores at neighborhood schools (Black(1999), Bogart and Cromwell (1997), Weimer and Wolkoff (2001)). Given the magnitude of the relationship between test scores and housing prices in the cross-section, one might expect the release of school report cards to have important effects on housing values and, indirectly, to provide incentives for schools to improve performance. However, there are also reasons to believe that the housing market would downplay the information in school report cards. In particular, school test scores are noisy measures of school performance (Kane and Staiger, 2002) and may provide homeowners with little new information regarding which are the best schools.

In this paper, we explore how test performance levels, changes in test performance levels and categorical ratings are related to housing values. To control for potential heterogeneity in tax rates and neighborhoods, we use the approach of Black (1999) and focus on homes near to elementary school attendance boundaries. In particular, the geographical detail in our data allow us to precisely determine the location of each home being sold and every school and school boundary, and focus our analysis on homes within a few thousand feet (or less) of school boundaries. Thus, our empirical strategy is to compare sales prices for homes located in the same neighborhood and taxing municipality, but that are assigned to different elementary schools. In addition, we control for a range of detailed observable characteristics of the house such as distance to school, lot/home size, and middle and high school assignments.

Our empirical analysis uses data from the housing market in Mecklenburg County, North Carolina, where various indicators of school quality were released by the state between 1993 and 2001 and reported each fall in the local paper. Between 1993 and 1996, average test scores were reported by grade level for the school overall and by two racial categories (African Americans and Whites/Others). Beginning in August 1997, the state began explicitly placing schools in performance categories (ranging from "low performing" to "schools of excellence"), using a combination of the proportion of students that achieved proficiency on the test and a value-added measure (based on average improvement in each student's score from the prior year). With this data, we are able to explore how housing values are related to the variation in performance across schools, the year-to-year variation in performance for a given school, and the change to categorical performance measures in 1997.

We begin by estimating the relationship between long-run measures of school test performance (scores averaged over many years) and housing values using the regression discontinuity design proposed by Black (1999) – comparing sales prices of homes near elementary school boundaries. We find a significant positive relationship between test performance and housing values, somewhat larger than that found by Black, and that is robust across a variety of specifications. Our estimates suggest that a one student-level standard deviation difference in mean performance is associated with an 18 to 25 percentage point difference in house value, controlling for neighborhood amenities and housing characteristics. A student-level standard deviation in test scores is quite large relative to the between-school differences. The implied impact of a school-level standard deviation is necessarily smaller, approximately 4 to 5 percentage points. Nevertheless, if year-to-year changes in school performance had effects of this magnitude, we would expect large swings in property values over time.

However, as noted above, there are reasons to believe that housing values may not respond strongly to the annual information that is released in school report cards. In previous work, we have highlighted the importance of year-to-year fluctuations in test performance, due to sampling variation and other one-time factors affecting school test scores (Kane and Staiger, (2002a, 2002b)). If the housing market were unaware of the importance of sampling variation and focused too heavily on annual announcements of test performance, there would be a considerable amount of regression to the mean in housing prices following short-term fluctuations in test scores up or down. Our results suggest that the market heavily discounts short-term fluctuations in school performance, focusing instead on long-term mean differences in school performance. We see no evidence of volatility in housing prices to match the annual volatility in test scores.

We further evaluate the housing market's response to the categorical rating of school performance created by school accountability systems, to see if this new source of information had a more pronounced impact on housing values. Figlio (2002) found some evidence that public reporting of school "report cards" (giving schools grades of A-F based on test performance) had an impact on house values in Florida. Using data from before and after the introduction of report cards in 1999, Figlio concluded that the assigned letter grades had large impacts on house values (approximately 10 percent for each full grade increment) in the months immediately following their release. In 1997, North Carolina labeled 13 of the 61 public elementary schools in our sample of schools in Charlotte as "low-performing" based upon the proportion of their students failing to achieve Level III proficiency in the end of grade exams. In contrast to Figlio, we see no evidence that housing prices declined in response to the categorical rating from the state, probably because these had been low-performing schools for some time, and were known to home buyers even without the state labels. Moreover, other categories which reflected the schools mean "value-added" also had no apparent impact on housing prices. Either home buyers were uninterested in value-added differences (and primarily focus on mean performance in evaluating schools) or they did not rely on any designation based upon a single year's worth of value-added measures. Such caution may be justified. Consistent with the findings in Kane and Staiger (2002a), schools often cycled in and out of these value-added categories between 1997 and 2001: an average of 37 percent of the elementary schools rated in the highest value-added category one year appeared in the lowest value-added category the following year.

Finally, we provide some evidence that school test scores in Charlotte are correlated with differences in measured housing characteristics, even when one focuses on houses near boundaries. This raises some concern over the extent to which school test scores may also be correlated with neighborhood quality differences for which we cannot control. Indeed, even if neighborhoods were similar on either side of school boundaries when the boundaries were originally drawn, it would be surprising if the two sides of the boundary did not evolve differently, as high quality schools lead to higher housing prices and attract home buyers with different preferences. The concern primarily affects the interpretation of the coefficient on long-term test scores. Our main findings regarding the effects of the short-term test score fluctuations and the impact of school ratings by the state would be unaffected by such unobserved differences in neighborhood quality, since such effects are identified with changes over time.

II. The Charlotte-Mecklenburg Housing and Test Score Data

A. Housing Data

We began with data on 304,000 real estate parcels in Mecklenburg County, North Carolina (population 640,000), including commercial properties, apartments and condo units as well as single family homes. Of these, only 192,000 were single-family homes (including some vacant lots zoned for single family use). We further limited the sample in two ways. First, we focused on the 138,000 parcels in the county with stable elementary school assignments between 1993 and 2001. This restriction eliminates parcels that experienced large changes in their school test scores because of changes in school assignment, and allows us to focus on whether new test score information for a given school effects property values. Second, we focused on non-vacant parcels that sold between 1993 and 2001 (for more than $14,000 and less than $674,000, roughly the 1st and 99th percentile in 2001 dollars). For each of these parcels, we were able to observe up to five sales.[1] After imposing these sample restrictions, we were left with a sample of 86,865 sales for 67,066 parcels.

[1]Since less than one percent of the sample had a fifth sale after September 1993, very few transactions were truncated by the limit of five per property and we have sales price data for virtually all single family sales transactions occurring between September 1993 and December 2001.

In Figure 1 we plot trends in the 10^{th} through 90^{th} percentile of the real home sales prices (2001 dollars) for each month in our data. Median real home values have risen about 3.6% per year in Mecklenburg County. This growth has been somewhat faster for low priced homes (5.7% per year at the 10^{th} percentile) than for high priced homes (3.1% per year at the 90^{th} percentile). Additional descriptive statistics for this sample on sales price and housing characteristics are given in Appendix Table 1.

The Charlotte-Mecklenburg School District (CMS) provided us with detailed school boundary information beginning in the fall of 1993 through the fall of 2001. Not all districts maintain such sophisticated geographical data. However, during the period we are studying, the district was under court order to maintain African American representation in each school within a target range. As a result, they carefully weighed the implications of changes in school boundaries, by precisely locating school boundaries and combining those boundaries with demographic information on different neighborhoods.

In Figure 2, we plot the boundaries of the elementary schools in Charlotte in 1999. Reflecting the requirements of the court order to achieve a racial mix of students in the schools, many of the school boundaries are quite irregularly shaped. To the extent that school assignment areas did not simply coincide with existing neighborhood boundaries, but crossed neighborhood boundaries, such irregularities will actually help us to separately identify the effects of school quality from other neighborhood amenities.

Because we were able to place each parcel in relation to the school boundaries, we calculated the distance of each parcel to the closest parcel with a different school assignment. Parcels were categorized by the closest boundary. For the parcels with stable school assignments between 1993 and 2001, there were 61 different elementary schools and 143 distinct boundaries with each boundary identified by a unique school pair. Due to mandatory busing in Charlotte during the period we are studying, some school assignment areas were non-contiguous-- that is, although it is not obvious in Figure 2, a given school may have school assignment areas in different parts of the city. In other words, a "boundary" between a pair of schools could be non-continuous and located in different neighborhoods. Accordingly, we experimented with a number of other geographic controls– essentially allowing for different fixed effects on different sections of a school boundary.

Figure 3 summarizes the geographic dimensions of the data. In the top left corner, we plot the coordinates of all the parcels in Mecklenburg County– both commercial and residential-- by their distance in feet from the southern and western edges of the county. In the top right corner, we plot the locations of single family homes which sold at some point between September 1993 and December 2001 which were located in areas with consistent school assignments from 1993 through 2001. The blank areas in the graph identify commercial districts as well as parts of the city where school assignment zones were redrawn at some point between 1993 and 2001. The bottom left figure plots the locations of all parcels that were located within 2000 feet of the closest school boundary. To highlight the location of the boundaries, the points on either side of each boundary were shaded a different color. Given the smaller lot sizes, a disproportionate share of the parcels close to boundaries were drawn from the central part of the county. In the bottom right, we plot the locations of all of the parcels within 1000 feet of a school boundary. These parcels were also disproportionately drawn from the central city for the same reason. However, it is also apparent from Figure 3 that the effect of school assignments will be evaluated for properties in very close proximity to one another and that there are a large number of boundaries to exploit.

B. Test Score Data

Each July, between 1993 and 1996, the Charlotte-Mecklenburg school district identified schools that had achieved certain targets for improved test scores. In the fall (usually in October), Charlotte Observer published mean test scores for schools in the district. The scores were reported by grade level for the school overall and by two racial categories (African Americans and Whites/Others). The reports also included information on the percentage of students in each racial group and other student characteristics, such as the proportion of students on free or reduced price lunch and the proportion of students with both parents living at home. Although the reports did not include any direct measure of value-added differences among schools, home buyers could do their own "regression adjustment", adjusting test performance for the demographic composition of each school. Beginning in August 1997, the state began explicitly rating schools, using a combination of performance levels and value-added measures. Schools that achieved "expected" or "exemplary" scores on the state's growth composite– a value-added measure of the mean growth in individual students' performance from the end of one grade to the next– were singled out. In fact, teachers in schools with "expected" or "exemplary" value-added scores received bonuses from the state. Among those failing to achieve "expected" value-added, schools were labeled "low-performing" if fewer than half their students reached a specific level of proficiency in end of grade tests. In addition, schools with very high levels of performance were identified as "schools of distinction" or "schools of excellence".

Our sample of parcels with stable assignments were assigned to one of sixty-one different elementary schools in the Charlotte Mecklenburg school system. During our sample time period, all of the schools were K-5 with students in grades 3 through 5 being tested. In 1999, the proportion of students in each of these schools achieving Level III and above on the state's end-of-grade tests ranged from 39 percent at the lowest-performing schools to 95 percent in the highest performing. The mean math score was .39 student-level standard deviations below the state mean for the lowest-performing school and was .70 student-level standard deviations above the state mean for the highest performing school. The percentage of tested students in each school who were African American ranged from 1 percent to 94 percent. However, because of court-ordered busing, school boundaries were drawn so that most students attended schools where between 33 and 54 percent of students tested were African American. See Appendix Table 1 for more details on how these variables varied across our sample.

The school district also operates a number of magnet schools, which allow students to attend schools outside their attendance area. The presence of such options may lead us to understate somewhat the housing market value of school quality. Four of the top ten elementary schools ranked by mean test performance in 2000 were magnet schools. (Magnet programs did not have assignment boundaries and are not included in our analysis.) However, entrance into the remaining six schools in the top ten was determined solely by residence. Moreover, the most desirable magnet programs were oversubscribed and subject to lotteries.

Before the state began providing categorical ratings for schools, test scores were generally released in the fall following each spring's test administration. [2] After the introduction of categorical ratings by the state in the summer of 1997, ratings were generally reported in August.[3] In our analysis, we matched the test data from the spring of a given year-- which would have been released the subsequent summer and fall-- to the housing sales data from subsequent September through August calendar year. Thus, we associate each house sale with the most recently available test score. For example, the results from the spring 1997 test administration, released in August of 1997, were matched to the housing sales data from September 1997 through August 1998.

We have student-level micro-data on math and reading performance and race in grades 3 through 8 for schools in North Carolina for 1993 through 1999. (We do not have the microdata for 2000 and 2001.) Using the microdata, we constructed mean scaled test scores (standardized by grade) for 1993 through 1999 for all of the Charlotte-Mecklenburg schools. Data similar to these were published in the newspaper.

In addition, the North Carolina Department of Public Instruction provided us with data on school ratings and performance composites for each year from 1997 through 2001. The

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[2]The Charlotte Observer reported lists of schools that had achieved targeted improvements in performance on August 26, 1993, July 14, 1994, July 12, 1995, and July 20, 1996. In addition, the Charlotte Observer contained special advertising supplements reporting school test scores and student characteristics on October 24, 1994, October 26, 1995, and October 30, 1996.

[3]The stories reporting schools' ratings under North Carolina's ABC's program appeared on August 8, 1997, August 7, 1998, August 6, 1999, August 4, 2000 and October 5, 2001. The scores were reported unusually late in 2001 due to the need for an equating study, given a change in the state testing program that year.

performance composite is the proportion of students scoring above a specific threshold in each grade and subject in a school. The performance composite seems to have been measuring the same attribute as the mean scaled score we calculated from the microdata: The correlation between the annual performance composite and the mean scaled score for 1997 through 1999 (the only three years in which we have both series) was .98.

III. Empirical Strategy

In the literature on school quality and housing values, the primary challenge has been to distinguish between the impact of school quality differences and other factors– such as neighborhood amenities and differences in the quality of other public services– which may be correlated with school quality. To address this issue, we focus on differences in housing values near school boundaries – parcels within 2,000, 1,000 or 500 feet of school boundaries – and control for housing characteristics and fixed effects for the areas where the boundaries are located. Black (1999) employed an analogous strategy by including properties within .33, .20 and .15 of a mile (approximately 800-1800 feet) on either side of a school boundary.

To the extent that the school boundaries coincide with natural boundaries between areas with different amenities and public services, our estimates would still be conflating the effects of school quality and other characteristics. As a result, rather than simply include boundaries for pairs of schools, we sought other ways to identify differences between neighborhoods. The tax assessor's office has identified 1048 different neighborhoods within Mecklenburg county. The typical neighborhood is rather small: half of all parcels are within 400 yards of the center of the neighborhood and ninety-five percent of parcels are within 2000 yards of the center of their neighborhood. We experiment with including fixed effects for each of these neighborhoods, thereby identifying the impact of school quality for properties in the same neighborhood assigned to different schools. Under this approach, when an entire neighborhood is assigned to the same school, none of the parcels in that neighborhood contribute to estimating the impact of school quality on housing values. The use of the neighborhood dummies also allows us to control for variation in housing prices along major roadways and other natural barriers, to the extent that bordering properties are recognized as being in different neighborhoods.

In addition to using neighborhood boundaries, we overlaid the map of Mecklenburg County with grids of arbitrary sizes and included fixed effects for each square block on the grid. We report results using 2,500 foot square blocks (slightly less than a half-mile square), but found similar results using blocks from 1,000 to 10,000 foot square. Just as with neighborhoods, only those square blocks which cross a school boundary contribute to estimating the impact of school quality. We also explicitly test for a discontinuity in housing prices at the boundaries themselves.

Mecklenburg County includes the city of Charlotte, as well as six additional municipalities (Cornelius, Davidson, Huntersville, Matthews, Mint Hill and Pineville). Tax rates vary by municipality; the quality of city services may also vary. In most cases, the neighborhood definitions lie within municipality boundaries and, therefore, implicitly control for these factors too. However, some neighborhoods do cross municipality boundaries. As a result, we include fixed effects for municipalities, implicitly controlling for tax rate differences and other differences between municipalities.

IV. Results

We report the empirical results in four sections. In the first section, we estimate the relationship between long-run measures of school test performance (scores averaged over many years) and housing values using the regression discontinuity design proposed by Black (1999), comparing sales prices of homes just on either side of elementary school boundaries. We find a significant positive relationship between test performance and housing values, somewhat larger than that found by Black, and that is robust across a variety of specifications. In the second section, we explore whether housing values respond to new information in the form of current year's test scores or the new ranking system adopted in 1997. We find no evidence that year-to-year changes in test scores or the release of the new school rankings had any impact on housing values. In the third section of the results, we explore whether school test performance is related to property values simply because it proxies for racial mix at the school. The evidence suggests that test performance does not proxy for racial mix, and the test performance of white students has the strongest relationship to property values. The final section evaluates the validity of the regression discontinuity design for evaluating the housing market payoff to long-run differences in test scores, exploring whether differences in test scores at school boundaries proxy for unmeasured characteristics of the house or its neighborhood. The evidence suggests that test performance may proxy for unmeasured characteristics of the house or its neighborhood.

<u>A. Long-run measures of school test performance and housing values</u>

Table 1 presents the coefficients on elementary school test scores and housing characteristics. The dependent variable is the natural log of sales price. The school test score is the mean elementary school math and reading score over the period 1993 through 1999, after subtracting the mean and dividing by the student-level standard deviation by grade. (The resulting score is in student-level standard deviation units.) Each specification also includes indicators for municipality. Although we do not include a separate measure for property tax rate, the dummy variables for each municipality implicitly controls for tax rates, as well as any other differences between the municipalities in Mecklenburg County. Finally, to account for seasonality and general trends in the housing market in Charlotte, we include as regressors academic year and month dummies as well as a time trend measured in months since January 1993, although these are not reported separately.

Column (1) reports the results for the full sample without including fixed effects for neighborhoods. A one student-level standard deviation difference in school test scores is associated with a 39.6 percent increase in housing values. Column (2) reports the results for the sample of parcels within 2000 feet of the boundary. A one student-level standard deviation difference in test scores is associated with a 62.7 percent difference in housing prices. Both of these specifications fail to account for neighborhood differences in housing values which are not captured by housing characteristics and are likely to be overstated as a result.

Column (3) includes fixed effects for each of the 143 boundaries between school assignment areas.[4] The coefficient on school test scores is cut in half after controlling for the variation between neighborhoods with the boundary fixed effects. It is worthwhile noting that the value of many other housing characteristics also changed after including the boundary fixed

[4]There were 143 boundaries in the full dataset, but only 107 in the sample of parcels within 2000 feet of a boundary.

effects. For example, the coefficient on lot acreage increased eight-fold, while the coefficient on the age of the building increased six-fold (while the coefficient on the quadratic term in age remained roughly constant). Presumably, these findings reflect the fact that the neighborhood dummies also implicitly control for distance from local business and entertainment districts, which is likely to be negatively related to housing prices, but positively correlated with lot size and age of building. Although our purpose here is to focus on the value of test score differences, the finding suggests that hedonic estimates of housing characteristics other than test scores may be subject to similar biases due to unmeasured neighborhood characteristics.

The impacts of school test scores in columns (1) and (2) are somewhat larger than similar estimates in Black (1999), although the relative impact of including boundary fixed effects is the same. Black (1999) found that a school-level standard deviation in elementary school test scores was associated with a 4.9 and 2.2 percentage point difference in housing price respectively, before and after limiting the sample to houses near school boundaries. In Charlotte, a school-level standard deviation is equal to .21 student-level standard deviations. Multiplying the coefficients in Table 1 by .21 implies a percentage point difference of 13 and 5 percentage points per one school-level standard deviation respectively.

One reason for the larger estimated impact of school test score coefficient than in Black (1999) may be that we also included the straight-line distance to the elementary school in miles. (We have also tried including a quadratic in distance, but the quadratic term was generally indistinguishable from zero.) With boundary effects, an additional mile in distance from the elementary school was associated with a 1 to 5 percentage point decline in housing value. This is quite large– implying, for instance, that a few miles of distance has the same implication for home value as a school-level standard deviation difference in test scores. (Bogart and Cromwell (2000) and Clotfelter (1975) suggest that the value of a neighborhood school may be substantial.) Including the distance controls led to increases in the estimated impact of test scores (from roughly .17 to .25 in a specification otherwise similar to that in column (3)), since distance and mean test scores are positively correlated.

In column (4), we included dummy variables for each of the 1048 neighborhood definitions used by the county tax assessor's office (the parcels within 2000 feet of the boundaries only fell within 316 such neighborhoods). The coefficient on test scores declines somewhat to 17.5 percent. The neighborhood definitions are used to distinguish among different areas for appraisal purposes and, as a result, presumably reflect differences in area amenities. We would expect such a decline if the neighborhood definitions were better at identifying when school boundaries coincided with informal neighborhood boundaries.

In column (5), we added fixed effects for 2500 foot square blocks. This is cutting the data even more finely, allowing for different fixed effects along each segment of a school boundary. However, the result is largely unchanged, with a coefficient of 24.5 percent per student-level standard deviation difference in test scores.

In columns (6) and (7), we focus even more on schools near the boundaries– limiting the sample to parcels within 1000 feet and within 500 feet of the closest parcel on the other side of the boundary. In many cases, this is limited to the first several of rows of parcels on each side of the boundary. The coefficients on mean test score in columns (6) and (7) are .188 and .191 respectively.

Table 2 reports results from the same specifications, using the mean performance composite for each school between 1997 and 2001. The school-level standard deviation in performance composites and mean scaled scores was 10.2 and .21 respectively. Multiplying the coefficients on school quality measures in Tables 1 and 2 by their respective school-level standard deviation reveals very similar implied impacts on housing values. Moreover, the pattern of results in Table 2 is quite similar to the results in Table 1.

Satellite Zones

One of the more striking findings in Table 1 is the magnitude of the effect of distance from one's elementary school on housing values. For example, the coefficients in column (3) imply that the impact on housing prices of a six-mile difference in distance is equivalent to the effect of moving from the school with the highest test scores in the county to a school with the lowest test scores. As noted above, the bussing plan in Charlotte created "satellite zones" for 15 of the elementary schools in our sample to achieve greater racial balance for schools in predominately white neighborhoods. The satellite zones were typically in low-income neighborhoods with high proportions of African American students (although for one of the schools in our sample, the satellite zone was created to boost white enrollments at a school in an African American neighborhood). The students from the satellite zones were required to travel longer distances to schools– the median distance to the school for parcels in satellite zones was 3.9 miles, as compared with 1 mile for parcels in non-satellite areas. In order to test whether the effect of distance in Tables 1 and 2 was due to the correlation between distance and parcels in satellite zones (which tended to be low-income neighborhoods with lower housing values), we re-estimated each of the specifications above, excluding parcels located in the satellite zones.

The results are reported in the top panel of Table 3. Although the point estimates are somewhat smaller than in Table 1, distance from the assigned elementary school continued to have a large impact on housing values, even after excluding the parcels in satellite zones.

Interactions with Household Income

We were interested in any differences in the valuation of school performance and distance by high and low income home buyers. Unfortunately, we did not have the household incomes of those living in individual parcels. Instead, we used the median household income in the 2000 census in for the census tracts in which the parcels were located. The bottom two panels of Table 3 report the results of analyzing differences separately for those parcels with income above and below the countywide median. Although the point estimates of the value of school quality are larger in columns (1) and (2) for low-income tracts, the estimates are quite similar in columns (3) through (7) in which a more complete set of geographic controls are included. Interestingly, the coefficient on distance from the assigned elementary school was indistinguishable from zero for high income tracts, but remained sizeable for the parcels in lower-income tracts. This may reflect the fact that it takes longer to travel a given distance in more densely populated neighborhoods where the lower-income households live than in suburbs, where the higher income households live.

Controlling for Middle School and High School Assignments

In addition to the elementary school assignments, we were able to attain information on middle school and high school assignments as well for each parcel in the county. Although we did not have ready access to middle school and high school test scores to separately estimate the payoff to middle school and high school test scores, we were able to included fixed effects for middle schools and high schools in the sample, to test the extent to which the observed value of elementary school performance may actually be reflecting middle school and high school assignments. We re-estimated the specification in column (3) of Table 1 with middle school and high school fixed effects respectively. Since most of the students from a given middle school were assigned to the same high school, we did not include both the middle school and high school effects in the same specification.

While they remain statistically different from zero, the point estimates of the value of test performance is slightly smaller with the inclusion of middle school and high school effects-- .164 and .192. respectively, rather than .247. As a result, only a portion of the value of student performance attributed to elementary schools appears to be due to middle school and high school assignments.

B. Do housing values respond to new test score information?

Short-Term Fluctuations in Test Scores

If short-term fluctuations in test scores are reliable indicators of changes in school quality, then real estate prices should be influenced by the most recently available scores. However, short-term fluctuations in test scores may be unreliable for at least two reasons. The first is sampling variation. The median elementary school in the United States has only 69 students per grade level.[5] Even if schools are drawing from the same neighborhoods, a few particularly bright or rowdy children can have a large impact on test scores. The second source of volatility are one-time factors– such as a dog barking in the parking lot on the day of the test, interactions between a particular school's curriculum and the test form being used, or other factors– whose variance does not shrink with sample size. If sampling variation and other one-time factors account for most of the short-term fluctuations in test scores, then real estate markets should ignore year-to-year changes in test scores and focus on estimates of persistent performance differences such as long-run averages of test scores .

Based on test performance in North Carolina for a single grade (4th grade), Kane and Staiger (2002b) estimate that 14 percent of the variance in test score levels for the median-sized school is attributable to the combination of sampling variation and other one-time factors. The proportion of variance due to one-time factors is much higher when focusing on changes in performance from one year to the next (73 percent) or when measuring "value-added" differences between school (49 percent).[6] (The latter fact is reflected in substantial year-to-year fluctuation in the proportion of schools achieving "expected" or "exemplary" value-added under the rating system started in 1997, as discussed in the next section.) North Carolina has been testing in grades 3 through 8 since 1993. As a result, the averaging across grade levels may reduce the variance due to one-time factors somewhat from the estimates above.[7] Nevertheless,

[5]In the 1999 Common Core of Data, among schools with a 4th grade classroom, the median school contained 69 students in the 4th grade and the mean number of students was 74.

[6]The value-added measure used was the average gain in student performance in combined reading and math scores between the end of third and fourth grades.

[7]It is a non-trivial exercise to estimate how much the averaging across grades would affect year to year volatility, since it requires estimating the possible persistence in shocks at the

these estimates suggest that short-term fluctuations in test scores are likely to be unreliable and, therefore, should have little impact on housing values if housing markets are cognizant of their volatility.

In Table 4, we investigate the impact of short-term fluctuation in test scores on housing values. In columns (1) and (5), we replicate the earlier specifications for mean scaled scores (1993-99) and for mean performance composite (1997-2001). In columns (2) and (6), in addition to the long-term mean performance, we included the difference between the single-year test score released that year and the long-term score. (Recall that we have matched test scores released in July or August to housing sale prices for the subsequent September through August period.) In both specifications, when both the long-term score and the annual deviation from the long-term score are included, it is only the coefficient on the long-term score that is statistically distinguishable from zero. In columns (3) and (7), we include fixed effects for 2500 square foot areas, with little impact on either set of estimates. In columns (4) and (8), we include fixed effects for each of the schools. Although the coefficient on the long-term mean test score is no longer identified since it does not vary for a given school, the coefficient on the annual deviation from the long-term mean remains small and statistically indistinguishable from zero.

In other words, the housing market seems to downplay short-term fluctuations in test scores and focus on long-term means. This is precisely what we would expect if home buyers have prior beliefs about school quality– based upon a history of test scores or other information– and if they are aware of the short-term volatility in the schools they are following. The more

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cohort level, for instance, as the third grade students this year become fourth grade students next year.

noise they expect to find in short-term fluctuations, the more slowly they will update these beliefs based on current test scores. Kane and Staiger (2002a) formalize such intuition with a method for "filtering" test scores over time, by constructing a weighted average of recent performance in which the weights are functions of school sample size, the estimated variance in long-term school quality and the variance in one-time shocks to performance. The fact that home-buyers down-weight recent test scores suggest that they may be implicitly applying some similar intuition to annual test score releases.

Impact of Test Performance in Different Time Periods

In the preceding analysis, we used the long-term mean test score as our measure of school performance and pooled observations over several years. In other words, even for transactions occurring in 1993, we used the long term-mean test score for the 1993-99 period in Table 1 and for the 1997-2001 period in Table 2. We calculated the long-term means in order to minimize the error in identifying school quality resulting from annual fluctuations in school mean scores. (See Kane and Staiger (2002) for more on volatility in school level test score measures.) Implicitly, we are assuming that performance differences between school are largely fixed, and that home buyers form impressions of schools over long periods. Although the test was different before 1993, scores were being published for each school in Charlotte several years before the beginning of our sample. If that is the case, then each year's test score contributes equally to the estimation of long-term performance differences. In our analysis, future test scores are essentially "standing in" for the past test scores (and other less quantitative information that forms the basis of a school's reputation in the community) that we did not have in allowing us to calculate the long-term mean. By including only the long-term mean, we are imposing the constraint that the coefficient on each year's mean score was the same. To test this hypothesis, we ran separate regressions for each year from 1993 through 2001, including as regressors the mean scores of all 7 years separately (1993 through 1999), and tested whether the evidence would lead us to reject that constraint. For 8 out of 9 years, we could not reject the hypothesis that the coefficients on all the year's scores were the same. In other words, we could not reject the hypothesis that even future years' test performance provides the same information as past years' performance. Each contribute similarly to forming the long-term impressions that home buyers are using.

In Table 5, we use the mean performance measures to study the relationship between test scores and housing values during different periods– 1993-96, 1997-99, and 2000-01. All columns of results use the same specification in column (3) of Tables 1 and 2 above. The school performance measures are not varying across periods– for each school, we are using the 1993-99 mean scaled score and 1997-2001 mean performance composite respectively. The coefficient on long-term mean test performance in each period is similar. In fact, it seems to increase slightly over time for both measures of mean school performance– possibly reflecting the rise in the labor market value of education and pre-market skills.

Introduction of Categorical Ratings in 1997

In 1997, the state of North Carolina began rating schools statewide based upon a combination of measures reflecting their students level of performance as well as the school's mean value-added. To measure performance-level, they used the same "performance composite" measure we are using, which is a weighted average of the proportions of students achieving proficiency of "Level III" or above in the reading and mathematics end of grade tests. (The performance composites also include writing in grades 4 and 7.) The state's value-added measure or "growth composite" is a function of the change in performance for the students currently enrolled in school over the same students' performance in the previous year.[8]

The table below summarizes the possible ratings:

NC School Rating Definitions

	Performance Composite:				
Growth Composite:9	Stat Sig < 50	< 50 But Not Stat Sig	>=50 ,< 80	>=80, <90	>=90
Below Expected	Low-Performing	No Recognition	No Recognition	School of Distinction	School of Distinction
>= Expected, < Exemplary	Expected Growth	Expected Growth	Expected Growth	School of Distinction	School of Excellence
>= Exemplary	Exemplary Growth	Exemplary Growth	Exemplary Growth	School of Distinction	School of Excellence

Schools achieving their expected growth targets could not be labeled low-performing, even if fewer than 50 percent of their students are performing at Level III and above. Moreover, schools with performance composite greater than 90 were recognized as "schools of excellence" if met the expected value-added standard and "schools of distinction" if they did not. A school could also earn the label "school of distinction" if they achieved a performance

[8]The growth composite is an algebraic function which simplifies to $\alpha_g + \beta_{1g} M_t - \beta_{2g} M_{t-1} + \beta_{3g} R_t - \beta_{4g} R_{t-1}$, where the parameters vary by grade level and the parameters $0 < \beta_{1g}, \beta_{2g}, \beta_{3g}, \beta_{4g} < 1$.

composite between 80 and 90 and also achieved at least expected value-added. Schools were designated low-performing if their performance composite was statistically significantly below 50 and if they failed to meet the growth target. Teachers in schools achieving "exemplary" growth received \$1500 bonuses (raised from \$1000 in 1998) and those in schools achieving "expected" growth received \$750 bonuses (beginning in 1998).

Table 6 summarizes the proportion of elementary schools serving our sample in Charlotte moving from one category to another from year to year. There is considerable year-to-year change in the schools' performance categories. There were 13 schools identified as low-performing in Charlotte in 1997. Two of these remained low performing in 1998. Six of the initially low-performing schools achieved "exemplary" growth in 1998. The "exemplary" and "expected" categories tend to be the most volatile, given that they are based solely on the value-added measures. For instance, 58 percent of the schools that achieved "exemplary" growth in 1998 did not even achieve their expected growth targets in 1999.

Table 7 reports the coefficients on each of the categories after controlling for the performance composite level. The labels reflect a mixture of performance levels and value-added measures. All schools were identified as having achieved "expected" or "exemplary" growth based upon their value-added measure. Those same schools were also identified if they achieved other distinctions, such as "schools of excellence" or "schools of distinction". In other words, the coefficients on the indicators for distinction and excellence measure the marginal impact of having high performance over and above reaching the expected or exemplary growth targets. Each specification is estimated only for those parcels within 2000 feet of a school boundary and was limited to 1997-2001, the years in which the award program operated.

Column (1) includes the annual performance composite as well as boundary fixed effects. Column (2) adds indicators for each of the rating categories– which are allowed to vary by year for each school. The left out category includes schools that were not recognized in that year, because they failed to achieve expected growth, but did not have fewer than 50 percent of their students scoring at Level III or above.

Conditional on the performance composite measure, none of the coefficients on the categorical ratings in column (2) were statistically significantly different from zero individually. Table 7 also reports the test of null hypothesis that the coefficients on all of the categorical dummies are equal to zero. Given the p-value in column (2) of .84, there is little evidence to reject the hypothesis that none of the categories matter. In column (3), we included fixed effects for all of the schools, essentially identifying the effect of categories for those who switch categories from year to year. The p-value on the test of joint significance is closer to the standard level for rejection (.11), but largely because of a *negative* estimated coefficient for schools of "excellence" (perhaps reflecting some non-linearity in the relationship with the performance composite at the top end).

Perhaps the failure to find an effect of the ratings is due to the fact that the ratings are quite volatile from year to year. As a result, in column (4) we include each school's *average* ranking between 1997 and 2001 (e.g. if a school was low performing for 1 out of 5 years, the value of the low-performing measure would be equal to .2) as well as their average score on the performance composite for those years. Again, we could not reject the hypothesis that the coefficients on all of the categories were jointly equal to zero, and the estimated coefficients for schools of "distinction" and "excellence" are unexpectedly negative.

The failure to find a relationship in any of these specifications between "exemplary" or "expected" growth and housing prices is particularly interesting for two reasons. First, the state focused the lion share of the financial rewards on the schools identified as meeting "exemplary" or "expected" growth targets. Apparently, housing markets did not share state policymakers enthusiasm for these measures. Second, while housing markets had available measures of the level of students' performance prior to 1997, the release of the "expected" and "exemplary" measures were the first explicit measures of value-added differences that were made available. Thus, one might have expected a larger response to this new information.

Although most of the coefficient estimates for the school rankings are insignificant or have unexpected signs, the coefficient for the proportion of years between 1997 and 2001 that a school was labeled "low-performing" in column (4) is negative and marginally significant. However, the lower property values associated with these schools appears to have been pre-existing, rather than the result of being labeled "low performing". In our sample, 11 schools were low performing in 1997 only, while two other schools were low performing in both 1997 and 1998 (one of these continued to be low performing through 2000). In columns (5) and (6) of Table 7, we include dummy variables for the schools that were low performing in 1997 only and for the schools that were low performing in 1997 and 1998. Column (5) includes only sales that occurred after release of the 1997 ratings but before the 1998 ratings were known (September 1997 through August 1998). In column 6 we include only sales after the 1998 ratings were released (September 1998 onward). The estimated coefficients are nearly identical in the two samples, and imply that home prices for the two schools that continued to be low performing in 1998 were about 12 percent lower than schools never identified as low performing -- but this difference existed even before the 1998 ratings had been released.

A simple plot of sales prices over time also suggests that the lower property values associated with low-performing schools were pre-existing, and there was no apparent impact of being so labeled. Figure 4 reports real median housing prices by 3-month interval, beginning in September 1993 and running through December 2001 (using September-November, December-February, etc., aligns with the release of test score data in August). We plot trends for houses assigned to three different groups of schools: those never identified as low-performing (the top line), those identified as low-performing only in 1997 (the second line) and those identified as low-performing in both 1997 and 1998 (the bottom line). Homes assigned to schools identified as low performing (particularly the two schools that continued to be low performing after 1997) have sold for lower prices throughout our sample period, with no obvious change in sales price occurring at the time of being identified as low performing. The first vertical line identifies the housing sales in September 1997, when the schools would have been originally identified as low performing. There is no apparent change in the bottom two lines relative to the top line, which we would have expected if the "low-performing" ranking had an impact on housing values. The second vertical line identifies September 1998, when the eleven school assignment areas represented by the middle line were taken off low-performing status. The remaining vertical lines identify September 1999 and 2001, when the remaining two schools represented by the bottom line were taken off low-performing status. Again, there is no evidence of any systematic change in existing trends.[9]

[9]Note that the percentage increase in prices was higher in the bottom two groups of neighborhoods over much of the period. Recall that prices for the lower percentiles of the housing price distribution rose more quickly than the median prices over this time period.

C. Do Test Scores Proxy For Racial Differences Between Schools?

There is a general concern that differences between schools in test score measures are more the result of differences in the socioeconomic status of their students rather than the value added of the school. A related question is whether homeowners are paying a premium for schools with high value added, or simply buying into a school with high socioeconomic status peers (and, as a result, high test scores).

In our data, most of the difference between schools in average test scores is attributable to racial composition. Figure 5 reports the average test score and the percent of students who are African American.[10] In Charlotte, the correlation between a school's average test score and the proportion of the students in the school who are African American is -.8. In other words, more than 60 percent of the variance in test scores is associated with racial composition alone. Some part of this association may be because schools with a high proportion of African American students are low value-added schools, but a larger part simply reflects the achievement gap: African American students in Charlotte score about two thirds of a standard deviation below white students. In this section, we explore whether the housing market makes any attempt to account for the percentage of students in a school who are African American in drawing inferences about school quality.

In column (1) of Table 8, in addition to average test score and distance measures, we include as a regressor the proportion of test-takers in each school who were African American between 1993 and 1999. Holding a school's average test score constant, a school with a higher

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[10]The relationship in Figure 5 reflects more than the fact that there is a difference in average scores between African American students and whites. The mean test scores for both groups are lower in schools with a high percentage of African American students.

proportion of African American students appears to be providing more value added to their students – they are doing just as well with a lower socioeconomic status population of students. Therefore, if homeowners are paying for value added, we would expect a positive coefficient on the proportion of students in a school who are African American. In fact, the point estimate of the coefficient on the percentage of students who are African American is negative and indistinguishable from zero, suggesting that homeowners are paying for peers rather than value added at a school.

But there are other reasons that the percentage of students who are African American may not have a positive effect on housing values, holding test scores constant. In particular, homeowners may have direct preferences for racial composition in the school. For instance, suppose that home buyers were adjusting scores to reflect value added, but also attached negative value to the proportion of students who were African American. The two effects could simply be offsetting each other.

An alternative approach to discerning whether home buyers account for racial composition when interpreting school mean test scores is to construct a test score measure that does not suffer from any composition bias, i.e. a fixed-weight average of performance for various racial groups – so that none of the variation in the measure comes from different racial composition across schools. There are three common-sense options for choosing the weights:

1. Use the average test scores among white students (all the weight on whites).
2. Use the average test scores among African American students (no weight on whites).
3. Use fixed weights, weighting the test scores of whites and African Americans by the overall proportion of each racial group in the Charlotte schools (roughly 60/40).

In the remaining columns of Table 8, we report results of using each of these measures in place of (columns 2-4) or in combination with (columns 5-7) the actual average test score in the school. We calculated mean test scores by school by race for the years 1993-99, using the micro-data on individual students' performance (similar racial breakdowns of test scores were available to parents over this time period in Charlotte).

There are several results in these columns suggesting that the housing market does indeed look past overall test scores alone in judging school quality. When used in place of overall test scores in columns (2) and (3), the association of the fixed-weight and the white test scores with housing values is roughly of the same magnitude and significance as when the actual test score is included – so the relationship between school quality and test scores is not simply being driven by racial composition in the school. When the overall test score is included along with the fixed-weight test score in columns (5), the fixed-weight test score is no longer significant. However, in column (6) the white test score continues to have a large positive and significant effect, while the overall test score is insignificant. Thus, these columns suggest that real estate values are not being driven by differences in the racial composition of schools, and that homeowners perceptions of school quality are most strongly associated with test scores among white students.

However, there are some puzzling results in Table 8 as well. It is somewhat perplexing that the coefficient on the mean test score for African American students in column (4) is not statistically distinguishable from zero. One might question why test score results for African American students-- roughly 40 percent of the students in Charlotte-- are being ignored in evaluating school quality. Moreover, the results in column (7) suggest that holding constant a school's overall score, the mean test score for African American students is actually negative and statistically significant. If high test scores among white students are an indicator of a good school, why should housing markets ignore, or even draw the opposite inference, from high test scores among African American students?

One possible clue in this puzzle is that average test scores by race are not correlated within schools. This is due to the fact that some of the highest scoring white students were attending several schools with some of the lowest-scoring African American students. Based on the differences in travel distance within the school, the minority students in these schools seem to have been bused into largely white neighborhoods from neighborhoods with high concentrations of African American students. One possible hypothesis which would reconcile the anomalies is that there are some low-scoring African American students being bused to attend a handful of the most desirable schools in the district. If that were the case, then even after conditioning on overall test scores, the presence of African American students from very poor neighborhoods could be positively correlated with unobserved school quality. This is a finding we intend to explore in future work that directly evaluates the patterns and implications of busing in Charlotte.

D. Validity of the Regression Discontinuity Identification Strategy

As we saw with the change in coefficient on test scores after including boundary and neighborhood fixed effects, there are a number of *unobserved* factors determining housing values that are correlated with test scores between different school boundary areas. The identification strategy used throughout the paper is that such unobserved factors change "smoothly" across space and are not systematically correlated with school test scores across the boundaries themselves. While we cannot test whether the unobserved factors systematically differ across school boundaries without an instrument, we can test whether those factors we do observe– acreage, number of bedrooms, number of bathrooms, number of half-bathrooms, heated square footage, the presence of air-conditioning and a garage– differ for those properties in areas assigned to higher performing schools.

In Table 9, we report the coefficient on school mean test scores and distance to the school using the same sample definitions and fixed effects as in Tables 1 and 2, with and without including the housing characteristics as controls. If the housing characteristics were not systematically different on either side of the school boundaries, we would expect to estimate a similar relationship between test scores, distances to school and housing values without the controls, albeit with slightly higher standard errors. In fact, in most specifications, the estimated coefficients on test scores and on distance roughly double when one excludes the housing characteristics– suggesting that the observed characteristics are indeed correlated with test scores, and homes are of higher quality on the side of the boundary with the better school.

In Table 10, we directly examine which of the housing characteristics seem to differ across boundaries. Each regression used a housing characteristic as the dependent variable and estimated the coefficient on test scores and distance for parcels within 2000 feet of school boundaries controlling for boundary fixed effects, a trend, year and month dummies, and municipality dummies. With the notable exception of lot acreage (which is difficult to alter), most of the characteristics are related to test scores even limiting the sample to schools near the borders.

These findings are not inconsistent with Black (1999, Table III), who also found differences in observed housing characteristics between homes on the high- versus low-scoring side of school boundaries. However, the magnitude of these differences, and the sensitivity of the estimates to controlling for these differences in observed housing characteristics, are somewhat more pronounced in our data. One potential reason for this difference may be our focus on parcels with stable school assignments throughout the sample period. One could argue that school boards are less likely to change school boundaries where housing quality is starkly different on either side of the boundary (because of pressure from homeowners), or that housing quality differences are more likely to arise in areas with stable boundaries (as high income families move in to areas with good schools). In either case, school boundaries in which differences in school test scores are more strongly correlated with differences in housing and neighborhood characteristics would tend to be over-represented in our sample.

Evaluating the Abruptness of the Change in Housing Prices

In Figure 6, we investigate the abruptness of the change in housing prices at school boundaries. If school assignment is the primary factor underlying the increase in property values, then housing prices should rise abruptly at the boundary. To test whether there is such a discontinuity in house prices, in Figure 6 we report the estimated log sales price of homes at 400 foot intervals on either side of school boundaries. We estimate the price for each interval from a regression with the same specification as in Table 1 column (3) (with boundary fixed effects), except rather than including test scores we include dummy variables for 400-foot intervals. The interval 0-400 feet from the boundary with a better school is the omitted reference category. The intervals were defined so that, for example, a home which is 350 feet from the boundary with a better school is assigned a distance of *negative* 350, and a home which is 350 feet within the better school's boundary is assigned a distance of *positive* 350. We limited the analysis to boundaries where there was at least a .25 student-level standard deviation difference in mean test scores between the schools on the high-scoring and low-scoring side of the boundaries. There were roughly 3000 home sales in each interval, except for the two intervals within 400 feet (either side) of the boundary that each had roughly 1000 home sales.[11]

According to the results in Figure 6, there were small differences in housing prices for houses within 400 feet of the boundary (or, more precisely, 400 feet from the closest house on the other side of the boundary). However, housing prices were sharply higher– about 8 percent-- for the houses 400 to 800 feet into the high-scoring district. The magnitude of this effect is consistent with our earlier estimates: The average difference in scores between the high-scoring school and the low-scoring school was .32, which multiplied by the coefficient from from column (3) of Table 1 (.247) would yield an effect on house prices of 0.08. Thus, we do observe an effect of about the expected magnitude *near* the boundary. However, the fact that the effect does not appear for homes 0-400 feet within the boundary of the better school raises additional questions of whether this is a causal effect of school quality.

Although these results do call into question the practicality of disentangling the effect of school quality from other neighborhood variables, perhaps they should not be surprising. Families who are willing to pay more to live in a school attendance area with higher test scores

[11]The lower numbers of sales within 400 feet of the boundary is an artifact of the way in which we define distance to the boundary. We actually measure distance to the nearest house that sold in a different school attendance area. So 400 feet is an over estimate of how far these homes are from the boundary.

may also invest more in their homes. Even if houses are very similar on either side of a school border *when the boundary is originally drawn*, the similarity may not last long as properties are bought and sold, and as houses depreciate and are improved. Areas very near the boundary may not do as much of this upgrading, either because there is less return to doing so (because of neighborhood externalities from nearby homes on the less desirable side of the boundary) or because of the possibility of boundaries being moved in the future.

Note that the finding suggesting potentially unobserved differences in neighborhoods near school boundaries, is primarily relevant for the cross-sectional effects of test performance on housing values. Those studies which have tried to estimate the cross-sectional relationship between test performance and housing values may be overstating the importance of test performance, even if they limit themselves to properties near school boundaries. The primary results of this paper, which focus on the effect of changes of test scores and the creation of the state's rating system, would not be affected by unobserved differences between neighborhoods, as long as those differences were stable over time.

V. Conclusion

In the housing literature, there is a long tradition of attempting to disentangle the value of school test scores from other neighborhood amenities. Although such studies typically control for standard housing characteristics (such as number of bedrooms, square footage, lot size, etc.) and other neighborhood characteristics (such as mean income and local tax rates), readers of that literature appropriately worry that such studies fail to control for all the relevant characteristics that might be correlated with school test scores. Black (1999) proposed a novel approach, by focusing on the values of properties near school boundaries, arguing that any differences in unmeasured neighborhood amenities would be minimized for properties that were in such close proximity. Using data from Mecklenburg County, North Carolina, and focusing on properties within 500 to 2000 feet of school boundaries, we replicate that approach and find similar results, suggesting that a one student-level standard deviation difference in a school's mean test score was associated with an 18 to 25 percentage point difference in house value. Nevertheless, we remain cautious in interpreting these estimates as reflecting the value of school quality alone, since there appeared to be changes in observable housing characteristics at the school boundaries in our data. One might be concerned that there are other unobserved differences in housing characteristics, even among properties near the school boundaries.

In the remainder of the paper, we focused on housing market reactions to the release of new information regarding the quality of schools, such as is currently being published by state departments of education around the country. Although most states were already publishing some information on school mean test scores by the spring of 2001, the No Child Left Behind Act of 2001 will require most states to publish even more detailed information at the school level than they currently provide. We are much more confident in our ability to isolate the impact of new information, because we can look at changes in housing values within school assignment zones as new information is released over time. Earlier work by Figlio (2002) in Florida, suggested large housing price swings following the announcement of school ratings in 1999. In North Carolina, we found no impact of annual changes in test scores on housing values. Moreover, we found no impact of the categorical rating system, which sorted schools into categories of "low-performing" or "exemplary" based upon a combination of baseline scores and “value-added” measures, which controlled for incoming students’ baseline performance. The failure to find an impact of “value-added” ratings was particularly important, given that it would have been difficult for parents to have controlled for students’ baseline scores with the data which had been available to them previously.

Our findings have two potentially important implications for the education policy debate. First, even relative to the estimate of the value of school mean test score differences that we fear may be overstated, parents– particularly low-income parents– attach a large value to the proximity of the local school. A six to eight mile difference in the distance to the local school had a similar effect on housing values as a full student level standard deviation in school mean test scores (roughly equivalent to moving from the highest to lowest scoring school in the district). Attempts to model the likely effect of school vouchers on the market for schooling typically focus on differences in school quality alone. However, to the extent that they ignore the interplay between school siting and neighborhood segregation by race and family income, such models may indeed lead to unrealistic predictions.

Second, the housing markets seem to respond quite slowly to new information about school quality. Given the potential for free-riding by some homeowners on the efforts of others to intervene in local schools, the housing market was already an unlikely source of pressure on local school officials to improve. Although some homeowners may be compelled to attend their local PTA meeting in order to protect their property values, this is unlikely to lead to an efficient solution, even with high quality measures of school performance. Regardless of this free-rider problem, our results suggest that short-term changes in test scores seem to be discounted. In other words, a school that is improving has a difficult time signaling that improvement to the housing market. This could be because there is so much other volatility in test scores that is difficult for home buyers to distinguish the signal from the noise, or because home buyers are primarily interested in the socio-economic characteristics of schools, which are unlikely to change so quickly. In either case, short-term fluctuations in test scores and state accountability ratings have little effect on housing values.

In September 1997, William Capacchione sued the school district, claiming that his daughter was denied enrollment to a magnet school simply because of race. The case eventually led the courts to revisit the original court case requiring busing students in Charlotte on the basis of race. That case was not resolved until April 15, 2002 when the U.S. Supreme Court announced that it would let stand a lower court decision ending required busing in Charlotte.[12] By the fall of 2002, mandatory busing on the basis of race had been terminated and many of the existing school boundaries had lost their importance as a public school choice program was implemented. The experience with the new school choice plan in Charlotte may yet yield valuable lessons on the interaction between housing markets and school quality.

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[12]Despite any uncertainty the legal proceedings may have created, we saw no evidence of a decline in values associated with high scoring schools between 1997 and the end of 2001

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Table 1. Housing Market Valuation of School Test Scores Using Average Math and Reading Score from 1993 to 1999

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full Sample	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <1k feet	Distance <500 ft
Math and Reading Score, 93-99	0.396	0.627	0.247	0.175	0.245	0.188	0.191
	(0.086)	(0.127)	(0.044)	(0.049)	(0.064)	(0.047)	(0.050)
Distance to School (miles)	-0.028	-0.065	-0.039	-0.022	-0.011	-0.044	-0.052
	(0.012)	(0.015)	(0.010)	(0.004)	(0.006)	(0.014)	(0.016)
# of Bedrooms	0.007	0.019	0.026	0.033	0.024	0.024	0.003
	(0.009)	(0.011)	(0.009)	(0.007)	(0.008)	(0.013)	(0.015)
# of Bathrooms	0.107	0.089	0.042	0.029	0.023	0.039	0.042
	(0.012)	(0.015)	(0.007)	(0.005)	(0.005)	(0.009)	(0.013)
# of Halfbaths	0.093	0.117	0.067	0.042	0.036	0.061	0.059
	(0.019)	(0.025)	(0.016)	(0.011)	(0.011)	(0.017)	(0.029)
Acreage	0.043	0.014	0.122	0.104	0.108	0.102	0.059
	(0.018)	(0.024)	(0.012)	(0.012)	(0.011)	(0.018)	(0.025)
Heated Squ. Feet /100	0.039	0.04	0.032	0.023	0.027	0.03	0.031
	(0.001)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Garage?	0.096	0.083	0.064	0.049	0.055	0.067	0.036
	(0.010)	(0.014)	(0.007)	(0.007)	(0.006)	(0.008)	(0.012)
Basement?	0.046	0.08	0.01	0.023	0.011	0.013	-0.002
	(0.034)	(0.037)	(0.027)	(0.016)	(0.020)	(0.022)	(0.036)
Air Conditioning?	0.238	0.178	0.123	0.088	0.081	0.11	0.094
	(0.031)	(0.028)	(0.020)	(0.010)	(0.011)	(0.021)	(0.019)
Age/10	-0.006	-0.013	-0.086	-0.072	-0.092	-0.09	-0.11
	(0.017)	(0.024)	(0.013)	(0.012)	(0.011)	(0.014)	(0.015)
Age2/100	0.004	0.005	0.006	0.004	0.007	0.006	0.008
	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
# Fixed Effects							
Boundary	0	0	107	0	0	94	81
Neighborhood	0	0	0	316	0	0	0
2500 feet square	0	0	0	0	553	0	0
Observations	83056	28168	28168	28101	28168	10975	3104
R-squared	0.74	0.71	0.81	0.85	0.85	0.81	0.81

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes all single-family home sales between 9/1/93 and 12/31/01.

Table 2. Housing Market Valuation of School Test Scores
Using Average Performance Composite From 1997 to 2001

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full Sample	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <1k feet	Distance <500 ft
Performance Composite/10, 97-01	0.073	0.154	0.054	0.055	0.046	0.058	0.068
	(0.020)	(0.042)	(0.015)	(0.015)	(0.016)	(0.015)	(0.017)
Distance to School (miles)	-0.027	-0.068	-0.039	-0.024	-0.01	-0.046	-0.055
	(0.012)	(0.014)	(0.011)	(0.006)	(0.007)	(0.014)	(0.016)
# of Bedrooms	0.006	0.01	0.025	0.032	0.024	0.023	0.001
	(0.009)	(0.013)	(0.009)	(0.007)	(0.008)	(0.013)	(0.014)
# of Bathrooms	0.116	0.098	0.043	0.029	0.024	0.039	0.042
	(0.011)	(0.014)	(0.007)	(0.005)	(0.006)	(0.009)	(0.013)
# of Halfbaths	0.095	0.103	0.066	0.041	0.036	0.06	0.057
	(0.019)	(0.025)	(0.016)	(0.011)	(0.011)	(0.017)	(0.029)
Acreage	0.043	0.015	0.122	0.105	0.107	0.101	0.057
	(0.018)	(0.023)	(0.012)	(0.012)	(0.012)	(0.018)	(0.024)
Heated Squ. Feet /100	0.04	0.044	0.032	0.023	0.027	0.03	0.032
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Garage?	0.099	0.083	0.064	0.05	0.055	0.067	0.036
	(0.010)	(0.015)	(0.007)	(0.006)	(0.006)	(0.009)	(0.012)
Basement?	0.045	0.076	0.01	0.023	0.01	0.014	-0.001
	(0.036)	(0.037)	(0.027)	(0.016)	(0.020)	(0.022)	(0.036)
Air Conditioning?	0.256	0.193	0.125	0.089	0.083	0.111	0.096
	(0.033)	(0.028)	(0.020)	(0.010)	(0.011)	(0.021)	(0.019)
Age/10	-0.002	-0.007	-0.087	-0.073	-0.094	-0.091	-0.11
	(0.017)	(0.024)	(0.014)	(0.012)	(0.011)	(0.014)	(0.015)
Age2/100	0.004	0.005	0.006	0.004	0.007	0.007	0.008
	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
# Fixed Effects							
Boundary	0	0	107	0	0	94	81
Neighborhood	0	0	0	316	0	0	0
2500 feet square	0	0	0	0	553	0	0
Observations	83056	28168	28168	28101	28168	10975	3104
R-squared	0.74	0.71	0.81	0.85	0.85	0.81	0.81

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes all single-family home sales between 9/1/93 and 12/31/01.

Table 3. Housing Market Valuation of School Test Scores Using Average Math and Reading Score from 1993 to 1999 Robustness To Alternative Samples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full Sample	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <1k feet	Distance <500 ft
	Excluding Parcels In Satellite Zones						
Math and Reading Score, 93-99	0.377	0.594	0.226	0.165	0.267	0.226	0.142
	(0.087)	(0.130)	(0.041)	(0.055)	(0.066)	(0.041)	(0.041)
Distance to School (miles)	0.003	-0.034	-0.017	-0.026	-0.010	-0.017	-0.030
	(0.013)	(0.014)	(0.006)	(0.007)	(0.007)	(0.006)	(0.012)
Observations	78036	25799	25799	25732	25799	25799	2757
	Parcels in Census Tracts With Above-Median Income						
Math and Reading Score, 93-99	0.143	0.105	0.160	0.181	0.207	0.160	0.203
	(0.088)	(0.174)	(0.047)	(0.095)	(0.070)	(0.047)	(0.035)
Distance to School (miles)	0.026	-0.020	-0.001	-0.012	0.013	-0.001	-0.016
	(0.019)	(0.030)	(0.014)	(0.018)	(0.014)	(0.014)	(0.026)
Observations	43430	9584	9584	9584	9584	9584	840
	Parcels in Census Tracts With Below-Median Income						
Math and Reading Score, 93-99	0.396	0.459	0.147	0.183	0.231	0.147	0.123
	(0.115)	(0.138)	(0.040)	(0.051)	(0.056)	(0.040)	(0.053)
Distance to School (miles)	-0.037	-0.046	-0.023	-0.025	-0.015	-0.023	-0.026
	(0.012)	(0.015)	(0.006)	(0.004)	(0.006)	(0.006)	(0.009)
Observations	39626	18584	18584	18517	18584	18584	2264

Note: The dependent variable is ln(sale price). Each regression also included the same control variables as in Table 1. Top panel regressions excluded parcels in satelite zones from which students were bussed. Regressions in bottom two panels split the sample into parcels from census tracts with above and below-median income, based on 1990 census. Huber-White standard errors were calculated allowing for clustering at the school level. Samples include all single-family home sales between 9/1/93 and 12/31/01.

Table 4. Housing Market Valuation of Alternative Test Score Measures
Long-Run Averages Versus Annual Deviations From Average

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Test Measure	Math and Reading (93-99)				Performance Composite/10 (97-01)			
Years in Sample	1993-1999	1993-1999	1993-1999	1993-1999	1997-2001	1997-2001	1997-2001	1997-2001
Average Test Score	0.244 (0.045)	0.24 (0.044)	0.247 (0.067)		0.057 (0.016)	0.056 (0.016)	0.052 (0.018)	
Single Year Test Score - Average Test Score		-0.02 (0.046)	0.008 (0.046)	-0.022 (0.047)		-0.003 (0.009)	-0.001 (0.008)	0 (0.009)
Distance to School (miles)	-0.04 (0.010)	-0.038 (0.010)	-0.009 (0.006)	-0.082 (0.012)	-0.037 (0.009)	-0.038 (0.009)	-0.011 (0.007)	-0.08 (0.012)
# Fixed Effects								
Boundary	106	106	0	106	106	106	0	106
2500 feet square	0	0	540	0	0	0	534	0
School	0	0	0	50	0	0	0	49
Observations	23638	23416	23416	23416	15400	15370	15370	15370
R-squared	0.82	0.82	0.85	0.82	0.8	0.8	0.84	0.81

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes only parcels within 2000 feet of a school boundary sold in the years indicated. Years refer to academic year beginning on September 1st of the given year.

Table 5. Comparing Housing Market Valuation of Alternative Test Score Measures in Different Time Periods

	(1)	(2)	(3)	(4)	(5)	(6)
Test Measure:	Average Math and Reading, 93-99			Performance Composite/10, 97-01		
Sample: (see note)	1993-1996	1997-1999	2000-2001	1993-1996	1997-1999	2000-2001
Average Test Score	0.232 (0.041)	0.269 (0.053)	0.291 (0.051)	0.054 (0.015)	0.053 (0.017)	0.068 (0.017)
Distance to School (miles)	-0.041 (0.011)	-0.039 (0.009)	-0.034 (0.009)	-0.041 (0.012)	-0.038 (0.010)	-0.037 (0.009)
# of Bedrooms	0.023 (0.010)	0.029 (0.011)	0.037 (0.011)	0.022 (0.010)	0.028 (0.011)	0.035 (0.011)
# of Bathrooms	0.042 (0.009)	0.045 (0.008)	0.054 (0.015)	0.043 (0.009)	0.046 (0.009)	0.054 (0.016)
# of Halfbaths	0.069 (0.020)	0.068 (0.019)	0.067 (0.021)	0.07 (0.020)	0.067 (0.019)	0.063 (0.021)
Acreage	0.087 (0.011)	0.138 (0.020)	0.155 (0.025)	0.088 (0.012)	0.138 (0.020)	0.154 (0.026)
Heated Squ. Feet /100	0.032 (0.001)	0.03 (0.002)	0.031 (0.002)	0.032 (0.001)	0.031 (0.002)	0.032 (0.002)
Garage?	0.068 (0.007)	0.065 (0.010)	0.051 (0.013)	0.069 (0.007)	0.065 (0.010)	0.048 (0.013)
Basement?	0.014 (0.029)	0.013 (0.032)	-0.007 (0.022)	0.014 (0.029)	0.015 (0.031)	-0.006 (0.023)
Air Conditioning?	0.121 (0.016)	0.135 (0.029)	0.126 (0.025)	0.122 (0.016)	0.138 (0.029)	0.126 (0.025)
Age/10	-0.088 (0.016)	-0.075 (0.013)	-0.062 (0.016)	-0.089 (0.016)	-0.076 (0.014)	-0.062 (0.016)
Age2/100	0.004 (0.003)	0.005 (0.002)	0.004 (0.003)	0.004 (0.003)	0.006 (0.002)	0.004 (0.003)
<u># Fixed Effects</u>						
Boundary	105	105	104	105	105	104
Observations	12768	10870	4530	12768	10870	4530
R-squared	0.83	0.8	0.82	0.83	0.8	0.82

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes only parcels within 2000 feet of an enrollment boundary. Years refer to academic year beginning on September 1st of the given year.

Table 6. Changes in Charlotte Mecklenburg Elementary School Ratings Under the North Carolina ABC Program

	Percentage of Schools in Each Row in 1997 Achieving Rating in 1998:					Percentage of Schools in Each Row in 1998 Achieving Rating in 1999:				
	Low Perf	Below Exp	Exp	Exm	Dst/ Exc	Low Perf	Below Exp	Exp	Exm	Dst/ Exc
Low Perf	15	8	31	46	0	50	0	0	50	0
Below Exp	0	33	42	25	0	0	50	42	25	0
Expect	0	8	15	54	23	0	41	14	12	6
Exemp	0	25	13	63	0	0	58	8	29	4
Distin/ Exc	0	0	0	0	100	0	17	0	0	83
Percent	3	20	28	39	10	2	46	23	18	11
	Percentage of Schools in Each Row in 1999 Achieving Rating in 2000:					Percentage of Schools in Each Row in 2000 Achieving Rating in 2001:				
	Low Perf	Below Exp	Exp	Exm	Dst/ Exc	Low Perf	Below Exp	Exp	Exm	Dst/ Exc
Low Perf	100	0	0	0	0	0	0	0	100	0
Below Exp	0	57	29	14	0	0	30	43	20	7
Expect	0	64	14	21	0	0	33	25	17	25
Exemp	0	45	18	36	0	0	18	27	45	9
Distin/ Exc	0	0	0	0	100	0	14	0	0	85
Percent	2	49	20	18	11	0	36	31	23	20

Note: Limited to non-magnet elementary schools with stable school assignments between 1993 and 2001.

Table 7. Housing Market Valuation of Alternative Test Score Measures
Long-Run Averages Versus North Carolina Rankings

	(1)	(2)	(3)	(4)	(5)	(6)
Rankings For Which Years?		Annual	Annual	Average 1997-2001	As Indicated	As Indicated
Sample Years:	1997-2001	1997-2001	1997-2001	1997-2001	1997	1998-2001
Average Performance Composite/10, 97-01	0.057 (0.016)	0.055 (0.017)		0.053 (0.025)	0.033 (0.023)	0.049 (0.017)
NC Ranking:						
Low Performing		-0.018 (0.028)	0.005 (0.020)	-0.132 (0.061)		
Expected Growth		0.003 (0.008)	0.006 (0.006)	-0.023 (0.054)		
Exemplary Growth		0.001 (0.008)	0.004 (0.007)	0.021 (0.042)		
Distinction		-0.025 (0.021)	0.011 (0.011)	-0.125 (0.072)		
Excellence		-0.009 (0.053)	-0.066 (0.031)	-0.084 (0.106)		
Low Performing in 1997 only					-0.021 (0.038)	-0.006 (0.026)
Low Performing in 1997 and at least one other year					-0.116 (0.069)	-0.119 (0.038)
F-Test for all Rank Coefficients=0		0.41	1.79	1.66	1.48	5.78
p-value		*0.84*	*0.11*	*0.14*	*0.23*	*0.003*
Distance to School (miles)	-0.037 (0.009)	-0.037 (0.010)	-0.08 (0.007)	-0.036 (0.010)	-0.037 (0.015)	-0.038 (0.009)
# Fixed Effects						
Boundary	106	106	106	106	106	106
School	0	0	49	0	0	0
Observations	15400	15400	15400	15400	15400	15400
R-squared	0.8	0.8	0.81	0.8	0.8	0.81

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. In column (3) only, standard errors were clustered at school-by-year level, to avoid bias in clustered standard errors for small cells. Sample includes only parcels within 2000 feet of a school boundary sold in the years 1997-2001. Years refer to academic year beginning on September 1st of the given year

Table 8. Housing Market Valuation of Alternative Test Score Measures
Alternative Adjustments for Racial Mix of School

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Math and Reading Score, 93-99	0.222 (0.052)				0.281 (0.106)	-0.115 (0.119)	0.356 (0.049)
Average % of Students Black	-0.064 (0.082)						
Fixed-Weight Score, 93-99		0.282 (0.052)			-0.044 (0.126)		
White Students Score, 93-99			0.261 (0.037)			0.353 (0.107)	
Black Students Score, 93-99				-0.058 (0.078)			-0.288 (0.065)
Distance to School (miles)	-0.039 (0.010)	-0.036 (0.010)	-0.038 (0.010)	-0.032 (0.010)	-0.039 (0.010)	-0.037 (0.011)	-0.041 (0.010)
# Fixed Effects							
Boundary	107	107	107	107	107	107	107
Observations	28168	28168	28168	28168	28168	28168	28168
R-squared	0.81	0.81	0.82	0.81	0.81	0.82	0.82

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes only parcels within 2000 feet of a school boundary sold in 1993-2001. Years refer to academic year beginning on September 1st of the given year.

Table 9. Housing Market Valuation of School Test Scores With and Without Controlling for Housing Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	Full Sample	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <2k feet	Distance <1k feet	Distance <500 ft
With Controls							
Math and Reading Score, 93-99	0.396	0.627	0.247	0.175	0.245	0.188	0.191
	(0.086)	(0.127)	(0.044)	(0.049)	(0.064)	(0.047)	(0.050)
Distance to School (miles)	-0.028	-0.065	-0.039	-0.022	-0.011	-0.044	-0.052
	(0.012)	(0.015)	(0.010)	(0.004)	(0.006)	(0.014)	(0.016)
R-squared	0.74	0.71	0.81	0.85	0.85	0.81	0.81
No Controls							
Math and Reading Score, 93-99	1.339	1.559	0.498	0.295	0.443	0.459	0.385
	(0.114)	(0.179)	(0.105)	(0.100)	(0.106)	(0.115)	(0.106)
Distance to School (miles	-0.041	-0.127	-0.081	-0.025	-0.027	-0.094	-0.104
	(0.025)	(0.020)	(0.024)	(0.007)	(0.010)	(0.029)	(0.031)
R-squared	0.37	0.41	0.66	0.79	0.78	0.69	0.7
# Fixed Effects							
Boundary	0	0	107	0	0	94	81
Neighborhood	0	0	0	316	0	0	0
2500 feet square	0	0	0	0	553	0	0
R-squared	0.74	0.71	0.81	0.85	0.85	0.81	0.81
Observations	83056	28168	28168	28101	28168	10975	3104

Note: The dependent variable is ln(sale price). Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Top panel regressions also included housing characteristics listed in tables 1-3. Huber-White standard errors were calculated allowing for clustering at the school level. Sample is all sales 1993-2001, restricted as stated at the top of each column.

Table 10. Housing Characteristics and School Test Scores

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dependent Variable:	# of Bedrooms	# of Bathrooms	# of Halfbaths	Acreage	Heated Sq Feet/100	Garage	Basement	Air Condition	Age/10
Math and Reading Score, 93-99	0.232	0.453	0.035	-0.005	4.049	0.085	0.052	0.198	-1.033
	(0.120)	(0.108)	(0.040)	(0.037)	(1.293)	(0.084)	(0.047)	(0.066)	(0.472)
Distance to School (miles)	-0.067	-0.049	-0.017	-0.011	-0.77	-0.021	-0.001	-0.032	0.112
	(0.015)	(0.019)	(0.007)	(0.005)	(0.192)	(0.017)	(0.004)	(0.011)	(0.094)
# Fixed Effects									
Boundary	107	107	107	107	107	107	107	107	107
R-squared	0.29	0.38	0.15	0.14	0.5	0.35	0.1	0.21	0.57
Observations	28168	28168	28168	28168	28168	28168	28168	28168	28168

Note: The dependent variable is given at the top of each column. Each regression also included academic year dummies, month dummies, a monthly trend, and dummies for municipality. Huber-White standard errors were calculated allowing for clustering at the school level. Sample includes only parcels within 2000 feet of a school boundary sold in the years 1993-2001.

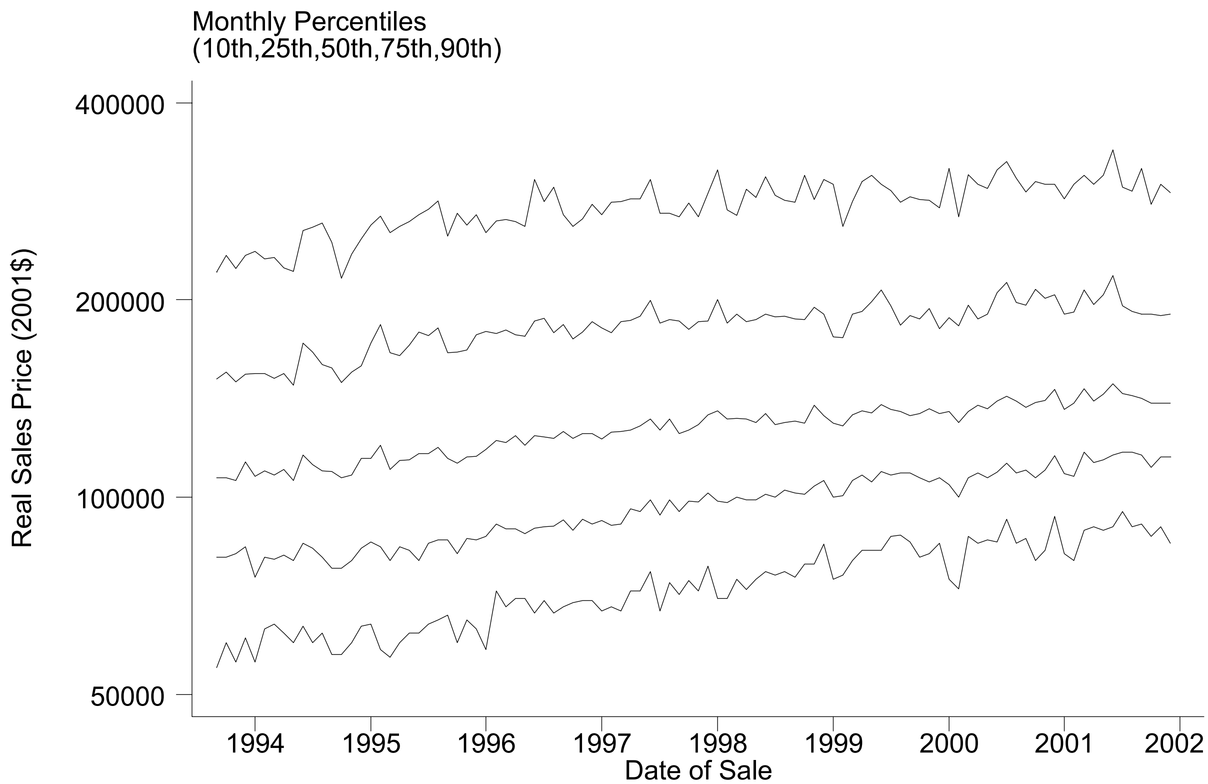

Figure 1. Trends in real sales price at various percentiles

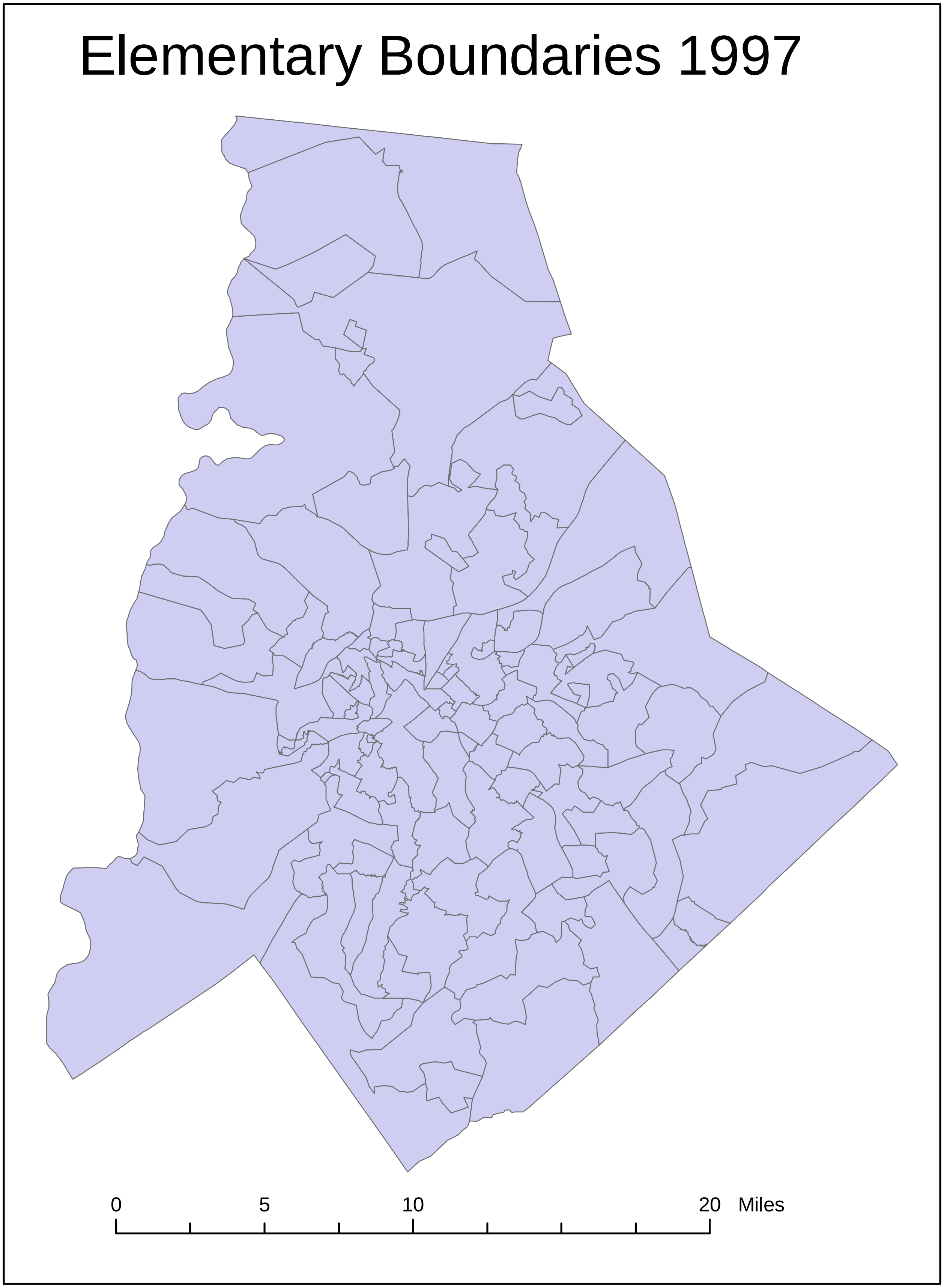

Figure 2.

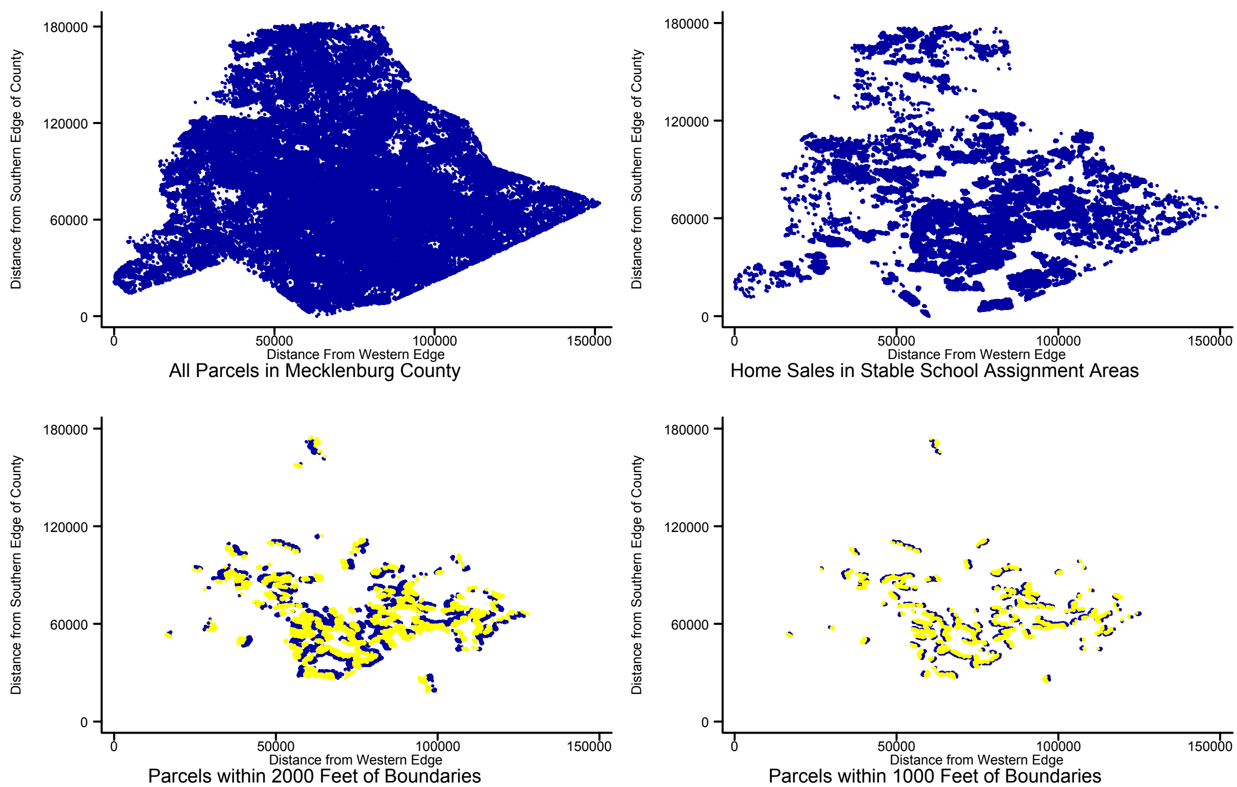

Figure 3. Geographic distribution of sale parcels for various samples

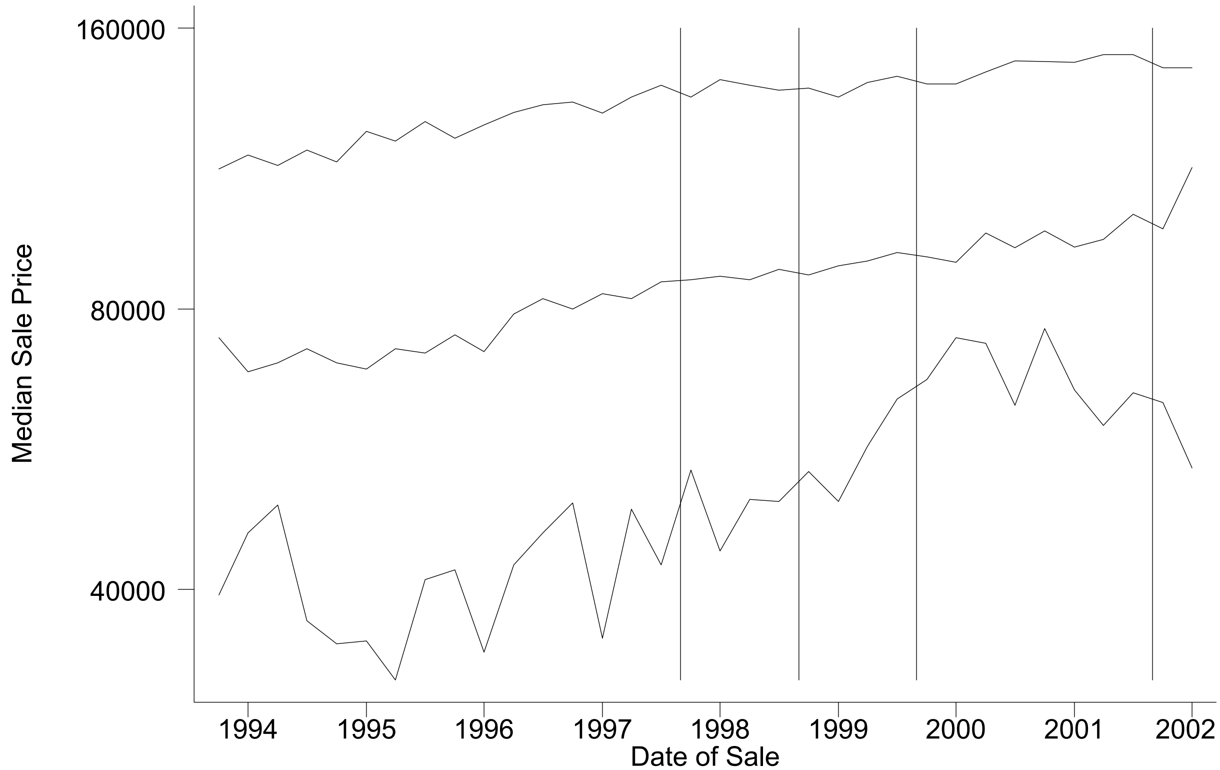

Figure 4. Trends in median real sales price for parcels whose schools were identified as "Low Performing" in August 1997 only (middle line) compared to schools never "Low Performing" (top line) and schools identified as "Low Performing" both 1997 and 1998 (bottom line).

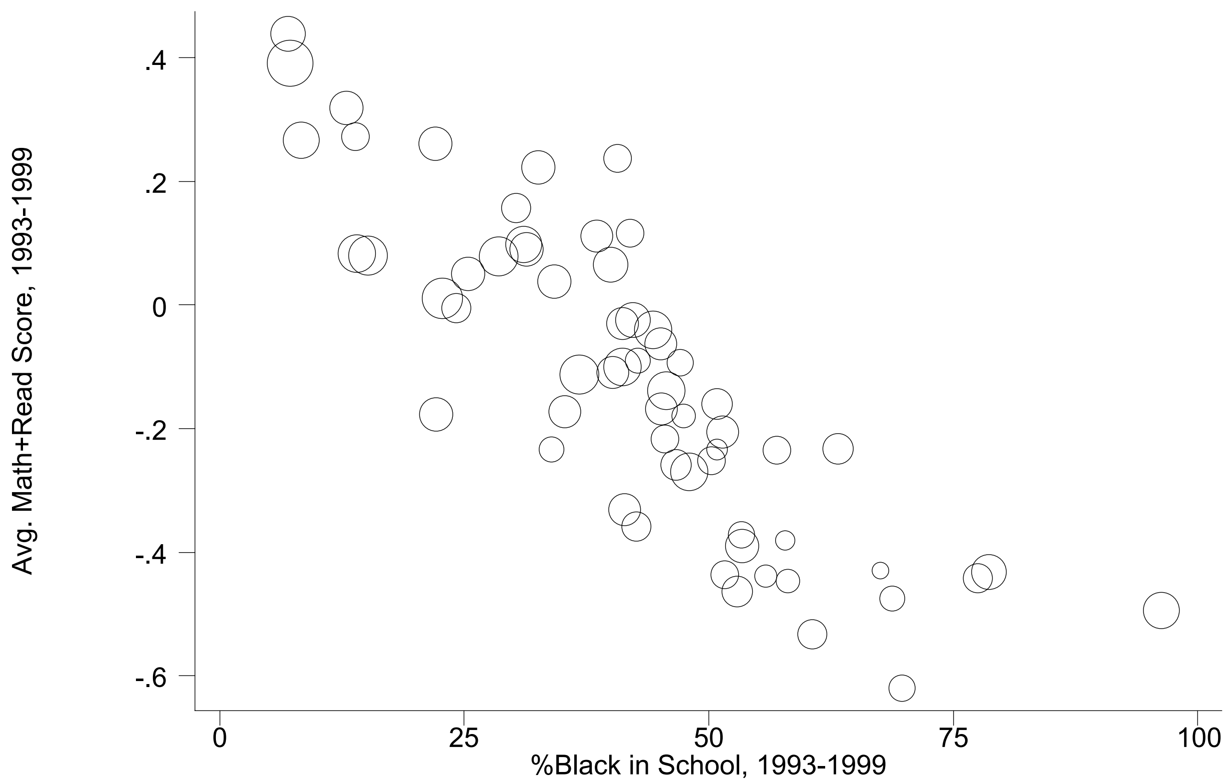

Figure 5. Plot of average test score and percent black in school. (Size of circle proportional to school size.)

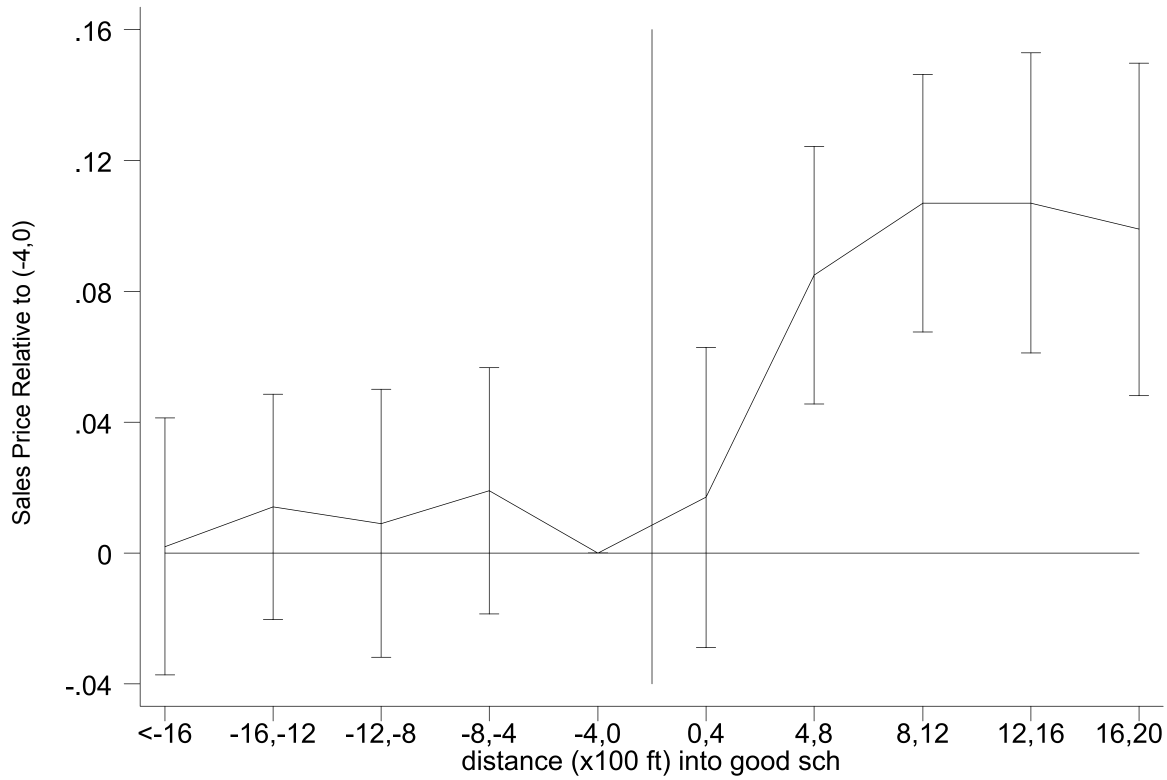

Figure 6. Is there a discontinuity in sales price at the boundary? Regression adjusted sales price in 400-foot intervals from school boundary for sample in which average test scores improve by at least 0.25 S.D.s at the boundary (distance>0 indicates inside good school attendance area).

Appendix Table 1. Summary Statistics

Variable Name	Full Sample					Within 2000 feet of boundary		
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.
House price:								
Real sale price (2001 dollars)	86865	156736	96300	12000	672500	28832	139072	94809
Ln(Real sale price)	86865	11.81	0.56	9.39	13.42	28832	11.66	0.59
Test score measures:								
Annual math and reading score	71061	-0.02	0.29	-0.79	0.81	23950	-0.12	0.27
Average math and reading score, 1993-1999	86865	-0.04	0.25	-0.62	0.44	28832	-0.13	0.23
Avg math+reading score, whites 1993-1999	86865	0.24	0.24	-0.37	0.83	28832	0.22	0.28
Avg math+reading score, Afr.Amer. 1993-1999	86865	-0.52	0.18	-0.80	-0.02	28832	-0.57	0.14
Percent of students Afr. Amer., 1993-1999	86865	0.37	0.17	0.07	0.96	28832	0.45	0.14
Annual performance composite/10	49926	6.89	1.18	3.63	9.76	15737	6.44	1.03
Average performance composite/10, 1997-2001	86865	7.00	1.06	4.19	9.46	28832	6.53	0.82
School achieved exemplary growth	49996	0.29	0.45	0	1	15767	0.26	0.44
School achieved expected growth	49996	0.33	0.47	0	1	15767	0.27	0.45
School achieved score of distinction	49996	0.11	0.31	0	1	15767	0.04	0.21
School achieved score of excellence	49996	0.06	0.24	0	1	15767	0.02	0.14
School was low performance	49996	0.16	0.36	0	1	15767	0.21	0.40
Travel distance:								
Distance to school (miles, straight line)	83056	1.42	1.17	0.04	9.58	28168	1.39	1.36
Characteristics of house								
# of bedrooms	86865	3.28	0.62	1	9	28832	3.16	0.61
# of bathrooms	86865	1.96	0.58	1	6	28832	1.80	0.63
# of halfbaths	86865	0.26	0.26	0	3.5	28832	0.22	0.26
Acreage (acres)	86865	0.37	0.40	0	5	28832	0.36	0.31
Heated square feet / 100	86865	19.54	8.03	4.14	100.61	28832	17.56	7.27
House has garage	86865	0.58	0.49	0	1	28832	0.35	0.48
House has basement	86865	0.07	0.25	0	1	28832	0.08	0.28
House has airconditioning	86865	0.93	0.26	0	1	28832	0.88	0.33
Age of house in years / 10	86865	1.64	1.91	0	10.10	28832	2.60	1.96