# The Effect of Liquid Housing Wealth on College Enrollment

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**Abstract**

This paper uses short-run housing wealth changes to identify the effect of housing wealth on college attendance. I find households used their housing wealth to finance postsecondary enrollment in the 2000s when housing wealth was most liquid; each $10,000 in home equity raises college enrollment by 0.7 of a percentage point on average. The effect is localized to lower-resource families, for whom a $10,000 increase in housing wealth increases enrollment by 5.7 percentage points. These estimates imply that the recent housing bust could significantly negatively affect college enrollment through the reduction in housing wealth of families with college-age children.

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# 1 Introduction

Whether family resources affect higher education investment decisions is an important empirical question in economics. The relevance of this question is underscored by the large differences across the income distribution in postsecondary enrollment. For example, between 2000 and 2005, the college attendance rate among college-age individuals in the lowest income quartile in the Current Population Survey (CPS) was 33.3%, while among those in the highest income quartile the attendance rate was 75.5%. Differences across the income distribution in college enrollment can be attributed in varying degrees to binding short-run credit constraints, differences in college preparation that are correlated with income, and a wealth effect whereby higher income families consume more higher education. As the differences in college investment across the income distribution may not be indicative of a causal role for family finances, it is important to identify whether family resources have a causal effect on the decision to invest in a higher education.

In the classical models of education investment that assume perfect access to capital markets, individuals invest in higher education until their internal rate of return equals the market rate of return to the investment (Becker, 1962; Ben-Porath, 1967; Mincer, 1958). Because the optimal educational investment decision should be independent of family resources absent liquidity constraints and wealth effects, much of the existing literature on the relevance of family resources in determining college enrollment focuses on the positive correlation between income and schooling, typically interpreting a positive income gradient as evidence of short-run credit constraints (e.g., Ellwood and Kane, 2000).

This interpretation of the positive income gradient in collegiate attainment is confounded by the strong association between student ability and family resources; for cohorts making college investment decisions in the early 1980s, controlling for ability measures significantly reduces the enrollment gap between higher and lower

income households (Carneiro and Heckman, 2002; Cameron and Heckman, 1998 and 2001).[1] In work using more recent data, however, Belley and Lochner (2007) find a stronger relationship between family income and children's educational attainment conditional on ability, suggesting income is becoming increasingly important for explaining teenagers' college attendance decisions.

The previous literature has focused almost exclusively on the role of family income rather than on the importance of total family resources in influencing college investment. The main reason for this focus is the lack of wealth information in the data sets researchers have used, but if families use both income and wealth to pay for college, excluding wealth will cause one to mis-measure the empirical relevance of household finances. Even if wealth measures are available, however, identifying the causal effect of wealth on college enrollment is difficult because families that accumulate more wealth typically are more likely to send their children to college due to unobservable attributes that are correlated both with savings behavior and education, such as child ability and preferences for education.

This paper adds to existing work on the role of parental resources in college attendance decisions by examining the relationship between family housing wealth and postsecondary enrollment,[2] which has received little previous attention.[3] The analysis makes contributions to two different areas of research. First, rather than assuming family resources are exogenous conditional on family characteristics and measured student ability, I use changes in individual housing wealth over time during a period of high housing wealth liquidity, the 2000s, to generate arguably exogenous variation in wealth to homeowners. By identifying the effect of household wealth on

[1] Similarly, Shea (2000) finds that while income is positively correlated with educational attainment in the raw data, when he instruments for income using parental labor supply shocks, he finds no evidence of short-run family income changes on education levels. In structural analyses, Cameron and Taber (2004) and Keane and Wolpin (2001) also find little evidence that financial constraints reduce college attendance.

[2] Throughout this paper, I use the terms "housing wealth" and "housing equity" interchangeably. These terms are distinct from "housing price" and "home value," which refer to the market price of the home rather than the amount of equity built up in the home.

[3] The only previous paper that examines the link between housing and college enrollment is Dynarski (2002), which uses the Higher Education Act of 1992 that excluded housing wealth from federal financial aid calculations to identify the effect of home equity on college enrollment. She finds weak evidence that enrollment post-1992 responded more to housing prices than pre-1992.

college enrollment, my estimates shed new light on the importance of family resources for higher education investment decisions. Second, given the large fluctuations in the housing market over the previous decade, including an unprecedented boom followed by a precipitous and sustained decline since 2006, identifying the effect of housing wealth on household decisions is of substantial policy interest in its own right. This analysis contributes to the growing work indicating the importance of housing wealth for various types of household behaviors; my estimates imply a sizable effect on college-going behavior, particularly for middle class families, from the large recent variation in home prices in the United States.

Although the motivating question for this paper involves total family resources, I focus on housing wealth for several reasons. A first-order reason to analyze housing wealth is that 85% of college attendees come from families that own a home. For all but the wealthiest families, housing wealth comprises the majority of household wealth, and for many families their home is their only financial asset.[4] In addition, the recent housing boom that began towards the end of the 1990s was characterized by both large increases in home values and an increasing liquidity of accumulated home equity: between 1990 and 2005, real median home prices in the United States increased by 55% and extracted home equity as a percent of personal income rose by over 600%. After 2000, a family that experienced a large increase in the value of its home would have a significantly easier time financing college expenditures due to the increased ease of borrowing against its home's value (Bennett, Peach and Peristiani, 2001; Deep and Domanski, 2002; Greenspan and Kennedy, 2005; Doms and Krainer, 2007).[5] The housing boom thus offers an opportunity to study the effect of large wealth changes in the time period just prior to students making college attendance choices on their subsequent investment decisions.

I test for the empirical relevance of housing wealth on college enrollment with data

[4] Author's calculations from the 1977 to 2005 October CPS and the Survey of Consumer Finances.

[5] There is some survey evidence on the use of home equity in financing college costs. *Next Step Magazine* conducted a survey of parents with college-age children and found nearly 25 percent reported they were planning to finance tuition using their home equity. Furthermore, about 3 percent of home equity loans in 2006, which translates into about $7 billion, were taken out to finance higher education expenditures (Grant, 2007).

from the Panel Study of Income Dynamics (PSID), using variation in housing wealth supplied by short-run changes in home prices and wealth in the four years before a child is of college-age in order to overcome the endogeneity of home equity levels and college enrollment. Specifically, I argue that a household's short-run housing wealth change is a valid instrument for its home equity level, and I use these short-run changes to identify the effect of housing wealth on college enrollment during the housing boom.

My main findings show a sizable positive relationship between housing wealth and college attendance: a $10,000 increase in home equity increases the likelihood a child goes to college by 0.71 of a percentage point, which translates into a 1.37 percent marginal effect. Since real average home equity rose by $57,965 between 2001 and 2005, the results imply a 7.91 percent increase in college attendance due to increased home equity over this time period. These estimates are the strongest for households earning less than $70,000 per year, for whom a $10,000 change in home equity leads to a 5.67 percentage point increase in college enrollment. In a series of robustness checks, I show the positive relationship between home equity and college enrollment is most prevalent during the housing boom when equity was the most liquid, and I present evidence that the results are driven predominantly by city-level variation in home prices that reflect differences in the strength and timing of the housing boom across cities and within cities over time. These estimates indicate that potentially endogenous idiosyncratic variation in individual home prices are not driving my results.

The central finding of this analysis is that households used their housing wealth to finance higher education during the recent housing boom. This result has important policy implications in light of the recent decline in housing prices and the increasing difficulty of tapping one's home equity. My estimates imply the collapse of the housing bubble and the "credit crunch" will have a negative effect on college enrollment through the reduction of family housing wealth and thus may have negative long-run

effects on the supply of skilled labor in the United States.

## 2 Aggregate State and MSA Level Trends

Before engaging in the main empirical analysis using micro-data, I first present state and MSA-level estimates of the correlation between home price changes and college enrollment to demonstrate that the aggregate trends are consistent with an effect of housing wealth on college attendance. Figure 1 presents the percent change in home prices plotted against the percent change in college enrollment at the state-level between 2000 and 2005.[6] As the figure indicates, there is a statistically significant positive correlation between home price growth and college enrollment growth during this period.

Column (i) of Table 1 presents state-level regressions of log first time, first year enrollment on the HPI, controlling for unemployment rates, real per-capita income, state population aged 18-22 and state and year fixed effects. In column (iii), I estimate similar regressions using October CPS data on college enrollment among 18-21 year olds at the MSA level. These estimates control for MSA and year fixed effects. The estimates in columns (i) and (iii) mirror the results in Figure 1: increases in housing prices are positively associated with increases in college attendance at the state and city level. Although the HPI estimate in column (i) only is significantly different from zero at the 10% level, these results indicate that home prices and college enrollment moved together during the 2000s.

In columns (ii) and (iv), I present similar estimates for the 1990s. Over this decade, home prices were weakly negatively correlated with college enrollment, as only the estimate in column (ii) is statistically different from zero at even the 10% level. Although these negative estimates are somewhat unexpected, they do show that the relationship between housing price variation and college enrollment changed

[6]Housing prices are measured using the Federal Housing Finance Agency's Housing Price Index (HPI). See Section 4 for a description of this index. Enrollment is calculated using first time, full time enrollment counts from the Integrated Postsecondary Education Data System (IPEDS) surveys for both two-year and four-year schools.

around the turn of the century. The differences between the 1990s and 2000s coefficients are statistically different from each other at under the 2% level, and they indicate housing became positively associated with home prices during the housing boom period that was characterized by rapidly rising home prices and rising liquidity of home equity. While one cannot necessarily interpret the relationships shown in Table 1 and Figure 1 as causal estimates of the effect of housing prices on college enrollment, the aggregate data are suggestive that one may exist, particularly during the 2000s. The remainder of this analysis seeks to identify this causal relationship using micro-data that will allow me to estimate how family-level variation in housing wealth affects college attendance decisions.

# 3 Empirical Methodology

## 3.1 Theoretical Issues

The goal of this analysis is to determine whether variation in housing equity impacts the propensity to enroll in college. There are two non-mutually exclusive theoretical reasons to expect a family's variation in its housing wealth to influence its children's education decisions. First, if education is purely an investment good, then a straightforward human capital investment model along the lines of Becker (1962) and Rosen (1977) predicts that one will invest in college only if the net rate of return is greater than or equal to the market rate of return one would earn by investing the foregone earnings and the direct cost of college. Critically, optimal education investment in such a model does not rely on family resources. Family resources in general, and housing wealth in particular, have the possibility of affecting college enrollment through the fact that the interest rate at which a household can borrow to finance a college education is a function of its assets (including government subsidized loans and grants).[7] Consider a credit constrained student, for whom it would be optimal

[7] Cameron and Taber (2004) make the same point in their analysis of credit constraints in college enrollment.

to invest in college if she could borrow at her internal rate of return but whose family lacks sufficiently inexpensive access to credit to make the investment worthwhile. If this student's home grows in value, this increases the amount of equity that can be used as collateral. Since home equity loans are relatively inexpensive, this home price change potentially reduces the average interest rate at which a family can borrow the funds for a college education. Thus, variation in home prices can affect college attendance decisions for otherwise liquidity constrained students.

If college attendance or completion is a consumption good for parents or students, however, housing wealth variation can affect college enrollment decisions even in the absence of credit constraints through a wealth effect. As home prices increase and homeowners become wealthier, they may consume more of all goods, which may include college for their children. To the extent that housing wealth changes affect college attendance behavior, it will be difficult to parse out the relative importance of these underlying mechanisms with my empirical strategy and data.[8] It is important to emphasize that given the large fluctuations in home prices over the past decade, identifying the causal effect of home prices on college enrollment is of much policy importance, regardless of the underlying reason for the estimated effect. The remainder of this paper will focus on identifying such an effect in the data, but I will discuss the evidence for a credit constraint interpretation of the results in Section 5.4.

### 3.2 Empirical Model

The central difficulty in identifying how housing wealth variation affects college enrollment decisions is that housing wealth is not randomly assigned across households: children from higher wealth households are more likely to attend college regardless

[8]Other papers on liquidity constraints in higher education that estimate income gradients face a similar challenge (Carneiro and Heckman, 2002; Ellwood and Kane, 2000; Belley and Lochner, 2007). While these papers discuss the consumption interpretation of income gradients in college investment, none of them is able to test for the empirical relevance of wealth effects. Keane and Wolpin (2001) include the consumption value of schooling in their model and find that while borrowing constraints exist, they affect student labor supply and consumption rather than attendance decisions. Keane (2002) also presents a discussion of the role of the consumption value of schooling in generating income differences in college attendance.

of the fact that their parents have access to more capital. I propose to overcome this problem by using short-run changes in individual housing wealth in the time period just prior to a child becoming of college age to generate exogenous variation in home equity levels. Specifically, I estimate the following model, instrumenting home equity with the four-year change in home price or equity ($H_t - H_{t-4}$):

$$Enroll_i = \beta_0 + \beta_1 Own_i + \beta_2 Equity_i + \beta_3 Y_i + \gamma X_i + c_i + t_i + \epsilon_i \quad (1)$$

where *Enroll* is a dummy variable equal to 1 if individual $i$ enrolls in a 2-year or 4-year college, *Own* is a dummy variable equal to 1 if the household owns its own home in time $t$,[9] *Equity* refers to real home equity, and $Y$ represents real total family income from all sources. The model also includes a vector of individual and household characteristics as well as state labor market measures ($X$), which are discussed in Section 4. Finally, I include year fixed effects ($t_i$) and geographic area fixed effects ($c_i$), where each respondent's geographic area is either his MSA or his state if he lives outside of an identified city. Because of the strong geographic component of housing wealth changes, all standard errors are clustered at the geographic area level in the results presented below.[10]

The rationale for instrumenting home equity level with the change in home equity or the change in housing price is two-fold. First, home equity levels are endogenous if families tap their equity to pay for college, and housing price levels are a poor measure of housing wealth because one can own an expensive home without having much home equity (and vice versa). Second, short-run housing wealth changes are an arguably exogenous source of home equity variation. Using the four-year change in housing wealth prior to the student becoming of college-age as an instrument for housing wealth levels allows me to identify $\beta_2$ in equation (1) under the conditions that housing wealth changes indeed provide a significant source of home equity variation

[9] There are few movers in my sample, and the results and conclusions are robust to dropping them. Thus, estimates would be unchanged if I defined homeownership as owning a home in *t-4*.

[10] In the models in Table 4 that use data from 1980 through 2005, the standard errors are clustered at the decade-by-area level.

and that this wealth variation is conditionally exogenous, i.e., is uncorrelated with the error term conditional on the observables.[11]

One important factor that would cause housing wealth changes to be endogenous is the existence of unobserved student characteristics that are correlated with both college enrollment and housing wealth changes, the most likely of which is student ability. If higher ability students are more likely to go to college and are more likely to be from higher housing wealth households, my estimate of $\beta_2$ will be biased upward. Furthermore, if such students sort into relatively higher housing growth localities over time, or if families with higher ability children are more likely to own homes in high housing growth periods and areas, I may find spuriously positive results.

Equation (1) contains many controls for such selection. I control for a rich set of family background characteristics, including family income and parental education, that are highly correlated with both ability of their children and with homeownership. I include a separate homeownership dummy variable in order to account for selection into homeownership as well. I also include in the model geographic area fixed effects, which control for the potential systematic selection of families with higher ability children into areas with higher housing price growth. For selection on unobservables to be driving my estimates, it has to be occurring within geographic regions.

Conditional on these controls, the housing wealth variation I use to identify equation (1) comes from several sources. First, there is a strong time- and area-specific component to home price changes. For example, home prices in Miami increased by 21% between 1998 and 2001 and increased by 70% between 2002 and 2005. In Dallas, home prices increased by 20% between 1998 and 2001 and by 9% between 2002 and 2005. Those who came of college-age in Miami in 2005 experienced much larger recent home price growth than those in Miami who came of college-age in 2001, and the 2005 Miami sample experienced larger recent home price growth than the 2005

[11]The models also assume that supply is perfectly elastic – any student who wishes to attend college at prevailing prices will be able to attend. This assumption is reasonable due to the prevalence of open enrollment institutions in each state, such as less prestigious state 4-year colleges as well as community colleges. Enrollment at these institutions is purely demand-driven. While supply at top-ranked public and private schools is inelastic, the aggregate supply curve in higher education, unadjusted for quality, is flat.

Dallas sample. This area-level variation is being driven by differences in the timing and strength of the housing boom and incorporates both differences in within-area home price growth over time and differences across geographic areas in a given year in the magnitude of recent home price growth. Using only these sources of variation for identification is ideal because it allows one to compare college-going decisions of students with the same observable characteristics but who experience different home equity growth based on their location and the timing of when they become of college age. Because I control for both location and the timing of becoming college-age, this source of variation is driven by the arguably exogenous timing and strength of the housing boom.

Individual housing wealth changes also are driven by variation in lagged home price levels and from idiosyncratic variation within areas in home price growth. Both of these sources of variation are potentially problematic. Lagged home values may be proxying for permanent income, which is likely to be positively correlated with unobserved academic ability. In addition, families with children who are more likely to attend college may sort into neighborhoods within a given geographic location in which home prices rise more. Both of these forms of variation could cause a spuriously positive relationship between individual housing wealth changes and college enrollment that is not due to housing wealth. In Section 5.3, I present evidence that neither of these sources of variation drive the identification of the effect of housing equity on college enrollment. However, this variation does increase the precision of my estimates, so due to the small sample size in the PSID, I incorporate this variation in the baseline estimates.

The final potential identification concern with equation (1) is that both housing wealth growth and college enrollment may be correlated with local labor market conditions. If local high-skilled labor demand shocks increase local housing prices and increase the local returns to college investment, my estimates of $\beta_2$ will be biased upward due to this spurious correlation. Note that the relationship between housing

prices and city-level macroeconomic conditions are inconsistent with such a story. During the housing boom, there was a negative correlation between mortgage credit growth and income growth (Mian and Sufi, 2010), suggesting that the housing boom was not occurring predominantly in high income growth areas. A regression of MSA HPI values on real MSA per capita income from 2000-2005 including MSA and year fixed effects shows a negative (although not statistically significant) correlation between city-level income changes and home price changes during this period as well. Taken together, this evidence suggests local macroeconomic shocks are unlikely to be driving both home price changes and college-going behavior post-2000. Nonetheless, I control directly for yearly variation in unemployment rates, real income per capita and the size of the college-age population at the state level in all models. In Section 5.3, I also estimate the model only for renters, who experience the local macroeconomic fluctuations but not the financial gains from housing wealth increases. I find renters do not respond to changes in MSA-level home prices, which suggests my estimates are not being biased by unobserved contemporaneous macroeconomic shocks.

# 4 Data

The individual-level data in this analysis come from the Panel Study of Income Dynamics (PSID). The PSID began following a nationally-representative sample of households in 1968 and has followed it and its descendants continuously since that time.[12] These data are particularly suited to address the central research questions set forth in this paper because they contain information on educational attainment, self-reported housing prices, housing equity, and a rich set of family background characteristics. Crucially, these data also allow one to link college students to their parents in order to measure family resources.

[12]In order to make the survey nationally representative, all tabulations and regressions with these data use the family weights given in the survey.

While there are PSID surveys available continuously between 1968 and 1997, after 1997 they were conducted every other year. I construct a repeated cross section of 18-19 year olds from each PSID survey in 2001, 2003 and 2005. Thus, my analysis will cover the housing boom of the late 1990s through 2006 but will not cover the subsequent slowdown in the housing market. On average, there are 499 observations in each year, with a total sample size of 1,497. For the models that include data from the 1980s and 1990s (see Section 5.3), I construct a repeated cross section of 18-19 year olds from each PSID survey in every second year beginning in 1980. Appendix Table A-1 presents descriptive statistics for the analysis variables by decade.

### 4.1 College Enrollment

The PSID does not directly ask for college enrollment but contains information on years of school completed. I measure enrollment as having completed more than 12 years of schooling. Note this definition of enrollment is somewhat different from most of the college enrollment literature as I do not count students who attend college but drop out before completing their first year. Because of the long nature of the panel, I can determine whether a student completed a thirteenth year of education in subsequent surveys follow-ups. If a student completed more than twelve years of education within two years of the survey, I classify him as enrolled. The baseline college enrollment rate of 52% (see Appendix Table A-1) thus is lower than the rates calculated from the CPS or from the US Census because it excludes "incidental attenders" who do not finish a year of college. Calculations from the October CPS show college attendance in the 2000s is about 58%, and Adelman (2004) shows that about 9% of the high school class of 1992 were incidental attenders. These estimates imply that incidental attendance accounts for the difference between the college attendance rate in the PSID and the college attendance rate calculated from other sources that include incidental attendees.

### 4.2 Housing Prices and Equity

The housing price measures in this analysis come from self-reported housing values in the PSID. Self-reports have the drawback that they may contain considerable measurement error, either because individuals do not know the price of their home or because they may systematically misreport this value. In Figure 2, I compare an index of home prices from the PSID (1980=100) to the Federal Housing Finance Agency's Housing Price Index (HPI) that is similarly scaled.[13] As the figure demonstrates, the aggregate median and mean reported housing values in the PSID track the national index quite closely. That the mean PSID index diverges slightly in more recent years is due to the fact that new homes are not included in the HPI, but they are included in the PSID measures. Figure 2 suggests that if there is measurement error in the PSID housing prices, it does not show up in the aggregate trends.

I use two different measures of four-year housing wealth changes as instruments to identify $\beta_2$ in equation (1). First, I calculate the change in housing prices over the past four years for all homeowners. Because all changes in housing prices are capitalized into wealth for a given homeowner, the change in one's home value is a good measure of the short-run change in family resources due to housing price changes.[14] However, depending on where a family lies on its mortgage repayment schedule, the four-year change in price may significantly understate the four-year change in housing wealth. While the four-year change in home equity for all homeowners is a more attractive housing wealth change measure conceptually, this change is endogenous if families with college-going children extract more of their home equity to pay for college. Thus, I construct a measure I term "counterfactual growth in home equity." This counterfactual growth is the amount of growth expected if the household had

[13]The HPI is an index of all repeat-sale single family home mortgages that were purchased or securitized by Fannie Mae or Freddie Mac over the course of a year.

[14]To the extent allowed by the data, I exclude those who move over the four-year period. The PSID does not ask respondents if they have moved homes, but I exclude any observation with a greater than 100% change in housing price over this four-year period and any household that moved across geographic areas in the previous four years in order to proxy for moving. This excludes about 4% of the sample. The estimates are not sensitive to dropping these observations, nor are they sensitive to dropping those who experience more than a 70% change in home price over the previous four years combined with those who move across geographic areas during this period.

continued paying its mortgage over the four-year period without tapping into its equity. This variable is intended to measure the amount of equity growth the household would expect to have over this period, which includes the change in home prices over the four years.

The central difficulty in constructing counterfactual equity is estimating the equity accumulation over the 4-year period. Given full information about the loan, this calculation is simple. However, I do not observe the interest rate or the age of the loan, but I do observe the yearly amount of mortgage payment and the remaining principal on the loan. I use the ratio of the mortgage payment to the remaining principal to estimate the interest rate and loan age, which I then use to calculate the equity accumulation the household would expect over the previous 4 years.[15]

Estimation of the interest rate and loan age proceeds as follows: first, I assume all loans have a 30-year term. I use the national average mortgage interest rate on single family homes reported by Freddie Mac and assign an interest rate to each loan age in each survey year.[16] For each year and mortgage age from 0 to 30, I calculate the ratio of the monthly mortgage to remaining principal implied by the interest rates I assigned to each year-mortgage-age combination. I then calculate this ratio for each respondent. The interest rate and mortgage age combination that minimizes the squared difference between the two ratios identifies the parameters of interest. Using the imputed interest rate and loan age, I calculate a counterfactual home equity level in year t that is the expected housing wealth if the household did not tap any of it's equity over the previous four years. Subtracting actual home equity in t-4 from counterfactual home equity in year t yields the counterfactual home equity change

[15]The Survey of Income and Program Participation (SIPP) contains real estate topical modules that have more information on home loans as well as on college enrollment status. These data allow one to calculate counterfactual home equity growth under a less restrictive set of assumptions because the term of each loan and the interest rate are observed. Unfortunately, there are only two SIPP waves that can be used for an analysis such as this one – 1996-1999 and 2001-2004 – because the other waves do not contain real estate modules more than a year apart. In these surveys, the topical modules allow one to observe only two years of housing price and equity changes, but given the added information in these surveys, they serve as a useful check on the assumptions I make with the PSID data. I conducted my analysis using the SIPP data and the results and conclusions are similar to those reported below from the PSID. The results using SIPP data are available from the author upon request.

[16]For example, in the 2001 survey, a loan that was 10-years old, thus originating in 1991, was assigned an interest rate of 9.25%. In 2003, a loan that was 12-years old would have the same interest rate, whereas a loan that was 10-years old would have an interest rate of 7.31%, which was the interest rate in 1993.

measure used in the analysis.

### 4.3 Demographic Characteristics and Labor Market Measures

The PSID also contains detailed demographic information about each respondent and household. I construct measures of the household head's education level, age, marital status, and sex, the number of other dependents under 18 living in the household, the respondent's race and gender, and total family income from all sources. These variables are taken directly from the PSID and are measured as of the current year of the survey. Notably, I have no information on financial aid received by each household. However, to the extent financial aid policies reduce the importance of family resources, this omission will bias my housing wealth estimates towards zero.

In order to control for local high-skilled labor demand, I control for state-level real per capita income. Per capita income comes directly from the U.S. Bureau of Economic Analysis, which I adjust for inflation using the CPI-U. State-level unemployment rates come from the Bureau of Labor Statistics Local Area Unemployment Statistics compilation. Data on the size of the state college-age population, defined as the population of 18 to 22 year olds, are collected from the U.S. Census Bureau population estimates.

## 5 Results

### 5.1 Baseline Estimates

Table 2 presents OLS and IV estimates of equation (1) using the PSID data described in Section 4 for the years 2001, 2003 and 2005. In the first column, I present OLS estimates of the relationship between home equity levels and college enrollment. Conditional on the extensive family background controls in the model, home equity levels are only weakly correlated with college attendance likelihood: a $10,000 change in equity is associated with 0.14 of a percentage point change in the probability of

college enrollment. There is reason to believe that this estimate is biased towards zero, however, because if families tap their home equity to pay for college, then students from college-going families will come from homes with lower home equity, *ceteris paribus*.

In the next two columns of Table 2, I instrument home equity levels with four-year changes in home price and counterfactual home equity, respectively. In column (ii), I find that when home price change is used as an instrument for home equity level, a $10,000 change in home equity leads to 0.56 of a percentage point change in the likelihood of college enrollment. This estimate is statistically distinguishable from zero at the 5.9% level. At the bottom of the table, the first-stage estimate of the home price change coefficient is shown. Changes in home prices are strongly associated with home equity levels, with a first-stage F-statistic of 20.96. Column (ii) thus shows evidence that households that experience home price increases while their children are in high school have higher home equity, and consequently their children are more likely to enroll in college.

In column (iii), I use the four-year change in counterfactual housing equity discussed in Section 4 as an instrument for home equity. As expected, the coefficient on the counterfactual equity change in the first-stage increases relative to the estimate shown in column (ii). This increase occurs because the counterfactual equity change accounts for the differential buildup in equity by households based on where they are on the mortgage repayment schedule. The second stage estimates in column (iii) shows that a $10,000 increase in home equity leads to 0.71 of a percentage point increase in the likelihood of college enrollment, which is statistically distinguishable from zero at the 0.4% level. These estimates are suggestive that households use their housing wealth during this time period to finance college for their children.

While the marginal effects in columns (ii) and (iii) of Table 2 appear somewhat modest, the changes in home equity during the housing boom were large enough to render even small responses meaningful. Between 2001 and 2005, average home

equity increased by $57,965, which implies an increase in college enrollment of 4.1 percentage points using the results from column (iii). Because college enrollment rates were 52% in this sample, my estimates suggest that home equity changes during the housing boom led to a 7.91% growth in college enrollment. This large predicted increase in college attendance indicates that college enrollment decisions were influenced significantly by housing wealth growth during the housing boom.

### 5.2 Sample Splits Based on Family Income

The results thus far have demonstrated a positive and statistically significant relationship between housing wealth and college enrollment during the housing boom for the average homeowner. I now turn to an analysis of whether these effects are larger or smaller for those with lower income. Understanding how housing wealth variation influences college investment across the distribution of family economic circumstances is important because those from lower-resource families invest much less in higher education. So, to the extent this group is highly responsive, it points to one source of variation that can induce those from poorer backgrounds to invest in college at higher rates.

Table 3 shows IV estimates of equation (1) by different family income levels, using counterfactual home equity growth as an instrument for home equity. The estimates in Table 3 show strong evidence that the effects in Table 2 are being identified off of relatively poorer families. For families with less than $70,000 in total income, a $10,000 change in home equity leads to a 5.7 percentage point increase in the likelihood of college enrollment. This estimate is statistically different from zero at the 2.4% level. The college enrollment rate for students from families earning less than $70,000 per year is 41.4%, implying a 13.8 percent increase in the college attendance probability from a $10,000 increase in home equity for this group. Average home equity increased by $15,611 between 2001 and 2005 among these homeowners, which my estimates suggest would lead to an increase in college attendance of 21.5 percent

for these students. Thus, for lower and middle income families, the housing boom had a large, positive effect on college enrollment.

The estimated effect of housing wealth on other income groups is more modest, as shown in columns (ii) and (iii) in Table 3. For families earning between $70,000 and $125,000 per year, a $10,000 increase in home equity increases the likelihood of college enrollment by 1.0 percentage point. The effect among families earning over $125,000 per year is much smaller, at 0.5 of a percentage point. Neither coefficient is statistically distinguishable from zero at conventional levels, although the point estimate for the second income group is consistent with a modest college attendance response to home equity for these students. While these families are not poor, they still may have trouble financing a college education due to the high cost of college and the fact that they likely qualify for little financial aid. It therefore is not surprising that this group would exhibit some sensitivity of college attendance to housing wealth variation.

The estimates from Table 3 indicate that it is the lowest-income families whose college investment decisions are most affected by housing wealth. Importantly, these estimates suggest that this group will be most affected by the subsequent housing bust, in which prices have declined nationally by 35% since the 2006 peak. The results by income indicate that the college investment decisions of the middle class families who compromise the majority of the lower-resource sample will be most negatively affected by the loss of wealth entailed by the recent housing market decline.

### 5.3 Robustness Checks

As discussed in Section 3, interpreting the coefficients on home equity in Tables 2 and 3 as causal is predicated on the assumption that individual-level home price and counterfactual home equity growth are exogenous. Particularly because this housing wealth growth is a function of lagged home price levels and of within-area differences in price growth, both of which could be correlated with unobserved factors that

affect college attendance, such as student academic preparation, it is important to assess the sensitivity of the results to potential sources of endogeneity of housing wealth growth. In Table 4, I present a series of robustness checks that support the assumption that housing wealth changes are conditionally exogenous.

First, in column (i), I include PSID data from the 1990s and 1980s to test whether the effect of housing wealth changed over time. This model uses four-year counterfactual home equity growth as an instrument for home equity separately for each decade. I also include in the model decade-by-area fixed effects as well as allow for the effect of homeownership and family income to vary by decade. The rationale for estimating the effect of home equity on college attendance by decade is that the recent housing boom was characterized by a stark change in financial markets; in the late 1990s, housing wealth became more liquid through increased consumer access to home equity loans, home equity lines of credit, and cash out refinances. Much of the increased liquidity of home equity was due to technological innovations in the mortgage industry that made it easier to assess risk and process loans. For example, between 1996 and 2000, average points on mortgage originations dropped from about 1.75 to below 1.0, driven mainly by the reduction in transaction costs (Deep and Domanski, 2002).[17] Bennett, Peach and Stavros (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. Figure A-1 shows the total amount of extracted home equity (Greenspan and Kennedy, 2005, Table 1) as a percent of total personal income in the United States between 1990 and 2004. The increases in observed home equity extraction as a percent of real income are striking. In 1990, home equity extraction was 2 percent of real income, while in 2004 it was almost 12 percent: an increase of almost 600 percent over the fourteen year period. The second line in Figure A-1 adjusts the observed extraction percent for home price changes by using a national home price index as a price deflator (1990=100). This

[17] See LaCour-Little (2000) for an overview of the technological changes that led to these transaction cost declines.

adjustment shows that if one accounts for the mechanical relationship between home prices and the value of equity extraction, equity extraction as a percent of personal income still would have increased by about 300 percent. Figure A-1 strongly supports the claim that home equity extraction became more prevalent post-2000.

Because housing wealth was both lower and less liquid prior to 2000, housing wealth should have less of an effect on college enrollment in the 1990s and 1980s than in the 2000s.[18] If my estimates are driven by the relationship between unobservables and home equity changes, however, one should expect to see a relatively constant effect of home equity on college enrollment across decades. Thus, evidence that the estimated effect of home equity tracks the liquidity of home equity will support the claim that my estimates are not being driven by unobserved variables correlated both with housing wealth changes and the propensity to enroll in college. This interpretation of such a time pattern of college enrollment is based on the absence of a change in the relationship between unobserved ability and housing wealth over the sample period. While I cannot test this assumption directly, the fact that the housing boom was associated with a relatively higher growth in capital access for lower-resource families suggests any change in this relationship would cause the estimates in the 2000s to be smaller relative to earlier decades.

Column (i) of Table 4 shows that the effect of home equity on college enrollment is the strongest during the 2000s. The estimate of 0.0071 for home equity in the 2000s is identical to the estimate reported in Table 2 and is statistically different from zero at the 0.4% level. In the 1990s and 1980s, however, there is weaker evidence of an effect of home equity on college enrollment. I obtain estimates of 0.0019 and 0.0011 in the 1990s and 1980s, respectively, neither of which is statistically distinguishable from zero at conventional levels. As the first-stage F-statistics show, this lack of a strong effect is unlikely to be driven by a weak first-stage, and the estimated effect in the 2000s is statistically different from the 1980s estimate at the 10.2 percent level.

[18] It also is possible that credit constraints have increased in recent years due to the rising cost of college attendance (College Board, 2010).

That the effects of home equity on college enrollment are the strongest in the 2000s suggests the central driving forces behind my results are the growth in home values and the increasing liquidity of housing wealth during the housing boom.

Another way to test that lagged home prices and within-area differences in home price growth are not driving my estimates is to use city-level home price changes as instruments for home equity. In column (ii), I show estimates that use the MSA-level home price index as an instrument for home equity, allowing the estimated equity effect to differ across decades. These estimates include only the 80% of my sample living in an identified MSA,[19] and because MSA-by-decade fixed effects are included in the model, the first-stage is identified off of short-run changes in city-level prices. The main identifying assumption in this model is that short-run home price changes are conditionally uncorrelated with unobserved individual factors that affect college enrollment probabilities. With the MSA-by-decade fixed effects, such correlations would have to be occurring due to within-decade systematic sorting of households with higher ability children into areas with higher home price growth or with contemporaneous shocks that affect both the likelihood of college enrollment and home prices.

The estimates in column (ii) of Table 4 are consistent with those in column (i): a $10,000 change in home equity is associated with an average increased likelihood of college attendance of 1.6 percentage points in the 2000s. This estimate only is statistically differentiable from zero at the 10.7% level, but it is *larger* than in column (i), which is inconsistent with the existence of a positive bias from the use of lagged home prices and within-area home price growth variation. However, the within-area variation is important for increasing the precision on my estimates, as shown by the large increase in the standard errors when such variation is removed. There also is little evidence of an effect of home equity on college enrollment in the 1990s or 1980s

[19]The estimates in Tables 2 and 3 are similar if I restrict the sample to those living in an MSA. I include those who do not live in an MSA in those estimates because of the limited sample size in the PSID data. Results for the MSA sample are available from the author upon request.

when the MSA-level HPI is used as an instrument, although the 2000s estimate only is statistically different from the 1980s estimate at the 15% level.

The main identifying assumption in the specification in column (ii) is that the detailed set of background characteristics, combined with decade-by-area fixed effects, are sufficient to control for any selection of families across MSAs occurring differentially over time within decade that is correlated with housing price increases. In order to test whether families with a higher unobserved likelihood of sending their kids to college are sorting into MSAs that will experience higher home price growth, I leverage the longitudinal structure of the PSID to assign each respondent to the MSA in which the original respondent in 1968 lived. This assignment is possible because each respondent in my data is directly descended from an original survey participant. I then use the HPI values from that MSA for each respondent as an instrument for her home equity level.[20] Critically, this model will be robust to any cross-city endogenous migration. The results using the 1968 MSA HPI are shown in column (iii). They are both qualitatively and quantitatively similar to those in column (ii), although they are even less precisely estimated. However, they provide evidence that endogenous cross-city migration is not driving the home equity estimates presented above.

Finally in Table 4, I estimate a version of equation (1) only for renters and use the MSA-level HPI as the measure of home prices. If there are city-level contemporaneous shocks that are correlated both with home prices and college enrollment, they should affect renters and homeowners alike. I present OLS estimates of the effect of city-level changes in home prices on college-going likelihoods of renters, using current MSA and 1968 respondent's MSA in columns (iv) and (v), respectively. In no decade are any of the coefficients large or statistically significantly different from zero at conventional levels, suggesting that spurious contemporaneous macroeconomic shocks are unlikely

[20]The current MSA and 1968 MSA HPI values are very highly correlated, with a correlation 0.9 that has remained relatively stable over time. This strong correlation is due to the fact that most people move across cities with similar home price trends (Sinai and Souleles, 2009). Note that this specification does not use 1968 prices but uses current prices in the 1968 respondent's MSA.

to be biasing the main estimates of the effect of home equity on college enrollment.

### 5.4 Credit Constraints or Wealth Effect?

The positive effect of housing wealth on college enrollment could be driven either by wealth effects or credit constraints. Although these two mechanisms are very difficult to disentangle with my data and research design, I argue that the results presented thus far are more consistent with credit constraints than with wealth effects. If households were to increase college consumption due to housing wealth increases, one might expect both poorer and wealthier households to increase college attendance. The results in Table 3 run counter to such expectations because the effect of housing wealth changes on college enrollment is strongest for lower income households, who are more likely to be credit constrained. While the consumption effect of housing prices on college enrollment could be be localized to those with lower resources, the most straightforward interpretation of the evidence in Table 3 is that housing equity and college enrollment are related through the relaxation of credit constraints when home prices rise.

A more direct method for examining whether I am identifying wealth effects or credit constraints is to examine the effect of housing wealth increases on the consumption of other goods. If the households in my stylized sample of families with 18 and 19 year olds do not consume more of other goods when their home equity increases, it is reasonable to argue the wealth effect of college also is negligible in this sample.[21] However, if they do not consume more of other goods, then it is suggestive the effects are driven by a change in the cost of funds when home prices increase. Because borrowing against home equity was relatively inexpensive during the housing boom,[22] an expansion in home prices likely decreased the cost of borrowing for

[21]There is a sizeable literature on the relationship between housing wealth and consumption, but one that does not reach a consensus. Many studies have found a positive relationship between housing wealth and consumption (Campbell and Cocco, 2007; Case, Quigley and Shiller, 2005; Hurst and Stafford, 2004; Lehnert, 2004). However, Attanasio et al. (2005) argue this relationship is incidental. In addition, Souleles (2000) examines directly how household consumption responds to college attendance and finds little evidence that nondurable consumption changes with higher education expenditures.

[22]See the interest rate trends between government education loans and home equity lines of credit shown in Figure

college. For some students, this may have made the investment worthwhile, while in the absence of the home price change the cost of borrowing for college would have been too large relative to the expected returns. Thus, credit constraints in eduction investment may exist even when households are not fully borrowing constrained.

In the PSID, I examine how consumption of food, automobiles and leisure respond to changes in counterfactual home equity for my sample of families with 18-19 year olds. The estimates, which are available in Web Appendix Table 1, suggest the consumption of these goods by these families responds at most weakly to home equity variation. While both food expenditures and the number of automobiles respond positively to home equity increases, the point estimates are small. Furthermore, leisure is unaffected by home equity variation. These results are inconsistent with the estimated relationship between housing wealth and college enrollment being solely due to a wealth effect, but they should be interpreted with care because food and automobiles may have different wealth elasticities than the consumption aspect of college enrollment. Although it is difficult to separate wealth effects from credit constraints empirically, the sum total of the evidence appears more consistent with a credit constraint explanation than a wealth effect explanation. More work attempting to separate these two competing hypotheses is needed.

## 6 Conclusion

Given the large differences across the income distribution in college investment, understanding how family resources affect college enrollment has become of preeminent importance. This paper adds to the sizeable existing literature in this area by examining the role of housing wealth in college enrollment behavior, using variation in housing wealth supplied by the recent housing boom. Using the Panel Study of Income Dynamics (PSID), I find a $10,000 increase in housing wealth during the 2000s increases the likelihood of college attendance by 0.71 of a percentage point,

A-2.

or 1.37%. Because home equity increased by $57,965 between 2001 and 2005, this marginal effect leads to sizable changes in college enrollment due to the housing boom. The effect of housing wealth is most pronounced for those with the fewest resources: a $10,000 increase in home equity leads to a 13.8% increase in college attendance among families that earn less than $70,000 per year. These estimates are suggestive that the relationship between college attendance decisions and college enrollment is driven at least in part by a relaxation of credit constraints, as those families most likely to be credit constrained are the most responsive. Additionally, I find little evidence that differential sorting of households with higher ability children into houses that appreciate more can account for my results.

These results have particular relevance to current policy as credit markets have tightened and housing prices have declined in many areas of the country. Considering the reduction in family resources caused by these problems in the housing market, it is likely many families will face increasing constraints in their ability to finance college in the near future. These constraints will exacerbate the negative long run effect of the housing bust on economic growth to the extent that they restrict the supply of high skilled, college educated labor. This consequence of housing market fluctuations largely has been ignored by policymakers, due primarily to the lack of evidence on the relationship between college attendance and housing wealth. The central implication of this work is that college attendance is sensitive to these fluctuations, and future research is needed on policies that can insulate the training of high-skilled labor from variation in the housing market.

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Table 1: State and MSA-Level Estimates of the Relationship Between Home Prices and College Enrollment

| | Dependent Variable: | | | |
|---|---|---|---|---|
| | Log First Time First-year Enrollment at the State Level | | Percentage of 18-21 Year Olds Enrolled at the MSA Levels | |
| | 2000-2005 | 1990-1999 | 2000-2005 | 1990-1999 |
| Independent Variable | (i) | (ii) | (iii) | (iv) |
| HPI/100 | 0.0344 | -0.1234 | 0.1338 | -0.0271 |
| | (0.0202) | (0.0740) | (0.0467) | (0.0662) |
| Unemployment Rate | 0.0058 | 0.0023 | 0.1415 | 0.0764 |
| | (0.0090) | (0.0099) | (0.2986) | (0.2195) |
| Log Real Income Per Capita | -0.0508 | 0.3322 | 0.0175 | -0.0014 |
| | (0.4236) | (0.5185) | (0.0197) | (0.0071) |
| State College-age Population | 0.0094 | 0.0026 | . | . |
| | (0.0097) | (0.0066) | . | . |

Source. – Author's calculation as described in the text from IPEDS enrollment data in columns (i)-(ii) and from the October CPS in columns (iii)-(iv).
Note. – Each column represents a separate regression and all regressions include year fixed effects. In columns (i) and (ii), all variables vary at the state-by-year-level and state fixed effects are included. In columns (iii) and (iv), all variables vary at the MSA-by-year-level and MSA fixed effects are included. Standard errors in parentheses are clustered at the state level in columns (i) and (ii) and are clustered at the MSA-level in columns (iii) and (iv).

Table 2: OLS and IV Estimates of the Probability of College Enrollment as a Function of Home Equity (2001-2005)

| | Dependent Variable: Dummy=1 if Enroll in College | | |
|---|---|---|---|
| | | Home Equity Level Instrumented With: | |
| Independent Variable | OLS (i) | Home Price Change (ii) | CF Equity Change (iii) |
| Real Home Equity ($10,000) | 0.0014 | 0.0056 | 0.0071 |
| | (0.0018) | (0.0030) | (0.0025) |
| Homeowner | 0.1944 | 0.1744 | 0.1615 |
| | (0.0506) | (0.0499) | (0.0479) |
| Real Family Income ($10,000) | 0.0031 | 0.0020 | 0.0017 |
| | (0.0013) | (0.0014) | (0.0014) |
| Log per Capita Income | 0.3945 | 0.4446 | 0.4855 |
| | (0.5113) | (0.4841) | (0.4893) |
| Log Population 18-22 | -0.0249 | -0.0199 | -0.0179 |
| | (0.1161) | (0.1123) | (0.1124) |
| Unemployment Rate | -0.0334 | -0.0236 | -0.0226 |
| | (0.0398) | (0.0370) | (0.0377) |
| Constant | 2.0831 | 2.1346 | 2.2211 |
| | (1.4550) | (1.4018) | (1.3605) |
| Number of Observations | 1,497 | 1,497 | 1,497 |
| First-Stage Home | . | 0.5940 | 0.7035 |
| Price/Equity Estimates: | . | (0.1297) | (0.1318) |
| First-Stage F-Statistic: | . | 20.96 | 28.51 |

Source. – Author's estimation of equation (1) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text.

Note. – All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include year and area fixed effects, where the area is defined as the MSA for respondents who live in a city and the state for those who do not. Controls for household head's education level, age, sex and marital status, respondent's age, sex and race, and the number of other dependents in the household also are included. The regressions are weighted by the family weights in the PSID. Standard errors clustered at the area level are in parentheses; respondents not living in an MSA are assigned to a state cluster.

Table 3: IV Estimates of the Probability of College Enrollment as a Function of Home Equity, Sample Splits Based on Household Income (2001-2005)

| | Dependent Variable: Dummy=1 if Enroll in College | | |
|---|---|---|---|
| Independent Variable | Family Income Less Than $70,000 (i) | Family Income $70,000-$125,000 (ii) | Family Income Greater Than $125,000 (iii) |
| Real Home Equity ($10,000) | 0.0567 | 0.0100 | 0.0054 |
| | (0.0252) | (0.0111) | (0.0047) |
| Homeowner | -0.1798 | 0.2966 | 0.2596 |
| | (0.1268) | (0.2211) | (0.2982) |
| Real Family Income ($10,000) | 0.04480 | -0.0445 | 0.0020 |
| | (0.0187) | (0.0214) | (0.0015) |
| Log per Capita Income | 1.6878 | 0.8068 | 1.4599 |
| | (0.7796) | (0.7528) | (2.6559) |
| Log Population 18-22 | 0.2606 | 0.5011 | 1.4841 |
| | (0.1486) | (0.1333) | (0.8393) |
| Unemployment Rate | 0.0423 | -0.1801 | 0.0555 |
| | (0.0619) | (0.0878) | (0.0988) |
| Constant | 2.3480 | -2.5083 | -16.4005 |
| | (1.8762) | (2.9220) | (10.4751) |
| Number of Observations | 828 | 419 | 250 |
| First-Stage Home | 0.3017 | 0.5008 | 0.6588 |
| Price/Equity Estimates: | (0.1037) | (0.1626) | (0.2440) |
| First-Stage F-Statistic: | 8.47 | 9.48 | 7.29 |

Source. – Author's estimation of equation (1) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text.
Note. – All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include year and area fixed effects, where the area is defined as the MSA for respondents who live in a city and the state for those who do not. Controls for household head's education level, age, sex and marital status, respondent's age, sex and race, and the number of other dependents in the household also are included. The regressions are weighted by the family weights in the PSID. Standard errors clustered at the area level are in parentheses; respondents not living in an MSA are assigned to a state cluster.

Table 4: IV Estimates of the Probability of College Enrollment as a Function of Home Equity: Cross-Decade Estimates, Estimates using MSA Home Price Index Variation, and Estimates for Renters (1980-2005)

| | Dependent Variable: Dummy=1 if Enroll in College | | | | |
|---|---|---|---|---|---|
| | Full Sample | | | Renters Only | |
| | Home Equity Instrumented With: | | | | |
| Independent Variable | CF Equity Change (i) | MSA Home Price Index (ii) | 1968 MSA Home Price Index (iii) | MSA Home Price Index (iv) | 1968 MSA Home Price Index (v) |
| I(1980s)*Real Home Equity ($10,000) | 0.0011 | 0.0012 | 0.0012 | . | . |
| | (0.0028) | (0.0055) | (0.0096) | . | . |
| I(1990s)*Real Home Equity ($10,000) | 0.0019 | 0.0012 | -0.0039 | . | . |
| | (0.0020) | (0.0146) | (0.0127) | . | . |
| I(2000s)*Real Home Equity ($10,000) | 0.0071 | 0.0161 | 0.0144 | . | . |
| | (0.0025) | (0.0100) | (0.0196) | . | . |
| I(1980s)*Home Price Index | . | . | . | 0.0018 | 0.0009 |
| | . | . | . | (0.0035) | (0.0036) |
| I(1990s)*Home Price Index | . | . | . | -0.0015 | 0.0009 |
| | . | . | . | (0.0060) | (0.0059) |
| I(2000s)*Home Price Index | . | . | . | 0.0003 | -0.0007 |
| | . | . | . | (0.0015) | (0.0017) |
| I(1980s)*Homeowner | 0.0491 | -0.0256 | -0.0120 | . | . |
| | (0.0478) | (0.0738) | (0.0637) | . | . |
| I(1990s)*Homeowner | 0.0857 | 0.0967 | 0.0984 | . | . |
| | (0.0310) | (0.1215) | (0.0734) | . | . |
| I(2000s)*Homeowner | 0.1122 | 0.0685 | 0.1085 | . | . |
| | (0.0461) | (0.0838) | (0.1015) | . | . |
| I(1980s)*Real Family Income ($10,000) | 0.0019 | -0.0005 | 0.0003 | 0.0011 | 0.0036 |
| | (0.0008) | (0.0016) | (0.0023) | (0.0046) | (0.0049) |
| I(1990s)*Real Family Income ($10,000) | 0.0084 | 0.0091 | 0.0140 | 0.0232 | 0.0240 |
| | (0.0026) | (0.0068) | (0.0066) | (0.0042) | (0.0049) |
| I(2000s)*Real Family Income ($10,000) | 0.0010 | -0.0013 | -0.0013 | 0.0150 | 0.0145 |
| | (0.0014) | (0.0034) | (0.0085) | (0.0182) | (0.0194) |
| P-Value$_{80s=90s}$ | 0.808 | 0.9391 | 0.326 | 0.608 | 0.639 |
| P-Value$_{80s=2000s}$ | 0.102 | 0.1510 | 0.1723 | 0.608 | 0.639 |
| Number of Observations | 7,014 | 5,401 | 5,042 | 1,567 | 1,490 |
| First-stage F-Statistic | | | | | |
| I(1980s)*Home Equity | 19.57 | 5.37 | 4.16 | . | . |
| I(1990s)*Home Equity | 14.38 | 4.10 | 3.37 | . | . |
| I(2000s)*Home Equity | 12.12 | 4.39 | 4.73 | . | . |

Source. – Author's calculations using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text. The estimates in columns (ii)-(v) include only those living in an identified MSA in the data.

Note. – All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include year and area-by-decade fixed effects, where the area is defined as the MSA for respondents who live in a city and the state for those who do not. Controls for household head's education level, age, sex and marital status, respondent's age, sex and race, and the number of other dependents in the household also are included. The regressions are weighted by the family weights in the PSID. Standard errors clustered at the area-by-decade level are in parentheses; respondents not living in an MSA are assigned to a state-by-decade cluster in column (i).

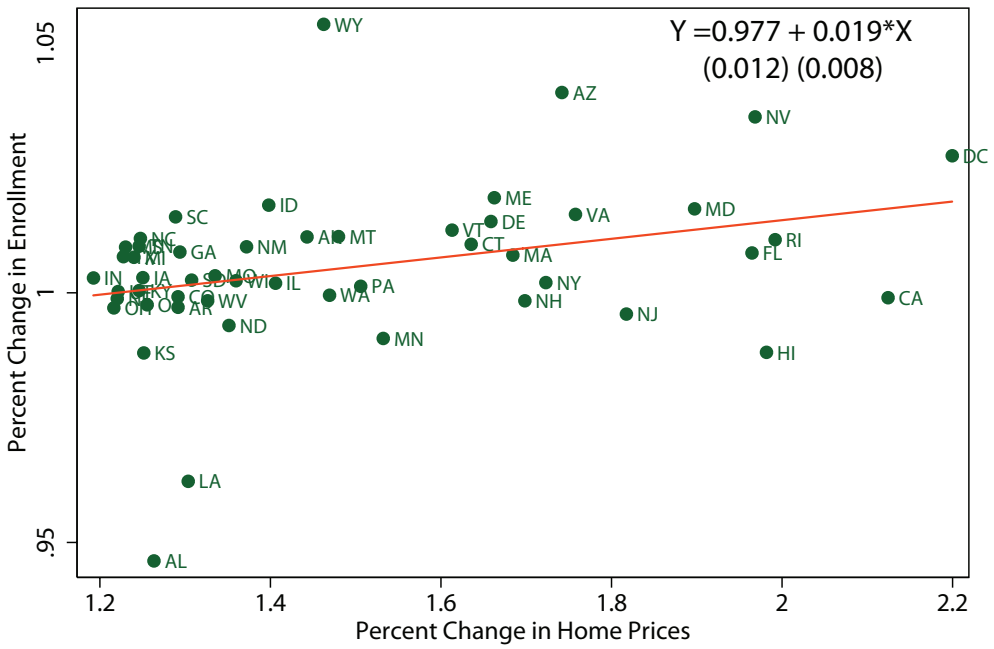


Fig. 1. – Changes in College Enrollment and Housing Prices at the State Level, 2000-2005. The data come from the Integrated Postsecondary Education Data System (IPEDS). Enrollment changes are changes in log average first time, full time college enrollment counts, and price growth is calculated by taking the ratio of the state-level HPI at the end of the period to the beginning of the period.

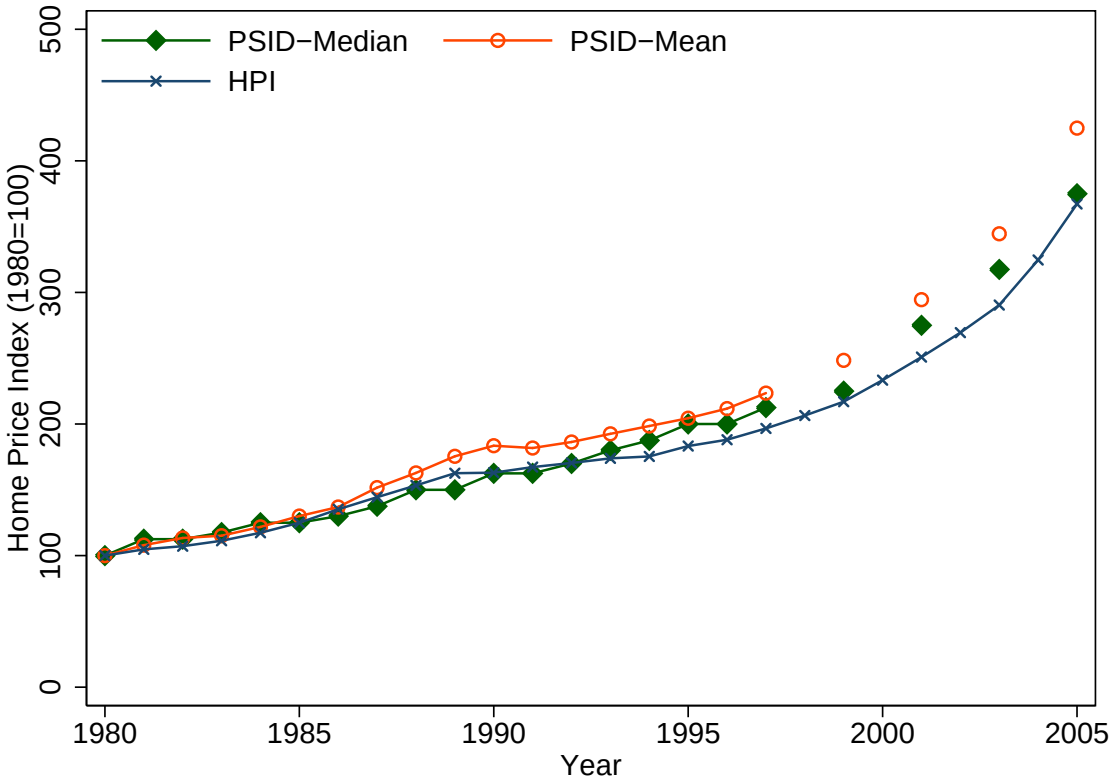


Fig. 2. – Comparison of Home Price Indices Constructed from Self-Reported PSID Home Prices and the Published HPI. The PSID indices are the respective reported mean and median home prices in each year for the full PSID sample, re-scaled such that year 1980=100. The housing price index (HPI) is reported by the Federal Housing Finance Agency for single-family repeat home sales.

Table A-1: Means and Standard Deviations of Analysis Variables

| | 2000s | | 1990s | | 1980s | |
|---|---|---|---|---|---|---|
| Variable | Mean | SD | Mean | SD | Mean | SD |
| Enroll | 0.52 | 0.50 | 0.44 | 0.51 | 0.39 | 0.49 |
| I(Homeowner) | 0.83 | 0.37 | 0.80 | 0.40 | 0.83 | 0.38 |
| Real Home Equity ($10,000) | 9.11 | 14.88 | 7.48 | 13.93 | 8.51 | 10.10 |
| Real Home Value ($10,000) | 15.93 | 18.63 | 12.04 | 16.67 | 11.36 | 11.92 |
| Real Home Value Change ($10,000) | 4.94 | 10.10 | 2.77 | 7.93 | 3.78 | 7.38 |
| Real Home Equity Change ($10,000) | 3.92 | 9.28 | 2.19 | 7.25 | 3.42 | 6.64 |
| CF Home Equity Change ($10,000) | 5.41 | 10.04 | 3.23 | 7.73 | 4.10 | 7.75 |
| Real Family Income ($10,000) | 9.93 | 14.02 | 8.05 | 7.18 | 8.03 | 9.21 |
| HH Head Age | 48.43 | 10.21 | 46.30 | 7.18 | 48.29 | 7.98 |
| Male HH Head | 0.78 | 0.41 | 0.81 | 0.40 | 0.84 | 0.37 |
| HH Head High School Dropout | 0.16 | 0.36 | 0.21 | 0.41 | 0.35 | 0.48 |
| HH Head High School | 0.34 | 0.47 | 0.33 | 0.47 | 0.31 | 0.46 |
| HH Head Some College | 0.21 | 0.40 | 0.22 | 0.42 | 0.15 | 0.35 |
| HH Head Some BA | 0.28 | 0.45 | 0.23 | 0.42 | 0.19 | 0.39 |
| HH Head Missing Education | 0.02 | 0.13 | 0.01 | 0.08 | 0.001 | 0.03 |
| White | 0.77 | 0.42 | 0.80 | 0.40 | 0.79 | 0.40 |
| Black | 0.20 | 0.40 | 0.17 | 0.37 | 0.16 | 0.36 |
| Hispanic | 0.01 | 0.11 | 0.02 | 0.12 | 0.04 | 0.19 |
| Other Race | 0.02 | 0.15 | 0.01 | 0.12 | 0.01 | 0.10 |
| HH Head Married | 0.69 | 0.46 | 0.72 | 0.45 | 0.77 | 0.42 |
| HH Head Single | 0.07 | 0.25 | 0.04 | 0.20 | 0.02 | 0.14 |
| HH Head Divorced | 0.24 | 0.43 | 0.23 | 0.42 | 0.21 | 0.41 |
| Number of Other Minors | 1.20 | 1.23 | 1.22 | 1.38 | 1.45 | 1.47 |
| ln(Per Capita Income) | 10.37 | 0.17 | 10.25 | 0.16 | 10.12 | 0.25 |
| ln(State College Age Pop) | 13.16 | 0.81 | 13.12 | 0.84 | 13.32 | 0.78 |
| State Unemployment Rate | 5.25 | 1.02 | 5.70 | 1.49 | 7.53 | 2.26 |

Note. – The table shows means and standard deviations from the PSID sample discussed in the text. All financial variables are in real 2007 $10,000, adjusted using the CPI-U. State College Age Population is defined as the number of 18-22 year olds living in the state.

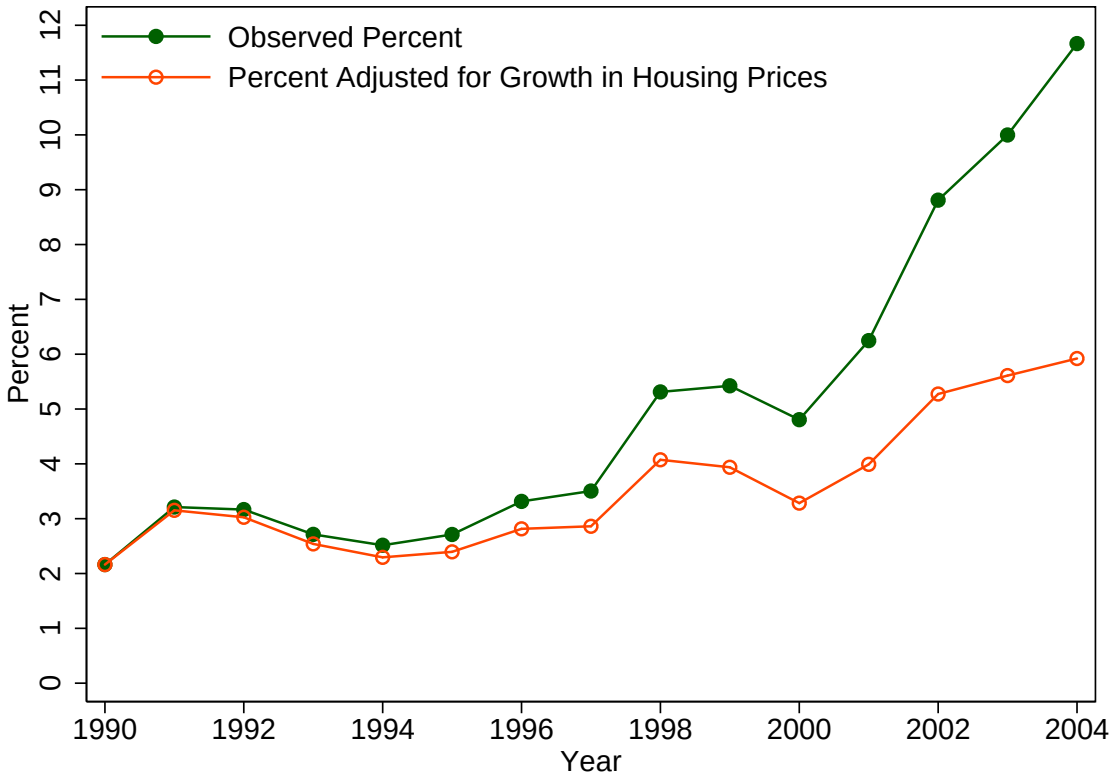


Fig. A-1. – Extracted Home Equity as a Percent of per-Capita Income. Estimates of gross equity extraction are taken from Table 1 in Greenspan and Kennedy (2005). Average per-capita income comes from "personal income" estimates calculated by the U.S. Bureau of Labor Statistics. The "Percent Adjusted for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

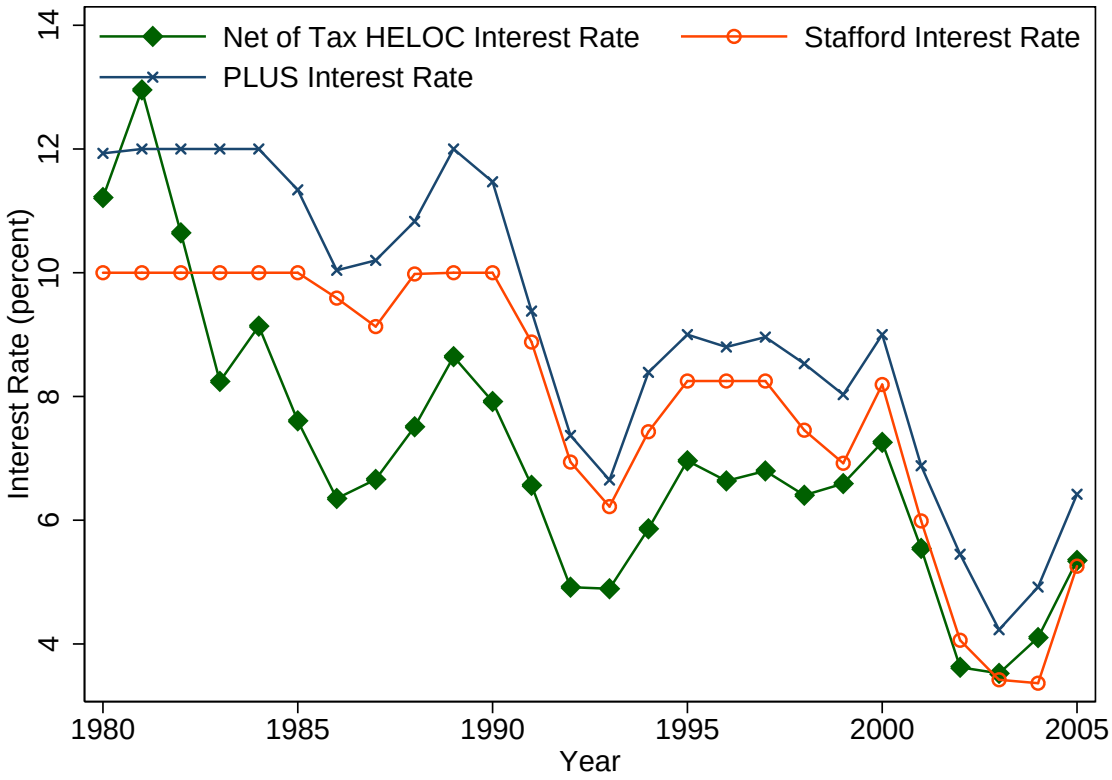


Fig. A-2. – Changes in HELOC, Stafford, and PLUS Loan Interest Rates, 1980-2005. Net of tax HELOC interest rates are indexed to the prime rate using a constant markup of 0.39 percent over prime, subtracting out the average marginal tax rate among homeowners taken from NBER's TAXSIM model. The 0.39 percent markup is the average markup over prime among those with home equity loans in the 2004 Survey of Consumer Finances. Stafford Loan interest rates are based on the 91-day rate from the last Treasury auction in May plus a constant markup equal to 3.25 percent prior to 1992, to 3.1 percent between 1992 and 1997, and to 2.3 percent between 1998 and 2005. Stafford Loan interest rates were subject to caps of 10 percent prior to 1992, of 9 percent between 1992 and 1993, and of 8.25 percent between 1994 and 2005. PLUS interest rates are based on the average one-year constant maturity Treasury yield (CMT) for the last calendar week in May plus a constant markup of 3.25 percent prior to 1992 and of 3.1 percent between 1992 and 2005. PLUS loans were capped at 12 percent prior to 1992, at 10 percent between 1992 and 1993, and at 9 percent between 1994 and 2005.