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 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 2.1 percent and decreases the relative probability of attending a community college by 1.6 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 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. Finally, for the lower-income sample, we find home price increases reduce student labor supply and that each $10,000 increase in home prices is associated with a 2.4% increase in the 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, 2009).[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, 2010a) and lower time to degree (Bound, Lovenheim and Turner, 2010b). 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. In the National Longitudinal Survey of Youth (NLSY), there is evidence of sizable income gradients in the two year-four year margin (Belley and Lochner, 2007) and that higher income students attend schools with higher SAT scores (Light and Strayer, 2000). Previous work also has found evidence that students are highly responsive to college quality differences among institutions (Long, 2004; Avery and Hoxby, 2004). Though informative of many of the factors that influence college choices, none of these papers is able to identify the causal effect of household resources on the college quality decisions of students.

This paper examines how household resources influence the quality and sector of

[1] Somewhat in contrast, 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 rationally choose less expensive (and thus lower-quality) schools. All of the studies estimating the returns to education quality are subject to identification concerns (see Hoxby (2009) for a discussion of the returns to college quality literature), but the identification assumptions across studies vary sufficiently that the sum total of the evidence points strongly to a significant wage return to college quality.

[2] For evidence on the negative effect of beginning college at a two-year school, see Reynolds (2009), Kurlaender and Long (2009) and Rouse (1995). Bound, Lovenheim and Turner (2010a) 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. Light and Strayer (2000) show similar negative effects on the likelihood of graduating from attending schools lower in the SAT score distribution, although they additionally highlight the importance of "match quality" between the quality of the school and the academic preparation of the student.

postsecondary schools in which students enroll, focusing specifically on the role of housing wealth because of the central importance of this form of wealth to the majority of families. For most American families, the home is the largest single asset, and for many households it is their only substantial asset. For example, in the 2004 Survey of Consumer Finances, 48% of homeowners had less than $10,000 in non-housing assets. Among homeowners with AGI less than $75,000, the median non-housing wealth amount was $6,300. The median home equity among these households was $80,000. In contrast, for households with AGI over $125,000, median non-housing wealth was $146,600 and median home equity was $293,500. Thus, for the lower and middle class, housing wealth is an extremely important component of total resources. An additional reason to focus on housing wealth is that there has been substantial variation in home prices in recent years that we argue generates plausibly exogenous variation in household finances. We exploit this variation to overcome the endogeneity problem that families who value education more will save more for college and will send their children to more expensive (and higher quality) schools.

Our analysis makes several contributions to the literature. First, we identify the effect of housing price changes on the quality of colleges in which students enroll 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 enrolling in 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, 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. How this type of wealth variation influences the intensive margin of college choice is an important policy parameter given the evidence

suggesting large labor market and educational returns to attending different types of colleges combined with the large fluctuations in home prices in the United States over the past decade. Finally, we are able to assess 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. Our empirical strategy is to compare the college choices of students within states or cities who come of college age in different years and thus who experience housing price increases of varying magnitudes when they are in high school. The main identifying assumptions are that housing price changes at the state or MSA level as well as initial home price and homeownership status are conditionally exogenous. We present detailed evidence supporting these assumptions below.

We find strong evidence that home price variation affects college quality. The multinomial logit estimates show a $10,000 increase in home prices in the four years prior to turning 18 increases the relative probability of attending a public flagship by 2.1 percent and decreases the probability of attending a community college by 1.6 percent. There is no apparent effect of home price growth on selection into private universities, however. 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 students

from lower and middle-class households earning less than $75,000 per year, and college choices of students from households with income over $125,000 per year are insensitive to short-run home price variation.

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 $52,460 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 1.3 points (out of 1600), increases the faculty-student ratio by 0.0004, increases expenditures per student by $398 and the institution-average graduate rate by 0.003. 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.

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 for the lowest-income households in our sample, increasing BA attainment rates by 2.4% for each $10,000 increase in home prices during high school. We also find student labor supply is negatively affected by home family price growth, which together with the school quality effect likely drives the BA result.

The sum total of the evidence presented in this paper indicate strongly that the quality of colleges students attend 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, we believe the heterogeneity we observe across the income distribution 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 results show that 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 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 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

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

than home price levels because the price of a home can bear little relationship to the amount of equity a family has in a home.[4] Because all home price changes are capitalized into equity, and because we lack direct home equity measures, 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 and provides a consistent measure of the MSA-average home price change in each year. The home price of homeowner i in MSA m in year t is calculated as:

$$\hat{P}_{imt} = P_{im1997} * \frac{CMHPI_{mt}}{CMHPI_{m1997}}. \quad (1)$$

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 $\hat{P}_{imt} - \hat{P}_{imt-4}$. 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 (2010) 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.

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[5] 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 in which respondents turn 18 in our sample. We construct averages over time of all measures within institutions due to item non-response by institutions in different years. 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] faculty-student ratios, total expenditures per student, instructional expenditures per student,

[5]We use this college as the flagship because it has the highest average SAT scores and graduation rate of all the SUNY schools.

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

institutional graduation rate, and posted tuition and fees.[7] We use multiple measures of collegiate resources and quality because no one variable constitutes an accurate proxy for quality.[8] 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, 2009; 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 to attend, with an in-state tuition difference of $1,210 per year and an out-of-state tuition difference of $4,104 per year. 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 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

[7] Henceforth, "tuition" refers to tuition and fees.
[8] See Black and Smith (2006) for a detailed discussion of college quality measures and measurement error.

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 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.[9] Although the low-income group extends high up into the income distribution, it outlines the group of middle-class students whose families likely qualify for little aid and thus for whom differences in college costs probably are the most relevant. Note that in Table 2, 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 $52,460, 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 $32,160 and $50,780, respectively. Furthermore, homeownership rates are high 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%,[10] 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

[9] All financial variables in this analysis are inflated to real $2007 using the CPI-U.
[10] Authors' tabulation from the Current Population Survey.

college,[11] 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.

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 sample, flagship enrollment is 5%, while for the highest income sample 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 lead to significant disparities in institutional quality and resource measures, which also are shown in Table 2. Some of these differences likely are due to the positive correlations among family income, AFQT scores, parental education and admission to higher-quality schools, but they 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.

[11] Lovenheim (2010) shows that the extensive margin is also responsive to housing wealth increases, particularly during the housing boom, so this sample restriction may bias our estimates. However, our multinomial logit results and conclusions are robust to including non-attenders in the sample as their own category, which suggests this restriction is not driving the estimates.

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, 2009; Black and Smith, 2004 and 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 he is admitted that leads to 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 expected utility. If education is purely an investment good, this problem reduces to maximizing net expected 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 net 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. The goal of this analysis is to identify the causal effect of short-run 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 it 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. Furthermore, the timing of steep home price increases varied across cities. For example, in Miami, home prices increased by 14% between 1993 and 1996, by 17% between 1996 and 2000 and by 45% between 2000 and 2003. In San Francisco, however, home prices remained flat between 1993 and 1996, rose by 67% between 1996 and 2000 and increased by 23% between 2000 and 2003. Thus, while home prices were increasing nearly universally within these cities over the sample period, respondents living in different cities experienced the largest home price increases at different times.

Housing wealth also became much more liquid over this time period.[12] This in-

[12]Technological innovations in the mortgage industry that made it easier to assess risk and process loans were a main driver of this shift. Between 1996 and 2000, average points on mortgage originations dropped from about 1.75 to below

creased 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 shift in the ease of extracting the wealth from one's home. 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.

The housing boom also coincided with a period of general credit expansion and liberalization, including private student loans. Between the 1992-1993 and the 2002-2003 school years, subsidized Stafford loans increased by 105% while unsubsidized Stafford loans increased by over 6,000% and private loans increased by 466% in constant dollars (College Board, 2003). The interest rate on Stafford loans does not depend on credit ratings, and these loans are un-collateralized, so access to these loans did not expand disproportionately for those with higher home prices. Private loans depend on credit scores, however, so it is possible that families experiencing the largest home price increases also gained more access to these loans. Although there is little evidence of such a differential private loan expansion in the data,[13] it is worth noting that private

1.0, which was due mainly to reductions in transaction costs (Deep and Domanski, 2002). See LaCour-Little (2000) for an overview of the technological changes that led to these transaction cost declines. Bennett, Peach and Peristiani (2001) show that declining transaction costs around the turn of the century led to large increases in the propensity to refinance mortgages and extract equity from the home.

[13]In order to gain some insight into whether households with more housing wealth were more likely to incur student

student loan expansion is a possible mechanism through which higher home prices induce college quality upgrading. If private loan companies extend more credit to families with higher home prices because they have more collateral, increased private borrowing could be a result of experiencing an increase in the value of one's home. While we believe it more likely families were tapping their home equity directly due to the more favorable interest rates (as well as the tax deductability of interest), even if a systematic expansion of private student loan access to those experiencing the largest home price increases did occur, it does not significantly alter the interpretation of our results.

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:

$$P(j^*_{imsc} = j_{imsc}) = \beta_0 + \beta_1 Own_i + \beta_2 \Delta P^h_{imc} + \gamma X_i + \alpha Z_{sc} + \delta W_{mc} + \theta_s + \psi_c + \epsilon_{imsc}, \quad (3)$$

where i indexes family, m indexes MSA, 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, W is a vector of MSA-by-cohort macroeconomic variables, and Z is a vector of 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 and W are measured as of when each respondent is 18, one can interpret the cohort fixed effects

loans during the housing boom, we estimate the relationship between the amount of education loans and the price and equity of homes for homeowners in five waves of the Survey of Consumer Finances: 1992, 1995, 1998, 2001, and 2004. In all periods, there is a negative relationship between home prices or home equity and education loans among all homeowners and among homeowners who are 40-55 years old. In fact, this relationship became more negative over time, from -0.004(0.015) in 1992 to -0.055(0.013) in 2004 in the home price model with all homeowners. These results control for family income and household head's education level, and they suggest that higher housing wealth households are not incurring more student loan debt during the sample period.

as year fixed effects 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 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.[14] There are several potential threats to credibly interpreting the β_2 coefficients as identifying the causal effect of housing wealth on college choice: the home price variation could be conditionally correlated with unobserved likelihoods of selection into different college sectors, selection into home ownership could be endogenous, and unobserved local macroeconomic shocks could drive both the home price changes and college choices. We discuss and attempt to dispel each of these concerns in turn.

First, it is possible that those families experiencing the largest home price increases are those that have unobserved characteristics that make their children more likely to attend higher quality schools. The most likely characteristic driving such selection is student ability or preparation for college. The NLSY97 is a particularly useful data set to address ability 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 academic preparation for college. 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

[14] 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 sign of 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.

cognitive abilities.

While the data we use allow us to control directly for an important avenue of selection, it is possible that there is selection on residual ability or some other unobservable characteristic uncorrelated with our rich set of controls. However, a main advantage of our research design is the plausible exogeneity of the home price variation used to identify β_2. In equation (3), this home price variation comes from three sources: 1) 1997 home price levels, 2) cross-sectional differences across cities in average home price changes and 3) changes within cities in the magnitude of four-year home price changes. Our identification strategy is based on the identifying home price variation being driven by exogenous within-city or state changes in housing values over time. Home price changes that are driven by 1997 home price levels are particularly problematic because home values are a weak measure of wealth and thus could be proxying for an unobserved component of ability or for permanent income. However, we find that 1997 reported home prices and current predicted home price levels are only weakly associated with college choices across sectors.[15] Thus, the variation in home values that identify the parameters of interest in equation (3) is not being driven by cross-sectional differences in 1997 home price levels nor by differences across cities in average home prices when respondents are 18. Put differently, the extensive set of student ability controls in equation (3) appear sufficient to control for any correlation between home price levels and subsequent college enrollment choices.

Some of the identifying home price variation is coming from cross-sectional differences across cities within each state in four-year MSA-level home price changes. 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 across states that may be correlated with short-run home price changes. Allowing for cross-sectional differences in home price growth across MSAs within states could bias our

[15] A $10,000 increase in 1997 home price levels increases the likelihood of attending a flagship by 0.0008 percentage points and decreases the likelihood of community college enrollment by 0.0006 percentage points. We estimate similar marginal effects if we use contemporaneous home prices (calculated by inflating the 1997 prices by the CMHPI) rather than 1997 home prices.

estimates if there are systematic differences across MSAs in school type selection that are correlated with home price changes and that are uncorrelated with our extensive set of observable respondent characteristics. Using MSA fixed effects would eliminate such variation if it existed and would identify equation (3) under less stringent assumptions. However, with only 2764 observations, 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 within-state, 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.

The remaining variation in home prices is coming from differences within cities in home price growth rates over time. Recall that, 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. Using only within-city variation in home price changes, β_2 would be identified solely off of the fact that different age cohorts within each city come of college age at different times and thus are exposed to different home price changes. The exogeneity of the within-city home price changes is supported by the fact that each respondent's home MSA is fixed as of 1997. Thus, endogenous mobility is extremely unlikely: any such selection must be based on families with higher unobserved preferences for or access to higher quality schools sorting into MSAs pre-1997 that will have the highest housing price growth when their children are in high school.[16] While we cannot rule out such

[16]Note that such sorting would have to be occurring differentially by child age within each city, otherwise an MSA fixed effect would control for such selection. As discussed above, while we cannot include MSA fixed effects in our model, the results from the direct resource models suggest that MSA fixed effects are not driving our results.

selection, we know of no evidence to suggest households sorted in this manner across cities in the mid-1990s.

Another potential identification threat is that home ownership is endogenous. As shown in Table 2, home ownership rates for our sample are very high, at 79%. The proportion of the sample potentially affected by endogenous home ownership thus is small. Furthermore, because home ownership is defined as of 1997 and we control for homeownership status in this year, for homeowner endogeneity to be driving our results it would have to be the case that families with higher unobserved likelihood of attending a higher quality school are more likely to own a home in 1997 in the MSAs in which home prices will rise more when their kids are in high school. We do not find such a selection story compelling, particularly because the estimated marginal effects of home ownership on college type do not indicate the existence of a statistically significant relationship between college quality and homeownership status. If we exclude renters from our analysis, the results are very similar, if somewhat stronger, than those reported below.

Finally, because identification of the β_2 parameters in equation (3) is coming through the differential timing and magnitude of home price changes across MSAs within states and within MSAs over time, any factor that would affect both home prices and expected returns to different college types could bias our estimates. For example, high-skilled labor demand shocks could both increase home prices and increase the returns to college quality. The existence of such shocks is unlikely since there was a negative relationship between MSA-level home price changes and real income per capita during the housing boom (Mian and Sufi, 2010). However, in order to address this potential source of bias, we control for real income per capita and the unemployment rate at the MSA-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, calculated from CPS Outgoing Rotation Group data.[17] These wage ratios control for the possibility

[17]We construct the ratio of hourly wages of 25-55 year olds with a bachelor's degree (BA) to the hourly wages of 25-55 year olds with an associate's degree (AA) in the state. We construct a similar wage ratio for those with a BA compared

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 shocks at the state-level, and it is possible that there are high skilled 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.[18]

The effect of housing wealth on the types of schools in which students enroll may vary 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. Our model is as follows:

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

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

to those whose highest level of educational attainment is a high school diploma. We also 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 and MSA variables are measured as of when each respondent is 18 years old. These variables all vary at the state or MSA by cohort level, where each cohort is defined by respondent age in 1997.

[18] 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.

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 income and to interpret the ϕ parameters as, for a given income group, marginal changes in the likelihood of attending a given school type due to a home price change relative to that income group-specific mean. We exclude all families with missing income from these estimates.[19]

A potential concern with employing a multinomial logit model is that it imposes an assumption of independence of irrelevant alternatives (IIA) across outcomes. To the extent this assumption is false, it could bias our estimates in either direction. Though testing for IIA is difficult, we generated suggestive evidence that our model is not prone to IIA concerns by estimating Hausman (1978) tests as proposed by Hausman and McFadden (1984). We test the full model given by equation (3) against models that omit each category separately. For each outcome the corresponding test statistic is very close to 1, suggesting that we cannot reject IIA in our data. Due to these potential issues with the multinomial logit model as well as to the fact that higher education sector is an incomplete measure of college quality, we estimate OLS models that examine the relationship between housing wealth and the direct resource and school quality measures students experience at the first postsecondary school in which they enroll. To the extent these estimates are similar to the multinomial logit results, it is further indication that the IIA assumption is not driving our estimates.

For our analysis of housing wealth and institutional quality measures, we estimate OLS models of the following form:

$$Y_{imsc} = \beta_0 + \beta_1 Own_i + \beta_2 \Delta P^h_{imc} + \gamma X_i + \alpha Z_{sc} + \delta W_{mc} + \theta_m + \psi_c + \epsilon_{imsc}, \qquad (5)$$

where 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-

[19]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.

run home price changes before they turn 18 due to the differential timing and strength of the housing boom across cities. This model is identified by comparing college choices within cities among students who were different ages in 1997 and thus who experienced different home price variation when they were 14 through 18 years old. 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 very unlikely. 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.

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. The 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 0.0018 percentage points and reduces the likelihood a student attends a community college by 0.0063 percentage points, although the

latter coefficient is only statistically significant at the 10% level. 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 2.1% (=(0.0018/0.086)*100) and decreases the probability of attending a community college by 1.6% (=(-0.0064/0.402)*100).

Given the substantial variation in home prices over the past decade, these marginal effects translate into large changes in college selection. The average homeowner in our sample experienced a four-year home price increase of $52,460, which leads to a 11.0% increase in the probability of attending a state flagship university and a decrease in the likelihood of attending a community college of 8.2%. 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 changes increased attendance at flagship universities by 14.9% and decreased community college attendance by 11.1%. The marginal effects for housing price growth in Table 3 therefore lead to sizeable shifts in the types and quality of schools students attend within the public sector, which has important implications given the recent large declines in home prices in many areas of the country.[20]

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.[21] 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

[20] 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 (2010), we find a $10,000 increase in four-year home price growth decreases the likelihood of college non-attendance by 0.0115 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.

[21] 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.

indicates that housing wealth changes affect sorting within the public sectors of higher education, not across the public and private sectors. This finding reinforces the importance of examining how family resources affect college selection within the public sector, which previous work largely has ignored.

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.

In our characterization of school sectors, we did not distinguish between in-state and out-of-state enrollment. Some students may decide to attend a public or private university outside their home state, which could increase institutional quality and/or match quality but would entail higher attendance costs. Using a dummy variable for out-of-state attendance as the dependent variable in equation (3), we estimate that a $10,000 increase in home prices while in high school increases the likelihood of leaving one's home state for college by 0.0044 percentage points, or 2.7%. Although sample size limitations prohibit an analysis of out-of-state attendance by sector, housing wealth increases while in high school lead to a higher proportion of students attending college away from their home state. This result provides further evidence that housing wealth increases lead to the purchase of more expensive higher education.

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 in Table 3 are included in the Table 4 results, but many of them are excluded from Table 4 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 0.0031 percentage points, or 6.2%,[22] 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. 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 0.0020 percentage points, or 2.4%. 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 0.0196 percentage point, or 4.0%, 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. The estimates for the lower-income group overall imply sizeable changes in college attendance patterns among these students due to home price changes.

Multiplying these marginal effects 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 19.9% and an average relative decrease in the likelihood of community college enrollment of 12.7%. Among twelve-year-olds in 1997, the average home price increase was $40,245, which leads to a 25.0% increase in flagship enrollment and a 15.9% decrease in community college enrollment relative to non-flagship public enrollment. Table 4 demonstrates that the housing boom caused large changes among lower and middle income families in the sectors in which their

[22] The percents in this paragraph are calculated by dividing the marginal effect by the baseline attendance probabilities for each group shown in Table 2.

children enrolled in college.

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 simply were re-sorted. Table 5 presents institution-level estimates of the relationship between state-level CMHPI growth and public sector enrollment in the three public sectors in our analysis.[23] Each cell of the table represents a separate regression of the log enrollment measure at an institution 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 to 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 university. 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 public sector is more enrollment-elastic than the flagship sector.

We observe no aggregate increase in enrollment at flagship public universities when home prices in the state increase, which is sensible given the fact that this sector is unlikely to be responsive to changes in student demand (Bound and Turner, 2007). There is some evidence applications increase when home prices in the state increase, but the estimated elasticity is not statistically distinguishable from zero. 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

[23] 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.

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 enrollment 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 recent housing wealth growth.

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 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 1.46 points, the student-faculty ratio by 0.0004, expenditures per student by $397.7, instructional expenditures per student by $69.8, 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. For example, a student experiencing the average home price change of $52,460 is predicted to attend a university that has a four-year graduate rate 1.5% higher, that spends $2086.6 more per student in total, spends $366.4 more on instruction per student, and that has a 75^{th} percentile SAT score that is 5.8 points higher. These estimates translate into between 7 and 9% of the large average differences between non-flagship and flagship university resources (see Table 1). The estimates in Table 6 thus indicate that no matter which quality measure 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, and the large housing price variation experienced by these cohorts is sufficient to create meaningful differences in college quality exposure.

Table 6 shows that home price changes have at most a small effect on tuition;[24] although each $10,000 of housing wealth is associated with attending a college that costs $58 more per year, this estimate is not statistically significant at conventional levels. Given that most students are likely to receive federal, state and institutional aid, however, posted tuition may be a poor proxy for the amount actually paid by families. Unfortunately, the NLSY97 does not contain information on paid tuition that would allow us to assess directly whether families that experience home price increases pay more for college.

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 two- and four-year schools. There is 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 prices should not affect the quality of the two-year school in which a student enrolls.

[24]We define tuition as posted in-state tuition if a student attends in the state in which she lived in 1997 and as out-of-state tuition if the student attends in a different state. Thus, these estimates incorporate the increased likelihood of going out-of-state for college discussed in the previous section.

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 in equation (3); 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 results in Table A-2 are extemely similar to, if mostly smaller in absolute value than, the estimates in Table 6, with the notable exception of tuition, 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 cross-sector selection. 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 example, for families earning less than $75,000 per year, a $10,000 increase in home prices leads to their children attending schools that spend $478 more in instruction per student and that have graduation rates 0.0025 percentage points higher. When compared to the average school quality levels for this group (see Table 2), these translate into a 9.7% increase in instructional expenditures per student and 0.5% increase in mean graduation rates at the universities students select into for each $10,000 increase in home prices while in high school. When multiplied through by the

mean home price increase for this group of $32,160, these estimates again suggest a large effect on school quality for the lower-income sample driven by home price changes during the housing boom.

For higher-income families, the coefficients mostly are smaller and not statistically different from zero at conventional levels. Although students from both lower and middle income families attend institutions with higher SAT scores and graduation rates when home prices increase, 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 findings, together with those in Table 4, 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. Although such an Engel curve is possible, we see no reason to expect wealth effects to be zero for higher income families. We thus favor a credit constraint interpretation of the estimates, but 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. This finding 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.[25]

[25]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, we also have used lagged 1992-1994 average institutional measures instead of average contemporaneous measures as the former are exogenous with respect to future home price changes. The IPEDS survey did not report SAT and graduation rate data in these years, but the faculty-student ratio, expenditure and tuition effects all are very similar to what we report in Tables 6 and 7. This similarity

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 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 levels of the community college students attend. These results suggest home price changes may have an even weaker effect on the quality of community college attended than we estimate in Table 6.

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

is unsurprising given the high correlation between the lagged and contemporaneous measures (between 0.8 and 0.97 depending on the variable), and it reinforces the claim that using contemporaneous resource measures is not driving our results.

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 than in 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 who experience home price increases are more likely to attend flagships despite these relative declines in financial aid, which is consistent with families using their increased housing wealth to finance a higher-quality college education for their children.

4.3 College 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 collegiate resource changes, combined with the increased access to family financial resources brought about by home price increases, affect students' postsecondary outcomes? In Table 9, we present estimates of the effect of home price changes in the four years prior to a child turning 18 on three college outcomes: time between college and high school, weekly hours worked during college and BA completion. These estimates present new evidence on the effect of family resources on collegiate outcomes, using wealth variation generated by the housing boom rather than conditional income gradients.

In Table 9, we show estimates for the full sample in Panel A and by income groups in Panel B 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 the first two columns show little evidence that housing price increases affect the length of time between high school and college for either the full sample or across income groups. In Panel B we find that a $10,000 home price increase among the lowest income families increases the likelihood of obtaining a BA by 0.007 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, 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, and we find no effect of housing wealth on BA completion rates for middle and high income families. Importantly, these estimates are suggestive of potential reductions in the BA attainment rate among lower-income families due to the housing market bust that began in 2006.

Finally, student labor supply has grown markedly in recent years (Scott-Clayton, 2007; Bound, Lovenheim and Turner, 2010b; Babcock and Marks, Forthcoming) and has been linked to reduced academic success (Stinebrickner and Stinebrickner, 2003; Kalenkoski and Pabilonia, 2010). Thus, the effect of home price changes on student working behavior is interesting in its own right as well as being one of the potential mechanisms by which home prices affect BA completion. The final two columns of Table 9 explore the effect of home price changes on student labor supply in the first year of enrollment. While there is little evidence of an overall relationship, for low income students, a $10,000 home price increase while a student is in high school reduces

average weekly hours worked by between -0.27 and -0.35 hours. Both estimates for the low income sample are significantly different from zero at the 5% level.[26] The median lower-income student works 14.5 hours per week in the sample, so these marginal effects are modest relative to the baseline. However, they do indicate that increased family resources cause a reduction in student labor supply for lower-income students, which together with the school quality effects documented above, lead to higher BA attainment rates for this group.

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 2.1 percent and decreases the relative probability of attending a community college by 1.6 percent. There is no effect

[26] We also estimated the effects of housing price increases on the number of credits attempted and full-time status of the student. We find that lower-income students are more likely to attend college full-time and attempt more credits when they experience increases in housing prices prior to turning 18. Student full-time status and attempted credits is insensitive to housing price increases for middle- and higher-income students. These results are consistent with lower-income students working less during college when family resources increase.

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 decreased student labor supply and 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 work, the housing bust may have long-run effects on the supply of high-skilled labor and on income inequality. Future research 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: 1997-2003 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 Analysis 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	4.357	1.490	4.475	1.551	4.319	1.502	4.132	1.366
Real Per Capita Income ($1,000)	32.01	5.93	31.78	5.91	31.83	6.04	32.50	6.05
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 Relative to a Non-flagship Public School

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change ($10,000)	0.0018**	-0.0001	-0.0063*
	(0.0007)	(0.0020)	(0.0039)
Home Ownership Dummy	0.0004	0.0100	-0.0177
	(0.0078)	(0.0220)	(0.0334)
Real Family Income ($10,000)	0.0014**	0.0029*	-0.0080**
	(0.0004)	(0.0016)	(0.0027)
Missing Income	0.0069	0.0159	-0.0467
	(0.0098)	(0.0311)	(0.0444)
AFQT Score	0.0011**	0.0020**	-0.0073**
	(0.0001)	(0.0004)	(0.0005)
Father HS Diploma	0.0052	0.0249	-0.0209
	(0.0127)	(0.0315)	(0.0401)
Father Some College	-0.0100	0.0551	-0.0717
	(0.0155)	(0.0370)	(0.0443)
Father BA+	0.0125	0.1381**	-0.1415**
	(0.0136)	(0.0357)	(0.0482)
Missing Father Education	0.0017	0.0891**	0.0085
	(0.0148)	(0.0340)	(0.0445)
Mother HS Diploma	-0.0024	-0.0318	-0.0399
	(0.0151)	(0.0385)	(0.0416)
Mother Some College	0.0103	-0.0182	-0.0461
	(0.0156)	(0.0398)	(0.0439)
Mother BA+	0.0110	0.0108	-0.1736**
	(0.0162)	(0.0379)	(0.0474)
Missing Mother Education	0.0314*	-0.0110	-0.0924
	(0.0186)	(0.0405)	(0.0596)
Female	0.0027	0.0235*	-0.0411*
	(0.0042)	(0.0135)	(0.0221)
Black	0.0074	0.0342	-0.2047**
	(0.0097)	(0.0217)	(0.0360)
Hispanic	-0.0047	0.0485**	-0.1180**
	(0.0095)	(0.0234)	(0.0423)
Other Race	0.0126	0.0361	-0.0988
	(0.0127)	(0.0318)	(0.0674)
Unemployment Rate	-0.0019	-0.0154**	-0.0199*
	(0.0028)	(0.0078)	(0.0103)
Real Per Capita Income	0.0006	0.0003	-0.0050
	(0.0004)	(0.0002)	(0.0031)
Public 2 Year Schools Per 18-24 Yr. Old	1.4770*	2.4472	-4.8322
	(0.8123)	(2.0823)	(4.1606)
Public 4 Year Schools Per 18-24 Yr. Old	0.0091	0.2857	0.4692
	(0.1111)	(0.2256)	(0.6702)
Real State Aid Per 18-24 Yr. Old	-0.0647	0.0722	-0.0230
	(0.0427)	(0.1393)	(0.2588)
BA/AA Wage Ratio	0.0141	0.0342	-0.2451
	(0.0391)	(0.1569)	(0.2078)
BA/HS Wage Ratio	-0.0120	-0.1743	0.0875
	(0.0493)	(0.1731)	(0.2367)

[1] All estimates include state fixed effects and age in 1997 fixed effects and are weighed by sampling weights. All results in the table come from one multinomial logit estimation of equation (3).

[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 Relative to a Non-flagship Public School

Independent Variable	Flagship Public	4 Year Private	Community College
4 Year Home Price Change ($10,000)*	0.0031**	0.0021	-0.0196**
I(Low Income)	(0.0007)	(0.0028)	(0.0091)
4 Year Home Price Change ($10,000)*	0.0020**	-0.0038	-0.0018
I(Middle Income)	(0.0007)	(0.0032)	(0.0047)
4 Year Home Price Change ($10,000)*	0.0009	-0.0021	0.0026
I(High Income)	(0.0007)	(0.0022)	(0.0043)
Home Ownership Dummy*	0.0019	0.0148	0.0226
I(Low Income)	(0.0081)	(0.0240)	(0.0565)
Home Ownership Dummy*	-0.0066	0.0885	-0.1231
I(Middle Income)	(0.0162)	(0.0584)	(0.0777)
Home Ownership Dummy*	-0.0030	0.0879	-0.1042
I(High Income)	(0.0217)	(0.0751)	(0.1335)
AFQT Score	0.0008**	0.0019**	-0.0076**
	(0.0001)	(0.0003)	(0.0006)
Real Family Income ($10,000)	0.0003	0.0032	-0.0071
	(0.0006)	(0.0020)	(0.0046)
I(Middle Income)	0.0202	-0.0895	0.0419
	(0.0166)	(0.0574)	(0.0877)
I(High Income)	0.0392*	-0.0800	-0.0242
	(0.0234)	(0.0804)	(0.1481)

[1] All estimates include state and age in 1997 fixed effects as well as controls for mother's and father's education, gender, race, MSA-level unemployment and real income per capita, state-level 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. All results in the table come from one multinomial logit estimation of equation (4).

[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

	Independent Variable: Home Price Change ($10,000)		
Dependent Variable	All Colleges	Four Year	Two Year
25^{th} Percentile Math SAT	1.463**	1.133**	.
	(0.576)	(0.548)	.
75^{th} Percentile Math SAT	1.133**	0.829*	.
	(0.543)	(0.518)	.
Faculty-Student Ratio	0.0004**	0.0005**	-0.0001
	(0.0002)	(0.0002)	(0.0001)
Expenditures Per Student	397.746**	588.365**	0.977
	(157.359)	(270.288)	(11.912)
Instructional Expenditures Per Student	69.843*	89.550*	3.870
	(35.847)	(54.367)	(7.254)
Graduation Rate	0.0029**	0.0023*	.
	(0.0014)	(0.0013)	.
Tuition	58.187	53.914	15.663
	(54.002)	(88.567)	(20.639)

[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, MSA-level unemployment and income per capita, stae-level 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. Each cell in the table represents a separate regression.

[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 by Family Income

Dependent Variable	Independent Variable: Home Price Change ($10,000) Low Income	Middle Income	High Income
25^{th} Percentile Math SAT	1.304**	1.337**	0.811
	(0.665)	(0.634)	(0.638)
75^{th} Percentile Math SAT	1.075*	0.943*	0.540
	(0.596)	(0.561)	(0.618)
Faculty-Student Ratio	0.0005**	0.0001	0.0002
	(0.0002)	(0.0002)	(0.0002)
Expenditures Per Student	478.230**	122.097	286.562
	(194.222)	(165.097)	(247.374)
Instructional Expenditures Per Student	94.164**	-11.567	28.925
	(49.264)	(47.156)	(62.688)
Graduation Rate	0.0025*	0.0027	0.0011
	(0.0015)	(0.0017)	(0.0016)
Tuition	49.513	-4.754	25.124
	(72.458)	(63.752)	(84.743)

[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, MSA-level unemployment and income per capita, state-level 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. Each row in the table represents a separate regression.

[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. Each cell in the table represents a separate regression.

[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 and Student Labor Supply

Panel A: Average Effects						
	Time Between HS and College		BA		Weekly Hours Worked	
4 Year Home Price Change ($10,000)	0.0019	0.0025	0.0023	0.0021	-0.1295	-0.0680
	(0.0040)	(0.0050)	(0.0021)	(0.0025)	(0.0932)	(0.1174)
Home Ownership Dummy	-0.1780**	-0.1888**	0.0532**	0.0538*	1.0526	0.4282
	(0.0534)	(0.0645)	(0.0271)	(0.0319)	(1.2138)	(1.4105)
Real Family Income	-0.0111**	-0.0098**	0.0068**	0.0050**	-0.1453**	-0.1575**
	(0.0026)	(0.0025)	(0.0021)	(0.0022)	(0.0532)	(0.0598)
AFQT Score	-0.0045**	-0.0044**	0.0049**	0.0048**	-0.0614**	-0.0574**
	(0.0008)	(0.0008)	(0.0004)	(0.0005)	(0.0134)	(0.0150)
MSA Fixed Effects?	No	Yes	No	Yes	No	Yes
Panel B: Effects by Family Income						
	Time Between HS and College		BA		Weekly Hours Worked	
4 Year Home Price Change*	-0.0075	-0.0064	0.0069**	0.0067*	-0.3495**	-0.2655**
I(Low Income)	(0.0047)	(0.0059)	(0.0034)	(0.0040)	(0.1165)	(0.1258)
4 Year Home Price Change*	0.0115	0.0090	0.0020	0.0025	0.0140	0.0680
I(Middle Income)	(0.0091)	(0.0094)	(0.0036)	(0.0043)	(0.1170)	(0.1425)
4 Year Home Price Change*	0.0042	0.0041	-0.0016	-0.0010	-0.1267	-0.0742
I(High Income)	(0.0037)	(0.0045)	(0.0027)	(0.0031)	(0.0852)	(0.0898)
Home Ownership Dummy*	-0.1526**	-0.1702**	0.0354	0.0422	2.0381	1.5598
I(Low Income)	(0.0617)	(0.0722)	(0.0265)	(0.0325)	(1.4089)	(1.6349)
Home Ownership Dummy*	-0.1413	-0.1516	0.1216*	0.0806	-3.8797	-4.7058
I(Middle Income)	(0.2297)	(0.2439)	(0.0704)	(0.0738)	(2.9302)	(3.3130)
Home Ownership Dummy*	-0.0831	0.0616	0.0566	0.0608	1.2893	-0.5043
I(High Income)	(0.1846)	(0.0971)	(0.1189)	(0.1249)	(2.9276)	(3.1926)
AFQT Score	-0.0044**	-0.0044**	0.0048**	0.0047**	-0.0566**	-0.0519**
	(0.0008)	(0.0008)	(0.0004)	(0.0004)	(0.0145)	(0.0158)
I(Middle Income)	-0.1571	-0.1786	-0.0539	-0.0084	3.6156	4.3398
	(0.2142)	(0.2223)	(0.0728)	(0.0767)	(2.9733)	(3.3606)
I(High Income)	-0.2527	-0.4773**	0.0753	0.0872	-2.2799	-0.3120
	(0.2022)	(0.1143)	(0.1107)	(0.1223)	(3.1069)	(3.2630)
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, parental income, gender, race, MSA-level unemployment and income per capita, state-level 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.

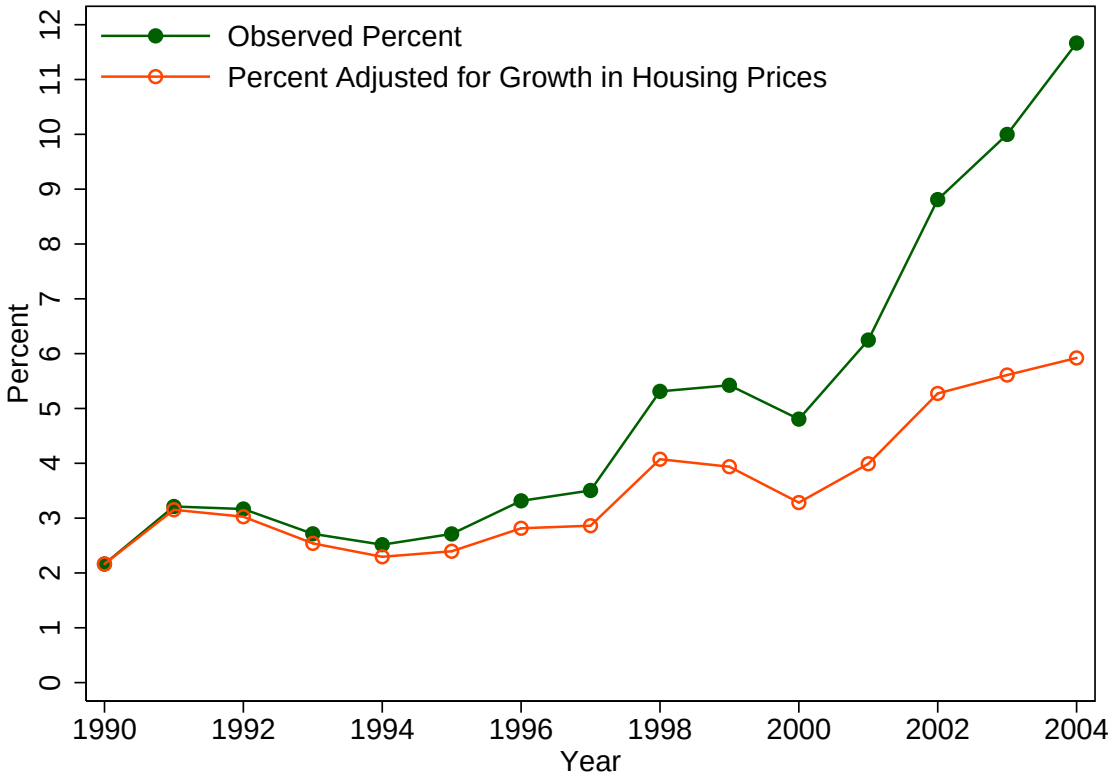
[2] Housing price changes are real housing price changes over the 4 years prior to students turning 18 predicted by the conventional mortgage housing price index.

[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] Weekly hours worked is calculated by dividing total yearly hours worked in the first year of college enrollment by 52, including respondents who work zero hours in the year.

[5] 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

Dependent Variable	Independent Variable: Home Price Change ($10,000) All Colleges	Four Year	Two Year
25^{th} Percentile Math SAT	1.227**	0.891**	.
	(0.418)	(0.378)	.
75^{th} Percentile Math SAT	0.857**	0.545*	.
	(0.375)	(0.337)	.
Faculty-Student Ratio	0.0004**	0.0003**	-0.00001
	(0.0001)	(0.0002)	(0.00004)
Expenditures Per Student	408.692**	462.694**	10.989
	(122.206)	(202.663)	(14.276)
Instructional Expenditures Per Student	91.505**	76.294**	13.191
	(27.383)	(39.214)	(8.602)
Graduation Rate	0.0021**	0.0015*	.
	(0.0009)	(0.0008)	.
Tuition	115.990**	99.716	25.900
	(47.949)	(66.327)	(18.992)

[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, MSA-level unemployment and income per capita, state-level 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. Each cell in the table represents a separate regression.

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