Did the Pursuit of Good Schools Contribute to the U.S. Housing Bubble?

Michael Insler[†]
U. S. Naval Academy, Department of Economics, 589 McNair Rd, Annapolis, MD 21402. Phone: 410-293-6881, Email: insler@usna.edu

Kurtis Swope
U. S. Naval Academy, Department of Economics, 589 McNair Rd, Annapolis, MD 21402. Phone: 410-293-6892, Email: swope@usna.edu

March 13, 2014

Abstract: Using data from the American Housing Survey, we find that purchase prices for homes selected primarily to access self-identified "good schools" rose (relative to homes selected for other reasons) during the key U.S. housing bubble period, compared to the periods before and after the bubble. We observe a similar pattern in homebuyers' mortgage-to-income ratios. Various regression specifications and propensity score matching techniques show that these trends persist conditional on a range of household, demographic, and economic controls. Our results suggest that the strong, bubble-era pursuit of good schools may have played a role in the housing bubble's expansion. **(**R21, I24, G01)

Keywords: Residential choice; housing expenditures; school quality; U.S. housing crisis

[†]*Corresponding author*

1. INTRODUCTION

In the U.S., access to a particular public school is typically linked directly to residential location, with each home address assigned to one public elementary school, middle schoo1, and high school. According to the U.S. Department of Education (2009), around 90 percent of K-12 students attend public schools, with 75 percent attending an "assigned" school and 15 percent attending a "chosen" public school. For families with school-aged or younger children, the quality of the schools in a neighborhood plays an important role in the choice of a neighborhood and home and, in some cases, is the primary factor. However, given the variation in school quality across neighboring districts, and given the scarcity of homes within a district, homebuyers seeking access to the best public school systems generally pay a significant premium to live in such districts (over $200,000 more, on average, in the 100 largest U.S. metropolitan areas, according to Rothwell (2012)). This may be because the value of a good public school system is capitalized into the value of homes in the district, and because homes in the best districts are typically larger and of higher quality (Rothwell, 2012). Affordable rental housing in such districts may also be limited by scarcity and exclusionary zoning practices (Rothwell, 2012) that are intended to limit the construction of multi-family dwellings. Furthermore, good public schools are often in "high-opportunity" neighborhoods (McClure, 2010) and accompanied by other local public good amenities, such as lower crime, better shopping, more parks and recreation facilities, and greater employment opportunities that further contribute to higher home prices in the area.

A large literature focuses on estimating willingness-to-pay for school quality using hedonic estimation techniques to capture how much school quality is capitalized into the value of a home. Estimating the demand for good schools alone is complicated since neighborhoods with strong schools tend to have other local public good amenities. When samples are restricted to only houses located

near district attendance boundaries, estimates of willingness-to-pay for school quality, though significant, are one-half (Black, 1999) to one-quarter (Kane et al., 2006) as large as with the unrestricted samples. Alternative approaches to measuring willingness-to-pay for school quality include analyzing changes in home values following the publication of new information on school quality (Figlio and Lucas, 2004; Fiva and Kirkenboem, 2008), or following policy changes, such as the adoption of school choice programs (Rebak, 2005). Results from these approaches consistently indicate a positive and significant willingness-to-pay for access to good public schools.

Because of the strong link between residential location and public schools, homebuyers must nevertheless purchase a bundle of neighborhood characteristics and cannot easily isolate the "good schools feature" of a neighborhood from other characteristics. The effective cost to access high-quality schools, therefore, may be significantly higher than the estimated willingness-to-pay for better schools alone found by Black (1999) and others.

In this paper we use data from the American Housing Survey (AHS) 2001-2009 to characterize the association between housing expenditures and the pursuit of good schools over the years before, during, and immediately after the U.S. housing bubble. Figure B.1, which shows the seasonally-adjusted U.S. housing price index since 1990, illustrates the housing price bubble. For the purposes of our analysis, we define the "pre-bubble" period as 2000-2002, the "bubble" period as 2003-2006, and the "bust" period as 2007-2009. We should note that our main results are robust to reasonable alternate year groupings for the pre-bubble, bubble, and bust periods. The AHS survey data provide information on the purchase price of the home, size of the homeowner's mortgage, and characteristics of the home, the homeowner, the household, and the neighborhood. Importantly, the data also provide information on the primary reason the homeowner chose the neighborhood and home. Such reasons include access to

good schools, the looks or design of the neighborhood, or proximity to work.[1] Therefore, we can identify the extent to which housing expenditures, measured by both home prices and resulting mortgage-to-income ratios, were associated with these "amenity preferences," conditional on income, demographics, and other factors.

We show that homebuyers who selected their homes primarily to access good schools paid more than comparable homebuyers who purchased their homes for other reasons, and the difference was significantly larger during the key bubble period. We investigate this finding using a series of empirical techniques. Estimates from bubble-period-stratified OLS regressions show that, holding a wide range of observable factors constant (housing unit, neighborhood, and the householders' characteristics), the strength of correlation between demand for school quality and housing expenditures grew to a peak during the critical boom years 2003-2006, and then vanished in the following years. Mortgage-to-income ratios follow a similar pattern. We show that these results hold up within full sample specifications that include a robust set of interaction terms, as well as within propensity score matching techniques. Throughout the exposition, we present various descriptive statistics and stylized facts to contextualize our findings; for instance, we provide evidence that the observable composition of "good schools preferring" homebuyers remained constant over the pre-bubble and bubble years. Our discussion suggests that the pursuit of good schools acted on homebuyers' willingness-to-pay particularly strongly during the height of the housing boom, perhaps (in part) fueling its expansion.

While it is difficult to compare our estimates of willingness-to-pay for good schools to those calculated by Black (1999) and others because our data lacks more objective measures of school quality, our estimates are reasonable in magnitude and consistent across various empirical analyses. Holding all other

[1] Refer to Table A.1 or Figure B.2 for the full list of primary reasons.

observable characteristics constant, we find that households who chose their neighborhood primarily to access high quality schools paid roughly 11.5 percent more at the bubble's height (2003-2006), compared to those who chose their neighborhood for other primary reasons before and during the bubble. For the median bubble-era homebuyer who favored good schools, this equates to a $26,000 premium.

The remainder of the paper proceeds as follows. Section 2 provides background on research examining the link between school quality, housing expenditures, and residential choice. Section 3 discusses the data and presents some empirical observations. Section 4 contains our main methods, results, and discussion. Section 5 provides concluding remarks.

2. RESIDENTIAL CHOICE AND SCHOOL QUALITY

Explanations for the recent U.S. housing market bubble, collapse, and resulting financial crisis include speculative and "irrationally exuberant" borrowers,[2] predatory lending practices,[3] excessive risk-taking by investment banks,[4] unsustainable global financial imbalances,[5] favorable treatment of capital gains from real estate,[6] prolonged expansionary monetary policy,[7] financial-sector deregulation,[8] rapid and inadequately-regulated financial innovation,[9] and government initiatives to increase home ownership rates among lower-income households.[10] Nearly all of these explanations ascribe a central role to the sub-

[2] Shiller (2000).
[3] Center for Responsible Lending (2009); Financial Crisis Inquiry Commission (2010).
[4] Stiglitz (2011).
[5] Obstfeld and Rogoff (2007).
[6] Smith (2007); Gjerstad and Smith (2011). For example, the 1997 Taxpayer Relief Act exempted from taxation housing capital gains (up to $500,000).
[7] Taylor (2011).
[8] Stiglitz (2011).
[9] Miele (2011).
[10] Roberts (2010); Wallison (2011). For example, the Community Reinvestment Act of 1977 (and subsequent amendments) and the 1992 Affordable Housing Goals (AHG) initiative led to lower

prime mortgage market both in generating the housing price bubble and subsequently precipitating the housing market collapse. Often ignored, however, is the fact that the vast majority of homebuyers, whether they are prime or sub-prime borrowers, or high, middle, or low-income families, simply choose to purchase a home in hopes of improving their well-being. And it takes buyers willing to pay increasing prices for homes to fuel a housing market bubble.

Buying a home brings many benefits including pride of ownership, access to a neighborhood and its amenities, and financial advantages from tax incentives and the acquisition of equity. For families with children or who plan to have children, home location also determines access to most public schools. Rental housing, particularly affordable, multi-family dwellings, is often restricted or limited in neighborhoods with the highest-performing public schools (Rothwell, 2012), making a home purchase often the most direct way to access high quality schools.[11] Open enrollment and intra-district school choice programs, such as the San Francisco Unified School District, are relatively uncommon.[12]

Stratification of households across districts that vary in the quality of public schools and other public services and amenities is formally explained by the well-known Tiebout (1956) model in public finance. According to the standard model, communities offer a basket of public goods and services and an attendant tax level necessary to finance the provision of public goods. Households (assuming a reasonable level of household mobility) sort themselves across

---

lending standards and increased the role of the Government-Sponsored Enterprises (GSEs) Fannie Mae and Freddie Mac in backing residential mortgage debt.

[11] Households may be able to access schools, in some cases, without necessarily living in the district by obtaining a limited number of waivers to attend an out-of-district school, or by illegally using a fraudulent mailing address or the address of a relative who lives in the district. Residency verification and the degree of enforcement vary significantly across school districts. Some schools may "turn a blind eye" while others will hire private residency verification contractors to enforce residency requirements.

[12] According to the U.S. Department of Education (2009), 16 percent of students in 2007 were attending a "chosen" public school (defined as any school other than the one they were assigned to), due to waivers, charter schools, or school choice programs.

jurisdictions based on their preferences for public goods and their ability to pay the associated taxes in a community. An equilibrium in the model consists of a set of communities, tax and public good levels, and household composition such that each community collects sufficient taxes to finance its public good level and no household can unilaterally increase its welfare by moving to a different community. Based strictly on the Tiebout model and the strong link between residential location and public school access in the U.S., we would expect lower-income households to live in communities with lower taxes, lower local expenditures on education, and lower-quality schools.

Supplemental state and federal funding of public schools can provide a more equitable allocation of funding resources across schools relative to the outcome under purely local financing. According to the U.S. Department of Education (2005), 46.9 percent of public K-12 education funding for the 2004-2005 academic year came from state governments, while 44 percent came from local governments. Federal government financing amounted to 9.2 percent. However, evidence on the link between levels of per pupil expenditures and student performance is mixed (for example, see Hanushek, 1996). While a thorough review of the large literature on this issue is not within the scope or purpose of our analysis, it is sufficient to note that households' perceptions of the quality of a particular school are driven by more than per pupil expenditures alone. Common perceptions of school quality are often driven by student learning outcomes, such as performance on standardized tests and graduation and college attendance rates. Although the U.S. Department of Education (2000) cites 13 distinct "indicators of school quality," many may be closely linked with financial resources and expenditures per pupil (such as teacher experience, class size, and available technology).

Empirical evidence generally confirms the importance of school quality for homebuyers. A rich literature has estimated the value of good schools through

various hedonic methods measuring the capitalization of school quality into house prices. The principle concern of these studies is isolating the value of good schools from other local services and amenities. For example, Bogart and Cromwell (1997) study homes that are in the same municipal jurisdictions and, therefore, should have common local government services, but are associated with different school districts. Black (1999) demonstrates that when samples are restricted to houses near school boundaries and, therefore, are very likely in the same neighborhood but associated with different school districts, the estimated value of school quality is about half of that obtained with a standard, unrestricted hedonic sample.

Alternatively, based on a unique dataset of residential choice decisions in the Columbus, Ohio area, Bayoh, et al. (2006) find that neighborhood public school quality has the single largest effect on the probability of a household choosing a particular neighborhood. Barrow (2002) investigates the relationship between school quality and residential choice by focusing on the differential in willingness-to-pay for good schools between families with children and those without children in the Washington, D.C. area from 1985-1990. This strategy may avoid the problem of school quality being correlated with other unobservable neighborhood attributes. Barrow estimates that white households with children are willing to pay approximately $1805 more per year in rent than white households with no children for a 100 point increase in average public school SAT scores. She also finds that willingness-to-pay is, in general, increasing in household income and education level. However, Barrow also finds insignificant or even slightly more negative correlations between school quality and willingness-to-pay for African American households with children compared to those without, indicating that these households may face additional unobserved constraints in their residential location decisions.

In this paper we take an alternative approach. Our analysis focuses on whether there was any significant change in the relationship between housing choices and school quality during the bubble period relative to the years around it. The "good schools effect" that we seek to uncover stems from the strong link between residential location and public school access, and the relative scarcity of homes in districts with the best schools. Our analysis is unique in that our data represent a cross section of home purchases across the nation and across time, and we are able to examine the pattern of home purchases before, during, and after the housing bubble, controlling for both characteristics of the household and home location. While our data do not provide quantitative information about school quality in a particular neighborhood, as measured by student test scores or other attributes of the individual schools, we do observe homebuyers' perceptions of school quality and its importance in their purchase decisions. And homebuyers' perceptions are what ultimately determine their willingness-to-pay when school quality is an important consideration.

3. DATA AND EMPIRICAL OBSERVATIONS

3.1 American Housing Survey

For the empirical analysis, we use microdata from the American Housing Survey (AHS), a longitudinal survey that addresses the quality of housing in the United States. In a joint effort with the U.S. Census Bureau, the U.S. Department of Housing and Urban Development collects AHS data every other year. The sampled objects are specific housing units, regardless of changes in ownership or residency that may occur between survey periods (although we observe such changes). Housing units participating in the AHS represent a cross section of all housing in the nation. The survey provides sampling weights; each housing unit in the sample represents about 2,000 housing units in the United States.

The construction of our sample is as follows. The unrestricted AHS sample contains 341,145 observations of housing units, taken from 85,913 unique housing units across five biennial survey waves from 2001-2009. We limit the sample to housing units classified as "house, apartment, or flat" and to those never listed as part of a condominium or cooperative. We also omit units that are (at any point in the sampling period) owned by a public housing authority or listed with a value less than $15,000. This reduces the number of observations to 266,674 (68,031 unique housing units). Since we aim to study the connection between residential choice and schooling—a choice made at the time of the home purchase—our sampling objects of interest consist of observations of housing *purchases*. So although we may observe each housing unit several times throughout the panel, we use only the first observation that follows the purchase of a unit.[13] As such, we restrict the sample to the initial observations of units purchased or constructed during the survey period from 2000-2009 [14] (46,377 observations from 29,283 unique housing units). In order to examine the subpopulation whose housing-purchase decisions reflect the needs of school-aged children, we omit residencies that contain more than one family, units that are not owner-occupied or purchased without a mortgage, units that are designated for "vacation or other short term use," and units in which both the householder and spouse (if present) are over age 60 (leaving 9,340 observations from 8,383 unique housing units). Lastly, we omit observations with missing values for crucial variables such as income, purchase price, or neighborhood choice preferences, giving us a final sample size of 6,475 observations of home purchases from 5,991 unique housing units. Although this number may appear small in comparison to

[13] Some housing units may change hands more than once within the panel, in which case we take multiple observations from that unit.

[14] Although the AHS has existed since 1973, it received a major overhaul in 1997. Our sample includes housing units purchased during the years 2000-2009 (i.e. over five waves of survey data:

size of the unrestricted sample, it is important to note that it represents only the population of suitable housing purchases occurring from 2000-2009. As each sampling unit in the AHS represents about 2,000 housing units in the U.S. as a whole, our final sample is representative of nearly 13 million housing transactions from that time span.

3.2 Descriptive Statistics

Table A.1 contains summary statistics for our final AHS sample of 6,475 households who purchased homes from 2000-2009. Relative to the U.S. population, our sample of homebuyers is disproportionately white, married, and has at least some level of college education or above. The average number of children per home is 1.3. The median household income in our sample ($75,000) is notably lower than the mean ($95,315). Importantly, respondents to the AHS survey are asked about their main reason for choosing a neighborhood (with options given towards the bottom of Table A.1), and 11 percent of our respondents chose "good schools" as the primary reason.[15] Table A.1 indicates that those whose primary reason for purchasing a home was for good schools tended to have higher family income ($103,648 versus $94,234) and more children (1.8 versus 1.2) compared to those who purchased a home for other reasons during this time period, but otherwise the two cohorts of homebuyers are comparable. The "good schools cohort" spent roughly $46,000 more, on average, to buy a home.

Figure B.2 gives the proportions of homeowners who reported buying a home for each primary reason from 2000-2008. The connected dots represent

---

2001, 2003, 2005, 2007, 2009) in order to focus on such decisions made shortly before, during, and after the housing price bubble in the United States.

[15] According to the U.S. Department of Education (2009), the parents of 27 percent of public school students indicated that they had moved to their current neighborhood so that their children

each reason's overall nine-year average, and a 95 percent confidence interval indicates the estimated proportion for each year. The "good schools proportion" was not statistically significantly higher during the bubble years.[16] Other popular primary reasons for neighborhood choice include the specific housing unit, work-related convenience, and the aesthetics of the neighborhood. Figure B.2 shows that most primary reasons for home purchase, including "for good schools," became less popular after the housing bubble, with the exception of "for job" and "all reasons equal" which both increased as explanations for home purchases.

Our objective is to characterize the pattern of housing expenditure decisions before, during, and after the U.S. housing bubble, particularly as it relates to the pursuit of high quality schools. For each primary home selection reason, Figure B.3 provides the 95 percent confidence intervals of mean purchase price for each purchase year; the figure also plots overall sample mean purchase prices for each year, indicated by the connected dots. The comparison is striking. Rising mean purchase prices reflect the general housing bubble that occurred over this period for each of the various primary purchase reasons. However, while mean home purchase prices for the "good schools cohort" were just marginally higher during 2000 and 2001, mean home purchase prices for this group rose sooner, greater, and faster, and peaked in 2006, a distinctly different pattern than for other purchase reasons. In fact, the "good schools series" is the only one with segments that are statistically different from the overall mean. There was a considerably greater crash in purchase prices for this cohort in the bust year of 2007 that corresponded with the acceleration of the subprime mortgage crisis.

An additional exercise is to examine the degree of leveraging associated with the home selection reasons by plotting mortgage size rather than purchase

---

could attend that school, but this does not imply that schools were the "primary reason" for all such households.

[16] Point estimates are 12.4 percent during 2003-2006, compared to 12.1 percent during the preceding three years.

price. Figure B.4 compares the mortgage-to-income ratios across the different homebuyer cohorts. While the confidence intervals are large, a consistent pattern remains: Households who moved primarily to access good schools borrowed more relative to income nearly every year from 2000-2009, with the greatest differences occurring in the years 2004 and 2005. The differences among these homebuyers appear more striking than among those buying for other reasons. If the priorities of homebuyers were generally flat (as seen in Figure B.2), then households with the "good schools priority" may have been different (e.g. wealthier) in the boom than in the pre-bubble, or were more aggressive in their bidding behavior during the boom. Our analysis in Section 4 provides indirect evidence of the latter, as we find that these patterns are robust to a large set of controls.

There is also descriptive evidence that such bidding behavior may have been an artifact of families' self-interest in access to public schools, rather than a pure investment motive. Of the 755 families purchasing for good schools, only 247 of them had no child in a public school. 23 of those 247 buyers had at least one child enrolled in a nearby private school. Of the remaining 224 households, 46 had no children and 178 had at least one child. Of those 178, only 44 had at least one child of school age but not currently in school. And of the 46 families with no children, only 6 had a female spouse over age 40 (suggesting most might still be planning to have kids). In other words, the vast majority of families who selected their homes primarily to access good schools were also utilizing those schools. These figures and stylized facts suggest that such bubble-era families faced a unique home-buying process. While compelling, these observations alone do not substantiate the claim that the pursuit of high quality public schools played a more significant role in the boom years of the U.S. housing bubble. Our analysis in the next section seeks to disentangle these possible effects, as far as our data permit.

4. EMPIRICAL METHODS AND RESULTS

In this section, we investigate whether the patterns cited in Figures B.3 and B.4 persist after controlling for a large set of observable characteristics. To do so, we perform three types of analysis: (1) Ordinary least squares (OLS) regressions on the sample stratified by the three bubble periods; (2) OLS regressions on the full sample with interaction terms for each bubble period and primary reason for home selection; (3) propensity score matching under bubble-period stratifications. Our results are qualitatively and quantitatively consistent across all three analyses. Throughout this section, we discuss the possible influence of unobservable information on our estimates, and we conjecture how our results might indicate the existence of a causal relationship, under certain circumstances.

4.1 Stratified Ordinary Least Squares

We consider a specification in which the natural logarithm of purchase price, $log(PP_{i,b})$, is the dependent variable and the good schools dummy, $NBD_{i,b}$, is the main control variable of interest.[17] In the following model, i represents a home purchase and b represents the sample stratifications by pre-bubble years (home purchases made during 2000-2002), bubble (2003-2006), and bust (2007-2009).[18] $X_{i,b}$ contains all other controls, and $u_{i,b}$ is the error term. Due to the stratifications, coefficients α_b, β_b, and γ_b are subsample-specific. We assume a linear specification of the following form:

$$log(PP_{i,b}) = \alpha_b + \beta_b X_{i,b} + \gamma_b NBD_{i,b} + u_{i,b} \qquad (1)$$

[17] Recall from Table A.1 and the figures in Appendix B that we also observe several other main reasons for choosing the neighborhood. Thus $NBD_{i,b}$ represents the set of these binary variables, and we use "other reason" as the reference category.

Covariates in $X_{i,b}$ include age, race, gender, and marital status of the responder, spouse's age, the education background of the responder and spouse, logarithm of household income, number of children in the household, and self-reported neighborhood quality (on a 1-10 scale). Geographic controls include the census region (Northeast, Midwest, South, and West) and whether the unit is part of a metropolitan statistical area (MSA).[19] Time dummies for year of the unit's purchase account for trends in nominal housing prices within each purchase year stratification (*b*-group).

Table A.2 displays regression results estimated via OLS, incorporating sampling weights and heteroscedasticity-robust standard errors. Household income is a principal determinant of housing expenditures with income elasticities ranging from 0.26 to 0.4 in the three subsamples. For brevity, Table A.2 omits estimates of several of the other household characteristics' coefficients.[20] We are most interested in the results as they pertain to good schools as the primary reason for home selection. Here, the coefficient on the good schools variable is positive for both the pre-bubble and bubble cohorts, but significant and nearly four times larger for the latter. The difference vanishes altogether during the bust period. The estimates imply that during the pre-bubble years, homebuyers who chose their

[18] Our qualitative results are robust to reasonable alternative year groupings, such as 2000-2001/2002-2006/2007-2009 or 2000-2003/2004-2005/2006-2009. Results from these robustness checks are available upon request.

[19] The Northeast and MSA central city categories are the reference groups, respectively. MSA categorical variable options are: MSA central city, MSA urban, MSA rural, no MSA urban, and no MSA rural. A metropolitan statistical area is a region with high population density at its core and close economic ties throughout the area. Examples of MSAs include the Washington—Arlington—Alexandria DC-VA-MD-WV MSA, or the Dallas—Fort Worth—Arlington TX MSA.

[20] Of these, older homebuyers tend to purchase more expensive homes, and the coefficient on number of children is positive for all three cohorts. There is evidence that, relative to white households, black and "other" minority households choose lower-priced homes, while Asian households pay more for their homes. In general, households where the responder and spouse had less than a bachelor's degree tend to spend less on homes compared to those with a bachelor's degree, while those with graduate degrees spend more. Housing in the South and Midwest is cheaper relative to the Northeast, on average, while the West is more expensive. Housing in an

neighborhood primarily for nearby schools paid on average 5 percent more for their housing (compared to those who chose their neighborhood for other reasons), holding all observable conditions constant, but they paid nearly 20 percent more during the bubble years. These results suggest a higher willingness-to-pay as the housing bubble expanded (specifically in order to access good schools) that is independent of observable trends in the housing market during the time. While we expect home prices to be higher in districts with the best performing public schools, the significant change in the magnitude of this coefficient indicates the presence of a response by homebuyers unique to the housing market boom. The estimates of the neighborhood preference dummy "looks/design of neighborhood" follow a similar pattern; they are small and positive during 2000-2002, significantly larger during the bubble period, and vanish thereafter. However, the estimated size of this alternate effect is smaller than that of "good schools," and there are no significant differences between pre-bubble and bubble estimates for the other home selection reasons.

In Table A.3 we maintain the same pre-bubble/bubble/bust stratifications, but we now use mortgage-to-income ratio as the dependent variable. These models are estimated as in Equation 1, except they omit the family income control to avoid its presence on both sides of the regression equation. The results for the neighborhood choice dummies are qualitatively similar to those in the previous table. Although estimates are no longer statistically significant, the "good schools variable's" coefficient is notably larger in the bubble years compared to before and after the bubble, and it is also larger than every other option for neighborhood choice (including "looks/design") in every time period.

It is important to note the limitations of this simple OLS specification. We cannot conclude that the primary preference for high quality schools directly

---

MSA but outside the city center is more expensive than in the city center, but housing outside an MSA entirely is cheaper.

compelled school-quality-loving homebuyers to pay more during the boom. OLS results show that, conditional on a robust set of observable characteristics, homebuyers paid a premium to live in districts with good schools particularly during the housing bubble, but there remains a possibility that the correlation between home selection preferences and purchase price stems from unobserved (or unmeasured) traits: While the most interesting finding in Tables A.2 and A.3 is that the magnitude of the "good schools estimate" grows substantially only during the bubble period, it is conceivable that subsample-specific unobserved information may be the cause. It is plausible that the composition of homebuyers changed throughout the three periods, conditional on observable covariates. If so, the coefficient estimates could reflect differences stemming from distinctly different subgroups of homebuyers.

4.2 Full Sample OLS with Interaction Terms

In this subsection, we estimate specifications using the full sample of 6,475 housing purchases from 2000-2009. We define these models similarly to Equation 1, now omitting the stratification via bubble period *b*. Recall that NBD_i represents the set of neighborhood choice dummy indicators (good schools, looks/design, etc.). BUB_i is an indicator for the time period during which unit *i* was purchased (pre-bubble, bubble, or bust). We assume a linear specification, now including interactions of these variables:

$$log(PP_i) = \alpha + \beta X_i + \gamma NBD_i + \delta BUB_i + \theta(NBD_i \times BUB_i) + u_i \qquad (2)$$

The first two columns of Table A.4 present OLS estimations of two versions of Equation 2. The table omits estimates of α and β for brevity; their estimates are both qualitatively and quantitatively similar to the OLS results in the previous subsection. In the first column, NBD_i takes only two categories: chose neighborhood primarily for good schools or chose neighborhood for any of the six other reasons. BUB_i has three categories (pre-bubble, bubble, or bust). As the

model is more complex than a simple binary interaction, it is helpful to clarify the interpretation of θ. It represents the premium paid for a primary home selection reason during the bubble period relative to one of the other two periods. Since only the bubble period coefficient estimate of the "good schools variable" is significant (in the first column of Table A.4), we can say that households favoring good schools paid (on average) 11.5 percent more for their home compared to families who chose the neighborhood for any other reason.

In the second column of Table A.4, NBD_i can take the six values shown,[21] with the reference category as "other." Thus in this model, we estimate differential effects for each category of NBD_i, compared to any other reason, across the three time periods. Bubble-era homebuyers favoring good schools paid 17 percent more, compared to the pre-bubble group. The difference is even larger versus the bust group.[22] We observe similar patterns in the categories "all reasons equal" and "looks/design of neighborhood" but their estimates are smaller and less statistically significant. Thus there may be effects for other home selection criteria over the housing bubble's cycle, but our estimates suggest that the "good schools effect" is the most potent.

The third and fourth columns of Table A.4 estimate interaction models using mortgage-to-income ratios (M_i / I_i) as the dependent variable. These models take the following form:

$$(M_i / I_i) = \alpha + \beta X_i + \gamma NBD_i + \delta BUB_i + \theta(NBD_i \times BUB_i) + u_i \qquad (3)$$

Estimates reveal similar patterns to previous models but with lower statistical significance. Depending on the reference group, homebuyers favoring good schools possessed larger mortgage-to-income ratios by 0.15 to 0.17 points. In the

[21] All reasons equal; for specific housing unit; convenient to job; for looks/design of neighborhood; convenient to friends/family; for good schools.

[22] We discuss below that the larger discrepancy here may be due to compositional changes within the groups during the bust period.

fourth column, the coefficient estimate for the "good schools variable" is the largest among the set of reasons in NBD_i.

We conjecture that these interaction models might be viewed as unconventional difference-in-differences (DD) models, in which the "policy change," per se, is the expansion and subsequent collapse of the housing bubble (rather than some exogenous and instantaneous change). The empirical observations of Section 3 imply a "treatment group" of homebuyers who selected their home for good schools during the bubble years. Given the time period of interest (2000-2009), this framework yields two possible "control groups:" (1) homebuyers who did not select their neighborhood for good schools before and during the bubble; (2) homebuyers who did not select their neighborhood for good schools during the bubble and bust years. For the remainder of this subsection, we discuss the potential to identify these "DD" estimates as causal; due to possible unobserved information, we can only speculate regarding such assumptions, but we argue the first control group is likely more valid than the latter.

First, we examine the composition of homebuyers in each group. The composition should remain fixed within our conjectured treatment and control groups over the three time periods. Table A.5 presents evidence in favor of this criterion. The table organizes summary statistics of important variables, stratified by treatment and control groups over time, to analyze possible compositional changes in observables.[23] In the group that did not favor good schools, summary statistics on the race, number of children, marital status, census region, and MSA variables are very stable across the time periods. Nominal family income is substantially higher in the bust period than in the pre-bubble period. Home selection variables also appear to notably change in the bust period. However, these characteristics are quite comparable between pre-bubble and bubble periods

[23] For brevity, we do not include our full set of covariates in the table. The variables shown form a subset of our covariates that should reflect any compositional changes in observed characteristics.

(also seen in Figure B.2), which we view as evidence that the pre-bubble/bubble segment serves as a better control group than bubble/bust. We have also inspected summary statistics such as in Table A.5 that are stratified into even smaller single year subgroups (2000-2009); we omit this large table of results from our exposition but note that it, too, displays few notable compositional changes until the bust years. Within the treatment group, the only notable compositional difference lies in the income variable, and again, the pre-bubble/bubble grouping appears more consistent. There remains a potential for unobserved compositional changes within treatment and control groups. Such heterogeneity should be at least partially correlated with observed information, which appears to be quite stable over time from pre-bubble to bubble periods. Given our data limitations, we are unable to test this hypothesis further, so we can only conjecture that a causal interpretation of the DD estimates is valid.

Second, trends in variables affecting the outcomes (home purchase price and mortgage-to-income ratio) should be parallel within each group over time, conditional on observed covariates. Figures B.3 and B.4 provide some supporting evidence. The trends are parallel between the group that favors good schools and the groups that favor other reasons, up through 2003. As the bubble reaches its peak, the "good schools group's" estimates appear to accelerate past the others'. The pattern diminishes upon entering the bust phase, again suggesting that the pre-bubble/bubble grouping yields a more viable control group than bubble/bust. Figure B.2 and Table A.5 display similar sustained trends in the home selection variables until the bust years. These stylized facts describe only trends in year-specific sample statistics; there remains potential for unobserved heterogeneity-related problems. Formal identification would require us to assume that nothing related to the outcome variables changes within the treatment group aside from the act of treatment itself, conditional on the set of covariates, and that nothing

related to the outcome variables changes within the control group, conditional on the set of covariates. As before, we cannot more formally test this with our data.

If there is a causal channel, we envision the "treatment effect" (i.e. of choosing a home primarily to access good schools) as an artifact of the bubble-era factors discussed in the introduction (loose credit, long-run trends in rising home prices, etc.). In this way, the effect would be driven by the set of homebuyers who were able to choose their homes primarily for nearby good schools during the bubble but could not have done so before the bubble. Our estimates would be biased if, for instance, some homebuyers who selected their homes to access good schools during the bubble would have selected them for another reason during a different period.

Across the various interaction models, our estimates are qualitatively and quantitatively comparable: Homebuyers in pursuit of good schools paid larger premiums for them during the bubble years of 2003-2006.

4.3 Propensity Score Matching

As a final experiment, we consider a propensity score matching framework, in which we utilize a similar treatment and control group breakdown as in the previous setting. For the matching models, we stratify the sample into pre-bubble (2000-2002), bubble (2003-2006), and bust (2007-2009) cohorts. Our matching model allows for only binary treatment, so we define the treatment group as homebuyers favoring good schools and the control group as households who chose the home for any other reason.[24] Since we cannot decompose the control group into the individual neighborhood choice categories, this setting is more restrictive. At the end of this subsection, we investigate this restriction via some robustness checks involving various alternate neighborhood choice categories.

We estimate the propensity score (of treatment) with probit models for each subsample. The set of matching variables is the same as the set of controls in Equation 1 (X_i). Table A.6 presents estimates of average treatment effects on two different outcome variables: purchase price and mortgage-to-income ratio. The first row of the table contains raw comparisons of average outcomes of treatment versus control groups before matching. The next five rows present comparisons of average outcomes after matching performed by five different matching algorithms: nearest neighbor (with 1, 5, or 20 nearest neighbors), radius matching (with a caliper size of 0.01), and kernel matching (with a bandwidth of 0.02). Results are consistent with previous subsections. During the bubble, households favoring good schools paid 14 to 16 percent more for their home than those not favoring good schools, compared to only 7 to 10 percent more in the pre-bubble period. Their mortgage-to-income ratios were 0.14 to 0.19 points larger during the bubble, compared to no significant difference before the bubble. Standard errors for treatment effect estimates are relatively small in the bubble periods, as well. Radius and kernel matching perform best, according to mean and median bias metrics.

Table A.7 presents a robustness check for the propensity score matching results. We redefine treatment to be choosing the neighborhood for its looks/design (in the first panel of the table), for its proximity to friends/family (in the second panel), and for the specific housing unit (in the third panel). Each panel compares the raw mean difference in outcomes before matching to the difference in outcomes after kernel matching. The only treatment category exhibiting similar results (to the main treatment of favoring good schools in Table A.6) is "looks/design." We estimate an average treatment effect of yielding a 10 percent higher purchase price for households favoring the looks/design of the neighborhood in the bubble period, compared to no significant effect in the pre-

[24] These groupings are similar to Columns 1 and 3 in the results in Table A.4.

bubble and bust periods. Overall, these alternative treatments yield smaller (if any) effects than the "good schools treatment."

4.4 A Note on the Economic Significance of the "Good Schools" Variable

Overall, the findings of this section substantiate the stylized facts presented in Section 3, which indicate that the intensity of the connection between school preferences and both home purchase price and household leveraging changed over the course of the housing bubble. The link between residential location and access to quality schools appears to have strengthened during the boom. While every home purchase decision is unique and driven by the individual needs and financial status of the household, our results suggest the presence of an additional facet of the complex processes that drove the U.S. housing market bubble. The pursuit of good schools may have played a role in the increasing household debt levels that were a hallmark of that period.

Whether or not this association stems from a causal channel, it is not obvious how contextualize its relation to the housing bubble. Unlike previous literature discussed in Section 2, we do not have direct information on school quality, and thus cannot use the "good schools preference" as a metric for willingness-to-pay for specific aspects of public schooling. Despite these limitations, a simple calculation can help frame the economic importance of our results. During the bubble years 2003-2006, we observe 344 cases in which homebuyers chose their neighborhood primarily due to good schools. Our estimates imply that those 344 "treated" homebuyers paid, on average, 11.5 percent more for their homes (from Table A.4, column 1).[25] Within the 344 members of the treatment group, the median purchase price was $250,000 and the average purchase price was approximately $327,000. Thus the median homebuyer

[25] Note that this is relative to the pre-bubble/bubble control group, for which we cannot conclude that the "good schools premium" is different from zero.

paid, on average, a $26,000 premium, and the average homebuyer paid a $34,000 premium. Each home purchase in our sample is representative of about 2,000 home purchases across the U.S. population, so our result represents a cumulative "good schools premium" of over $23 billion (using the average homebuyer's premium). Although this may seem small in the context of a multi-trillion dollar housing market, the figure may be a lower bound as it is derived from purchases for which schools were the *main* reason behind neighborhood selection. Many more households that valued school quality, though perhaps not above all else, may have raised their willingness-to-pay during the bubble as well. If equipped with quantifiable data on school quality or regional information, this rough calculation could be supplemented by future research.

5. CONCLUSION AND IMPLICATIONS

In light of the far-reaching consequences of the most recent real estate bubble, it is imperative that we investigate all of the factors that may have contributed. While it is well-known that investor speculation played an important role in driving up real estate values, particularly in certain localized markets, our paper explores speculation of a different variety. Because of the strong link in the U.S. between residential location and access to a public school system, the quality of the schools in a neighborhood is an important part of the decision to purchase a home; for many families it is the primary reason for choosing a particular neighborhood. Given a pattern of rising home prices during the bubble period, many families may have speculated on their own children's future, spending greater amounts of their income on homes in neighborhoods with quality schools in the hopes that this one-time investment would yield returns in the form of a better future for their children.

The results of our analysis of home purchase data from the American Housing Survey are consistent with this hypothesis. Homebuyers who primarily

chose their neighborhood to access good schools paid more for their homes during the key bubble period relative to buyers who chose their neighborhood for other reasons *and* relative to other "good schools favoring" buyers from before or after the bubble. Furthermore, mortgage-to-income ratios were also higher for the "good schools cohort" specifically during the bubble period. We verify these findings via three empirical approaches: OLS applied to three sample stratifications, full sample OLS models with interaction terms, and propensity score matching techniques. In general, our results contribute to our understanding of the dynamics of the U.S. housing bubble and the link between residential choice and school quality.

There may be competing explanations for our main results arising from changes in exogenous information about the location of good schools during the time period of the sample. For example, the No Child Left Behind Act (2001) expanded assessment, accountability, and reporting requirements in public schools receiving federal funds, and this additional information on school quality may have influenced homebuyers' purchase decisions in the subsequent years. If present, this additional effect would have worked in the same direction and aided our efforts to empirically capture higher willingness-to-pay during the bubble years. Widespread waivers for NCLB were granted to over half the states in 2012. Additional research on the behavior of homebuyers during the post-bubble period may shed some light on the importance of NCLB, or may reveal additional explanations.

ACKNOWLEDGEMENTS

The authors thank Gregorio Caetano, Manu Raghav, Ian McCarthy, and participants at the Alan Stockman Conference and Midwest Economic Association Conference for helpful comments and suggestions.

REFERENCES

American Housing Survey for the United States, 2001-2009. U.S. Department of Housing and Urban Development and U.S. Census Bureau.

Barrow, L. School Choice through Relocation: Evidence from the Washington, D.C. Area. *Journal of Public Economics* 86, 2002, 155-189.

Bayoh, I., Irwin, E., and Haab, T. Determinants of Residential Location Choice: How Important are Local Public Goods in Attracting Homeowners to Central City Locations? *Journal of Regional Science* 46, 2006, 97-120.

Black, S. Do Better Schools Matter? Parental Valuation of Elementary Education. *Quarterly Journal of Economics* 114, 1999, 577-599.

Bogart, W. and Cromwell, B. How Much More is a Good School District Worth? *National Tax Journal* 50, 1997, 215-232.

Brasington, D. Private Schools and the Willingness to Pay for Public Schooling. *Education Finance and Policy* 2, 2007, 152-172.

Center for Responsible Lending. Restoring Integrity to the Financial System Predatory Lending and the Economic Crisis, Faith and Credit Issue Guide, September, 2009.

Figlio, D. and Lucas, M. What's in a Grade? School Report Cards and the Housing Market. *American Economic Review* 94, 2004, 591-604.

Financial Crisis Inquiry Commission. Final Report of the National Commission on the Causes of the Financial and Economic Crisis in the United States, Internal Report, 2010.

Fiva, J. and Kirkenboen, L. Does the Housing Market React to New Information on School Quality. CESifo *Working Paper No. 2299*, 2008.

Gjerstad, S. and Smith, V. Monetary Policy, Credit Expansion, and Housing Bubbles, 2008 and 1929, in Jeffrey Friedman, ed., *What Caused the Financial Crisis?* Philadelphia: U. of Philadelphia Press, 2011, 107-136.

Hanushek, E. School Resources and Student Performance, in Gary Burtless, ed., *Does Money Matter? The Effect of School Resources on Student*

Achievement and Adult Success. Washington, D.C.: Brookings Institution Press, 1996, 74-92.

Kane, T., Riegg, S., and Staiger, D. School Quality, Neighborhoods, and Housing Prices. *American Law and Economics Review* 8, 2006, 183-212.

McClure, K. The Prospects for Guiding Housing Choice Voucher Households to High-Opportunity Neighborhoods. *Cityscape: A Journal of Policy Development and Research* 12, 2010, 101-122.

Miele, M. The Financial Crisis and Regulation Reform. *Journal of Banking Regulation* 12, 2011, 277-307.

Obstfeld, M., and Rogoff, K. The Unsustainable U.S. Current Account Position Revisited. In *G7 Current Account Imbalances: Sustainability and Adjustment*, ed. Richard H. Clarida. Chicago: University of Chicago Press, 2007.

Rebak, R. House Prices and the Provision of Local Public Services: Capitalization Under School Choice Programs. *Journal of Urban Economics* 57, 2005, 275-301.

Roberts, Russell. *Gambling with Other People's Money: How Perverted Incentives Caused the Financial Crisis*, George Mason University: Mercatus Center, May, 2010.

Rosenbaum, P.R. and Rubin, D.B. Constructing a Control Group Using Multivariate Matched Sampling Methods that Incorporate the Propensity Score. *The American Statistician* 39, 1985, 33-38.

Rothwell, J. Housing Costs, Zoning, and Access to High-Scoring Schools. Brookings Institution, April, 2012.

Shiller, R. *Irrational Exuberance*. Princeton University Press: Princeton, New Jersey, 2000.

Smith, V. We Have Met the Enemy, and He is Us. AEI-Brookings Joint Center Policy Matters, Paper 07-32, 20 December, 2007.

Stiglitz, J. The Anatomy of a Murder: Who Killed the American Economy?, in Jeffrey Friedman, ed., *What Caused the Financial Crisis?* Philadelphia: U. of Philadelphia Press, 2011,139-149.

Taylor, J. Monetary Policy, Economic Policy, and the Financial Crisis: An Empirical Analysis of What Went Wrong, in Jeffrey Friedman, ed., *What Caused the Financial Crisis?* Philadelphia: U. of Philadelphia Press, 2011, 150-171.

Tiebout, C. A Pure Theory of Local Expenditures. *Journal of Political Economy* 64, 1956, 416-424.

U.S. Census Bureau . *Demographic Trends in the 20th Century*, 2002.

U.S. Department of Education. National Center for Education Statistics. The Condition of Education 2009 (NCES 2009-081), 2009.

U.S. Department of Education. National Center for Education Statistics. Monitoring School Quality: An Indicators Report, 2000.

U.S. Department of Education. *Digest of Education Statistics*, Table 162, 2005.

Wallison, P. *Dissent from the Majority Report of the Financial Crisis Inquiry Commission*, Washington, D.C.: AEI, Press, 2011.

A. **APPENDIX**

TABLE A.1

Summary statistics for full AHS sample and grouped by choice of neighborhood "for good schools"[a]

	Full Sample		No – "Good Schools"		Yes – "Good Schools"	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Female*	0.40	0.49	0.40	0.49	0.38	0.49
Age (yrs.)	38.2	10.0	38.3	10.3	37.8	7.7
Race/ethnicity:						
White*	0.85	0.36	0.85	0.36	0.82	0.39
Black*	0.08	0.27	0.08	0.27	0.07	0.25
Asian*	0.05	0.21	0.04	0.20	0.08	0.27
Other race*	0.03	0.17	0.03	0.16	0.04	0.19
Hispanic*	0.11	0.31	0.11	0.31	0.10	0.29
Education level:						
No high school diploma*	0.06	0.24	0.06	0.24	0.03	0.18
High school diploma*	0.19	0.39	0.19	0.40	0.17	0.38
Some college or A.A.*	0.32	0.47	0.32	0.47	0.32	0.47
Bachelor's degree*	0.28	0.45	0.28	0.45	0.31	0.46
Graduate level degree*	0.14	0.35	0.14	0.35	0.16	0.37
Number of children	1.29	1.17	1.23	1.18	1.83	0.95
Married*	0.88	0.32	0.88	0.32	0.87	0.34
Census region:						
Northeast*	0.14	0.34	0.13	0.34	0.18	0.39
Midwest*	0.25	0.43	0.24	0.43	0.26	0.44
South*	0.39	0.49	0.40	0.49	0.35	0.48
West*	0.23	0.42	0.23	0.42	0.20	0.40
Population density:						
MSA, central city*	0.23	0.42	0.24	0.43	0.18	0.38
MSA, urban*	0.41	0.49	0.40	0.49	0.50	0.50
MSA, rural*	0.17	0.38	0.17	0.37	0.23	0.42
No MSA, urban*	0.07	0.26	0.07	0.26	0.05	0.22
No MSA, rural*	0.12	0.32	0.13	0.33	0.05	0.22
Family income ($)	95,315	85,209	94,234	84,525	103,648	89,928
Purchase price of housing unit ($)	236,668	196,768	231,371	194,745	277,474	207,347
Mortgage APR (%)	6.3	1.3	6.3	1.3	6.2	1.2
Mortgage term length (yrs.)	27.8	5.8	27.7	5.8	28.1	5.7
Neighborhood quality (rated 1-10)	8.4	1.5	8.3	1.5	8.5	1.4
Main reason you chose this neighborhood:						
All reasons equal*	0.09	0.29	0.11	0.31		
For specific housing unit*	0.23	0.42	0.26	0.44		
Convenient to job*	0.13	0.34	0.15	0.35		
Looks/design of neighborhood*	0.20	0.40	0.22	0.41		
Convenient to friends/family*	0.10	0.29	0.11	0.31		
Good schools*	0.11	0.32				
Other*	0.28	0.45	0.30	0.46		
Number of observations:	6,475		5,720		755	

[a] *Denotes sample proportion rather than sample mean (i.e. dummy variable).

TABLE A.2
Stratified OLS results for home purchase price (by year-of-purchase)[b]

Dependent variable: log(Purchase price)	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009
log(Family income)	0.327***	0.262***	0.399***
	(0.0860)	(0.0354)	(0.0378)
Neighborhood quality self-rating (1-10)	0.0391***	0.0595***	0.0692***
	(0.00972)	(0.00957)	(0.0124)
Main reason chose nbhd. (ref. group: Other)			
All reasons equal	-0.0220	0.0330	-0.0154
	(0.0680)	(0.0557)	(0.0558)
For specific housing unit	-0.0188	0.0220	-0.105*
	(0.0416)	(0.0529)	(0.0547)
Convenient to job	-0.00392	0.0122	-0.137**
	(0.0640)	(0.0633)	(0.0688)
Looks/design of neighborhood	0.0243	0.157***	-0.0109
	(0.0450)	(0.0468)	(0.0542)
Convenient to friends/family	-0.0887	0.0682	-0.127*
	(0.0591)	(0.0520)	(0.0721)
Good schools	**0.0508**	**0.197*** **	**-0.0909**
	(0.0434)	**(0.0534)**	**(0.0611)**
Purchased unit in 2000	ref. group		
Purchased unit in 2001	0.0641*		
	(0.0332)		
Purchased unit in 2002	0.138***		
	(0.0313)		
Purchased unit in 2003		ref. group	
Purchased unit in 2004		0.0959**	
		(0.0382)	
Purchased unit in 2005		0.212***	
		(0.0382)	
Purchased unit in 2006		0.170***	
		(0.0432)	
Purchased unit in 2007			ref. group
Purchased unit in 2008			-0.0556
			(0.0374)
Purchased unit in 2009			-0.0626
			(0.0462)
Constant	7.545***	8.193***	7.206***
	(0.912)	(0.414)	(0.438)
Number of observations:	2403	2769	1303
R^2	0.372	0.337	0.457

[b] Note: * *p<.10*, ** *p<.05*, *** *p<.01*. Standard errors are in parentheses. Table omits coefficient estimates for the following control variables (which were included in the estimations): gender, age, race, ethnicity, marital status, and education level of respondent; spouse's age and education level; number of children in the household; census region; MSA classification.

TABLE A.3
Stratified OLS results for mortgage-to-income ratio (by year-of-purchase)[c]

Dependent variable: Mortgage/Income ratio	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009
Mortgage term length (yrs.)	0.00793*	0.0158***	0.0169*
	(0.00464)	(0.00490)	(0.0102)
Neighborhood quality self-rating (1-10)	0.00921	0.0600***	0.0762***
	(0.0159)	(0.0203)	(0.0275)
Main reason chose nbhd. (ref. group: Other)			
All reasons equal	0.166	0.0710	-0.0263
	(0.144)	(0.134)	(0.135)
For specific housing unit	0.128*	-0.0839	-0.105
	(0.0767)	(0.0971)	(0.138)
Convenient to job	0.136	-0.0857	-0.152
	(0.0892)	(0.114)	(0.133)
Looks/design of neighborhood	0.101	0.0601	-0.163
	(0.0747)	(0.0999)	(0.127)
Convenient to friends/family	0.0180	0.112	-0.119
	(0.0997)	(0.125)	(0.174)
Good schools	**0.0227**	**0.171**	**-0.0797**
	(0.0862)	**(0.117)**	**(0.156)**
Purchased unit in 2000	ref. group		
Purchased unit in 2001	0.159***		
	(0.0579)		
Purchased unit in 2002	0.281***		
	(0.0589)		
Purchased unit in 2003		ref. group	
Purchased unit in 2004		0.0385	
		(0.0745)	
Purchased unit in 2005		0.240***	
		(0.0850)	
Purchased unit in 2006		0.253***	
		(0.0876)	
Purchased unit in 2007			ref. group
Purchased unit in 2008			-0.0562
			(0.0821)
Purchased unit in 2009			-0.0661
			(0.125)
Constant	1.722***	1.389***	1.663***
	(0.336)	(0.361)	(0.528)
Number of observations:	2361	2675	1261
R^2	0.127	0.128	0.143

[c] Note: ** p<.10, ** p<.05, *** p<.01.* Standard errors are in parentheses. The mortgage-to-income ratio regressions have smaller sample sizes because outlying ratios were omitted (i.e. *0.1<ratio<10*). Table omits coefficient estimates for the following control variables (which were included in the estimations): gender, age, race, ethnicity, marital status, and education level of respondent; spouse's age and education level; number of children in the household; census region; MSA classification.

TABLE A.4

Interaction model results for purchase price and mortgage-to-income ratio (full sample)[d]

Dependent variable:	log(Purchase price)		Mortgage/Income ratio	
	(1)	(2)	(3)	(4)
Main reason chose nbhd. (ref. group: Other)				
All reasons equal				
(Pre-bubble)		-0.0654		0.0332
		(0.0575)		(0.137)
(Bubble)		0.132*		0.121
		(0.0797)		(0.187)
(Bust)		0.0359		-0.0985
		(0.0800)		(0.190)
For specific housing unit				
(Pre-bubble)		0.0113		0.0466
		(0.0196)		(0.0451)
(Bubble)		0.00589		-0.122
		(0.0547)		(0.106)
(Bust)		-0.117**		-0.156
		(0.0591)		(0.143)
Convenient to job				
(Pre-bubble)		-0.0114		-0.0205
		(0.0226)		(0.0449)
(Bubble)		0.0221		-0.0551
		(0.0654)		(0.119)
(Bust)		-0.106		-0.136
		(0.0668)		(0.137)
Looks/design of neighborhood				
(Pre-bubble)		0.0479**		0.0235
		(0.0206)		(0.0414)
(Bubble)		0.106**		0.0363
		(0.0502)		(0.105)
(Bust)		-0.0422		-0.214
		(0.0573)		(0.132)
Convenient to friends/family				
(Pre-bubble)		-0.0262		-0.0239
		(0.0233)		(0.0513)
(Bubble)		0.102*		0.131
		(0.0563)		(0.135)
(Bust)		-0.106		-0.0721
		(0.0745)		(0.177)
Good Schools				
(Pre-bubble)	**0.0330**	**0.0277**	**0.0370**	**0.0171**
	(0.0244)	**(0.0234)**	**(0.0451)**	**(0.0474)**
(Bubble)	**0.115*** **	**0.172*** **	**0.148**	**0.172**
	(0.0414)	**(0.0560)**	**(0.0974)**	**(0.120)**
(Bust)	**-0.0597**	**-0.114***	**-0.0251**	**-0.112**
	(0.0504)	**(0.0640)**	**(0.126)**	**(0.156)**
Purchase period (ref. group: during pre-bubble (2000-2002))				
During bubble (2003-06)	0.211***	0.164***	0.477***	0.480***
	(0.0198)	(0.0431)	(0.0401)	(0.0826)
During bust (2007-09)	0.267***	0.335***	0.450***	0.569***
	(0.0211)	(0.0444)	(0.0475)	(0.102)
Number of observations:	6475	6475	6297	6297
R^2	0.373	0.376	0.132	0.134

[d] Note: * *p<.10*, ** *p<.05*, *** *p<.01*. Standard errors are in parentheses. The mortgage-to-income ratio regressions have smaller sample sizes because outlying ratios were omitted (i.e. *0.1<ratio<10*). For brevity, estimates of parameters α and β are omitted. Only columns (1) and (2) include an income covariate, and only columns (3) and (4) include a mortgage term covariate.

TABLE A.5
Summary statistics for key variables (by treatment and control groupings)[e]

	No – "Good Schools"						Yes – "Good Schools"					
	Pre-bubble: 2000-2002		Bubble: 2003-2006		Bust: 2007-2009		Pre-bubble: 2000-2002		Bubble: 2003-2006		Bust: 2007-2009	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Race/ethnicity:												
White*	0.84	0.36	0.86	0.34	0.84	0.36	0.81	0.40	0.83	0.38	0.80	0.40
Black*	0.08	0.27	0.08	0.27	0.09	0.28	0.08	0.27	0.05	0.23	0.09	0.29
Asian*	0.04	0.19	0.04	0.19	0.05	0.22	0.08	0.27	0.08	0.28	0.07	0.25
Other race*	0.04	0.20	0.02	0.14	0.02	0.13	0.04	0.19	0.03	0.18	0.04	0.20
Hispanic*	0.12	0.33	0.11	0.31	0.09	0.29	0.09	0.29	0.09	0.29	0.12	0.32
Number of children	1.2	1.2	1.3	1.2	1.1	1.2	1.9	0.9	1.8	0.9	1.8	1.1
Married*	0.89	0.32	0.89	0.32	0.88	0.32	0.89	0.31	0.87	0.34	0.84	0.37
Family income (thousands $)	90.3	87.0	93.2	82.9	102.2	83.4	101.2	93.4	108.2	94.0	96.5	68.4
Census region:												
Northeast*	0.13	0.34	0.13	0.34	0.12	0.33	0.18	0.39	0.18	0.39	0.18	0.39
Midwest*	0.25	0.43	0.24	0.42	0.25	0.43	0.25	0.43	0.30	0.46	0.17	0.38
South*	0.38	0.49	0.41	0.49	0.40	0.49	0.33	0.47	0.34	0.47	0.43	0.50
West*	0.23	0.42	0.22	0.42	0.23	0.42	0.23	0.42	0.18	0.38	0.21	0.41
Population density:												
MSA, central city*	0.23	0.42	0.24	0.43	0.25	0.43	0.18	0.38	0.18	0.38	0.16	0.37
MSA, urban*	0.40	0.49	0.40	0.49	0.39	0.49	0.51	0.50	0.48	0.50	0.51	0.50
MSA, rural*	0.19	0.39	0.16	0.37	0.14	0.35	0.21	0.41	0.25	0.43	0.21	0.41
No MSA, urban*	0.06	0.24	0.08	0.27	0.08	0.28	0.05	0.22	0.04	0.20	0.08	0.28
No MSA, rural*	0.12	0.33	0.12	0.33	0.14	0.34	0.05	0.22	0.05	0.22	0.04	0.20
Main reason you chose this neighborhood:												
All reasons equal*	0.05	0.22	0.11	0.32	0.17	0.38						
For specific housing unit*	0.29	0.46	0.26	0.44	0.19	0.39						
Convenient to job*	0.14	0.35	0.14	0.34	0.18	0.38						
Looks/design of nbhd.*	0.25	0.43	0.22	0.41	0.18	0.39						
Convenient to friends/fam.*	0.11	0.31	0.11	0.31	0.10	0.30						
Other*	0.16	0.36	0.17	0.37	0.17	0.38						
Number of observations:	2,113		2,425		1,182		290		344		121	

[e] *Denotes sample proportion rather than sample mean (i.e. dummy variable).

TABLE A.6
Propensity score matching models (grouped by matching algorithm and year-of-purchase)

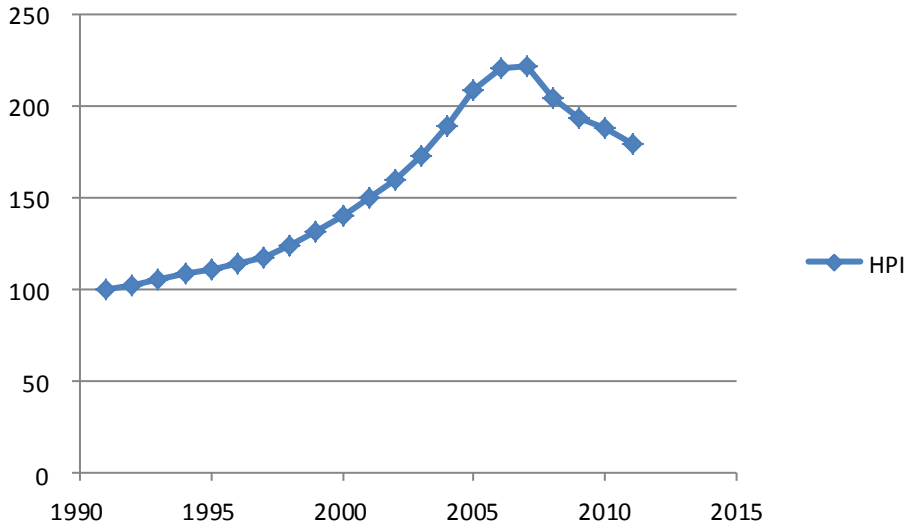
Outcome:	log(initial purchase price)			Mortgage/Income ratio		
	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009
Treatment: Chose neighborhood because of good schools						
Raw (unadjusted) difference	0.2009	0.2906	0.0814	0.0084	0.2414	0.1466
s.e.	0.0489	0.0495	0.0728	0.0772	0.0941	0.1367
mean bias	10.2	12.7	12.1	10.2	12.3	12.4
median bias	6.6	11.2	8.8	6.8	10.6	9.8
Nearest neighbor (n = 1)	0.1049	0.1644	-0.0553	-0.0336	0.1424	0.1360
s.e.	0.0648	0.0648	0.0939	0.1067	0.1351	0.1957
mean bias	6.1	4.5	5.3	5.3	5.2	7.7
median bias	5.5	3.7	4.8	5.3	5.3	6.9
Nearest neighbor (n = 5)	0.0815	0.1495	0.0405	-0.0849	0.1843	0.0624
s.e.	0.0494	0.0529	0.0738	0.0837	0.1065	0.1464
mean bias	2.6	1.8	4.2	2.8	1.9	2.9
median bias	2.4	1.4	4.3	2.1	1.9	2.8
Nearest neighbor (n = 20)	0.0765	0.1578	-0.0071	-0.0617	0.1900	0.0083
s.e.	0.0445	0.0502	0.0681	0.0775	0.1012	0.1405
mean bias	2.1	1.6	2.5	1.8	1.5	2.6
median bias	1.6	1.2	2.2	0.8	1.4	2.6
Radius matching (caliper = 0.01)	0.0697	0.1430	-0.0035	-0.0578	0.1869	-0.0362
s.e.	0.0445	0.0499	0.0685	0.0767	0.1003	0.1409
mean bias	1.6	1.6	2.6	1.6	2.0	1.9
median bias	1.3	1.4	1.3	1.1	1.7	1.5
Kernel matching (bandwith = 0.02)	0.0792	0.1527	-0.0199	-0.0645	0.1689	-0.0260
s.e.	0.0440	0.0492	0.0662	0.0758	0.0991	0.1380
mean bias	1.7	1.6	1.9	1.5	1.6	2.0
median bias	1.5	1.3	1.6	1.1	1.5	2.1

TABLE A.7
Propensity score matching models (robustness check for alternate treatment effects)

Outcome:	log(initial purchase price)			Mortgage/Income ratio		
	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009	Pre-bubble: 2000-2002	Bubble: 2003-2006	Bust: 2007-2009
Treatment: Chose neighborhood because of its looks/design						
Raw (unadjusted) difference	0.1105	0.1591	0.1891	-0.0351	0.0081	-0.1074
s.e.	0.0384	0.0413	0.0564	0.0606	0.0787	0.1069
mean bias	6.4	7.1	10.0	6.4	6.8	9.8
median bias	4.6	4.7	9.3	4.6	4.9	8.2
Kernel matching (bandwith = 0.02)	0.0361	0.1041	0.0636	0.0267	0.0458	-0.0704
s.e.	0.0396	0.0366	0.0554	0.0587	0.0790	0.1067
mean bias	0.7	0.7	1.2	0.7	0.7	2.1
median bias	0.5	0.5	1.0	0.5	0.6	1.9
Treatment: Chose neighborhood because convenient to friends/family						
Raw (unadjusted) difference	-0.2240	-0.1165	-0.2412	-0.0682	0.0776	-0.0803
s.e.	0.0543	0.0557	0.0734	0.0861	0.1056	0.1406
mean bias	9.7	9.3	11.0	9.5	8.9	11.7
median bias	9.5	7.9	10.7	8.5	7.1	11.5
Kernel matching (bandwith = 0.02)	-0.1072	-0.0097	-0.0882	-0.0598	0.1269	-0.0519
s.e.	0.0573	0.0463	0.0749	0.0910	0.1113	0.1591
mean bias	1.3	1.3	2.1	1.3	1.2	2.0
median bias	1.0	1.0	2.0	1.0	0.9	1.5
Treatment: Chose neighborhood for specific housing unit						
Raw (unadjusted) difference	-0.1015	-0.1216	-0.1431	0.0798	-0.1232	0.0006
s.e.	0.0365	0.0391	0.0561	0.0576	0.0740	0.1065
mean bias	6.7	5.5	7.7	6.5	5.6	7.9
median bias	6.4	4.6	6.3	6.0	3.9	6.1
Kernel matching (bandwith = 0.02)	-0.0254	-0.0735	-0.0585	0.0653	-0.1433	-0.0535
s.e.	0.0336	0.0421	0.0558	0.0626	0.0745	0.1148
mean bias	0.8	0.8	2.0	0.7	0.8	1.8
median bias	0.8	0.6	1.8	0.6	0.6	1.8

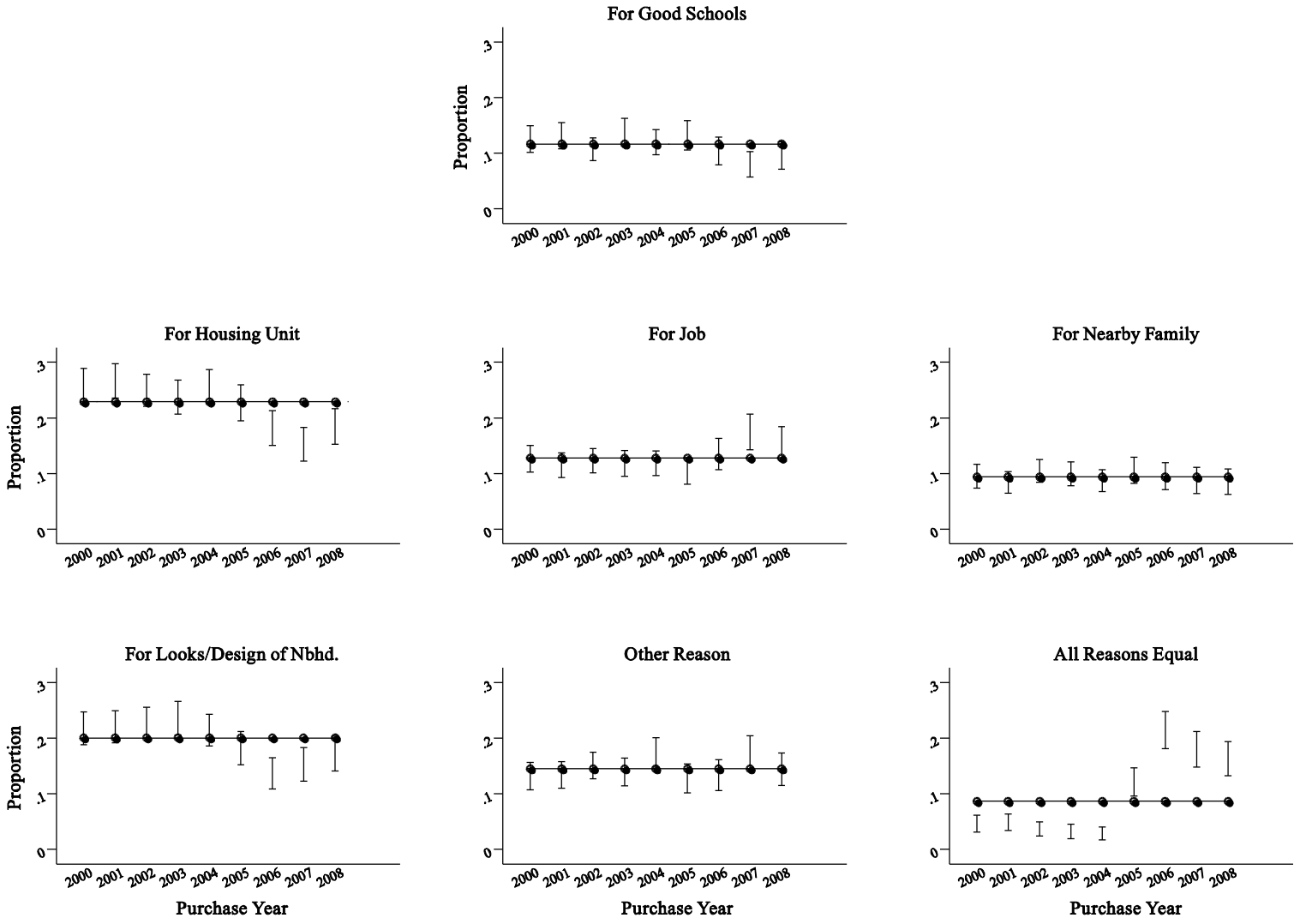
B. **APPENDIX**

FIGURE B.1



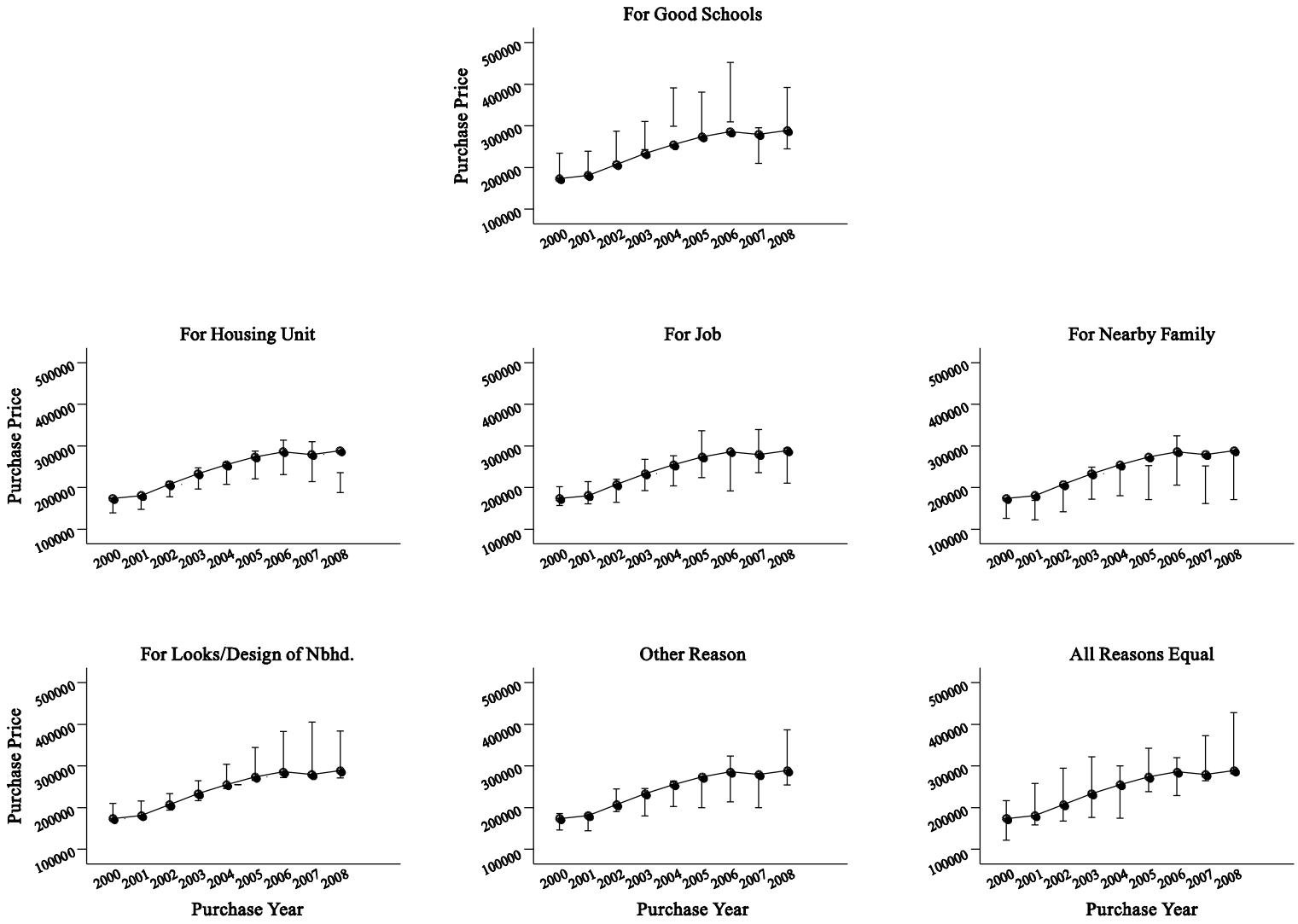
Caption: Housing price index (HPI) 1990 – 2012 (1991=100). (Source: Federal Housing Finance Authority)

FIGURE B.2



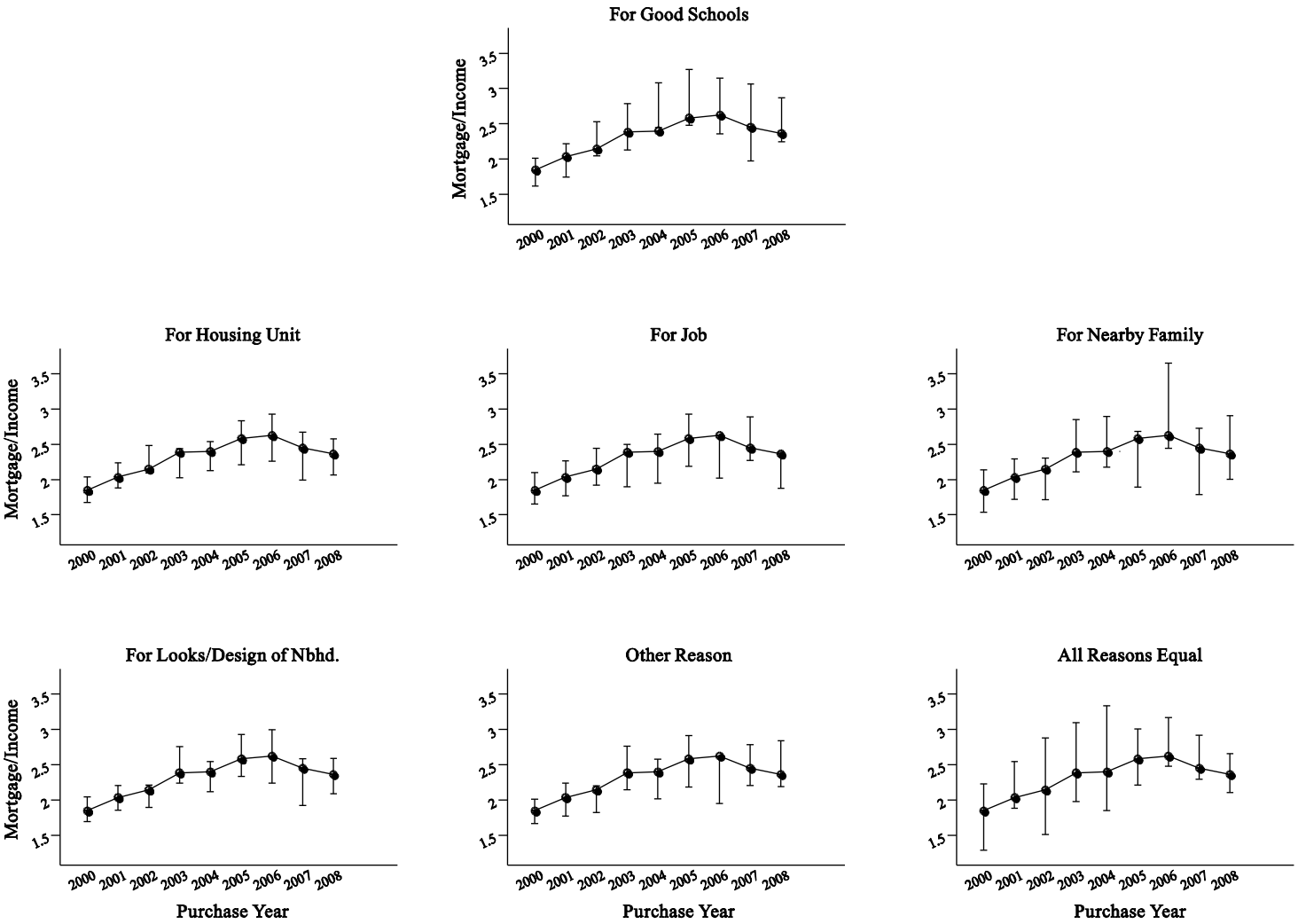
Caption: Sample proportions of all seven primary reasons for a home purchase. Connected dots represent the primary reason's proportion from the full sample. Brackets represent 95 percent confidence intervals for year-specific proportions.

FIGURE B.3



Caption: Connected dots are the same series in each plot; they represent the year-specific average purchase prices from the full sample. Brackets represent 95 percent confidence intervals for year-specific mean purchase price, grouped by the seven primary reasons for a home purchase.

FIGURE B.4



Caption: Connected dots are the same series in each plot; they represent the year-specific average mortgage-to-income ratios from the full sample. Brackets represent 95 percent confidence intervals for year-specific mean mortgage-to-income ratio, grouped by the seven primary reasons for a home purchase.