The Effect of Housing Wealth on College Choice: Evidence from the Housing Boom

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Abstract

The higher education system in the United States is characterized by a large degree of quality heterogeneity, and there is a growing literature suggesting students attending higher quality universities have better educational and labor market outcomes. In this paper, we use the difference in the timing and strength of the housing boom across cities to examine whether recent high school graduates whose parents experienced a short-run increase in their home price were more likely to attend a higher-quality college or university. We employ restricted-use NLSY97 data containing information on post-secondary institutions attended and MSA in which respondents lived in 1997 as well as detailed demographic information and AFQT scores that allow us to control for virtually all of the confounding relationships between housing price growth and college attendance decisions that do not operate through the wealth afforded by increased home values. Our findings indicate a $10,000 increase in a family's housing wealth in the four years prior to a student becoming of college-age increases the likelihood he attends a flagship public university relative to a non-flagship public university by 0.2 percentage points and decreases the relative probability of attending a community college by 0.6 percentage points. There is no effect of home price growth on selection into private universities, however. By splitting our sample into different income groups, we show these effects are driven by relatively low-income families. We also estimate the effect of home price growth on the resource measures students are exposed to in college; short-run increases in home prices lead to substantial increases in the SAT scores, faculty-student ratios, institutional graduation rates, and per-student expenditures of the institutions students attend. For the lower-income sample, home price increases also are associated with an increased likelihood of completing college.

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1 Introduction

The higher education system in the United States is characterized by a large degree of stratification across sectors in both resources and student outcomes. The labor market returns to graduating from an elite public or private institution are high and have grown substantially over time (Brewer, Eide and Ehrenberg, 1999; Black and Smith, 2004; Black and Smith, 2006; Hoekstra, forthcoming).[1] The higher level of resources at elite public and private institutions also translate into more favorable student outcomes, including higher completion rates (Bound, Lovenheim and Turner, forthcoming) and lower time to degree (Bound, Lovenheim and Turner, 2010). Furthermore, there is considerable evidence that the type of institution in which students initially enter the postsecondary education system affects the likelihood of graduation and future wages.[2]

Given these large returns to college quality, little work has been done examining how students make decisions about which college to attend and, in particular, what role household finances play in this decision. Long (2004) uses conditional logit models to show that students are decreasingly price-sensitive and increasingly quality-sensitive over time in deciding which colleges to attend. Belley and Lochner (2007) show a sizeable income gradient in the probability of attending a four-year college conditional on any college enrollment using the 1997 National Longitudinal Survey of Youth (NLSY97), which suggests family income is an important determinant in explaining the selection of students across two and four-year schools.

This paper examines the effect of housing wealth changes experienced by families in the time period prior to their children becoming of college-age on the type and

[1] Dale and Krueger (2002) find much lower returns to attending a higher average SAT university overall, but show sizeable impacts for students from lower-income families. Furthermore, they show that students attending schools with higher tuition have higher returns, which is consistent both with a positive return to school quality and with a human capital model in which students with lower returns are priced out of the more expensive schools.

[2] For evidence on the negative effect of beginning college at a two-year school, see Reynolds (2009) and Rouse (1995). Bound, Lovenheim and Turner (forthcoming) also show that even conditional on institutional resources, BA completion rates are much lower at community colleges and less selective four-year public schools than at elite public and private institutions. Kurlaender and Long (2009) find that students who initially attend a community college are 14.5% less likely to obtain a BA within 9 years using data from Ohio.

quality of postsecondary institutions the children attend. We make several contributions to the literature. First, we examine the effect of housing price changes on the quality of colleges students attend both across the community college and four-year sectors and within the four-year sector. In particular, we estimate the effect of housing wealth on the likelihood a student attends a flagship public university, a private university or a two-year college, all relative to the likelihood of attending a non-flagship public university. This is the first paper to explicitly estimate how family resources affect how students choose between all of the different types of schools available to them within their home state, rather than focusing only on the two-year, four-year margin or on the extensive margin of college enrollment. Second, instead of examining conditional income gradients, we use quasi-experimental variation in home prices generated by the most recent housing boom to identify the effect of household wealth on college choice. Lovenheim (2009) uses similar variation to identify the effect of housing wealth on the extensive margin of college enrollment, which is based on the exogeneity of the timing and geographic variation in the magnitude of the housing boom. We focus on how this type of wealth variation influences the intensive margin of college choice, which as previously discussed is an important policy parameter given the evidence suggesting large labor market and educational returns to attending different types of colleges. Finally, we are able to examine directly how housing wealth affects the collegiate resources students experience while enrolled due to the type of college they choose, and we analyze whether housing price growth leads to more favorable educational outcomes.

We quantify the effect of individual-level home price growth that is driven by MSA-level home price changes on college choice using restricted-use NLSY97 data that provide detailed information on post-secondary institutions attended and the Metropolitan Statistical Area (MSA) in which the student's family lived in 1997 as well as AFQT scores and student demographic characteristics. We estimate multinomial logit models of the likelihood of attending a flagship state university, a private

university or a community college, with non-flagship public four-year schools as the omitted category, as a function of home price growth in the four years prior to a student turning 18. We also control for a detailed set of student background characteristics that include AFQT scores and state fixed effects. We find a $10,000 increase in home prices in these four years increases the relative probability of attending a public flagship by 0.2 percent and decreases the probability of attending a community college by 0.6 percent. We find no effect of home price growth on selection into private universities. We split our sample into three income groups and find that the effect of short-run housing wealth changes on enrollment decisions is largest for student from households earning less than $75,000 per year. The effect of home price growth on selection into flagship public schools also is evident among households earning between $75,000 and $125,000 per year, but there is no evidence that college choices of students from households with income over $125,000 per year are sensitive to short-run home price variation.

We examine whether the cross-sector changes in student selection brought about by home price changes are manifested in changes in overall enrollment across these sectors or, alternatively, whether the housing boom simply reshuffled students across sectors. Consistent with more selective universities being less demand-responsive, we find that total first-year enrollment in flagship public universities is unresponsive to home price changes in the state. However, total enrollment in non-flagship public schools and community colleges increases substantially, which can be explained largely by increased applications.

The effect of home price changes on selection across sectors translates into sizeable increases in institutional quality and resources for affected students, particularly since the average homeowner experiences a four-year $52,000 increase in home prices during our sample period. A $10,000 increase in home prices in the four years prior to a child turning 18 increases the 25^{th} percentile SAT score of the institution she attends by 1.5 points, increases the faculty-student ratio by 0.0004, increases expenditures

per student by $441 and the institution-average graduate rate by 0.003. In the four-year public sector, housing price increases also are associated with students attending institutions with higher tuition. These effects are largest for families with household income below $75,000 per year, suggesting housing price growth serves to increase the quality of the institutions attended by lower-income families. Using institution-level data on resources and state-average housing prices, we show that state-average home price growth has at most a small effect on institutional resources themselves, which indicates that our analysis using the NLSY97 data is identifying a change in institutional quality experienced by the student because of changes in student selection.

Finally, we present evidence that short-run housing price growth in the time period prior to children being of college age is positively associated with the likelihood of obtaining a BA and a shorter time between high school and college. The effect on BA completion is strongest for the lowest-income households in our sample. These estimates are consistent with the increased college quality students experience due to housing wealth increases improving collegiate educational outcomes.

The sum total of the evidence we present in this paper strongly suggests that the quality of colleges students attend, however defined, is affected by short-run variation in families' housing wealth. That the effects are most prevalent for relatively lower-income households is suggestive of potential credit constraints that affect students' decisions of where to enroll in college. Though our estimates could reflect the existence of consumption value of college quality, the heterogeneity we observe across the income distribution we believe is more consistent with a credit constraint interpretation of the evidence. Regardless of whether one can separate the consumption versus credit constraint hypotheses with our data, our findings indicate college choices are sensitive to family housing wealth variation, which has important implications given the collapse of the housing market in many areas and the severe reduction in home price growth in others. To the extent decisions about where to attend influence the

likelihood of graduation, which both we and previous literature present evidence they do, the burst of the housing bubble could have long-run consequences for the stock of college-educated labor in the United States.

The rest of this paper is organized as follows: Section 2 discusses the data we use in our analysis. Section 3 presents our empirical models and provides a discussion of identification. Results are shown in Section 4, and Section 5 concludes.

2 Data

2.1 NLSY97 Data

The data we use for this analysis come from the restricted-access National Longitudinal Survey of Youth 1997 (NLSY97), which contains detailed information on post-secondary colleges attended by respondents and the Metropolitan Statistical Area (MSA) in which they lived in 1997. The NLSY97 is a nationally-representative survey of children age 12 through 18 in 1997. Respondents are interviewed initially in 1997 and then yearly thereafter until 2007, which is the most recent follow-up available.

The NLSY97 data contain detailed family background and student demographic information, including mother's and father's education levels, family income, respondent race and gender. For mother's and father's education, we include dummy variables indicating highest level of schooling completed: no high school diploma, high school diploma (or GED), some college, and BA or more. We also include dummy variables to indicate whether mother's and father's education is missing in the data. While 10.8% of the sample do not have a valid father's education level, only 4.4% are missing information on mother's education. The difference between these missing rates most likely reflects the prevalence of single-parent families with no father present. Approximately 16.6% of the sample also is missing family income information. We include a dummy variable for missing income in our empirical specifications

below for sample size considerations. Note that in no case is this dummy variable statistically significant, suggesting income is missing conditionally at random; all of our estimates and conclusions are robust to omitting those with no income data.

One of the major advantages of the NLSY97 is that respondents were given the Armed Forces Qualifying Test (AFQT) in 1997, which is a comprehensive test of cognitive skills. Together with controls for parental education and income, these test scores allow us to control for the ability level of students, which is correlated with college choices and potentially with housing price growth. About 16% of the sample of respondents who attend college do not have AFQT scores. Due to the importance of controlling for selection into different school types based on underlying college preparation, we exclude these respondents from our analysis. This exclusion is common in the literature (e.g., Belley and Lochner, 2007; Cameron and Taber, 2004; Carneiro and Heckman, 2002).

We further limit our sample to those who attend college within two years of their high school graduation and who are 17 or younger in 1997.[3] In the NLSY97, 9.7% of respondents who attend college do so more than 2 years post-high school graduation. The reason we condition on attending college within two years of high school graduation is so that we can more directly link home price changes while respondents are in high school to their subsequent college choices. Given the small number of students who delay attendance beyond two years, this restriction has little affect on our results and conclusions.

2.2 Measuring Housing Prices

The main variable of interest in this analysis is the four-year home price change of students' families prior to the student turning 18. We focus on this variable rather than home price levels because the price of a home can bear little relationship to

[3]Less than half a percent of the sample is 18 in 1997, so this restriction has negligible consequences for our results.

the amount of equity a family has in a home.[4] Because all home price increases are capitalized into equity, we examine the four-year change in home prices during the high school years.

In the NLSY97, housing information only is collected in 1997. We take the self-reported 1997 home prices reported by the parents and calculate predicted home values in each calendar year using the MSA-level Conventional Mortgage Housing Price Index (CMHPI). The CMHPI is a home price index created from all mortgages securitized by Fannie-Mae and Freddie-Mac for repeat-sale, single family homes. It is a widely used home price index in the housing literature[5] and provides a consistent measure of the MSA-average home price change in each year. The home price of homeowner i in MSA j in year t is calculated as:

$$\hat{P}_{ijt} = P_{ij1997} * \frac{CMHPI_{jt}}{CMHPI_{j1997}}. \tag{1}$$

Note that this method does not allow any within-MSA variation in home price growth rates in a given year. Instead, all growth rate variation is coming from differential home price changes across MSAs and within MSAs over time. We calculate the four-year change in home price for each homeowner in 1997 as $\hat{P}_{ijt} - \hat{P}_{ijt-4}$. For all renters in 1997, the four-year change in home values is set to zero. However, we also create a homeowner indicator variable that equals 1 if the student's family owned a home in 1997 and equals zero otherwise. Because our home price change measure requires information about aggregate MSA-level home prices, we additionally limit the sample to respondents who live in an identified MSA, which eliminates a further 4.7% of the sample. Our final analysis sample contains 2,764 students.

[4]Both Lovenheim (2009) and Lovenheim and Mumford (2010) find little behavioral response to home price levels but show that families respond to variation in home price changes. This finding is consistent with the importance of measuring housing wealth, not simply housing prices.

[5]Lovenheim (2009) and Dynarski (2002) both use this home price index to study the effect of home prices on college attendance, for example.

2.3 Institutional-level Data and Student Outcomes

We categorize students into four mutually exclusive sectors of higher education: non-flagship public four-year schools, flagship public universities, private four-year institutions and community colleges. Assignment to institution type is based on the UNITID code of the first postsecondary institution at which a student enrolled after high school. Appendix Table A-1 contains a list of public flagship universities. In most cases, determining which institution is the flagship university is straightforward; flagship schools typically report that they are so on their websites. In several states, however, there is not a designated flagship university. In California, the University of California system is considered a flagship system, but we assign University of California at Berkeley and University of California at Los Angeles as the two flagship universities in the state. In Texas, there are two flagship universities: University of Texas at Austin and Texas A&M. Finally, in New York, there is no designated flagship. We assign State University of New York at Binghamton and the statutory colleges of Cornell University as the flagship state institutions.

For each initial institution attended by a respondent, we merge in a set of mean institutional quality characteristics using Integrated Postsecondary Education Data System (IPEDS) data from 1997 through 2003, corresponding to the years of college entry in our sample. We construct averages over time of all measures within institutions due to item non-response by institutions in different years. Using averages thus allows us to maximize the number of institutions at which we can measure collegiate characteristics. We show below that institutional quality does not respond to home price growth, suggesting that the use of average measures over much of our sample period does not create a mechanical positive relationship between home price changes and quality measures of the institution.

The quality measures we use are 25^{th} and 75^{th} percentile of the SAT scores,[6]

[6]For those schools only supplying ACT scores, ACT scores were converted to SAT equivalents using concordance tables developed by the ACT.

faculty-student ratios, total expenditures per student, instructional expenditures per student, institutional graduation rate, in-state posted tuition and out-of-state posted tuition. We use multiple measures of collegiate resources and quality because no one variable constitutes an accurate proxy for quality.[7] Table 1 presents means of these measures by our four higher education sectors, which are undergraduate-enrollment weighted averages across all higher education institutions in the IPEDS surveys. Focusing on the first two columns, there is a clear quality difference between flagship public schools and non-flagship public four-year schools. The flagship institutions have higher SAT scores, with a 71 point difference in the 75^{th} percentile. Faculty-student ratios are 54% higher in the flagship public schools, and both total and instructional expenditures per student are substantially larger as well. These large resource and quality differences across schools, even within the public four-year sector, are consistent with the high returns to attending a flagship public university found in previous studies (Hoekstra, forthcoming; Brewer, Eide and Ehrenberg, 1999) and reinforce the importance of understanding how students select across different types of institutions.

Critically, the flagship public institutions also are more expensive, with an in-state tuition difference of $1210 per year and an out-of-state tuition difference of $4104. Although this calculation omits financial aid, at least with regards to posted tuition, these means suggest students must pay more to access the higher quality and resources available at the state's flagship university.

There also are substantive differences across public and private schools as well as between two- and four-year schools that are evident in Table 1. Due to sample size limitations, we do not split the private sector by selectivity (all of our results are unchanged by splitting the private sector in this manner). For the resource and quality measures, the four-year private schools on average are very similar to the public schools. However, they are significantly more expensive. The two-year sector

[7] See Black and Smith (2006) for a detailed discussion of college quality measures and measurement error.

is characterized by much lower resources per student but also by a significantly lower cost of attendance than the four-year sector. Focusing on the public sector, moving from a community college to a non-flagship four-year college to a flagship public university, which describes the relevant choice set for the vast majority of students, entails significant increases in per-student resources and institutional quality while raising attendance costs through higher tuition.

2.4 State-level Variables

In addition to the NLSY97 data, we create several state-level measures that allow us to control for macroeconomic conditions and higher education supply-side conditions in the state that may be correlated both with the type of colleges students attend and housing wealth. We control for state macroeconomic conditions using the state-by-year unemployment rate and real per-capita income, both calculated from Bureau of Labor Statistics data. We further control for the number of four-year and two-year institutions per 18-24 year old in the state and year in order to control for potential demand shocks correlated with the size of the college-age population. Using CPS Outgoing Rotation Group data, we construct the ratio of hourly wages of 25-55 year olds with a BA to the hourly wages of 25-55 year olds with an AA degree. We construct a similar wage ratio for those with a BA compared to those whose highest level of educational attainment is a high school diploma. These hourly wage ratios measure the relative returns to different broad educational options that could affect student enrollment decisions. Finally, we control for real need-based aid per student provided by the state, calculated from National Association of State Student Aid Providers (NASSGAP) surveys. All state-level variables are measured as of when each respondent is 17 years old. These variables all vary at the state-by-cohort level, where each cohort is defined by respondent age in 1997.

2.5 Descriptive Statistics

Means and standard deviations of the variables used in this analysis for our analysis sample are presented in Table 2. We present means for the full analysis sample and by income group: low income are households with family income under $75,000, middle income are households with total real income between $75,000 and $125,000 and high income households are those with real income above $125,000.[8] The means and standard deviations by income group exclude respondents with missing income information.

The mean four-year home price change among homeowners in the sample is over $52,000, with a standard deviation larger than the mean. These tabulations underscore the large variation in home prices that occurred over this time period. While these increases were largest for the highest income households, at over $85,000, both lower and middle income homeowners experienced large relative home price increases of about $32,000 and $50,000, respectively. Furthermore, note that homeownership rates are high overall and across all income groups. The lower income sample has an ownership rate of 65%, and 94% of middle and higher income households own their own homes. While these homeownership rates are higher than the U.S. average, which is about 65%,[9] this sample is comprised of families with adolescent children whose parents are more likely to be homeowners than the average adult. Furthermore, the sample contains only families whose child attends college,[10] and these families are higher income, better educated and more likely to own a home than families whose children do not attend college. Given the high percentage of homeownership in this sample, the large variation in home prices during the housing boom substantially affects the household resources available to the vast majority of respondents.

[8] All financial variables in this analysis are inflated to real $2007 using the CPI-U.

[9] Authors' tabulation from the Current Population Survey.

[10] Lovenheim (2009) shows that the extensive margin is also responsive to housing wealth increases, so this sample restriction may bias our estimates. However, all of our results and conclusions are robust to including non-attenders in the sample.

Table 2 also shows the distribution of attendance patterns across the four sectors of higher education discussed in Section 2.3. Within the four-year sector, public non-flagship schools enroll the largest proportion of students, followed by the private sector and then the flagship publics. For example, while 32.2% of attendees enroll in a non-flagship public school, only 8.6% enroll in a flagship. The largest single sector is comprised of community colleges, at 40.2%. Enrollment trends across the income distribution largely conform to expectations, with community college enrollment declining with family income and flagship enrollment rising. For the lowest income group, flagship enrollment is 5%, while for the highest income group it is 19%, an almost fourfold increase across groups. Private sector enrollment exhibits similar patterns, though less dramatic, over the income distribution. Non-flagship public enrollment is non-linear across income groups: it rises from 29.1% to 37.7% from low to middle income and then declines to 32.6% for the high income group. The differences across the income distribution in college selection patterns illustrate that exposure to institutional quality and resources varies substantially by parental income. Some of this difference likely is due to the positive correlations among family income, AFQT scores, parental education and admission to higher-quality schools, but these differences are at least suggestive of a role for family resources in affecting where students enroll in college. The remainder of this paper seeks to identify the effect of such resources empirically, using housing wealth variation supplied by the housing boom.

3 Empirical Methodology

We begin our empirical analysis by estimating the effect of housing price changes on the types of colleges students attend. Assume students have a choice over J alternatives for the type of college to attend and that each college type has associated with it a different labor market return, W_j, a different quality level, q_j, and a different

cost, C_j. Consistent with Table 1 and with previous studies showing large labor market returns to college quality (Hoekstra, forthcoming; Black and Smith, 2006; Brewer, Eide and Ehrenberg, 1999), we assume both attendance costs and returns are increasing in the quality of the institution.

A straightforward human capital model predicts that students will enroll in the school that maximizes their net return. For simplicity, first assume there is no consumption value to college quality. In this case, a student will enroll in the institution to which they are admitted with the highest net rate of return ($W_j(q_j) - C_j(q_j)$). With perfect access to credit, changes in family resources should not affect this decision – students are able to borrow at their internal rate of return to the investment. However, because one cannot collateralize human capital, it may not be possible to borrow at one's rate of return, which creates the possibility for a binding credit constraint to affect college choice.

More generally, let $j_i^* = max(j \in J)$ be the college choice that student i makes. By revealed preference:

$$j_i^* = j_i \text{ iff } U(j_i) > U(k_i \neq j_i) \tag{2}$$

In other words, j_i^* is chosen to maximize student i's utility. If education is purely an investment good, this problem reduces to maximizing net returns across the different college choices. Critically, this decision is independent of family resources, as it only is a function of net returns from attending institution j. Without credit constraints, this net return relies only on one's internal rate of return to attending this institution, as by definition unconstrained students can borrow at this rate. If there is consumption value to schooling, and in particular to college quality, then home price changes also can influence college enrollment through an income effect, regardless of whether there are liquidity constraints.[11] We seek to identify the causal effect of short-run

[11]Lovenheim (2009) shows evidence using the PSID that food, automobile and leisure consumption is largely unresponsive to home price and wealth changes for families with college-age children. This evidence suggests that income effects are unlikely to explain any positive relationship between home price changes and college enrollment decisions. Furthermore, it is unclear whether home price increases represent an increase in real wealth for homeowners;

home price changes on students' college enrollment decisions. This is an important policy parameter independent of whether it is driven by liquidity constraints or an income effect, especially given recent large fluctuations in the housing market.

The time period of our analysis, which uses home price variation over the period 1993 (four years prior to the 17-year-old cohort turning 18) to 2003 (when the 12-year-old cohort turns 18) is particularly appropriate to identify the effect of housing wealth on the college choices of students because this time period coincides with a large increase in home prices in many areas. Between 1993 and 2003, the CMHPI home price index increased by 121% nationally and did so unevenly across cities. For example, home prices in New York City increased by 194% but only increased by 38% in Rochester and 52% in Syracuse. Miami home prices rose by 276%, while prices in Jacksonville increased by 185% and in Tallahassee increased by 136%. These tabulations underscore the differences across cities within states in growth rates as well as the existence of a state-level component in the amount of price growth.

Housing wealth also became much more liquid over this time period. This increased liquidity has been well documented by researchers and in the popular press; towards the turn of the millennium, it became much easier for families to extract the wealth from their homes using cash out refinances, home equity loans, and home equity lines of credit. Figure 1 presents extracted home equity from 1990-2004 as a percent of per-capita income, taken from Federal Reserve Board flow of funds data reported in Greenspan and Kennedy (2005). Over this period, home equity extractions as a percentage of per-capita income rose from 2.16 in 1990 to 11.67 in 2004, an increase of over 439 percent. The open-circle line shows this ratio deflated by the CMHPI and suggests about half of the increase in equity extraction can be explained by rising home prices, which implies that the other half of the increase indicates a

home price changes within cities are highly correlated, and home price changes also covary positively with cities to which people are likely to move (Sinai and Souleles, 2010). Thus, a 10% increase in home prices is unlikely to make one wealthier because the cost of housing consumption also has risen by 10%. In order to realize this wealth increase, one must sell one's home and move to a location in which home prices have not exhibited such changes. Sinai and Souleles (2010) argue these types of moves are uncommon in the data.

shift in the ease of extracting the wealth from one's home.[12] Home equity liquidity increased the most between 1997 and 2002, the period when most of the respondents in our sample are making college decisions. Thus, if enrollment decisions are sensitive to housing wealth fluctuations, it should be most apparent in the time period we are studying, because home prices rose dramatically as did the liquidity of the wealth generated by these rising prices.

In order to test whether home price changes in the four years prior to a child becoming of college age affects her decision of where to enroll, we estimate multinomial logit models of the following form:

$$P(j^*_{isc} = j_{isc}) = \beta_0 + \beta_1 Own_i + \beta_2 \Delta P^h_i + \gamma X_i + \alpha Z_{sc} + \theta_s + \psi_c + \epsilon_{isc}, \tag{3}$$

where i indexes family, s indexes state and c indexes cohort. The cohort of each respondent is defined by age in 1997. The variable Own is a dummy variable equal to 1 if the respondent's family owns their home in 1997, and ΔP^h_i is the four-year real home price change in the time period prior to the respondent turning 18. The vector X is comprised of the set of individual and family background characteristics listed in Table 2, and Z is a vector of state macroeconomic variables and state higher education provision measures that are presented in Table 2 as well. Equation (3) also contains state fixed effects (θ) and cohort fixed effects (ψ). Note that because cohorts are defined as of 1997 and because the variables in Z are measured as of when each respondent is 18, one can interpret the cohort fixed effects as a type of year fixed effect that describe national economic and higher education conditions when respondents first become eligible for college enrollment.

We estimate the multinomial logit model given by equation (3) using our four school-type categories discussed in Section 2.3: non-flagship public universities, flagship public institutions, private four-year schools and community colleges. For all of our estimates, the non-flagship public sector is the omitted category. The parameter

[12] See Lovenheim (2009) for a discussion of why liquidity increased over this period.

of interest in this analysis is the marginal effect of a $10,000 change in home values over the four years before a child turns 18 on the likelihood she enrolls in a given type of university. This marginal effect is a function of the β_2 estimate for each outcome, which are our parameters of interest in equation (3).[13] In order for equation (3) to identify these parameters, the change in housing values must be conditionally exogenous to enrollment decisions. Put differently, the home price increases must be uncorrelated with unobserved factors that affect where students decide to enroll.

The most likely characteristic driving selection is student ability or preparation for college. The NLSY97 is a particularly useful data set to address such selection because it contains AFQT scores as well as parental background characteristics, such as income and education, all of which can be used to control for student ability. Student AFQT scores have been used extensively in previous work to control for student selection in studies examining the effect of liquidity constraints on the extensive margin of college enrollment (e.g., Carneiro and Heckman, 2002; Belley and Lochner, 2007; Cameron and Taber, 2004), and such work has argued convincingly that these tests are a strong proxy for student cognitive abilities.

The home price variation we use to identify β_2 also is plausibly exogenous. This variation comes from two sources. First, as discussed in Section 2, our use of MSA-level home price indices forces all homes within an MSA to grow at the same rate. Thus, much of the identifying variation we use comes from within-MSA changes in home prices over time, and we leverage the fact that our sample is comprised of individuals who become college-eligible at different times and thus experience different short-run home price changes in the time period in which they are making college enrollment choices. The second source is cross-sectional variation across MSAs within states. We include in our model state fixed effects, which control for the fact that student selection into different types of postsecondary schools is systematically different

[13]The formula for the marginal effect of a change in variable x_k on the probability of a given outcome being chosen (i.e., $p(j^* = j|X)$) is $P_j(\beta_{jk} - \frac{1}{J}\sum_{j=1}^{J}\beta_{jk})$, where P_j is the predicted probability of outcome j occurring. So, the marginal effect is a function not only of the parameter value for that specific option but also of the average of all parameter values for that variable.

across states that may be correlated with the size and timing of the housing boom. Allowing for cross-sectional differences in home price growth across MSAs within states could bias our estimates if there are systematic differences across MSAs in school type selection that are correlated with home price growth and uncorrelated with our extensive set of observable respondent characteristics. Using MSA fixed effects would eliminate such variation and would identify equation (3) under less stringent assumptions. However, given the sample size limitations, we were not able to achieve convergence in the multinomial logit model with these fixed effects. Given the richness of our student background controls, including direct ability measures, we believe it unlikely that there are cross-MSA differences in unobserved student ability correlated with home price changes that are driving our results. In addition, we demonstrate below using direct resource and quality measures that using state instead of MSA fixed effects *reduces* the estimated effect of housing price changes. Because the sector definitions we use correlate closely with resource and quality differences among institutions, this finding suggests that using state fixed effects rather than MSA fixed effects actually understates the true relationship between home price changes and college quality selection.

Identification of the β_2 parameters in equation (3) is coming through the differential timing and magnitude of the housing boom across MSAs within states and within MSAs over time. Any factor that would affect both home prices and expected returns to different college types thus could bias our estimates. In particular, high-skilled labor demand shocks could both increase home prices and increase the returns to college quality. In order to address such a possibility, we control for real income per capita and the unemployment rate at the state-by-cohort level. We also control for the state-by-cohort mean of average college graduate wages relative to both high school wages and associate's degree wages. Again, because each cohort is defined by age in 1997, these state-by-cohort means are actually state-by-year means. These wage ratios control for the possibility of high-skilled labor demand shocks that

likely impact individuals' college enrollment decisions and could be correlated with home price growth. Note that we only control for these macroeconomic factors at the state-level, and it is possible that there are labor demand shocks occurring unevenly within states that impact home prices. However, high-skilled labor demand is not highly localized within states within the country (Bound, Groen, Kezdi and Turner, 2004). Thus, to the extent the local demand shock affects all students in the state roughly equally, such within-state changes will not bias our estimates of β_2.[14]

The effect of housing wealth on the types of schools in which students enroll likely varies over the income distribution, especially if such a response is indicative of binding credit constraints. In order to test for heterogeneity based on parental income, we split the sample into the three groups shown in Table 2: less than $75,000 (low income), $75,000 to $125,000 (middle income) and greater than $125,000 (high income). Because we lack the sample sizes necessary to estimate equation (3) separately by income group, we interact income group dummy variables with the home ownership and home price change variables in order to determine whether there are differences across groups. More specifically, our model is as follows:

$$\begin{aligned} P(j^*_{isc} &= j_{isc}) = \beta_0 + \delta_1 I(Low)_i * Own_i + \delta_2 I(Middle)_i * Own_i \\ &+\delta_3 I(High)_i * Own_i + \phi_1 I(Low)_i \Delta P^h_i + \phi_2 I(Middle)_i * \Delta P^h_i + \phi_3 I(High)_i * \Delta P^h_i \\ &+\zeta_1 I(Middle) + \zeta_2 I(High) + \zeta_3 Faminc + \gamma X_i + \alpha Z_{sc} + \theta_s + \psi_c + \epsilon_{isc}, \end{aligned} \tag{4}$$

where all variables are as defined in equation (3). The coefficients of interest in equation (4) are ϕ_1, ϕ_2 and ϕ_3, and we expect $\phi_1 < \phi_2 < \phi_3$ because the effect of a given resource increase should be largest for those families most likely to be constrained. Note that we control for the income group dummies directly in equation (4) as well as real family income level, which allows us to more flexibly control for

[14] As of yet, there is no consensus in the literature regarding why the housing boom varied across cities and over time. Gyourko, Mayer and Sinai (2007) and Glaeser, Gyourko and Saks (2005) suggest that local supply constraints are an important cause of these differences. To the extent that these housing supply constraints are responsible for the temporal and geographic variation in the housing boom, it suggests home price changes are exogenous because such MSA-level constraints are unlikely to be directly related to individual collegiate selection.

income and allows one to interpret the ϕ parameters as marginal changes in the likelihood of attending a given school type for a given income group due to a home price change relative to that income group-specific mean. We exclude all families with missing income from these estimates.[15]

Finally, we examine the effect of housing price changes on direct resource and institutional quality measures students experience at the first postsecondary school in which they enroll. We estimate models of the following form using OLS:

$$Y_{imsc} = \beta_0 + \beta_1 Own_i + \beta_2 \Delta P_i^h + \gamma X_i + \alpha Z_{sc} + \theta_m + \psi_c + \epsilon_{imsc}, \tag{5}$$

where m indexes MSA, the θ_m are MSA fixed effects and all other variables are as previously defined. This model identifies β_2 using only within MSA-level variation in home price growth rates over time, using the fact that different age cohorts in 1997 experienced different short-run home price changes before they turn 18 due to the differential timing and strength of the housing boom across cities. The identifying assumptions underlying identification of β_2 in equation (5) are similar to those in equation (3), but now any selection on unobservables would have to be occurring by families with children of different ages who have unobserved characteristics that make them more likely to go to a higher quality university selecting into MSAs prior to 1997 that will have higher home price growth rates during the child's high school years. Given the richness of the characteristics we observe about students, we believe such selection is unlikely. Furthermore, this model assumes that local labor demand shocks are not driving both college quality decisions and home price changes. Similar to our multinomial logit models, we will estimate a version of equation (5) that includes interactions between income groups and housing measures to determine whether lower income students upgrade college quality more in response to short-run home price variation.

[15]This exclusion does not account for differences between equation (3) and equation (4) estimates. The missing income dummy variable is never significantly different from zero, and results when excluding the missing income group are similar for equation (3). These estimates are available from the authors upon request.

4 Results

4.1 Multinomial Logit Estimates

Marginal effects at the mean of all variables calculated from multinomial logit estimates of equation (3) are shown in Table 3. All marginal effects are relative to non-flagship public four-year institutions, and all standard errors are clustered at the MSA-level to reflect the within-MSA correlation of home price changes. All estimates shown in Table 3 are from one multinomial logit regression.

The table shows a strong relationship between home price changes in the four years before a respondent turns 18 and her decision to attend a more prestigious college or university. A $10,000 increase in home prices increases the likelihood that a student attends a public flagship university by 0.0021 percentage points and reduces the likelihood a student attends a community college by 0.0064 percentage points. The respective baseline attendance probabilities in these sectors were 8.6% and 40.2%, indicating that a $10,000 increase in home prices in the four-years prior to college attendance increase the probability of attending a flagship public by 2.4% (=(0.0021/0.086)*100) and decreases the probability of attending a community college by 1.6% (=(-0.0064/0.402)*100).

We find no effect of 4-year home price changes on the probability a student selects into a private university, which can be partially explained by the fact that private universities are more likely to "tax" home equity for the purposes of financial aid than public universities.[16] It also is possible that the home price increases we observe in the data are not large enough to induce individuals to incur the substantially larger cost associated with attending a private rather than a public university. Table 3 thus indicates that housing wealth changes affect sorting within the public sectors of higher education, not across the public and private sectors. This finding reinforces

[16] In 1992, the federal government exempted home equity from federal financial aid calculations. See Dynarski (2002) for more details on this change. Institutions still can include family housing wealth as a part of institutional support, and although systematic data on which institutions engage in this practice are unavailable, conversations with financial aid officers at various universities suggest private universities are more likely to account for home equity when calculating institutional aid.

the importance of examining how family resources affect college selection within the public sector, which previous work largely has ignored.

Given the variation in home prices over the past decade, these marginal effects translate into substantial changes in college selection. The average homeowner in our sample experienced a four-year home price increase of $52,460, which translates into a 12.6% increase in the probability of attending a state flagship university and a decreased in the likelihood of attending a community college of 8.7%. These average effects mask a large change across cohorts: the average four-year home price increase was $71,088 for the sample of 12-year-olds in 1997. For this cohort, home price increases increased attendance at flagship universities by 17.1% and decreased community college attendance by 11.4%. The marginal effects for housing price growth in Table 3 therefore lead to sizeable shifts in the types and quality of schools students attend, which has important implications given the recent large declines in home prices in many areas of the country.[17]

Table 3 also demonstrates considerable selection by student ability across sectors: those with higher AFQT scores are more likely to attend flagship public and private universities and are much less likely to attend community colleges. Family income also is positively correlated with flagship and private university attendance and is negatively associated with community college attendance. This finding suggests neither family income nor housing wealth are sufficient statistics to characterize the family resources that influence college enrollment choices. Since we lack a natural experiment or instrument to generate exogenous income variation, we do not stress the family income results, however.

Finally, Table 3 shows no strong relationship between state-level macroeconomic factors and postsecondary sector selection. In no case are the estimates statistically

[17]In results not reported, we also have estimated a version of equation (3) that includes college non-attendance as its own category. Consistent with Lovenheim (2009), we find a $10,000 increase in four-year home price growth decreases the likelihood of college non-attendance by 0.12 percentage points relative to attending a public non-flagship university. The marginal effects for other sectors are largely unaffected by the inclusion of non-attenders, so our main results exclude them in order to focus on the sorting decision among college-goers. These results, which are available on request, show that this omission does not bias our estimates.

significant from zero at the 5% level and they often are of the opposite sign than would be predicted if macroeconomic shocks were jointly determining home prices and student enrollment decisions. Overall, these estimates suggest that such local economic shocks are not driving our estimates of β_2.

Table 4 shows estimates of equation (4) that include income group interactions. As in Table 3, all estimates are marginal effects at the mean of all variables and come from one multinomial logit regression. All variables shown in Table 3 are included in the Table 4 results, but many of them are excluded for the sake of brevity.

The estimates in Table 4 indicate a large amount of heterogeneity across income groups and show that most of the estimated effect of home price changes in Table 3 is coming from relatively lower-income households. The probability a student attends a public flagship increases by 0.0033 percentage points for every $10,000 four-year home price increase for families with income under $75,000. This estimate is statistically significantly different from zero at the 5% level. Furthermore, families earning between $75,000 and $125,000 also are more likely to send their child to a flagship university, although the marginal effect is smaller at 0.0023. We find a small and statistically insignificant effect of home price growth on flagship attendance among families with incomes over $125,000. It is only among lower-income families that community college attendance is influenced by home price changes. The estimated marginal effect is large, however, suggesting a $10,000 increase in four-year home price growth leads to a 0.02 percentage point decline in community college enrollment. Even for the private sector, the point estimates are consistent with a positive effect of home price growth on selection into this sector relative to the non-flagship public sector for lower-income students. But, the marginal effect is not precisely estimated, so it is largely inconclusive. However, taking the estimates for the lower-income group at face value, these marginal effects imply sizeable changes in college attendance patterns among these students due to home price increases. Multiplying these estimates by the average four-year home price change for the lower-income

sample of $32,160 (see Table 2) yields an average relative increase in the likelihood of flagship enrollment of 1.1 percentage points (off of a baseline of 5.0 percentage points), an average relative increase in the likelihood of private enrollment of 1.1 percentage points (off of a baseline of 16.3 percentage points), and an average relative decrease in the likelihood of community college enrollment of 6.5 percentage points (off of a baseline of 49.6 percentage points). Overall, Table 4 demonstrates that it is among the relatively lower-income sample that the response to home price increases is the largest. This finding in particular is suggestive of a liquidity constraint interpretation of the evidence, as if we were identifying an income effect one would expect it to affect decisions across the income distribution.

An important question left unaddressed by the results in Tables 3 and 4 is whether the changing selection induced by housing price growth was accompanied by an expansion or contraction of certain higher education sectors or rather whether students were simply re-sorted. Table 5 presents state-level estimates of the relationship between CMHPI growth and public sector enrollment in the three public sectors in our analysis.[18] Each cell of the table represents a separate regression of the log enrollment measure on log CMHPI at the state level. All regressions include institutional dummy variables, year fixed effects, and controls for state unemployment rate and real per capita income.

The estimates indicate that home price increases at the state-level were accompanied by a significant expansion of the non-flagship public sector. This increase was driven by increases in both applications and admissions; when state home prices rise, students in that state are more likely to apply to a less-selective four-year college and be admitted. Ostensibly, this sector is expanding because students who would have gone to a two-year school absent the home price increase now attend a non-flagship four-year public. In addition, this result is consistent with an increase in the number of students who attend college when home prices increase; since the non-flagship

[18] We exclude the private sector because it is unlikely to be responsive to own-state growth in home prices due to the more national market for students in the private sector.

public sector is more enrollment-elastic, those who attend a four-year school do so in this sector.

We observe no increase in enrollment at the flagship public universities, which is sensible given the fact that this sector is unlikely to be responsive to changes in student demand (Bound and Turner, 2007). These results suggest that home price increases serve to reshuffle students between the flagship and the non-flagship sectors based on housing wealth rather than increase the size of the flagship public sector. Finally, we find that the size of the community college sector increases with home prices in the state, with a total enrollment elasticity of 0.371, which is statistically significantly different from zero at the 5% level but is smaller than the non-flagship public elasticity. Table 5 thus indicates that the housing boom caused an expansion of the most demand-elastic sectors – non-flagship publics and community colleges – while inducing a shift in the types of students gaining access to flagship public universities based on their family's housing wealth.

4.2 Direct Resource and Quality Effects

Because college sector is an imperfect proxy for college resources and because students may be changing their selection behavior within our four sectors when home prices change, we examine the effect of housing price changes on direct quality and resource measures in Table 6. In the table, each cell comes from a separate regression of equation (5), and each column represents a separate estimation sample. In the first column, we estimate equation (5) for all institutions that report each measure. Because few two-year colleges collect data on SAT scores and four-year graduation rates, we restrict our sample in the second column to all four-year institutions. In the third column, we examine quality effects of home price increases within the four-year public sector, and in the fourth column we provide estimates for the two-year sector for those measures that a sufficient number of community colleges report.

The estimates in Table 6 are consistent with those in Table 3, suggesting that

students attend higher quality and resource institutions when their parents' home value increases over the previous four years. For example, a $10,000 increase in four-year home prices increases the 75^{th} percentile SAT scores of the attending university by 1.54 points (out of 1600), increases the student-faculty ratio by 0.0004, expenditures per student by $441, instructional expenditures per student by $80.4, and the six-year BA graduation rate of the university by 0.003. Although many of these marginal effects are modest, each of these measures is at best a partial proxy for the underlying quality of the institution. Furthermore, when multiplied by the average changes in home prices shown in Table 2, these marginal effects translate into sizeable institutional quality changes experienced by students driven by changing selection behavior due to home price growth during the housing boom. The estimates in Table 6 indicate that no matter which proxy we use, a family's home price growth in the four years prior to a student becoming of college age increases the quality of the institution she attends.

Estimates in the four-year sector are very similar to those for the whole sample, though somewhat attenuated as expected due to the large resource and quality differences between the two- and four-year sectors. In the public four-year sector, the estimates also point to resource and quality upgrading by those experiencing recent home price increases. However, the estimates are smaller than in the previous two columns and often are not statistically distinguishable from zero at conventional levels. This result indicates that housing wealth increases affect the types of schools students attend in the four-year private sector and across the public and private four-year sector in a manner our multinomial logits are unable to detect. In the public sector, there still is evidence that students attend higher resource and quality schools due to home price increases, and unlike in the previous columns in Table 6, they also attend higher tuition cost universities. This finding is suggestive that households use their housing wealth to finance a higher quality education for their children.

We find no effect of housing price increases on the quality and resource measures of community colleges students attend. This finding is reassuring because the quality of the community college a student attends is defined by where he lives (Stange, 2009), which implies that home price increases should not have an effect on the quality of the two-year school in which a student enrolls.

One important distinction between the estimates in Table 3 and Table 6 is that the Table 6 estimates include MSA fixed effects rather than state fixed effects. Estimating equation (5) using state fixed effects provides a check on the use of state fixed effects; if the estimates are much larger, it will suggest our multinomial logit results are overstated. Appendix Table A-2 shows such estimates, and the results are inconsistent with the existence of across-MSA selection within states driving our multinomial logit estimates. The estimates in Table A-2 are almost universally smaller in absolute value than in Table 6, meaning that state fixed effects lead to smaller estimates than MSA fixed effects. While this is not a perfect test for MSA-level selection in our multinomial logit models, the strong correlation between sector and our resources/quality measures (see Table 1) make it unlikely that state fixed effects would understate direct quality effects while overstating the cross-sector selection effects. At the very least, these results are strongly suggestive that our multinomial logit estimates are not being driven by selection on unobservables across MSAs within states.

Table 7 presents similar estimates to Table 6 for the four-year sample, but allowing for the effect of home price increases to vary by income group. As with the multinomial logit results, we find that the effect of housing wealth on the quality and resource levels is largest for the lowest income group. The effect on faculty-student ratios, expenditures per student and instructional expenditures per student are sizeable in magnitude and are statistically different from zero at the 5 percent level for the lowest income families. For other families, the coefficients are smaller and not statistically different from zero at conventional levels. Students from both lower

and middle income families attend institutions with higher SAT scores and graduation rates when home prices increase, but again there is no significant effect among families with income over $125,000 per year. The multinomial logit estimates are suggestive that at least some of these results are being driven by the higher likelihood of both lower and middle income families to send their children to flagship public schools that have higher SAT scores and graduation rates when they experience housing price increases. These results are consistent with lower income and resource families purchasing access to higher resource and higher quality institutions when their home price increases over the previous four years. We believe these findings again point to a relaxation of credit constraints binding on the intensive margin of college choice among lower-resource families during the housing boom. While there may be a consumption value to schooling, for income effects to be driving our results they would have to differ systematically by income and be stronger for lower-income families. While such an Engel curve is possible, we see no reason to expect wealth effects to be zero for higher income families. Although we favor a credit constraint interpretation of the estimates, our results present clear evidence that lower-income households responded to home price increases during the housing boom by upgrading the quality of schools attended by their children, which has important policy ramifications regardless of whether the effect is being driven by credit constraints or wealth effects.

As discussed in Section 2, we use average measures of the quality and resource variables shown in Tables 6 and 7. If housing price increases cause an increase in these measures, this could cause a mechanical relationship between quality/resources and home price changes that is not reflective of changes in student enrollment decisions.[19] Table 8 examines this possibility at the state-aggregate level, regressing various log resource and quality measures on the four-year percentage change in the

[19]From a budgeting perspective, this story is unlikely because property taxes are not used to fund four-year schools and only are used to fund two-year schools in certain states. However, if macroeconomic conditions are correlated with home price changes at the state level, tax revenues (and thus ostensibly higher education funding) and housing prices could be positively correlated.

state home price index. The estimates show at most a weak relationship between housing price changes and higher education resources. There is some evidence of a positive effect of home price increases on total expenditures in flagship public universities, but not instructional expenditures. In the four-year sectors, total and first-year faculty-student ratios decrease when home prices increase. In the non-flagship public universities, there is a statistically significant negative effect of home price changes on first year faculty-student ratios, which is driven by the expansion of this sector (see Table 5) without a commensurate increase in the number of faculty. Overall, Table 8 lends little support to the hypothesis that home price increases serve to increase institutional resources and quality in the public four-year sectors.

For two-year schools, our estimates are consistent with an increase of per-student instructional expenditures and an increase in faculty when state home prices increase. This result is due to the fact that in some areas local property taxes partially fund community colleges and that community colleges can be more demand-responsive in faculty hiring through the use of adjuncts and lecturers. Note that despite these positive resource effects, we find no effect of individual home price growth on the resource level of the community college students attend. These results suggest our community college estimates in Table 6 may be biased upwards slightly, which implies home price changes have an even weaker effect on the quality of community college attended than we estimate.

In the public flagship sector, we find a weak negative correlation between home price changes and posted tuition, with an elasticity of -0.167 that is statistically significant at the 10% level. However, the tuition elasticity in the non-flagship public sector is very similar (although not statistically significantly different from zero), meaning that home prices are associated with at most a very small relative price change across sectors. Due to the large wealth increases provided by home price increases, we view it as unlikely that such small price changes are driving our results. Furthermore, these posted tuition prices mask changes in financial aid associated

with home price changes. Appendix Table A-3 contains regressions similar to those in Table 8 but with financial aid outcomes as the dependent variables. The table shows log home prices are associated with declines in financial aid in all sectors and at all funding levels (federal, state and institutional). Note that the elasticities are larger in absolute value in the non-flagship sector relative to the flagship public sector, suggesting net-of-aid tuition costs may decline in the non-flagship publics relative to the flagship publics when home prices in the state rise. We find students attend flagships in general and more expensive universities in particular despite these declines in financial aid, which is consistent with families using their increased housing wealth when home prices increase to finance a higher-quality college education for their children.

4.3 Educational Outcomes

The results thus far indicate that students who experience increases in their parents home price in the four years prior to turning 18 attend higher resource and higher quality postsecondary institutions. Do these changes affect their postsecondary outcomes? In Table 9, we present estimates of the effect of home price increases in the four years prior to a child turning 18 on three college outcomes: time between college and high school, BA completion, and time to degree. Note that these estimates include the effect of school quality changes associated with home price changes as well as the direct effect of increased family resources on collegiate outcomes.

In Panel A of Table 9, we show estimates for the full sample that include state fixed effects in the odd columns and MSA fixed effects in the even columns. That these estimates are very similar, both qualitatively and quantitatively, again suggests that the lack of MSA fixed effects in our multinomial logit models is not driving our results. Overall, the estimates in Panel A indicate a weak relationship between household home price changes and student educational outcomes.

In Panel B, we show estimates of the effect of home price changes by household

income group. In this panel, we find that a $10,000 home price increase among the lowest income families increases the likelihood of obtaining a BA by 0.7 percentage points, regardless of the type of fixed effects used. Table 2 shows the baseline graduation rate for the lower-income sample is 28.6 percent, which implies that the probability of graduating increases by 2.4 percent for every $10,000 increase in home prices when a child is in high school. Over the sample period, the average home price increase for a low income household was $32,160, implying the housing boom increased BA completion rates of children from households earning less than $75,000 per year by 7.9%. For the sample of low income 12-year olds in 1997, whose families experienced a four-year average increase in home prices of $40,245, the housing boom increased BA completion rates by 9.8%. These tabulations represent large changes in the BA completion rate of lower-income families over this time period, some of which is due to fact that these students are attending higher-quality institutions on average and part of which may be caused directly by the higher resources available to parents who experienced a large home price increase. In addition, these estimates are suggestive of potential reductions in the BA attainment rate among lower-income families due to the subsequent housing market bust.

Finally, Panel B of Table 9 presents evidence that housing price increases significantly reduce the time between high school and college[20] but have little effect on time to degree. We urge caution in interpreting the latter effect, however, since particularly our younger sample, who are treated with the largest home price increases, likely have not been enrolled long enough in school to detect a time to degree effect as of 2007. Our estimates indicate increased home prices in the previous four years reduce the time students take to enroll in college, which is consistent with more resource-constrained students spending time in the labor force post high school in order to finance subsequent college enrollment.

[20]These estimates are not restricted to those who attend college within two years of high school graduation.

5 Conclusion

With growing evidence of the high labor market and educational attainment returns to college quality, determining how students make college choices and, in particular, whether higher costs deter students from attending higher quality institutions is of preeminent importance. This paper uses quasi-experimental evidence from the housing boom to examine whether families that experienced increases in their home values in the time period prior to their children becoming of college-age due to the fact that they live in high home price growth cities make systematically different decisions about where to send their children to college. Employing restricted-use data from the National Longitudinal Survey of Youth 1997 (NLSY97) that contains detailed demographic and ability measures as well as the MSA of residence in 1997 that allow us to control for selection of families with higher-ability children into MSAs that will have higher home price growth, we estimate multinomial logit models of higher education sector choice. We find a $10,000 increase in a family's housing wealth in the four years prior to a student becoming of college-age increases the likelihood he attends a flagship public university relative to a non-flagship public university by 0.2 percent and decreases the relative probability of attending a community college by 0.6 percent. There is no effect of home price growth on selection into private universities, however. By splitting our sample into different income groups, we show these effects are driven by relatively low-income families.

We also estimate the effect of home price growth on the direct resource and quality measures students are exposed to in college; short-run increases in home prices lead to substantial increases in the SAT scores, faculty-student ratios, institutional graduation rates, and per-student expenditures of the institutions students attend. We find no evidence that these measures are influenced by changes in home prices at the state level, suggesting our estimates are driven by changing student selection rather than by institutional quality upgrading due to the housing boom. Similar to

our multinomial logit estimates, these results are most pronounced among lower-income families. Finally, for the lower-income sample, home price increases are associated with an increased likelihood of BA attainment on the order of 2.4 percent for every $10,000 increase in home prices.

These results have particular importance for current policy as housing prices have fallen about 32% in the United States since their peak in 2006. These declines have been even more dramatic in certain metro areas in which the housing bubble was most severe. Our estimates are suggestive that these home price declines will have an effect on the quality and sector of postsecondary schools students attend and that the attendance decisions of lower-income students will be most affected. To the extent that these changes in attendance decisions translate into declines in graduation and labor market outcomes as suggested by previous literature, the housing bust may have long-run effects on the supply of high-skilled labor and on inequality. Future work examining policies that may insulate lower-income families from housing price volatility in the college attendance decision is warranted.

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Table 1: Means of College Resource and Quality Measures by Higher Education Sector

	Non-flagship Public	Flagship Public	Private Four-year	Two Year
25^{th} Percentile Math SAT	455.31	525.14	494.66	
75^{th} Percentile Math SAT	569.52	640.72	607.52	
Faculty-Student Ratio	0.041	0.063	0.045	0.020
Expenditures Per Student	18337	41350	25482	7698
Instructional Expenditures Per Student	5649	10188	8434	2796
Graduation Rate	0.461	0.674	0.560	
In-state Tuition	4536	5746	18161	2805
Out-of-state Tuition	12072	16176	18170	6017

[1] Source: 1997-2005 IPEDS data as described in the text. All monetary figures are in real $2007 and are weighted by total undergraduate enrollment. All per-student means are per total enrollment. Graduation rates are for BA degrees within six years of initial enrollment.

[2] SAT scores and graduation rates are reported for a small percentage of two-year schools. Because of the open-admission mandate of community colleges and the fact that many students do not intend to obtain a BA, we do not report means for SAT scores and graduation rates.

Table 2: Means and Standard Deviations of Selected NLSY97 and State-level Variables

	Full Sample		Low Income		Middle Income		High Income	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
4 Year Home Price Change ($10,000)	5.246	6.130	3.216	4.036	4.961	5.078	8.547	8.367
Home Ownership Dummy	0.791	0.407	0.646	0.479	0.937	0.243	0.941	0.236
Real Family Income ($10,000)	9.023	6.781	4.500	1.962	9.566	1.310	19.95	7.61
Missing Income	0.166	0.372						
AFQT Score	63.08	25.93	57.80	27.02	67.01	23.52	72.95	21.86
Father HS Dropout	0.076	0.265	0.125	0.331	0.036	0.186	0.023	0.150
Father HS Diploma	0.285	0.451	0.343	0.475	0.298	0.458	0.141	0.349
Father Some College	0.204	0.403	0.193	0.395	0.261	0.439	0.147	0.355
Father BA+	0.327	0.469	0.195	0.396	0.349	0.477	0.640	0.481
Missing Father Education	0.108	0.310	0.144	0.351	0.057	0.232	0.049	0.215
Mother HS Dropout	0.073	0.260	0.129	0.335	0.022	0.146	0.008	0.089
Mother HS Diploma	0.293	0.455	0.357	0.479	0.289	0.454	0.161	0.368
Mother Some College	0.282	0.450	0.283	0.451	0.339	0.474	0.221	0.415
Mother BA+	0.309	0.462	0.187	0.390	0.325	0.469	0.559	0.497
Missing Mother Education	0.044	0.205	0.050	0.219	0.025	0.155	0.051	0.220
Female	0.536	0.499	0.561	0.496	0.515	0.500	0.534	0.500
White	0.716	0.451	0.613	0.487	0.808	0.395	0.874	0.332
Black	0.123	0.328	0.181	0.385	0.064	0.244	0.032	0.177
Hispanic	0.105	0.307	0.146	0.354	0.076	0.265	0.031	0.173
Other Race	0.056	0.231	0.060	0.237	0.053	0.225	0.062	0.242
Age 12	0.141	0.348	0.160	0.366	0.127	0.333	0.133	0.340
Age 13	0.198	0.398	0.194	0.396	0.213	0.410	0.168	0.375
Age 14	0.204	0.403	0.189	0.391	0.228	0.420	0.227	0.420
Age 15	0.198	0.399	0.199	0.399	0.193	0.395	0.185	0.389
Age 16	0.199	0.400	0.200	0.400	0.180	0.385	0.214	0.410
Age 17	0.060	0.237	0.058	0.234	0.060	0.237	0.072	0.259
Non-Flagship Public	0.322	0.467	0.291	0.454	0.377	0.485	0.326	0.469
Flagship Public	0.086	0.280	0.050	0.217	0.084	0.278	0.193	0.395
Private 4-Year	0.189	0.392	0.163	0.370	0.187	0.390	0.256	0.437
Community College	0.402	0.490	0.496	0.500	0.352	0.478	0.226	0.419
Unemployment Rate	4.572	1.054	4.621	1.050	4.509	1.061	4.513	1.060
Real Per Capita Income ($1,000)	33.53	3.91	32.98	3.81	33.80	3.62	34.22	3.96
2-Year Schools Per 18-24 Year Old	0.038	0.018	0.040	0.019	0.036	0.016	0.038	0.017
4-Year Schools Per 18-24 Year Old	0.070	0.042	0.065	0.036	0.073	0.042	0.074	0.048
Real Need-based Aid Per Student	0.451	0.436	0.412	0.415	0.481	0.442	0.432	0.397
BA-AA Wage Ratio	1.405	0.088	1.403	0.089	1.408	0.084	1.404	0.090
BA-HS Wage Ratio	1.843	0.130	1.836	0.133	1.850	0.120	1.854	0.131
25^{th} Percentile Math SAT	482.60	67.61	464.08	65.90	477.83	58.36	517.13	67.89
75^{th} Percentile Math SAT	594.46	64.50	577.20	65.90	591.37	53.31	626.56	61.49
Faculty-Student Ratio	0.037	0.024	0.033	0.020	0.037	0.022	0.048	0.031
Expenditures Per Student	15792	18372	12896	13482	14972	16093	24740	27110
Instructional Expend. Per Student	5786	5330	4920	3924	5503	4069	8603	8351
Graduation Rate	0.560	0.175	0.512	0.171	0.553	0.158	0.647	0.164
In-state Tuition	6848	7316	5788	6415	6906	6901	9288	9372
Out-of-state Tuition	11479	6802	9988	6162	11741	6296	14828	7857
Time Between HS and College	0.204	0.425	0.266	0.484	0.177	0.402	0.084	0.229
BA	0.391	0.488	0.286	0.452	0.426	0.495	0.600	0.491
Time to Degree	4.703	1.025	4.889	1.160	4.660	0.911	4.529	0.947

[1] All estimates include sample weights and are for the sample who attend college within two years of high school graduation.
[2] Low-income families are those with total income under $75,000, medium income families are those with total income between $75,000 and $125,000, and high-income families are those with total income over $125,000.

Table 3: Marginal Effects from Multinomial Logit Estimates of the Effect of Housing Price Changes on the Likelihood of Attending a Given Type of College

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change ($10,000)	0.0021**	0.0002	-0.0064**
	(0.0007)	(0.0019)	(0.0034)
Home Ownership Dummy	0.0003	0.0086	-0.0256
	(0.0080)	(0.0217)	(0.0340)
Real Family Income	0.0014**	0.0029*	-0.0079**
	(0.0005)	(0.0017)	(0.0026)
Missing Income	0.0072	0.0138	-0.0471
	(0.0115)	(0.0329)	(0.0425)
AFQT Score	0.0012**	0.0021**	-0.0073**
	(0.0002)	(0.0004)	(0.0005)
Father HS Diploma	0.0001	0.0273	-0.0228
	(0.0131)	(0.0342)	(0.0395)
Father Some College	-0.0105	0.0630	-0.0738*
	(0.0131)	(0.0447)	(0.0429)
Father BA+	0.0116	0.1631**	-0.1467**
	(0.0158)	(0.0475)	(0.0441)
Missing Father Education	0.0006	0.1050**	-0.0092
	(0.0153)	(0.0463)	(0.0441)
Mother HS Diploma	-0.0029	-0.0281	-0.0268**
	(0.0153)	(0.0370)	(0.0409)
Mother Some College	0.0112	-0.0164	-0.0345
	(0.0188)	(0.0391)	(0.0420)
Mother BA+	0.0107	0.0110	-0.1553**
	(0.0194)	(0.0398)	(0.0430)
Missing Mother Education	0.0485	-0.0145	-0.0822
	(0.0422)	(0.0394)	(0.0549)
Female	0.0027	0.0246*	-0.0424*
	(0.0043)	(0.0138)	(0.0221)
Black	0.0064	0.0287	-0.1910**
	(0.0108)	(0.0238)	(0.0303)
Hispanic	-0.0048	0.0427	-0.1276**
	(0.0094)	(0.0267)	(0.0412)
Other Race	0.0158	0.0411	-0.0929
	(0.0183)	(0.0385)	(0.0592)
Unemployment Rate	-0.0088	-0.0005	-0.0314
	(0.0066)	(0.0236)	(0.0339)
Real Per Capita Income	-0.0041	0.0115	0.0122
	(0.0072)	(0.0186)	(0.0289)
Public 2 Year Schools Per 18-24 Yr. Old	1.4416*	2.7968	-4.9299
	(0.7946)	(2.2172)	(4.2076)
Public 4 Year Schools Per 18-24 Yr. Old	0.0069	0.3530*	0.4747
	(0.1125)	(0.2152)	(0.6686)
Real State Aid Per 18-24 Yr. Old	-0.0668	0.0976	0.0223
	(0.0460)	(0.1411)	(0.2639)
BA/AA Wage Ratio	0.0029	0.0450	-0.2433
	(0.0414)	(0.1605)	(0.2098)
BA/HS Wage Ratio	-0.0023	-0.2063	0.1127
	(0.0509)	(0.1802)	(0.2404)

[1] All estimates include state fixed effects and age in 1997 fixed effects and are weighed by sampling weights.
[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.
[3] Standard errors clustered at the MSA-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 4: Marginal Effects from Multinomial Logit Estimates of the Effect of Housing Price Changes on the Likelihood of Attending a Given Type of College

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change ($10,000)*	0.0033**	0.0034	-0.0202**
I(Low Income)	(0.0007)	(0.0028)	(0.0084)
4 Year Home Price Change ($10,000)*	0.0023**	-0.0026	-0.0041
I(Middle Income)	(0.0007)	(0.0030)	(0.0040)
4 Year Home Price Change ($10,000)*	0.0012	-0.0010	0.0011
I(High Income)	(0.0007)	(0.0024)	(0.0043)
Home Ownership Dummy*	0.0012	0.0112	0.0157
I(Low Income)	(0.0081)	(0.0239)	(0.0558)
Home Ownership Dummy*	-0.0086	0.0848	-0.1211
I(Middle Income)	(0.0162)	(0.0590)	(0.0787)
Home Ownership Dummy*	-0.0053	0.0814	-0.0889
I(High Income)	(0.0221)	(0.0815)	(0.1321)
AFQT Score	0.0008**	0.0020**	-0.0075*
	(0.0001)	(0.0003)	(0.0046)
Real Family Income ($10,000)	0.0002	0.0029	-0.0075*
	(0.0006)	(0.0021)	(0.0046)
I(Middle Income)	0.0215	-0.0894	0.0488
	(0.0165)	(0.0579)	(0.0877)
I(High Income)	0.0411	-0.0763	-0.0275
	(0.0241)	(0.0847)	(0.1446)

[1] All estimates include state and age in 1997 fixed effects as well as controls for mother's and father's education, gender, race, state-level unemployment, income per capita, public and private institutions per college age population, per-student state need-based aid, the ratio of BA to associates degree wages and the ratio of BA to high school wages. All estimates also are weighted by NLSY97 sampling weights.

[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[3] Low-income families are those with total income under $75,000, medium income families are those with total income between $75,000 and $125,000, and high-income families are those with total income over $125,000.

[4] Standard errors clustered at the MSA-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 5: Effect of Statewide Housing Price Changes on College Enrollment Across Institutions Types

Independent Variable: Ln(Home Price Index)				
Sector	First-year Enrollment	Applications	Admissions	Yield
Flagship	-0.022	0.108	0.048	-0.039
	(0.073)	(0.184)	(0.129)	(0.122)
Other public four-year	0.428**	0.548**	0.494*	-0.243
	(0.138)	(0.203)	(0.249)	(0.152)
Two-year	0.371**			
	(0.157)			

[1] Each cell represents a separate regression, and all dependent variables are logged. All estimates include state unemployment rates, real state per capita income, institution fixed effects and year fixed effects.

[2] Two-year institutions are primarily open admission so two-year institutions are removed from the analysis of applications, admissions and yield.

[3] Standard errors clustered at the state-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 6: OLS Estimates of the Effect of Housing Price Changes on College Resources

	Home Price Change ($10,000)			
	All Colleges	Four Year	Public Four Year	Two Year
25^{th} Percentile Math SAT	1.528**	1.189**	0.840	.
	(0.601)	(0.560)	(0.699)	.
75^{th} Percentile Math SAT	1.226**	0.914*	0.578	.
	(0.562)	(0.522)	(0.652)	.
Faculty-Student Ratio	0.0004**	0.0005*	0.0003	-0.0001
	(0.0002)	(0.0003)	(0.0002)	(0.0001)
Expenditures Per Student	440.635**	650.164**	349.913	3.335
	(160.767)	(284.793)	(267.622)	(13.533)
Instructional Expenditures Per Student	80.355**	104.406*	55.130	4.991
	(37.528)	(60.617)	(49.527)	(8.266)
Graduation Rate	0.0031**	0.0025**	0.0030*	.
	(0.0014)	(0.0013)	(0.0017)	.
In-state Tuition	-15.952	-88.872	32.899*	.
	(44.761)	(82.300)	(17.287)	.
Out-of-state Tuition	89.669**	64.893	94.802**	.
	(44.415)	(54.385)	(43.468)	.

[1] All estimates include MSA fixed effects and controls for age in 1997, AFQT score, parental income, mother's and father's education, gender, race, state-level unemployment, income per capita, public and private institutions per college age population, per-student state need-based aid, the ratio of BA to associates degree wages and the ratio of BA to high school wages. All estimates also are weighted by NLSY97 sampling weights.

[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[3] Low-income families are those with total income under $75,000, medium income families are those with total income between $75,000 and $125,000, and high-income families are those with total income over $125,000.

[4] Standard errors clustered at the MSA-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: OLS Estimates of the Effect of Housing Price Changes on College Resources in the Four-year Sector by Family Income

	Home Price Change ($10,000)		
	Low Income	Middle Income	High Income
25^{th} Percentile Math SAT	1.407**	1.437**	0.832
	(0.689)	(0.619)	(0.650)
75^{th} Percentile Math SAT	1.210**	1.088*	0.589
	(0.610)	(0.569)	(0.627)
Faculty-Student Ratio	0.0005**	0.0002	0.0002
	(0.0002)	(0.0002)	(0.0002)
Expenditures Per Student	525.252**	183.479	322.236
	(197.898)	(179.502)	(247.190)
Instructional Expenditures Per Student	107.053**	2.228	37.229
	(51.441)	(55.626)	(62.597)
Graduation Rate	0.0028*	0.0030*	0.0012
	(0.0015)	(0.0017)	(0.0015)
In-state Tuition	-28.646	-81.270	-24.106
	(64.199)	(74.737)	(72.719)
Out-of-state Tuition	116.235*	31.651	36.224
	(63.480)	(59.838)	(64.443)

[1] All estimates include MSA fixed effects and controls for age in 1997, AFQT score, parental income, mother's and father's education, gender, race, state-level unemployment, income per capita, public and private institutions per college age population, per-student state need-based aid, the ratio of BA to associates degree wages and the ratio of BA to high school wages. All estimates also are weighted by NLSY97 sampling weights.

[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[3] Low-income families are those with total income under $75,000, medium income families are those with total income between $75,000 and $125,000, and high-income families are those with total income over $125,000.

[4] Standard errors clustered at the MSA-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 8: Effect of Statewide Housing Price Changes on College Resources Across Institutions Types

	Independent Variable: Ln(Home Price Index)					
Sector	Total Expend.	Inst. Expend.	Faculty/ Total	Faculty/ First-year	Faculty	In-state Tuition
Flagship	0.122**	0.106	-0.008	-0.006	-0.015	-0.167*
	(0.061)	(0.088)	(0.109)	(0.132)	(0.119)	(0.091)
Other public four-year	0.032	0.144	-0.066	-0.234**	0.024	-0.117
	(0.097)	(0.094)	(0.090)	(0.109)	(0.132)	(0.115)
Two-year	0.115	0.187*	0.169**	-0.113	0.127*	0.128
	(0.130)	(0.095)	(0.057)	(0.131)	(0.071)	(0.172)

[1] All dependent variables are logged. All estimates include state unemployment rates, real state per capita income, institution fixed effects and year fixed effects.
[2] All monetary variables are in 2007 dollars.
[3] Standard errors clustered at the state-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 9: The Effect of Housing Wealth on Collegiate Outcomes

Panel A: Average Effects						
	Time Between HS and College		BA		Time to Degree	
4 Year Home Price Change ($10,000)	0.0010	0.0017	0.0028	0.0024	-0.0022	0.0014
	(0.0034)	(0.0059)	(0.0020)	(0.0026)	(0.0067)	(0.0108)
Home Ownership Dummy	-0.1737**	-0.1852**	0.0527*	0.0520	-0.1534	-0.1170
	(0.0528)	(0.0633)	(0.0272)	(0.0321)	(0.1169)	(0.1368)
Real Family Income	-0.0110**	-0.0095**	0.0067**	0.0049**	-0.0109**	-0.0127**
	(0.0026)	(0.0025)	(0.0021)	(0.0022)	(0.0041)	(0.0044)
AFQT Score	-0.0045**	-0.0045**	0.0049**	0.0048**	-0.0093**	-0.0090**
	(0.0008)	(0.0008)	(0.0004)	(0.0005)	(0.0019)	(0.0022)
MSA Fixed Effects?	No	Yes	No	Yes	No	Yes
Panel B: Effects by Family Income						
	Time Between HS and College		BA		Time to Degree	
4 Year Home Price Change*	-0.0086*	-0.0073	0.0070**	0.0069*	0.0065	-0.0005
I(Low Income)	(0.0044)	(0.0064)	(0.0034)	(0.0039)	(0.0097)	(0.0145)
4 Year Home Price Change*	0.0104	0.0068	0.0027	0.0029	-0.0105	-0.0083
I(Middle Income)	(0.0084)	(0.0112)	(0.0033)	(0.0042)	(0.0118)	(0.0204)
4 Year Home Price Change*	0.0032	0.0040	-0.0012	-0.0004	-0.0032	-0.0052
I(High Income)	(0.0032)	(0.0054)	(0.0027)	(0.0031)	(0.0084)	(0.0121)
Home Ownership Dummy*	-0.1493**	-0.1677**	0.0367	0.0412	-0.1948	-0.0939
I(Low Income)	(0.0612)	(0.0711)	(0.0267)	(0.0326)	(0.1445)	(0.1592)
Home Ownership Dummy*	-0.1338	-0.1240	0.1202*	0.0814	0.0941	0.0361
I(Middle Income)	(0.2282)	(0.2462)	(0.0703)	(0.0742)	(0.1485)	(0.1777)
Home Ownership Dummy*	-0.0754	0.0650	0.0526	0.0559	-0.2918	-0.3161
I(High Income)	(0.1832)	(0.1029)	(0.1169)	(0.1241)	(0.3174)	(0.3987)
AFQT Score	-0.0044**	-0.0044**	0.0048**	0.0047**	-0.0092**	-0.0089**
	(0.0008)	(0.0008)	(0.0004)	(0.0004)	(0.0019)	(0.0022)
I(Middle Income)	-0.1610	-0.1995	-0.0547	-0.0102	-0.2687	-0.1576
	(0.2138)	(0.2241)	(0.0732)	(0.0775)	(0.1757)	(0.2106)
I(High Income)	-0.2597	-0.4855**	0.0766	0.0894	-0.0408	-0.0246
	(0.2022)	(0.1182)	(0.1093)	(0.1209)	(0.3069)	(0.3744)
MSA Fixed Effects?	No	Yes	No	Yes	No	Yes

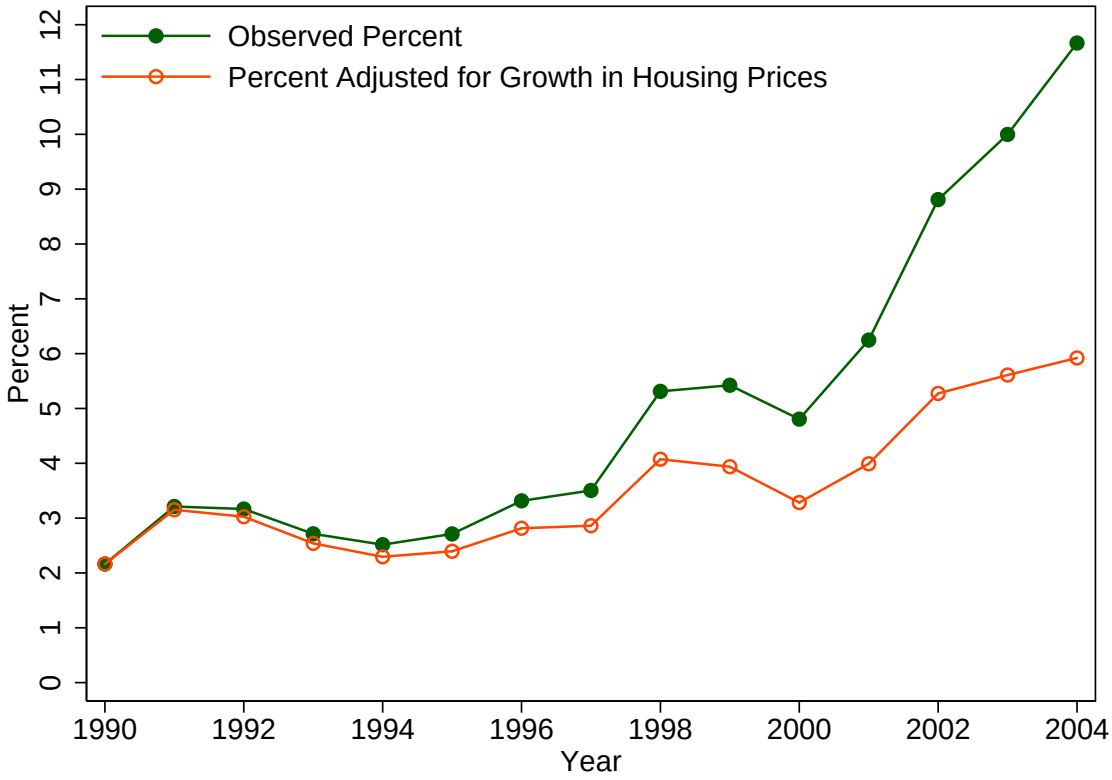
[1] All estimates include state fixed effects and controls for age in 1997, mother's and father's education, gender, race, state-level unemployment, income per capita, public and private institutions per college age population, per-student state need-based aid, the ratio of BA to associates degree wages and the ratio of BA to high school wages. All estimates also are weighted by NLSY97 sampling weights.

[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[3] Low-income families are those with total income under $75,000, medium income families are those with total income between $75,000 and $125,000, and high-income families are those with total income over $125,000.

[4] Standard errors clustered at the state-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Figure 1: Extracted Home Equity as a Percent of per-Capita Income



Sources: Estimates of gross equity extraction are taken from Table 1 in Greenspan and Kennedy (2005). Average per-capita income comes from "personal income" estimates calculated by the U.S. Bureau of Labor Statistics. The "Percent Adjusted for Growth in Housing Prices" is calculated by adjusting the "Observed Percent" for housing inflation, using the CMHPI (1990=100) as the housing inflation measure.

Table A-1: State Public Flagship Schools

State	University Name
Alaska	University of Alaska - Fairbanks
Alabama	University of Alabama
Arkansas	University of Arkansas - Fayetteville
Arizona	University of Arizona
California	University of California - Berkeley
California	University of California - Los Angeles
Colorado	University of Colorado - Boulder
Connecticut	University of Connecticut
Delaware	University of Delaware
Florida	University of Florida
Georgia	University of Georgia
Hawaii	University of Hawaii - Manoa
Idaho	University of Idaho
Iowa	University of Iowa
Illinois	University of Illinois - Urbana/Champaign
Indiana	University of Indiana - Bloomington
Kansas	University of Kansas
Kentucky	University of Kentucky
Louisiana	Louisiana State University - Baton Rouge
Massachusetts	University of Massachusetts - Amherst
Maryland	University of Maryland - College Park
Maine	University of Maine - Orono
Michigan	University of Michigan - Ann Arbor
Minnesota	University of Minnesota - Twin Cities
Missouri	University of Missouri
Mississippi	University of Mississippi - Oxford
Montana	University of Montana - Missoula
North Carolina	University of North Carolina - Chapel Hill
North Dakota	University of North Dakota
Nebraska	University of Nebraska - Lincoln
New Hampshire	University of New Hampshire
New Jersey	Rutgers University
New Mexico	University of New Mexico
Nevada	University of Nevada - Reno
New York	Statutory Schools of Cornell University
New York	State University of New York - Binghampton
Ohio	Ohio State University
Oklahoma	Oklahoma State University
Oregon	University of Oregon
Pennsylvania	Pennsylvania State University
Rhode Island	University of Rhode Island
South Carolina	University of South Carolina - Columbia
South Dakota	University of South Dakota
Tennessee	University of Tennessee
Texas	University of Texas - Austin
Texas	Texas A&M - College Station
Utah	University of Utah
Virginia	University of Virginia
Vermont	University of Vermont
Washington	University of Washington
West Virginia	West Virginia University
Wisconsin	University of Wisconsin - Madison
Wyoming	University of Wyoming

Table A-2: OLS Estimates of the Effect of Housing Price Changes on College Resources With State Fixed Effects

	Home Price Change ($10,000)			
	All Colleges	Four Year	Public Four Year	Two Year
25^{th} Percentile Math SAT	1.288**	0.928**	0.825**	.
	(0.415)	(0.356)	(0.402)	.
75^{th} Percentile Math SAT	0.938**	0.607*	0.624	.
	(0.371)	(0.314)	(0.385)	.
Faculty-Student Ratio	0.0004**	0.0003**	0.0003*	-0.00001
	(0.0001)	(0.0002)	(0.0002)	(0.00004)
Expenditures Per Student	420.351**	451.243**	342.076	11.655
	(113.576)	(189.838)	(222.270)	(20.569)
Instructional Expenditures Per Student	101.462**	83.517**	66.025*	12.382
	(23.930)	(31.874)	(39.678)	(11.052)
Graduation Rate	0.0023**	0.0018**	0.0023**	.
	(0.0008)	(0.0008)	(0.0010)	.
In-state Tuition	40.925	-34.501	29.134**	.
	(36.970)	(53.608)	(9.453)	.
Out-of-state Tuition	122.169**	56.944*	84.427**	.
	(31.888)	(33.701)	(26.426)	.

[1] All estimates include state fixed effects and controls for age in 1997, AFQT score, parental income, mother's and father's education, gender, race, state-level unemployment, income per capita, public and private institutions per college age population, per-student state need-based aid, the ratio of BA to associates degree wages and the ratio of BA to high school wages. All estimates also are weighted by NLSY97 sampling weights.

[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[3] Standard errors clustered at the state-level are in parentheses: ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table A-3: Effect of Log Statewide Housing Price Index on Financial Aid Offerings by Institution Types

	Any Aid	Federal Grants	State Grants	Institutional Grants	Loans
Dependent variable: percent of entering cohort receiving aid					
Flagship	-0.085	-0.226	-1.198**	-0.210	-0.251**
	(0.080)	(0.212)	(0.539)	(0.189)	(0.118)
Other public four-year	-0.143**	-0.285**	0.164	-0.281	-0.511**
	(0.057)	(0.084)	(0.187)	(0.196)	(0.135)
Two-year	0.047	-0.098	-0.126	0.294**	-0.302**
	(0.075)	(0.092)	(0.183)	(0.124)	(0.090)
Dependent variable: natural log of real average aid given					
Flagship		0.037	-0.366	-0.210	0.048
		(0.144)	(0.245)	(0.189)	(0.168)
Other public four-year		-0.265*	-0.281	-0.007	-0.216**
		(0.054)	(0.164)	(0.196)	(0.108)
Two-year		-0.082**	0.155	0.294**	-0.133**
		(0.037)	(0.218)	(0.124)	(0.039)

[1] Each cell represents a separate regression, and all dependent variables are logged. All estimates include state unemployment rates, real state per capita income, institution fixed effects and year fixed effects. Standard errors are clustered at the state level.
[2] All monetary variables are in 2007 dollars.
[3] Standard errors are in parentheses below coefficients. Asterisks indicate statistical significance at the 10% (*), 5% (**) and 1% (***) levels.