Housing Wealth, Liquidity Constraints and College Enrollment

Michael F. Lovenheim *†
Stanford University

May 2009

Abstract

This paper tests for the existence of short-run credit constraints surrounding the decision to invest in college, which is of particular concern given the recent large increases in the real cost of college attendance. The analysis adds to the literature on higher education credit constraints by examining the role of housing wealth in the college enrollment decision, using the timing and geographic dispersion of the recent housing boom to generate exogenous household housing wealth variation. I identify how changes in a household's housing equity in the four years prior to its child being of college-age affect the likelihood that child attends college. The central finding of the analysis is households used their housing wealth to relax credit constraints in higher education when housing wealth became more liquid during the recent housing boom; I find the four-year growth in housing equity raises college enrollment only post-2000, and the effect is localized to households most likely to be credit constrained. The effects of housing equity on college enrollment also are restricted to those who live in MSAs that experienced high price growth due to housing supply constraints, and there is little evidence that differential sorting of households with higher ability children into houses that appreciate more can account for my results. I calculate that upwards of 9 percent of families with children in college use housing equity to relax potential short-run credit constraints, and the estimates imply that the recent bust in the housing market may reduce college enrollment by 2.6 percentage points. This finding has important ramifications for the long-run supply of high-skilled labor.

KEYWORDS: Housing, Credit Constraints, Liquidity Constraints, Higher Education, College Enrollment.
JEL CLASSIFICATION: E21, I22

*I would like to thank John Bound, John Shoven, Joel Slemrod, Jeff Smith, Sarah Turner, Manuel Amador, Raj Chetty, Giacomo De Giorgi, Caroline Hoxby, Nir Jaimovich, Lance Lochner, John Pencavel, Luigi Pistaferri, Greg Rosston and seminar participants at Stanford University, University of Michigan, Rice University, Texas A&M, University of British Columbia, University of California-Berkeley, University of California-Davis, University of Houston, the Institute for Research on Poverty Summer Workshop, and the American Education Finance Association Annual Meeting for helpful comments. This research has been generously supported by the Searle Freedom Trust and by the Stanford Institute for Economic Policy Research (SIEPR). All errors, omissions and conclusions are my own.

†Author contact information: Stanford Institute for Economic Policy Research, Stanford University, 579 Serra Mall at Galvez Street, Stanford, CA 94305; *email:* mlovenhe@stanford.edu; *phone:* (650)736-8571.

1 Introduction

Whether liquidity constraints prohibit individuals from investing and consuming optimally over the life cycle is an important empirical question in economics. This paper examines the existence and extent of short-run credit constraints surrounding the decision to invest in college. Such constraints are important to identify because if some households cannot finance higher education, the supply of college-educated, high-skilled workers can be too low, which can have negative long-run effects on economic growth (DeLong, Goldin and Katz, 2003). In addition, depending on the joint distribution of the returns to education and family resources, imperfect capital markets can cause an allocative inefficiency in who goes to college. This inefficiency also will negatively impact growth by restricting high-skilled labor supply.

Because of the importance of supplying skilled labor to the workforce and the growing cost of obtaining a college degree, there is a large literature on the existence of credit constraints and their relevance for educational attainment. 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, 1964; Ben-Porath, 1967; Mincer, 1997). Because the optimal educational investment decision should be independent of family resources absent liquidity constraints, much of this literature focuses on the positive correlation between income and schooling, 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; 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] For example, after controlling for AFQT quartile, Carneiro

[1]Similarly, Shea (2001) 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.

and Heckman (2002) find only a weak relationship between income and educational attainment. The authors argue from these results that short-run credit constraints influence college enrollment less than the long-run access to resources that is reflected in high school test scores and ability measures.[2] In work using more recent data, however, Belley and Lochner (2007) find a stronger relationship between family income and children's educational attainment, suggesting short-run credit constraints are becoming increasingly important for explaining teenagers' college attendance decisions.

The previous literature on credit constraints in higher education has focused exclusively on the role of family income rather than on the importance of total family resources. 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 liquidity constraints. 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.[3]

This paper adds to existing work on short-run credit constraints by examining the relationship between housing wealth and college enrollment,[4] which has not been analyzed previously. The analysis makes two contributions to the literature. First, rather than assuming family resources are exogenous conditional on family characteristics and measured student ability, I use the timing and geographic differences in the magnitude of the recent housing boom to generate exogenous variation in wealth to

[2]Dahl and Lochner (2005) also present evidence of the importance of long-run credit constraints by examining how student test scores respond to exogenous changes in family permanent income generated by changes in the Earned Income Tax Credit. They find a $1,000 increase in family income raises math scores by 2.1% and reading scores by 3.6% of a standard deviation.

[3]The National Longitudinal Survey of Youth 1997 (NLSY97) contains a measure of total family wealth, and Belley and Lochner (2007) control for wealth quartile in attendance regressions. They find a steep wealth gradient in college enrollment, but as they note, their wealth variation is probably endogenous for the reasons discussed above.

[4]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.

homeowners. By identifying the effect of household wealth on college enrollment, my estimates shed new light on the existence and extent of credit constraints in higher education. Second, I am able to determine whether households use their housing wealth to relax short-run credit constraints. This analysis allows me to assess the implications of the recent slowdown in the housing market for college attendance.

There are a number of reasons to expect housing wealth to be an important factor in the college enrollment decision, particularly during the recent housing boom that began in the late 1990s. First, 85% of college attendees come from families that own a home, and housing wealth comprises the majority of household wealth for most Americans.[5] Second, the recent housing boom 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).[6]

At the same time, there is reason to believe that housing wealth will have no effect on college attendance. If the college enrollment margin is inelastic or if the marginal students are attending two-year schools where liquidity constraints are less likely to bind due to lower costs, then college attendance will not be affected by changes in family resources at the margin. Rather, family resources may affect where students go to school (and hence match quality) or the timing of college enrollment. This paper will focus only on the attendance margin due to data limitations, but if liquidity constraints affect where students choose to attend college or the timing of college entry, the estimates presented here will be a lower bound on the total effect

[5] Author's calculations from the October CPS and the Survey of Consumer Finances, respectively.

[6] 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. Further, 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).

of liquidity constraints on college attendance behavior.

The analysis begins with an educational investment model that allows for different interest rates at which families can borrow and save. The insight of the model is that a family's resource levels determine their cost of borrowing a given amount of funds; a student will be "credit constrained" if his internal rate of return to the college investment is greater than the market rate of return but lower than the cost of funds for financing the investment. Insofar as an increase in the value of one's parent's home reduces the cost of funds, housing wealth variation can be used to identify credit constraints in the higher education investment decision.

I then test empirically for the existence of credit constraints using this implication of the model with data from the Panel Study of Income Dynamics (PSID). I examine the effect of the growth in each family's home equity in the four years before a child is of college-age between 1980 and 2005 on college attendance. Because there were large increases in the both the real cost of college attendance over this time period as well as the value and liquidity of housing, I compare effects across the 1980s, 1990s and 2000s. Prior to the turn of the century, housing equity changes should have had little effect on college enrollment because it was difficult and expensive to tap one's home equity and the demand for funds was lower because college cost less to attend.

My results are consistent with this prediction. Housing equity increases had no effect on enrollment in the 1980s and 1990s but between 2000 and 2005, I find a $10,000 increase in housing equity in the 4-year period prior to a household's child becoming of college-age increases the probability of college enrollment of the child by 0.4 percentage points. Since real average real housing equity rose by $51,117 between 2001 and 2005, my estimates imply a 2.0 percentage point increase in college attendance due to increased home equity over this time period. These estimates point to the importance of housing wealth in relaxing short-run credit constraints post-2000: I calculate upwards of 9 percent of households with children in college use housing wealth to relax such constraints.

After 2000, effects are restricted to those groups who are more likely to be credit constrained, as defined by income and home equity levels. Neither selection across MSAs nor selection within MSAs of families with higher ability children into homes that appreciate more accounts for these findings, and the positive relationship between housing wealth and college enrollment is occurring solely in the MSAs that experienced high price growth due to housing supply constraints. These results suggest I am identifying credit constraints rather than simple correlations between housing equity and college investment.

The central finding of this analysis is that households used their housing wealth to relax short-run credit constraints in higher education during the recent housing boom. This finding has important policy implications in light of the recent decline in housing prices and the increasing difficulty of tapping one's home equity.[7] I estimate the collapse of the housing bubble and the "credit crunch" will reduce college enrollment by about 2.6 percentage points and thus may have negative long-run effects on the supply of skilled labor in the United States.

The rest of this paper is organized as follows: Section 2 presents a model of education attainment that incorporates the cost of funds for college investment, and Section 3 describes the empirical models as well as the assumptions underlying identification of credit constraints. Section 4 discusses the data and presents descriptive tabulations. Results are presented in Section 5, and Section 6 concludes.

2 Optimal Educational Investment and Liquidity Constraints

This section presents a theoretical model of education investment[8] and outlines the definition of credit constraints I will use throughout the analysis. Assume each individual, i, can borrow against one of N different assets at interest rates $r_1, \ldots, r_N$.

[7] For example, in August 2007, National City Bank's home equity unit froze all new applications for home equity loans (Grant, 2007).

[8] This model is similar to the canonical education investment models first developed by Becker (1962) and Rosen (1977) but augmented to take into account the fact that agents face different interest rates for borrowing and lending. While Cameron and Taber (2004) also augment their model in this manner, they do not focus on why these interest rates are different nor do they examine how this difference changes with variation in family assets.

Without loss of generality, assume $r_1 <, \ldots, < r_N$. One of these interest rates is the "market interest rate," r_m, which is the real rate of return on private savings that individuals can get in the marketplace. Thus, r_m is the rate at which the forgone earnings from attending college and the net present value of tuition payments should be evaluated.

Let the expected wage for a given college-goer be Y_c^i and the expected wage for a non-college goer be Y_0. Note that Y_0 is fixed for all agents, but Y_c^i varies across individuals.[9] I assume the future wages of college-goers can be described by an increasing function of ability, $f(a)$, and a random component described by the random variable ν with distribution $\mathrm{G}(\nu)$. The expected college wage therefore is $Y_c^i = f(a_i) + E(\nu)$.[10]

The direct pecuniary cost of a year of college is p, which can be interpreted as the cost of tuition, fees and books. I model education investment as a binary choice, with each individual either investing in T years of education or not.[11] For an individual who invests in college, the cost of T years of education is the direct cost of education plus forgone wages:

$$C \equiv \int_0^T Y_0 e^{-r_m t} dt + \int_0^T p e^{-r_m t} dt = \frac{1}{r_m}(Y_0 + p)(1 - e^{-r_m T}) \tag{1}$$

In this setup, the net pecuniary returns to investing in college are:

$$\int_T^\infty Y_c^i e^{-r_m t} dt - \int_0^T p e^{-r_m t} dt = \frac{1}{r_m} Y_c^i e^{-r_m T} - \frac{p}{r_m}(1 - e^{-r_m T}) \tag{2}$$

[9] This model embodies the assumption that expected post-college earnings are a constant for each agent. While this is a strong assumption, what matters for the optimal investment decision is the net present value of post-collegiate earnings (when agents are risk neutral). Fixing earnings to be constant is a notational and mathematical convenience, but it will not affect the results of the model.

[10] Note that this setup ignores student labor supply, which has grown markedly over the time period of my analysis (Bound, Lovenheim and Turner, 2007). Keane and Wolpin (2001) show in a dynamic structural model of education investment that students will relax binding credit constraints by working more while in school, which is consistent with the recent upward trends in both college costs and student labor supply. To the extent that students substitute parental transfers and working while in school, my estimates will be biased towards zero. However, because there is a negative link between student working behavior and academic achievement (Stinebrickner and Stinebrickner, 2003), housing wealth increases that increase parental transfers may increase student academic attainment.

[11] In actuality, this choice is not binary, and over the time period of my analysis, time to degree has increased and college completion rates have declined (Bound, Lovenheim and Turner, 2007). However, because this assumption simplifies the model and conforms with my data, I maintain it throughout. With endogenous degree time and college non-completion, the basic intuition and results of the model remain, but the solution becomes significantly more complex.

and the pecuniary returns to not investing in college are:

$$\int_0^{\infty} Y_0 e^{-r_m t} dt = \frac{1}{r_m} Y_0. \tag{3}$$

The individual will undertake the investment if the net returns to doing so are greater than the opportunity cost of the funds needed to finance the investment:

$$Y_0 \quad \leq \quad Y_c^i e^{-r_m T} - p(1 - e^{-r_m T}) \tag{4}$$

Re-arranging and taking logs, equation (4) becomes:

$$\frac{ln(\frac{Y_c^i + p}{Y_0 + p})}{T} \geq r_m. \tag{5}$$

Equation (5) is similar to the well-known formula for optimal education investment, although it shows the optimality condition for the binary decision rather than for the continuous investment decision. The formula implies an individual will find it optimal to invest in college when the private rate of return to the investment is greater than the return from investing in an asset with return r_m. This is the return the individual would get if he did not undertake the college investment and instead invested the savings from earnings. Crucially, the individually optimal investment decision is not a function of family resources.

Borrowing constraints in this model come about because, while individuals can invest at rate r_m, they cannot necessarily borrow at rate r_m. Consider the supply of funds (SOF) to individual i who wishes to invest in college. The SOF comes from the N assets available to each family. One such asset may be federal loans. Other assets are income and private savings, which can be borrowed at rate r_m. Housing equity is another source of funds, and the interest rate for borrowing against this equity may be higher or lower than r_m (taking into account the fact that mortgage interest is tax-deductible). This treatment of the supply of funds assumes no intra-household

bargaining.[12]

If individuals could borrow against future income (i.e., against human capital), then all students for whom $\frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T} \geq r_m$ would be able to borrow C at interest rate $\frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$. However, there is a built in borrowing constraint in higher education because individuals cannot borrow against their future wages, so only liquid assets at the time of the college decision can be used to fund the investment. In what cases will this constraint bind? First, note that because of the ordering of the interest rates, each family will exhaust fully each asset before moving on to the next, from $1, \ldots, N$. For example, the family likely first will exhaust government-subsidized loans, such as Stafford loans, then use collateralized loans, such as home equity loans and home equity lines of credit, and then rely on private savings as well as uncollateralized loans such as Federal PLUS loans and credit card debt.

The average interest rate for each consumer will be:

$$\bar{r_i} = \sum_{j=1}^{N} \frac{d_j^i}{\sum_{p=1}^{N} d_p^i} r_j, \tag{6}$$

where

$$d_j = \begin{cases} W_j & : \quad \sum_{s=1}^{j} W_s < C \\ C - \sum_{s=1}^{j-1} W_s & : \quad \sum_{s=1}^{j-1} W_s \geq C > \sum_{s=1}^{j} W_s \\ 0 & : \quad C < \sum_{s=1}^{j-1} W_s \end{cases} \tag{7}$$

is the amount borrowed from source j.

Thus, while the individual's optimal decision depends on r_m, her ability to act on this optimal decision is a function of $\bar{r_i}$.[13] In the case where equation (5) holds with equality, there are three distinct possibilities:

[12]For simplicity, I assume parents will fund their child's education if it is optimal for the child to undertake the investment. There is a recent literature on intra-household transfers and their relationship to education investment (Brown, Scholz and Seshadri, 2009 and Brown, Mazzocco, Scholz and Seshadri, 2006) that presents evidence this assumption is not valid for all individuals. To the extent children do not have access to the panoply of their parents' resources, my empirical estimates will be biased towards zero.

[13]Note that regardless of $\bar{r_i}$, no individual will attend college if equation (5) does not hold because the individual returns are lower than one could get in the marketplace. Lowering the cost of funds does not change the fact that the opportunity cost of funding college when $\frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T} < r_m$ is higher than the pecuniary returns from the investment.

1. $\bar{r_i} < r_m$: The individual's average cost of funds is lower than the market rate of return. The individual will undertake the investment, and the relatively low cost of funds simply increases the net rate of return.

2. $\bar{r_i} = r_m$: If the market rate of interest equals the average cost of funds, then the cost of funds does not cause a distortion in college investment nor does it alter the net rate of return.

3. $\bar{r_i} > r_m$: The cost of funds is higher than the market interest rate, so the investment is individually optimal but students lack access to sufficiently inexpensive credit to fund the investment. I will refer to this case as "binding credit constraints," because the prohibition against borrowing against future human capital is binding.

An implication of this model is that if credit constraints bind, college investment will be sensitive to changes in the value of liquid family assets that are available when the child is of college age. Take a simple case in which a family has access only to government-subsidized student loans (r_1), housing equity (r_2), and private loans (r_3); it has no private cash savings. Further, assume the student finds college investment just optimal ($r_m = \frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$).

Figure 1 depicts this situation. In the figure, the saw-toothed curve is the marginal cost of funds (MCOF), which increases discontinuously after each asset is exhausted. The curved line shows the average cost of funds (ACOF) given the MCOF curve. The average interest rate at which the individual can fund C is where the ACOF curve (i.e., the supply curve of funds) hits the vertical line at C (i.e., the demand curve for funds). The solid lines show the original position in which the student is credit constrained: though $r_m = \frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$, $\bar{r_i} > \frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$, so the constraint on borrowing against human capital binds and the student does not invest in college.

Consider what happens when the value of the family's house increases. This increases the amount of equity against which the family can borrow; it has received

an increase in liquidity due to the increase in its home price. This scenario is shown with the dashed lines in Figure 1: an increase in the value of the house extends the amount of borrowing one can do at rate r_2, which lowers the ACOF curve such that investing in college is now affordable for the individual. A reduction in the interest rate on home equity would cause a similar effect, shifting the ACOF curve downward. Finally, it is important to note Figure 1 assumes housing wealth is liquid. If housing wealth were not liquid, it means either that the implicit interest rate on home equity is infinite or that the effective amount of home equity (W_2 in this example) is zero.

Figure 1 illustrates there are likely to be many inframarginal individuals. If a potential student has a return to education investment above r_3 in Figure 1, his investment decision will be unaltered by changes in home equity. Furthermore, as previously discussed, any individual for whom equation (5) does not hold will be inframarginal because he will not make the college investment.

One important characteristic of the definition of higher education credit constraints I use in this analysis is that it is not dependent on wealth variation being predictable or unpredictable. As long as education is purely an investment good, there should be no wealth effect; enrollment responses to any wealth variation will indicate the existence of credit constraints. The intuition for this result is embodied in equation (5): the optimal attendance decision is a function only of the internal rate of return and the market interest rate, not family resources. Any dependance of attendance on family resources therefore identifies higher education credit constraints. This definition is in stark contrast to the definition of credit constraints used in the consumption literature to test the permanent income hypothesis (Zeldes, 1989; Runkle, 1991; and Jappelli, Pischke, and Souleles, 1998). For consumption goods, perfect capital markets imply no behavioral response to *expected* wealth or income changes, whereas for education, perfect capital markets imply no behavioral responses to *any* income or wealth changes.

Increasing housing wealth also may cause higher college enrollment due to a wealth

effect if home equity increases represent real household wealth increases and if there is consumption value to college. Changes in housing wealth arguably do not raise the real wealth of homeowners, though, because if the home is sold, the family must buy or rent a new home and those prices have increased as well. The only way to fully realize housing wealth increases is to move outside one's housing market, but it is unlikely parents move in this manner in order to pay for their children's post-secondary education.[14] Housing wealth increases therefore serve mostly to increase household access to capital.

The remainder of this paper seeks to identify the existence of short-run credit constraints in college enrollment empirically using the implications of the model presented above. For the majority of the analysis, I assume education is purely an investment good, but I examine some evidence on whether I am identifying a wealth effect rather than a liquidity effect in Section 5.4.

3 Empirical Models

The central implication of the model presented in Section 2 is that housing wealth only should affect the college attendance decision if there are binding credit constraints. The goal of the empirical analysis is to determine whether short-run variation in housing equity impacts the propensity to enroll in college. The difficulty in identifying such a relationship is that housing wealth is not randomly assigned across households: children from higher wealth households are more likely to attend college regardless of the fact that their parents have access to more capital.

I overcome this problem by using the timing and geographic dispersion of the recent housing boom. The implicit "experiment" is that housing prices grew dramatically in real terms beginning in the late 1990s and did so unevenly across cities. Nationally, real average housing prices grew by 9 percent between 1980 and 1990,

[14]For example, in the Panel Study of Income Dynamics data I use in this analysis, only 4.4 percent of families with 18-19 year old children move outside their MSA when their children go to college.

they grew by only 1 percent between 1990 and 2000, but they grew by 62 percent between 2000 and 2005. These increases were highly variable across cities: between 1980 and 2005, San Francisco witnessed a sixfold increase in housing prices, while Oklahoma City prices barely doubled and were lower than San Francisco prices in absolute terms. A family with a 14-year old in 2000 that owns a home in San Francisco will experience a significantly larger increase in housing wealth in the four years prior to the child becoming of college age than an identical family that owns its home in Oklahoma City. Both families will experience larger housing wealth increases than if their children had been 14 in 1990 instead of 2000.

The recent housing boom also 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.[15] Figure 2 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 2 shows that if one adjusts the amount of equity extraction for the growth in home prices, the observed increase in equity extraction can be accounted for equally by increased liquidity of housing wealth and increases in the amount of housing wealth.

The housing boom also coincided with an increase in the cost of college attendance. Figure 3 shows the total average cost (including room and board) of 4-year attendance and the total amount of the maximum Pell Grant and Stafford loans, which are the predominant forms of federal financial aid. The net cumulative cost is the total cost

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

net of average grant aid and tax deductions summed over the four years starting in the year indicated on the x-axis. Figure 3 illustrates that after 1990, federally subsidized loans and grants were insufficient to cover the cost of attending a four-year public university, and as federal aid has decreased in real terms, the net cost of attendance increased by almost 30 percent between 2000 and 2005.[16] Furthermore, because many middle class families are ineligible for Pell Grants and subsidized Stafford loans,[17] and because these families are likely to own a home, it is reasonable to expect their reliance on housing equity to finance college has increased.[18]

Because college costs were lower pre-2000 and because housing wealth was both lower and less liquid prior to 2000, housing wealth should have little effect on college enrollment in the 1990s and 1980s. I use this implication of the national trends in housing wealth liquidity and college costs combined with the fact that the housing boom occurred with different magnitudes across different cities to test the main implication of equation (5), that absent credit constraints there should be no relationship between housing equity and college enrollment. The baseline econometric models are as follows:

$$\begin{aligned} Enroll_{isdt} &= \beta_0 + I(1980s)[\kappa_1 Own_{isdt} + \psi_1 H_{isdt} + \phi_1 Y_{isdt}] + I(1990s)[\kappa_2 Own_{isdt} \\ &\quad + \psi_2 H_{isdt} + \phi_2 Y_{isdt}] + I(2000s)[\kappa_3 Own_{isdt} + \psi_3 H_{isdt} + \phi_3 Y_{isdt}] \\ &\quad + \gamma X_{isdt} + \delta_t + \theta_{sd} + \epsilon_{isdt} \end{aligned} \tag{8}$$

[16] While it is possible that tuition and school resources are affected by changes in housing values, I find no evidence that state-level housing price variation from 2000 to 2005 is correlated with state-level average tuition and fees or resources per student. This finding is true for both 4-year and 2-year public schools and suggests that school quality and the price of college attendance are not responding to housing price changes at the state level. These results are available from the author upon request.

[17] There are two types of Stafford loans: subsidized and unsubsidized. While both types have the same interest rate, repayment of subsidized loans can be deferred until after college without accumulating interest. Both types of Stafford loans are backed by the federal government.

[18] While there are no published aggregate trends of home equity extraction to pay for college, the increased reliance of many homeowners on their home equity is consistent with the change in borrowing patterns among college attendees. Between 1996 and 2005, real subsidized Stafford loans increased by 17 percent, but real unsubsidized Stafford loans increased by 94 percent and PLUS loans increased by 177 percent (College Board, 2007). Appendix Figure A-1 shows the historical interest rates associated with home equity lines of credit (HELOC), Stafford loans, and PLUS loans. Since 1985, when interest rates for federal financial aid fell below the statutory caps, these rates have moved similarly. Most notably, federally-backed PLUS loans, which are loans designed to cover the remaining cost of college after all financial aid is accounted for, and HELOC loans have almost identical interest rates. Due to the similarity of pricing between PLUS and HELOC loans, it is probable that home equity loans among college-going families have grown similarly.

$$
\begin{aligned}
Enroll_{isdt} \;=\; & \beta_0 + I(1980s)[\kappa_1 Own_{isdt} + \psi_1(H_{isdt} - H_{isd,t-4}) + \phi_1 Y_{isdt}] \\
& + I(1990s)[\kappa_2 Own_{isdt} + \psi_2(H_{isdt} - H_{isd,t-4}) + \phi_2 Y_{isdt}] \qquad (9) \\
& + I(2000s)[\kappa_3 Own_{isdt} + \psi_3(H_{isdt} - H_{isd,t-4}) + \phi_3 Y_{isdt}] + \gamma X_{isdt} \\
& + \delta_t + \theta_{sd} + \epsilon_{isdt},
\end{aligned}
$$

where *Enroll* is a dummy variable equal to 1 if individual i in state s in decade d and in year t 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, H refers either to housing value or home equity, and Y is real total family income from all sources.[19] The models also include 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 (δ_t) and state-by-decade fixed effects (θ_{sd}) in the model.

Equations (8) and (9) differ in how housing prices and equity (H) are entered. In equation (8), H refers to contemporaneous home value or housing equity of the household. In equation (9), I use the 4-year change in housing value or equity instead of the level. This equation represents a more direct test of short-run liquidity constraints because it relates short-run wealth variation to college attendance behavior.

The main parameters of interest in equation (8) and (9) are ψ_1, ψ_2 and ψ_3, which show how housing wealth variation is related to college attendance behavior. In order to interpret these parameters as causal, it is necessary that the housing wealth variation used is conditionally exogenous, i.e., is uncorrelated with the error term conditional on the observables.[20] There are two main reasons why this assumption may be violated. The first is that there can be unobserved student characteristics that are correlated with both college enrollment and housing prices, the most likely

[19]The PSID conducted wealth supplements in 1984, 1989, 1994, 1999, 2001, 2003 and 2005 that contain information on non-housing wealth. I estimated equations (8) and (9) including non-housing wealth for these years and results were unchanged. These results are available from the author upon request.

[20]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.

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, estimates of ψ_1, ψ_2 and ψ_3 will be biased upward. Furthermore, if such students sort into relatively higher housing growth localities over time, or families with higher ability children are more likely to own homes in high housing growth periods, I may find spuriously positive results.

Equations (8) and (9) contain many controls for such selection. First, 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 separate homeownership dummy variables by decade in order to account for differential selection into homeownership over time.[21] I also include in the model state-by-decade fixed effects, which control for the potential systematic selection of families with higher ability children into states with higher housing price growth separately by decade. For selection on unobservables to be driving my estimates, it has to be occurring within states and within decade.

Comparing the effects of housing wealth across decades also allows me to test whether any positive relationship between housing wealth and college enrollment is being confounded by omitted ability bias. Because illiquid wealth should have little effect on college enrollment if the only mechanism linking the two is financial, comparing the relationship between housing equity and college enrollment across periods of differential home equity liquidity is instructive. If housing wealth has a large effect on college enrollment in the 1980s (i.e., $\psi_1 > 0$), when housing wealth was relatively illiquid, college costs were lower and interest rates were high, it may point to a potential omitted variables bias in my estimates. On the other hand, if the estimated effects match the trends in equity extraction (i.e., $0 = \psi_1 \leq \psi_2 < \psi_3$),

[21]Note that the trends over time in homeownership have been towards more access to less wealthy families. Particularly during the recent housing boom when subprime loans became available to relatively low resource families, homeownership among those families rose. This differential selection into homeownership, to the extent it is not captured in the decade-by-homeowner dummies, will bias my estimates towards zero because those selecting into being homeowners during the 2000s have lower probabilities of sending their children to college, all else equal.

it will suggest the effects of omitted ability are small.[22]

The geographic variation in the magnitude of the housing boom also can be used to test for omitted ability bias. If families with higher ability children reside in or move to cities that experience higher housing price growth during the housing boom, equations (8) and (9) will lead me to find spuriously positive results. I therefore estimate these models using MSA-by-decade fixed effects instead of state-by-decade fixed effects.[23] These models restrict housing price variation to be within-MSA over time and across households within MSAs.

These estimates still can be confounded by ability bias if families with a higher likelihood of sending their children to college within MSAs purchase homes that grow more in value during the housing boom. To test for such selection, I further restrict the housing price variation to be only at the MSA level over time by simulating housing price growth for each homeowner based on the MSA-aggregate percentage change in housing prices over the previous four years. MSA-level housing prices come from the Conventional Mortgage Housing Price Index (CMHPI).[24] Household i's simulated home price in MSA j at time t conditional on its $t-4$ home price is:

$$\hat{P_{ijt}} = P_{ij,t-4} * \frac{cmhpi_{jt}}{cmhpi_{j,t-4}}. \tag{10}$$

Using simulated housing values at the MSA-level is the specification that is most closely in the spirit of the natural experiment provided by the housing boom. I essentially am determining whether homeowners who happen to live in MSAs that

[22]Equations (8) and (9) also assume households are not endogenously placing more of their wealth in their home to take advantage of expected housing price growth or because after 1992, housing wealth was exempted from federal financial aid calculations. Reyes (2008) shows that the federal financial aid tax has no effect on the amount of housing equity held by households, which makes sense considering that housing wealth is still taxed for purposes of institutional aid. Furthermore, because one does not need to increase one's equity position in a home to obtain the equity benefits of a given price increase, it is unlikely households respond to future expected housing price growth by putting more of their liquid wealth into housing, conditional on owning a home.

[23]These estimates contain only the 80 percent of my sample that lives in an identified MSA. The results for this restricted sample using state fixed effects are similar to those for the full sample and are available from the author upon request.

[24]The CMHPI is an index of all mortgages that were purchased or securitized by Fannie Mae or Freddie Mac over the course of a year. These mortgages are conventional in the sense that they are not insured by the federal government and are for single family homes only. The CMHPI also does not include "jumbo loans," which in 2007 was any loan above $417,000. While the index does include appraisals from refinances, it does not include price data from new homes. Instead, it is based solely on repeat transactions.

experienced relatively larger housing price increases post-2000 were more likely to send their children to college. The identifying assumption in this specification is that the detailed set of background characteristics in the data, combined with MSA-by-decade fixed effects, is sufficient to control for any selection of families across MSAs occurring differentially over time within decade. Because using simulated housing prices significantly reduces the amount of identifying variation, I present results from models that allow both within state and within MSA housing price variation as well.

The second potential identification concern with equations (8) and (9) is that both housing price 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 ψ will be biased upward due to this spurious correlation. To account for these confounding factors, I control directly for the unemployment rate, real income per capita and the size of the college-age population at the state level. I also conduct sample splits by housing wealth and family income, because if my estimates are contaminated by shocks to high-skilled labor demand, both wealthier and poorer households should be affected. However, if increasing housing equity serves to relax credit constraints, only the poorer groups who are more likely to be credit constrained should be affected. Finally, I estimate my model only for those MSAs that most likely experienced housing price growth due to housing supply restrictions. As long as these restrictions are uncorrelated with local high-skilled labor demand shocks, supply restrictions provide a valid instrument for MSA-level housing price growth that will yield insight into the extent of the bias introduced by unobserved local labor market factors.

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.[25] 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.

While there are PSID surveys available continuously between 1968 and 1997, after 1997 they were conducted every other year. To make a data set consistent with the PSID sample timing, I construct a repeated cross section of 18-19 year olds from each PSID survey in every second year beginning in 1980. This methodology also has the advantage of maximizing the number of observations within each year, which will help identify the year fixed effects in the regressions. The years included in the analysis are 1980, 1982, 1984, 1986, 1988, 1990, 1992, 1994, 1996, 1999, 2001, 2003, and 2005. The panel ends in 2005 as this is the most recent PSID survey year. Thus, my analysis will cover the housing boom of the late 1990s through 2006 but will not cover the recent slowdown in the housing market.

On average, there are 560 observations in each year for a total of 7,276 observations. I include only 18 and 19 year olds in the sample, which ensures I do not double count the same individual in subsequent years. Furthermore, respondents who are 18 or 19 years old are the ones making the college attendance decision and for whom this decision is most likely to be dependent on their parents' resources.

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

[25] I include families from the original 1968 family sample as well as the low-income sample drawn from the Survey of Economic Opportunity. In 1997, a refresher sample of post-1968 immigrant households and their adult children were added to the PSID, and I include these families in my analysis. In order to make the survey representative of the national sample, all tabulations and regressions with these data use the family weights given in the survey.

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.[26]

4.2 Housing Prices and Equity

The housing price measures used in this analysis all are derived 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 4, I compare an index of home prices from the PSID (1980=100) to a similarly scaled CMHPI measure. 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 home sales and jumbo loans are not included in the CMHPI, but they are included in the PSID measures. Figure 4 suggests that if there is measurement error in the PSID housing prices, it does not show up in the aggregate trends.

I use five different measures of housing prices and wealth in the estimation of equations (8) and (9). The first measure is contemporaneous housing prices. Because one can own an expensive home without having much home equity (and vice versa), current home price may be a poor proxy for housing wealth. Thus, I construct a measure of contemporaneous housing equity, which is the reported price minus the remaining mortgage principal. Because only liquid wealth is relevant for college financing, home equity is a much more accurate measure of the resources families have at their disposal to pay for college than home prices. However, current home

[26]For the 2005 survey, this methodology is not possible. Thus, the enrollment levels in the 2005 PSID are slightly lower than in the previous survey waves. I include year fixed effects in my regressions in part to deal with this problem.

equity is likely to be endogenous because families that extract more money from their homes to pay for their children's college attendance will have less equity, *ceteris peribus*, than an otherwise identical family whose child does not attend college. This endogeneity will bias the ψ coefficients towards zero.

In order to overcome many of the problems associated with using housing price and equity levels to identify credit constraints in higher education attendance, I calculate the change in housing prices and equity 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. 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. For this reason, I calculate the four-year change in housing equity for all homeowners as well. As this change may be endogenous for the same reason that home equity levels are endogenous, I construct a fifth housing equity measure that I term "counterfactual growth in home equity." This counterfactual growth is the amount of growth expected if the household had continued paying its mortgage over the 4-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.

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.

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.[27] 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 measure used in the analysis.

4.3 Demographic Characteristics

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 alleviate credit constraints, this omission will bias my housing wealth estimates towards zero.[28]

4.4 Labor Market Measures

In order to control for local high-skilled labor demand, I control for state- or MSA-level real per capita income. Per capita income comes directly from the U.S. Bureau

[27] 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.

[28] Omitting financial aid will cause a negative bias in my estimates if college attendance and financial aid are positively correlated, as argued by Dynarski (2002), and financial aid and housing wealth are negatively correlated. The latter correlation is likely to be negative because housing wealth often is "taxed" for the purposes of institutional aid, even though it is not for the purposes of federal aid after 1992.

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, which I define as the population of 18 to 22 year olds, are collected from the U.S. Census Bureau population estimates.

4.5 Descriptive Statistics

Before undertaking the empirical analysis, it is instructive to examine descriptive tabulations of the relationships among housing wealth, family income and college attendance. Figure 5 shows means of real home values, home equity and counterfactual home equity in each year of the analysis for my PSID sample.[29] Several relevant trends become apparent: First, real home values increased by 65 percent across the entire sample between 1990 and 2005, with the most significant growth between 2001 and 2005. Second, housing equity grew less rapidly than home prices, suggesting not all of this growth was capitalized into wealth. Finally, while housing equity and counterfactual housing equity track each other closely through the 1990s, in the 2000s, counterfactual housing equity rose faster than housing equity. This differential growth is consistent with households tapping their equity in the time period surrounding when their children become of college age in the 2000s.

The previous literature examining the income gradient in college attendance and academic attainment has ignored housing wealth (Ellwood and Kane, 2000; Shea, 2001; Carneiro and Heckman, 2002; Cameron and Heckman, 1998 and 2001; Plug and Vijverberg, 2005; Brown, Scholz and Seshadri, 2007; Belley and Lochner, 2007). Omitting household wealth ignores a potentially important aspect of household resources that can be used to finance college, but ignoring housing wealth will only cause a bias in the identification of credit constraints if housing wealth (or housing wealth changes) and income are not perfectly correlated.

[29] All references to "real" prices refer to prices that have been adjusted to 2007 dollars using the CPI-U.

Table 1 shows the joint distribution of the quartiles of changes in housing wealth and total family income quartiles. The quartiles are constructed for all homeowners in the PSID sample discussed in the previous section. Panels A-C show joint distributions for four year changes in housing values, housing equity, and counterfactual housing equity, respectively. The table shows that there are significant numbers of high-income, low-housing equity change households as well as low-income, high-housing equity change households, suggesting income is not a sufficient statistic to characterize changes in family resources. For example, in Panel C, only 36.1% of households that own a home are in the same family income quartile and quartile of the change in their counterfactual home equity. Over 23.2% are in the upper diagonal, and 40.7% are in the lower diagonal. Changes in housing wealth have occurred relatively evenly across the income distribution, suggesting the importance of this form of wealth, particularly for low-income households wishing to finance a college education.

5 Results

5.1 Within-State Estimates

Table 2 presents logit estimates of equations (8) and (9) using the PSID data described in Section 4. The columns differ in the housing measure included in each regression. Column (i) contains results using contemporaneous home prices and column (ii) uses contemporaneous home equity. Columns (iii) and (iv) show results from regressions in which the 4-year change in home prices and home equity are used, respectively. Column (v) contains estimates from the counterfactual home equity change specification. The numbers in square brackets are the marginal effects implied by the logit estimates, calculated at the mean of all dependent variables.

Recall that the implication of the theoretical human capital model presented in Section 2 is if credit constraints exist, one should observe a positive relationship

between housing equity and college enrollment. Furthermore, as discussed in Section 3, the national trends in the liquidity of housing wealth and college costs suggest that housing wealth should most influence the college attendance decision post-2000. The results presented in Table 2 are consistent with both of these predictions. Across columns, there is no evidence that housing prices or home equity were correlated with college enrollment in the 1980s or 1990s; all point estimates and marginal effects are close to zero and none are statistically significant. Furthermore, there is no evidence that housing price and equity levels are associated with higher rates of college attendance post 2000 in columns (i) and (ii), respectively. This result could be due to the lack of credit constraints in college attendance, or it could be reflective of the problems associated with using these measures as measures of family housing wealth that were discussed in Section 4.2.

In column (iii), I find a $10,000 increase in housing prices in the four years prior to a child turning 18 or 19 increases the likelihood of college attendance by 0.3 percentage points post-2000,[30] which is statistically significant at the 10 percent level. Given that real average home prices increased by $60,918 between 2001 and 2005, my estimates imply a 1.8 percentage point increase in college attendance due to housing price appreciation during the housing boom. This result suggests that families used their housing wealth gains from the housing boom to relax post-secondary credit constraints.

The change in counterfactual home equity has similar effects on enrollment to the change in housing prices. The coefficient on the counterfactual growth in housing equity in the 2000s is 0.019 (column (v)), which implies that a $10,000 increase in counterfactual home equity in the four years prior to a child becoming of college age leads to a 0.4 percentage point increase in the likelihood of college attendance. Between 2001 and 2005, home equity in my sample increased by $51,117, which translates into a 2.0 percentage point increase in college enrollment. In addition, the fact

[30]The percentage point effects reported in this section come from the marginal effects in brackets shown in the results tables.

that counterfactual home equity increases are more strongly associated with college attendance than home equity changes (column (iv)) is consistent with homeowners extracting their home equity to pay for their children's college, because the change in home equity for those who enroll is endogenously smaller than for those who do not enroll.

The results in Table 2 are inconsistent with the existence of omitted ability bias because if the growth in housing wealth were just proxying for unmeasured ability, I should find effects in the 1980s and 1990s as well as post-2000. I find the effect of housing wealth on college enrollment is localized to the 2000s, which suggests the central driving forces behind my results are the growth in home values and the increasing liquidity of housing wealth. Furthermore, I find consistent evidence across columns that higher family income is associated with higher college-going, particularly in the 1990s and 2000s. That these coefficients are not zero pre-2000 suggests liquidity constraints may have been relevant prior to 2000 but that housing wealth was relatively illiquid and therefore was not used to relax financial constraints for families with college-age children.

According to the human capital model shown in Section 2, individuals should respond to the level of resources, not necessarily the change. As Table 2 illustrates, though, one cannot use housing wealth levels to test for credit constraints in higher education. Instead, one can use the changes in housing prices and home equity as an instrument for home equity levels. Appendix Table A-1 shows the results from such an exercise; the marginal effect of a change in equity post 2000 due to housing price or counterfactual equity changes are virtually identical to those presented in Table 2. In addition, the OLS estimates are zero in all decades, suggesting individuals are endogenously extracting their home equity to send their children to college. For the rest of the analysis, I will continue estimating models of the form given in equations (8) and (9), but Appendix Table A-1 shows these results are akin to using IV models that instrument home equity levels with home equity or price changes.

Although my data end in 2005, the estimates in column (v) of Table 2 can be used to simulate the effect on college enrollment of the recent housing bust combined with the "credit crunch" that has limited households' access to their home equity. One way to assess the economic significance of these results is to calculate what college enrollment would be if housing prices fell by 20.9 percent for all households in the four years before they have children of college age, which is the national percent decline in home prices according to the Case-Shiller home price index since the housing market peaked in August 2006. If all home prices declined by 20.9 percent, this would cause a 2.6 percentage point decline in college enrollment due to the fact that a 20.9 percent decline in home prices represents a significant reduction in home equity for most households. This exercise likely understates the effect of the current housing market decline on college enrollment because it assumes the liquidity of housing wealth has not changed. Given that the housing bust has been accompanied by a reduction in consumer access to home equity loans and lines of credit, the effect on college enrollment could be much larger than I estimate.

I also use the estimates in Table 2 to construct an upper bound on the percent of households that use housing wealth to relax short run credit constraints. Using the estimates from column (v), I simulate what college enrollment would be if all housing wealth became illiquid. I perform this calculation by assuming each homeowner loses all of the equity in his home in the four years prior to his child becoming of college age. If all housing equity were to become illiquid, I estimate college enrollment would decline by 4.4 percentage points. Because college attendance rates in the PSID are about 50 percent,[31] this estimate implies 8.8 percent of families with children in college use housing wealth to relax potential credit constraints. This back-of-the-envelope calculation suggests housing wealth serves to relax credit constraints for a

[31]This college attendance rate is lower than the rates calculated from the CPS or from the US Census because, as discussed in Section 4, 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.

non-trivial portion of the college-going population.

5.1.1 Sample Splits Based on Housing Wealth and Income

As discussed in Section 3, if housing prices and enrollment respond positively to local labor market shocks, the coefficient on the change in housing wealth will be biased. Table 3 tests for such a bias by splitting the sample into those who are more and less likely to be liquidity constrained.[32] The first two columns show the results for those families with counterfactual housing equity over and under $125,000, respectively. In columns (iii) through (v), I show parameter estimates for families with less than $125,000 of counterfactual home equity by increasing family income levels.

The estimates in Table 3 show strong evidence that the effects in Table 2 are being identified off of relatively poorer families. The effect of housing wealth in the 2000s is small and not statistically significant for households with more than $125,000 in equity, and for those with less than $125,000 in equity, a $10,000 increase in equity in the four years prior to their child becoming of college age increases the likelihood that child attends college by 1.3 percentage points post-2000. This effect is largest for those with family income less than $65,000 (1.7 percentage points) and then decreases with income, as shown in columns (iv) and (v).

That the effects of housing wealth changes on college enrollment are limited to post-2000, when housing wealth was most liquid, and to lower housing wealth and income households, who are likely to be more credit constrained, suggests these regressions are identifying how families used their housing wealth during the 2000s to relax credit constraints in college attendance. If the estimates of ψ were being driven by omitted ability bias or by the endogeneity of housing price changes and college attendance to local labor market shocks, one would not expect the pattern of results reported in Table 3.

[32] This strategy has been used widely in the literature on liquidity constraints (Zeldes, 1989; Jappelli, Pischke and Souleles, 1998; and Souleles, 2000).

5.2 Within-MSA Estimates

Some of the variation in housing prices used to identify the housing price and wealth coefficients in Tables 2 and 3 is across MSAs. Because this variation might be correlated with non-random sorting across MSAs of families with higher ability children into MSAs with higher housing price growth, I estimate equation (9) controlling for MSA-by-decade fixed effects. These fixed effects constrain the housing price variation to be within MSAs within a given decade and across individuals within MSAs. I estimate this specification for the full sample of those living in MSAs and for those with counterfactual housing equity above and below $125,000.[33]

The results from this specification are presented in columns (i)-(iii) of Table 4. Aside from increasing the size of the standard errors on the housing equity coefficients, including MSA-by-decade fixed effects in the model has little effect on the estimates. In fact, the coefficient on the change in counterfactual housing equity post 2000 is actually larger than in Table 2, at 0.005. In addition, although the standard errors are large in columns (ii) and (iii), it is clear all of the effects during the 2000s are being driven by lower-equity households. Overall, these estimates show little evidence of systematic cross-MSA sorting within states that is correlated with housing wealth growth and college enrollment.

As a falsification exercise, I also estimate a version of equation (9) only for renters, assigning renters the percentage change in the CMHPI in their MSA over the previous four years. The coefficient on this percentage change in the 2000s is -0.577 with a standard error of 1.470, so there is no evidence MSA-level housing price increases are positively correlated with college attendance among renters. However, the coefficients on family income are quite similar to those in Table 4. That renters are not increasing attendance due to housing increases suggests labor demand shocks are not driving my estimates as these shocks would impact renters and homeowners alike.

[33]The results for those with less than $125,000 in equity by family income block are similar to those from Table 3. I have omitted them for the sake of brevity, but they are available upon request from the author.

There could be additional selection within MSAs of those with higher ability children purchasing houses that appreciate more. To assess the severity of this selection, I estimate equation (9) using MSA-level simulated housing price changes (see equation (10)) as well as MSA-by-decade fixed effects. Conditional on the fixed effects, the coefficients on the simulated price changes are identified only off of MSA-level housing price variation over time within a decade. Because this specification imposes the condition that all homeowner families in a given MSA and year experience the same percent four-year growth in housing prices, the estimates will not be affected by within-MSA selection of families with higher ability children into houses that appreciate at relatively higher rates. Note as well that this measure abstracts from home equity – it only includes MSA-level housing *price* changes.

Results from estimation of equation (9) using simulated changes in home prices are presented in columns (iv)-(vi) of Table 4. The estimates show little evidence of within-MSA selection: the point estimates and marginal effects both are qualitatively and quantitatively similar to those in Tables 2 and 3. In fact, the marginal effect of a \$10,00 change in Simulated Home Value post 2000 is 67% higher than the associated estimated effect in column (iii) of Table 2 (0.005 vs. 0.003). Similar to the previous results, these effects are localized to those households with lower housing wealth in the 2000s. However, the standard errors become quite large in these specifications because I have restricted significantly the amount of variation used to identify the housing value parameters. Although none of the coefficients of interest are statistically different from zero at conventional levels, the point estimates are consistent with a positive link between housing wealth and college enrollment post-2000 and are inconsistent with selection within MSAs driving the results.

5.3 Evidence From Housing Supply Constraints

Another method for generating plausibly exogenous variation in housing wealth is to restrict the analysis to the MSAs that more likely experienced exogenous housing

price increases. Similar in spirit to Gyourko, Mayer and Sinai (2007) and Glaeser, Gyourko and Saks (2005), I identify MSAs that had relatively high housing price growth and relatively low population growth. These MSAs more likely experienced exogenous housing price growth because, as these papers argue, the housing price changes were driven by supply constraints rather than demand shocks that could be correlated with college investment behavior.

I classify these MSAs using population estimates from the U.S. Census Bureau and MSA-level CMHPI housing price indices. I classify an MSA as low population growth and high housing price growth if annualized housing price growth either between 1990 and 2005 or between 2000 and 2005 was above the median for all MSAs and if annualized population growth was below the median. This methodology leads to 51 MSAs classified as high housing and low population growth using 1990-2005 growth rates and 48 MSAs so classified using 2000-2005 growth rates.[34]

Figure 6 shows trends in college attendance rates among high school graduates by MSA growth type from the October CPS. As the figure illustrates, high price and low population growth MSAs, classified using 2000-2005 growth rates, exhibit trends in college enrollment that are nearly identical prior to 1998. Beginning in 1998, which was the start of the housing boom in many areas, the rates began to diverge such that by 2005 there was a 6.7 percentage point difference in college attendance rates between the two different types of MSAs. This evidence is suggestive that differential housing growth rates are a factor that explains the divergence in college attendance rates between these two groups of MSAs.

Table 5 shows estimates of equation (9) by MSA growth type. These estimates include MSA fixed effects[35] but allow for individual-level housing price variation within MSAs in order to maximize the amount of identifying variation. For the low

[34]See Appendix Table A-2 for a list of low population growth, high housing price growth MSAs. As the table shows, California cities make up a large proportion of these samples. All reported results in this paper are robust to dropping respondents from California. The results also are robust to excluding Texas, which did not allow home equity loans prior to 1997.

[35]Due to the small number of MSAs in columns (i) and (iii), I lack sufficient power to control for MSA-by-decade fixed effects.

population, high housing price growth MSAs, results follow a similar trend across decades, but the estimates in the 2000s are larger than those shown in Table 2 for the full sample. The effect of $10,000 in housing equity growth on the likelihood of college enrollment is 0.008 using the 1990-2005 annualized growth rates and is 0.007 using the 2000-2005 annualized growth rates. Of equal importance, columns (ii) and (iv) show that results from all other MSAs are smaller and not statistically significant. Overall, the results in Table 5 illustrate that all of the estimated effect of housing wealth growth on college enrollment in Table 2 is coming from respondents in MSAs that most likely experienced exogenous housing price increases due to supply constraints.

5.4 Credit Constraints or Wealth Effect?

As discussed in Section 2, one of the central assumptions in my model underlying identification of credit constraints is that there is no wealth effect on college enrollment from changes in housing equity. If college attendance has consumption value, however, increasing household wealth will increase consumption of college regardless of credit constraints. In this case, my estimates still will be identifying the causal effect of housing wealth on college attendance, which is an important policy parameter, but one will not be able to interpret the estimates as indicative of credit constraints in college enrollment, *per se*. The existence of consumption value of schooling is difficult to test for with my research design, because both wealth effects and higher education credit constraints will manifest themselves similarly in the data.

I argue that the results presented thus far are more consistent with credit constraints than wealth effects. If households were to increase college consumption due to housing wealth increases, one would expect to see this behavior in the 1980s and 1990s. Similarly, one might expect both poorer and wealthier households to increase college attendance if wealth effects were the dominant explanation for the positive housing wealth, college enrollment relationship. The results from Tables 3 and 4

run counter to such expectations, but depending on the shape of the Engel curve for college consumption and on how households responded to increases in less liquid housing wealth in the 1980s and 1990s, my results do not rule out wealth effects.

Another way to examine 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. 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, 2003). However, some recent work by 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.

To test for evidence of consumption responses to counterfactual home equity changes in the time period surrounding the college attendance decision, I estimate equation (9) using four consumption measures in the PSID as dependent variables: total food consumption, number of automobiles owned, whether the household head took a vacation in the past year, and the number of vacation weeks taken by the household head in the past year. The results are presented in Table 6 for the full sample (Panel A), for the sample living in high housing price and low population growth MSAs (Panel B) and for all other MSAs (Panel C). In Panel A, total food expenditures and the number of automobiles are positively related to increases in home equity post-2000, but the point estimates are small and only significant at the 10% level. The estimates in Panel B, though, suggest my estimates are not picking up a general consumption effect of housing equity increases because these are the

MSAs in which the college attendance effect is localized, but there is no evidence of increased consumption due to housing equity growth in these areas. In contrast, the MSAs in which there was no college attendance effect are responsible for the observed positive correlations in the full sample.

While the estimates in Table 6 are inconsistent with the estimated relationship between housing wealth and college enrollment being solely due to a wealth effect, they should be interpreted with care because food, automobiles, and leisure may have different wealth elasticities than the consumption aspect of college enrollment. The assumption that college is a pure investment good is prevalent in the literature, and Table 6 is in line with this assumption. Although it is difficult to separate wealth effects from credit constraints empirically, the sum total of the evidence is 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

With large real increases in the cost of attending college in recent years, the assumption of perfect capital markets in models of optimal education investment has become increasingly problematic. This paper adds to the sizeable literature on credit constraints and college enrollment by examining the role of housing wealth, using a natural experiment supplied by the geographic heterogeneity and timing of the recent housing boom. Using the Panel Study of Income Dynamics (PSID), I find a $10,000 increase in housing wealth in the four year prior to a child becoming of college age increases the likelihood that child attends college by 0.4 percentage points but only post-2000 when home equity was the most liquid and college costs were growing the fastest. While this marginal effect is modest, housing equity increased by $51,117 between 2001 and 2005, rendering even small effects meaningful. These estimates imply upwards of 9 percent of families with children in college use housing equity

to relax short-run credit constraints. I show the effect is most pronounced and is localized among families that have relatively low amounts of home equity and family income and that are therefore most likely to be credit constrained. 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 rising cost of college and 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. A simulation of the recent housing market slowdown using my estimates suggests that the 20.9 percent housing price decline since August 2006 could reduce college enrollment by about 2.6 percentage points. This will exacerbate the negative long run effect of the housing bust on economic growth, to the extent that it restricts 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.

References

[1] Adelman, Clifford, 2004. *Principal Indicators of Student Academic Histories in Postsecondary Education, 1972–2002.* Washington, DC: U.S. Department of Education, Institute of Education Sciences.

[2] Attanasio, Orazio P., Laura Blow, Robert Hamilton, and Andrew Leicester, 2005. "Booms and Busts: Consumption, House Prices and Expectations." IFS Working Paper WP05/24.

[3] Becker, Gary, 1962. "Investment in Human Capital: A Theoretical Analysis." *Journal of Political Economy* 70(5): 9–49.

[4] Belley, Philippe and Lance Lochner , 2007. "The Changing Role of Family Income and Ability in Determining Educational Achievement." *Journal of Human Capital* 1(1): 37–89.

[5] Ben-Porath, Yoram, 1967. "The Production of Human Capital and the Lifecycle of Earnings." *Journal of Political Economy* 75(4): 352–365.

[6] Bennett, Paul, Richard Peach and Stavros Peristiani, 2001. "Structural Change in the Mortgage Market and the Propensity to Refinance." *Journal of Money, Credit and Banking* 33(4): 956–975.

[7] Bound, John, Michael F. Lovenheim and Sarah E. Turner, 2007. "Understanding the Decrease in College Completion Rates and the Increased Time to the Baccalaureate Degree." PSC Research Report No. 07-626, Population Studies Center, University of Michigan.

[8] Bound, John, and Sarah E. Turner, 2007. "Cohort Crowding: How Resources Affect Collegiate Attainment." *Journal of Public Economics* 91(5-6): 877–899.

[9] Brown, Meta, John Karl Scholz and Ananth Seshadri , 2009. "A New Test of Borrowing Constraints for Higher Education." NBER Working Paper No. 14879.

[10] Brown, Meta, Maurizio Mazzocco, John Karl Scholz and Ananth Seshadri , 2006. "Tied Transfers." University of Wisconsin Mimeo.

[11] College Board, 2007. "Trends in Student Aid 2007." *Trends in Higher Education Series.*

[12] Campbell, John Y. and João F. Cocco, 2007. "How Do House Prices Affect Consumption? Evidence From Micro Data." *Journal of Monetary Economics* 54: 591–621.

[13] Cameron, Stephen V. and James J. Heckman, 1998. "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males." *Journal of Political Economy* 106(April): 262–333.

[14] Cameron, Stephen V. and James J. Heckman, 2001. "The Dynamics of Educational Attainment for Black, Hispanic, and White Males." *Journal of Political Economy* 109(June): 455–499.

[15] Cameron, Stephen V. and Christopher Taber, 2004. "Estimation of Educational Borrowing Constraints Using Returns to Schooling" *Journal of Political Economy* 112(1): 132–182.

[16] Carneiro, Pedro and James J. Heckman, 2002. "The Evidence on Credit Constraints in Post-Secondary Schooling." *The Economic Journal* 112(482): 705–734.

[17] Case, Karl E., John M. Quigley, and Robert J. Schiller, 2005. "Comparing Wealth Effects: The Stock Market versus the Housing Market." *Advances in Macroeconomics* 5(1): 2–3.

[18] Dahl, Gordon B. and Lance Lochner, 2005. "The Impact of Family Income on Child Achievement." NBER Working Paper No. 11279.

[19] Deep, Akash and Dietrich Domanski, 2002. "Housing Markets and Economic Growth: Lessons from the US Refinancing Boom." *Bis Quarterly Review* September: 37–45.

[20] DeLong, J. Bradford, Claudia Goldin and Laurence Katz, 2003. "Sustaining U.S. Economic Growth," in H. Aaron, J. Lindsay and P. Nivola, eds, *Agenda for the Nation*, Brookings Institution: 17-60.

[21] Doms, Mark S. and John Krainer, 2007. "Innovations in Mortgage Markets and Increased Spending on Housing." Federal Reserve Bank of San Francisco Working Paper 2007-05.

[22] Dynarski, Susan, 2002. "The Behavioral and Distributional Implications of Aid for College." *American Economic Review* 92(2): 279–285.

[23] Ellwood, David and Thomas Kane, 2000. "Who is Getting a College Education? Family Background and the Growing Gap in Enrollment." In *Securing the Future* (Sheldon Danziger and Joel Waldfogel, eds.), New York: Russell Sage.

[24] Glaeser, Edward L., Joseph Gyourko and Raven E. Saks, 2005. "Why Have Housing Prices Gone Up?" NBER Working Paper No. 11129.

[25] Grant, Timothy, 2007. "Need Tuition? Don't Count on Home Equity Loans." *Pittsburgh Post-Gazette*, August 17.

[26] Greenspan, Alan and James Kennedy, 2005. "Estimates of Home Mortgage Originations, Repayments and Debt on One-to-Four Family-Residences." Federal Reserve Board Working Paper, Finance and Economics Discussion Series.

[27] Gyourko, Joseph, Christopher Mayer and Todd Sinai, 2007. "Superstar Cities." Mimeo.

[28] Hurst, Eric and Frank Stafford, 2004. "Home is Where the Equity Is: Mortgage Refinancing and Household Consumption." *Journal of Money, Credit and Banking* 36(6): 987–1014.

[29] Keane, Michael P. and Kenneth I. Wolpin, 2001. "The Effect of Parental Transfers and Borrowing Constraints on Educational Attainment." *International Economic Review* 42(4): 1051–1103.

[30] LaCour-Little, Michael, 2000. "The Evolving Role of Technology in Mortgage Finance." *Journal of Housing Research* 11(2): 173–205.

[31] Jappelli, Tullio, Jörn-Steffen Pischke and Nicholas S. Souleles, 1998. "Testing for Liquidity Constraints in Euler Equations with Complementary Data Sources." *Review of Economics and Statistics* 80(2): 251–262.

[32] Lehnert, Andreas, 2003. "Housing, Consumption and Credit Constraints." Mimeo.

[33] Mincer, Jacob, 1997. "The Production of Human Capital and the Life Cycle of Earnings: Variations on a Theme." *Journal of Labor Economics* 15(1): S26—S47.

[34] Plug, Eric and Wim Vijverberg, 2005. "Does Family Income Matter for Schooling Outcomes? Using Adoptees as a Natural Experiment." *The Economic Journal* 115(506): 879—906.

[35] Runkle, David E., 1991. "Liquidity Constraints and the Permanent Income Hypothesis: Evidence from Panel Data." *Journal of Monetary Economics* 27: 73–98.

[36] Reyes, Jessica Wolpaw, 2008. "College Financial Aid Rules and the Allocation of Savings." *Education Economics* 16(2): 187–189.

[37] Rosen, Sherwin, 1977. "Human Capital: Relations Between Education and Earnings." In Michael D. Intriligator (ed.), *Frontiers of Quantitative Economics,* Vol. 3B. Amsterdam: North-Holland.

[38] Shea, John, 2000. "Does Parents' Money Matter?" *Journal of Public Economics* 77(2): 155–184.

[39] Souleles, Nicholas S., 2000. "College Tuition and Household Saving and Consumption." *Journal of Public Economics* 77(2): 185–207.

[40] Stinebrickner, Ralph and Todd R. Stinebrickner, 2003. "Working During School and Academic Performance" *Journal of Labor Economics* 21(2): 473–491.

[41] Zeldes, Stephen P., 1989. "Consumption and Liquidity Constraints: An Empirical Investigation" *Journal of Political Economy* 97(April): 305–346.

Table 1: Joint Distributions of Real Family Income Quartiles and Quartiles of the 4-Year Change in Real Home Prices and Home Equity Among Homeowners

Panel A: Home Price Changes

Family Income Quartile	Quartile of Price Change				
	1	2	3	4	Average
1	5.49%	3.85%	3.25%	2.34%	14.93%
2	6.85%	6.32%	6.05%	3.98%	23.20%
3	7.30%	8.43%	7.28%	6.21%	29.23%
4	5.38%	6.54%	8.45%	12.28%	32.64%
Average	25.01%	25.14%	25.03%	24.81%	100%

Panel B: Home Equity Changes

Family Income Quartile	Quartile of Equity Change				
	1	2	3	4	Average
1	4.73%	4.44%	3.51%	2.20%	14.89%
2	6.39%	6.83%	5.86%	4.13%	23.21%
3	7.57%	8.01%	7.90%	5.77%	29.26%
4	6.32%	5.73%	7.70%	12.89%	32.64%
Average	25.01%	25.01%	24.98%	25.00%	100%

Panel C: Counterfactual Home Equity Changes

Family Income Quartile	Quartile of Counterfactual Equity Change				
	1	2	3	4	Average
1	7.31%	3.85%	2.75%	1.20%	15.11%
2	7.85%	6.39%	5.76%	3.28%	23.28%
3	5.85%	8.64%	8.26%	6.39%	29.13%
4	4.00%	6.12%	8.26%	14.09%	32.47%
Average	25.01%	25.00%	25.03%	24.96%	100%

[1] Source: Reported home prices, remaining mortgage principal, and family income come from the Panel Study of Income Dynamics (PSID). All quartiles are for the period 1976-2005 and are for homeowner households with an 18 or 19-year old.

[2] The averages at the bottom of each panel are not identical due to a small number of observations with missing remaining loan principal information. Home equity cannot be calculated for these households and they are dropped from the calculations in Panels B and C but not Panel A.

[3] The counterfactual change in home equity is defined as the change in housing equity expected over the previous four years if the household accumulated housing equity without extracting any of its housing wealth.

Table 2: Logit Estimates of Probability of Enrollment as a Function of Housing Measures, Demographic Characteristics and State Labor Market Measures – Within State Housing Price Variation

	Dependent Variable: Dummy=1 if Enroll in College				
Independent Variable	Price Level (i)	Equity Level (ii)	Price Change (iii)	Equity Change (iv)	CF Equity Change (v)
I(1980s)*I(Homeowner)	0.112	0.161	0.196	0.221	0.162
	(0.222)	(0.217)	(0.213)	(0.213)	(0.213)
	[0.026]	[0.037]	[0.044]	[0.050]	[0.037]
I(1990s)*I(Homeowner)	0.517**	0.540**	0.540**	0.565**	0.532**
	(0.173)	(0.169)	(0.167)	(0.168)	(0.167)
	[0.120]	[0.126]	[0.126]	[0.132]	[0.124]
I(2000s)*I(Homeowner)	0.678**	0.706**	0.632**	0.668**	0.609**
	(0.241)	(0.230)	(0.228)	(0.227)	(0.226)
	[0.161]	[0.168]	[0.150]	[0.159]	[0.144]
I(1980s)*Home Value ($10,000)	0.004	.	-0.006	.	.
	(0.007)	.	(0.009)	.	.
	[0.001]	.	[-0.001]	.	.
I(1990s)*Home Value ($10,000)	0.002	.	0.002	.	.
	(0.005)	.	(0.008)	.	.
	[0.000]	.	[0.000]	.	.
I(2000s)*Home Value ($10,000)	0.003	.	0.015*	.	.
	(0.007)	.	(0.008)	.	.
	[0.001]	.	[0.003]	.	.
I(1980s)*Home Equity ($10,000)	.	-0.001	.	-0.014	-0.000
	.	(0.008)	.	(0.010)	(0.009)
	.	[-0.000]	.	[-0.003]	[-0.000]
I(1990s)*Home Equity ($10,000)	.	-0.000	.	-0.008	0.003
	.	(0.005)	.	(0.010)	(0.008)
	.	[0.000]	.	[-0.002]	[0.001]
I(2000s)*Home Equity ($10,000)	.	-0.002	.	0.011	0.019**
	.	(0.008)	.	(0.010)	(0.009)
	.	[0.001]	.	[0.002]	[0.004]
I(1980s)*Real Family Income ($10,000)	0.013	0.015	0.016	0.017	0.015
	(0.010)	(0.011)	(0.011)	(0.011)	(0.010)
	[0.002]	[0.003]	[0.004]	[0.004]	[0.003]
I(1990s)*Real Family Income ($10,000)	0.041**	0.042**	0.043**	0.044**	0.042**
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
	[0.009]	[0.009]	[0.010]	[0.010]	[0.009]
I(2000s)*Real Family Income ($10,000)	0.015	0.018*	0.015*	0.015*	0.013*
	(0.010)	(0.010)	(0.008)	(0.009)	(0.008)
	[0.003]	[0.004]	[0.003]	[0.003]	[0.003]
Observations	7105	7039	6967	6962	7035

[1] Source: Author's estimation of equations (8) and (9) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text.

[2] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include decade-by-state and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, the number of other dependents in the household, state-level unemployment, real per capita income and 18-22 year old population. The regressions are weighted by the family weights in the PSID.

[3] Heteroskedasticity-robust standard errors are in parentheses: * indicates significance at the 10 percent level and ** indicates significance at the 5 percent level.

[4] Marginal effects at the mean of all variables are in brackets.

Table 3: Logit Estimates of Probability of Enrollment as a Function of Counterfactual Home Equity Changes, Demographic Characteristics and State Labor Market Measures; Sample Splits Based on Income and Wealth Levels – Within State Housing Price Variation

	Dependent Variable: Dummy=1 if Enroll in College				
	CF Home Equity	CF Home Equity Under $125,000			
Independent Variable	Over $125,000 (i)	Full Sample (ii)	Income Under $65,000 (iii)	Income $65,000 to $100,000 (iv)	Income Over $100,000 (v)
I(1980s)*Counterfactual Housing Equity Change ($10,000)	-0.010	-0.018	-0.087**	-0.015	-0.021
	(0.013)	(0.024)	(0.036)	(0.049)	(0.022)
	[-0.002]	[-0.004]	[-0.014]	[-0.003]	[-0.005]
I(1990s)*Counterfactual Housing Equity Change ($10,000)	0.001	0.015	0.028	0.021	-0.008
	(0.010)	(0.025)	(0.050)	(0.045)	(0.013)
	[0.000]	[0.003]	[0.004]	[0.004]	[-0.002]
I(2000s)*Counterfactual Housing Equity Change ($10,000)	0.009	0.060**	0.104*	0.041	0.016
	(0.011)	(0.030)	(0.061)	(0.059)	(0.013)
	[0.002]	[0.013]	[0.017]	[0.008]	[0.004]
I(1980s)*Real Family Income ($10,000)	0.001	0.050**	0.088	0.032	-0.008
	(0.008)	(0.019)	(0.082)	(0.146)	(0.012)
	[0.000]	[0.011]	[0.014]	[0.006]	[-0.002]
I(1990s)*Real Family Income ($10,000)	0.017	0.075**	0.199**	0.169	0.030
	(0.019)	(0.028)	(0.105)	(0.157)	(0.035)
	[0.004]	[0.017]	[0.032]	[0.033]	[0.008]
I(2000s)*Real Family Income ($10,000)	0.014	0.023	0.371**	-0.219	0.015
	(0.010)	(0.019)	(0.155)	(0.202)	(0.018)
	[0.004]	[0.005]	[0.060]	[-0.043]	[0.004]
Number of Observations	970	3,677	1,938	995	571

[1] Source: Author's estimation of equation (9) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text.

[2] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include decade-by-state and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, the number of other dependents in the household, state-level unemployment, real per capita income and 18-22 year old population. The regressions are weighted by the family weights in the PSID.

[3] Heteroskedasticity-robust standard errors are in parentheses: * indicates significance at the 10 percent level and ** indicates significance at the 5 percent level.

[4] Marginal effects at the mean of all variables are in brackets.

Table 4: Logit Estimates of Probability of Enrollment as a Function of Counterfactual Home Equity Changes, Simulated Housing Value Changes, Demographic Characteristics and MSA Labor Market Measures – Within MSA Housing Price Variation

	Dependent Variable: Dummy=1 if Enroll in College					
		CF Home Equity			CF Home Equity	
	Full	Over	Under	Full	Over	Under
	Sample	$125,000	$125,000	Sample	$125,000	$125,000
Independent Variable	(i)	(ii)	(iii)	(iv)	(v)	(vi)
	0.259	.	.	0.390**	.	.
I(1980s)*I(Homeowner)	(0.269)	.	.	(0.156)	.	.
	[0.057]	.	.	[0.079]	.	.
	0.391**	.	.	0.384**	.	.
I(1990s)*I(Homeowner)	(0.227)	.	.	(0.160)	.	.
	[0.087]	.	.	[0.079]	.	.
	1.070**	.	.	0.697**	.	.
I(2000s)*I(Homeowner)	(0.324)	.	.	(0.190)	.	.
	[0.252]	.	.	[0.149]	.	.
I(1980s)*Counterfactual Housing	-0.003	-0.010	0.036	.	.	.
Equity Change ($10,000)	(0.011)	(0.015)	(0.035)	.	.	.
	[-0.001]	[-0.002]	[0.007]	.	.	.
I(1990s)*Counterfactual Housing	0.006	0.009	-0.030	.	.	.
Equity Change ($10,000)	(0.011)	(0.020)	(0.046)	.	.	.
	[0.001]	[0.002]	[-0.006]	.	.	.
I(2000s)*Counterfactual Housing	0.024**	-0.009	0.047	.	.	.
Equity Change ($10,000)	(0.012)	(0.028)	(0.038)	.	.	.
	[0.005]	[-0.002]	[0.009]	.	.	.
I(1980s)*Simulated Home	.	.	.	0.002	0.046	-0.009
Value Change ($10,000)	.	.	.	(0.024)	(0.043)	(0.103)
	.	.	.	[0.000]	[0.011]	[-0.002]
I(1990s)*Simulated Home	.	.	.	-0.013	-0.014	-0.081
Value Change ($10,000)	.	.	.	(0.026)	(0.048)	(0.108)
	.	.	.	[-0.003]	[-0.004]	[-0.017]
I(2000s)*Simulated Home	.	.	.	0.023	-0.036	0.129
Value Change ($10,000)	.	.	.	(0.026)	(0.044)	(0.131)
	.	.	.	[0.005]	[-0.009]	[0.027]
	0.007	0.007	0.061*	0.025*	0.006	0.079**
I(1980s)*Real Family Income ($10,000)	(0.008)	(0.008)	(0.032)	(0.013)	(0.008)	(0.036)
	[0.002]	[0.002]	[0.012]	[0.005]	[0.002]	[0.016]
	0.052**	0.014	0.122*	0.065**	0.016	0.124**
I(1990s)*Real Family Income ($10,000)	(0.025)	(0.024)	(0.064)	(0.022)	(0.026)	(0.056)
	[0.011]	[0.003]	[0.025]	[0.013]	[0.004]	[0.026]
	0.022*	0.023*	0.046	0.020*	0.028**	0.049*
I(2000s)*Real Family Income ($10,000)	(0.012)	(0.013)	(0.029)	(0.013)	(0.014)	(0.029)
	[0.005]	[0.006]	[0.009]	[0.004]	[0.007]	[0.010]
Number of Observations	5,100	688	2,385	5,109	712	2,187

[1] Source: Author's estimation of equation (9) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text. The estimation sample includes only those living in an identified MSA who do not move across MSAs between time t-4 and t.

[2] Simulated housing price growth is calculated by attributing the percent growth in each MSA from the previous 4 years from the CMHPI to each homeowner in an MSA.

[3] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include MSA-by-decade and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, the number of other dependents in the household, MSA-level real per capita income, unemployment rate, and state 18-22 year old population. The regressions are weighted by the family weights in the PSID.

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

[5] Marginal effects at the mean of all variables are in brackets.

Table 5: Estimates of Probability of Enrollment as a Function of Counterfactual Home Equity Changes, Demographic Characteristics and MSA Labor Market Measures by MSA-Growth Type

	Dependent Variable: Dummy=1 if Enroll in College			
	1990-2005		2000-2005	
	Low Pop High Price	All Other	Low Pop High Price	All Other
Independent Variable	(i)	(ii)	(iii)	(iv)
I(1980s)*I(Homeowner)	0.534**	0.483*	0.117	0.659**
	(0.236)	(0.252)	(0.268)	(0.249)
	[0.113]	[0.103]	[0.025]	[0.139]
I(1990s)*I(Homeowner)	0.099*	0.469**	0.403	0.287*
	(0.232)	(0.187)	(0.272)	(0.171)
	[0.020]	[0.101]	[0.090]	[0.059]
I(2000s)*I(Homeowner)	0.544**	0.507**	0.511	0.532**
	(0.271)	(0.224)	(0.322)	(0.204)
	[0.119]	[0.110]	[0.116]	[0.114]
I(1980s)*Counterfactual Housing Equity Change ($10,000)	-0.015	0.016	-0.014	0.022
	(0.013)	(0.014)	(0.012)	(0.015)
	[-0.003]	[0.003]	[-0.003]	[0.004]
I(1990s)*Counterfactual Housing Equity Change ($10,000)	0.017	-0.000	0.020	-0.001
	(0.014)	(0.013)	(0.015)	(0.013)
	[0.004]	[-0.000]	[0.004]	[-0.000]
I(2000s)*Counterfactual Housing Equity Change ($10,000)	0.039**	0.010	0.032**	0.015
	(0.017)	(0.010)	(0.017)	(0.010)
	[0.008]	[0.002]	[0.007]	[0.003]
I(1980s)*Real Family Income ($10,000)	0.017	0.030	0.016	0.036**
	(0.015)	(0.018)	(0.014)	(0.018)
	[0.003]	[0.005]	[0.003]	[0.007]
I(1990s)*Real Family Income ($10,000)	0.052**	0.062**	0.067**	0.053**
	(0.023)	(0.029)	(0.030)	(0.025)
	[0.011]	[0.013]	[0.014]	[0.011]
I(2000s)*Real Family Income ($10,000)	0.029	0.016	0.035	0.014
	(0.023)	(0.010)	(0.025)	(0.010)
	[0.006]	[0.003]	[0.008]	[0.003]
Number of Observations	2,271	3,274	1,746	3,812

[1] Source: Author's estimation of equation (9) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text. The estimation sample includes only those living in an identified MSA who do not move across MSAs between time t-4 and t.

[2] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include MSA and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, the number of other dependents in the household, MSA-level real per capita income, unemployment rate, and state 18-22 year old population. The regressions are weighted by the family weights in the PSID.

[3] Low population growth MSAs are those with 1990-2005 or 2000-2005 annualized population growth below the median. High price growth MSAs are those with above median 1990-2005 or 2000-2005 annualized housing price growth rates, calculated from the MSA-level CMHPI. All other MSAs are all MSAs with above-median population or below-median housing price growth.

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

[5] Marginal effects at the mean of all variables are in brackets.

Table 6: Estimates of The Relationship Between Housing Wealth Changes and Different Measures of Consumption by Decade

Panel A: Full Sample				
	Dependent Variable:			
Independent Variable	Total Food Expenditure OLS (i)	Number of Automobiles OLS (ii)	Take a Vacation? Logit (iii)	Number of Vacation Weeks OLS (iv)
I(1980s)*I(Homeowner)	1399.77**	0.470**	0.780**	0.767**
	(451.37)	(0.129)	(0.351)	(0.236)
I(1990s)*I(Homeowner)	882.29**	1.028**	-0.205	0.585**
	(312.96)	(0.203)	(0.301)	(0.243)
I(2000s)*I(Homeowner)	808.52*	0.394**	0.682*	0.335
	(435.61)	(0.141)	(0.391)	(0.330)
I(1980s)*Counterfactual Housing Equity Change ($10,000)	98.85**	0.004	0.023	0.002
	(29.83)	(0.006)	(0.019)	(0.012)
I(1990s)*Counterfactual Housing Equity Change ($10,000)	19.88	-0.015**	0.069**	-0.000
	(16.89)	(0.006)	(0.030)	(0.008)
I(2000s)*Counterfactual Housing Equity Change ($10,000)	35.56*	0.008*	0.006	-0.002
	(18.66)	(0.004)	(0.015)	(0.008)
I(1980s)*Real Family Income ($10,000)	48.09	0.012	-0.014	0.004
	(39.39)	(0.011)	(0.010)	(0.013)
I(1990s)*Real Family Income ($10,000)	136.49**	0.012	0.195**	0.022**
	(29.64)	(0.009)	(0.041)	(0.011)
I(2000s)*Real Family Income ($10,000)	48.65**	-0.002	0.011	-0.001
	(10.83)	(0.006)	(0.055)	(0.005)
Panel B: Above Median Housing and Below Median Pop Growth (90-05)				
	Dependent Variable:			
Independent Variable	Total Food Expenditure OLS (i)	Number of Automobiles OLS (ii)	Take a Vacation? Logit (iii)	Number of Vacation Weeks OLS (iv)
I(1980s)*I(Homeowner)	823.03**	0.844**	0.216	0.373
	(361.21)	(0.165)	(0.396)	(0.228)
I(1990s)*I(Homeowner)	823.03**	0.844**	0.216	0.373
	(361.21)	(0.165)	(0.396)	(0.228)
I(2000s)*I(Homeowner)	823.03**	0.844**	0.216	0.373
	(361.21)	(0.165)	(0.396)	(0.228)
I(1980s)*Counterfactual Housing Equity Change ($10,000)	86.57**	-0.004	0.002	-0.004
	(26.48)	(0.011)	(0.032)	(0.027)
I(1990s)*Counterfactual Housing Equity Change ($10,000)	21.58	-0.013**	0.078	0.010
	(34.31)	(0.004)	(0.059)	(0.012)
I(2000s)*Counterfactual Housing Equity Change ($10,000)	-19.33	-0.015	0.005	-0.023
	(51.06)	(0.010)	(0.037)	(0.019)
I(1980s)*Real Family Income ($10,000)	106.95**	0.041**	0.066	0.034
	(34.04)	(0.013)	(0.065)	(0.028)
I(1990s)*Real Family Income ($10,000)	158.35**	0.075**	0.163**	0.068**
	(39.14)	(0.037)	(0.072)	(0.027)

I(2000s)*Real Family Income ($10,000)	180.63**	0.046**	0.135**	0.024
	(70.19)	(0.014)	(0.057)	(0.023)

Panel C: All Other MSAs

	Dependent Variable:			
Independent Variable	Total Food Expenditure OLS (i)	Number of Automobiles OLS (ii)	Take a Vacation? Logit (iii)	Number of Vacation Weeks OLS (iv)
I(1980s)*I(Homeowner)	684.66**	0.122	0.201	0.633**
	(293.58)	(0.139)	(0.208)	(0.201)
I(1990s)*I(Homeowner)	684.66**	0.122	0.201	0.633**
	(293.58)	(0.139)	(0.208)	(0.201)
I(2000s)*I(Homeowner)	684.66**	0.122	0.201	0.633**
	(293.58)	(0.139)	(0.208)	(0.201)
I(1980s)*Counterfactual Housing Equity Change ($10,000)	82.47**	0.019	0.034*	0.008
	(28.59)	(0.014)	(0.019)	(0.012)
I(1990s)*Counterfactual Housing Equity Change ($10,000)	4.79	0.010	0.039	-0.009
	(32.52)	(0.030)	(0.045)	(0.011)
I(2000s)*Counterfactual Housing Equity Change ($10,000)	41.78**	0.010**	0.017	0.001
	(20.58)	(0.005)	(0.020)	(0.010)
I(1980s)*Real Family Income ($10,000)	6.49	0.001	-0.017	-0.002
	(39.46)	(0.006)	(0.009)	(0.010)
I(1990s)*Real Family Income ($10,000)	135.20*	0.009	0.150**	0.014
	(70.23)	(0.010)	(0.053)	(0.009)
I(2000s)*Real Family Income ($10,000)	46.08**	-0.003	0.006	0.001
	(10.95)	(0.005)	(0.046)	(0.007)

[1] Source: Panel Study of Income Dynamics repeated cross section of families with 18-19 year olds as described in the text. The estimation sample in Panels B and C includes only those living in an identified MSA who do not move across MSAs between time t-4 and t.

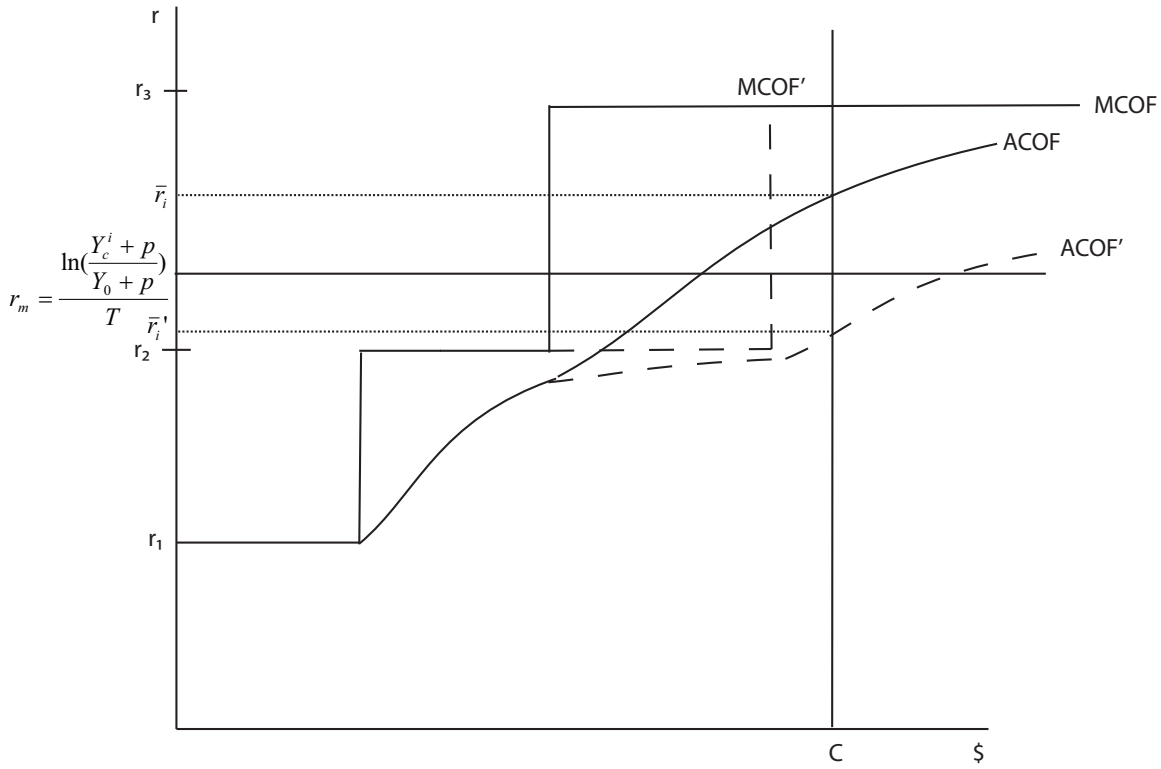
[2] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include decade-by-MSA and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, and the number of other dependents in the household. The regressions are weighted by the family weights in the PSID.

[3] Low population growth MSAs are those with 1990-2005 annualized population growth below the median. High price growth MSAs are those with above median 1990-2005 annualized housing price growth rates, calculated from the MSA-level CMHPI. All other MSAs are all MSAs with above-median population or below-median housing price growth.

[4] Estimates for total food expenditures exclude 1988 and estimates for number of automobiles exclude years 1988-1996. The PSID did not collect consumption information on those goods in these years.

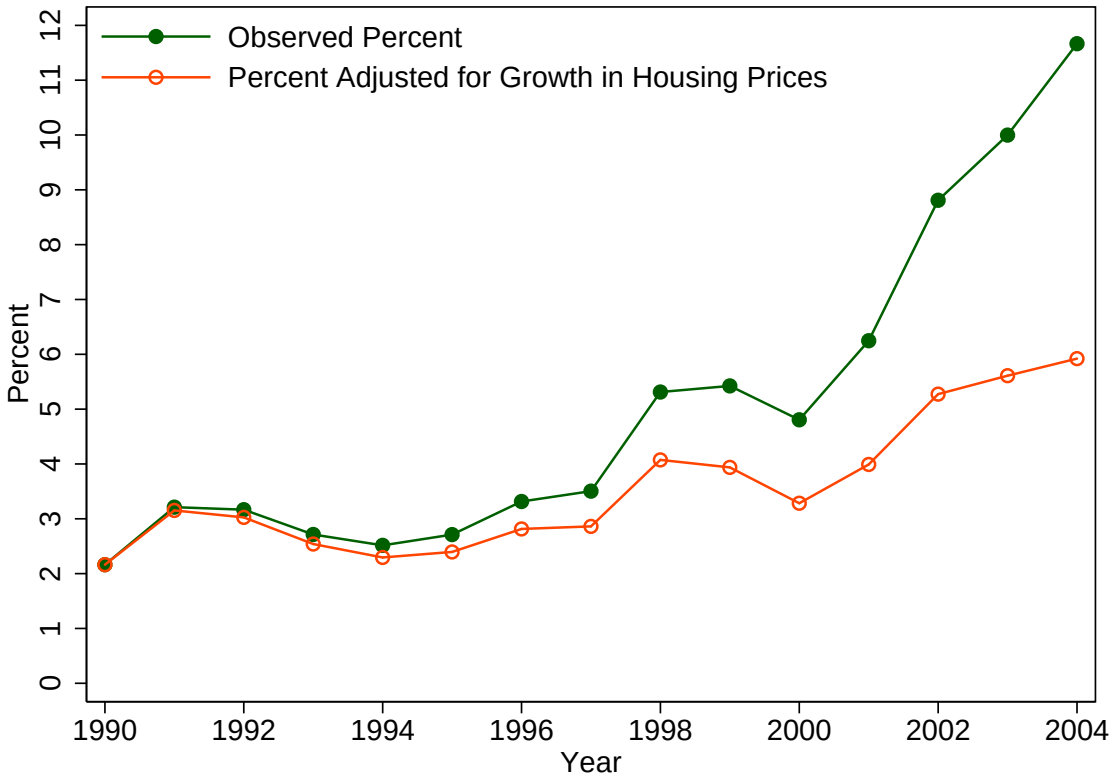
[5] Standard errors are in parentheses and are clustered at the MSA-level: * indicates significance at the 10 percent level and ** indicates significance at the 5 percent level.

Figure 1: The Education Investment Decision and The Cost of Funds



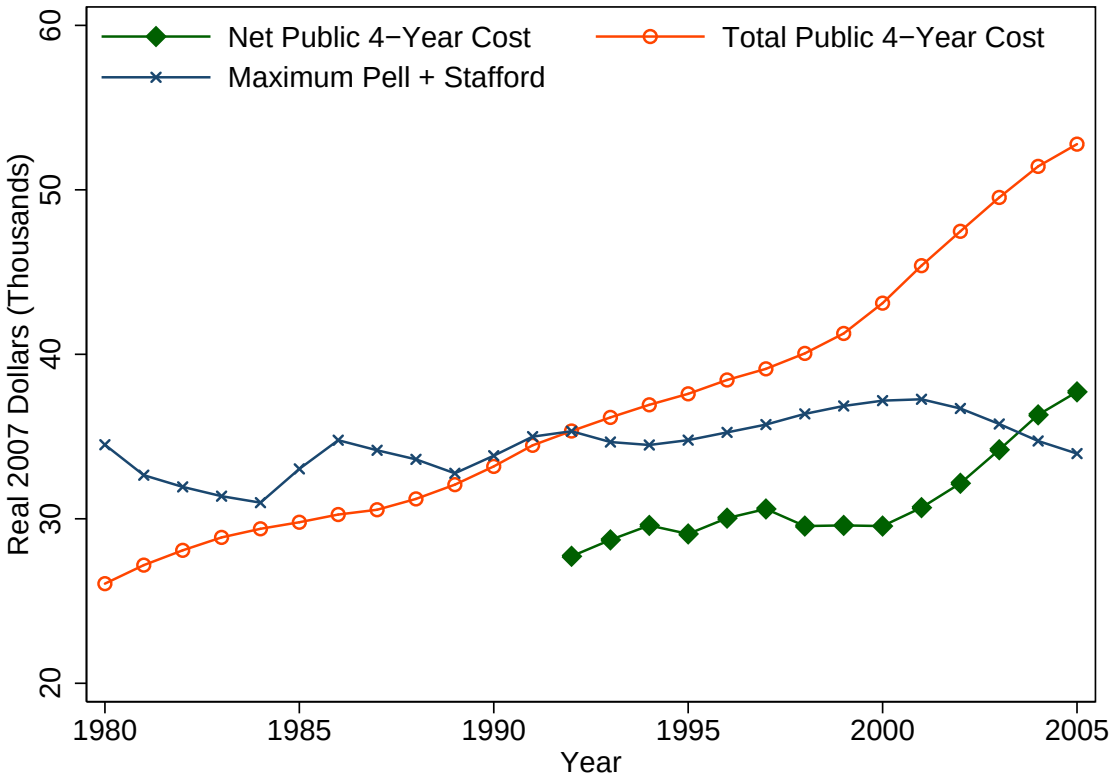
The figure depicts the optimal education investment choice for an agent for whom $r_m = \frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$. ACOF is the average cost of funds and MCOF is the marginal cost of funds. C is the total demand for funds and r_m is the market interest rate. r_1 refers to the interest rate on government subsidized loans, r_2 refers to the interest rate on home equity, and r_3 refers to the interest rate on private loans. Because the investment decision is binary, the individual invests in college if the intersection of the ACOF curve and C is less than or equal to $\frac{ln(\frac{Y_c^i+p}{Y_0+p})}{T}$, which equals r_m in the figure.

Figure 2: Extracted Home Equity as a Percent of per-Capita Income



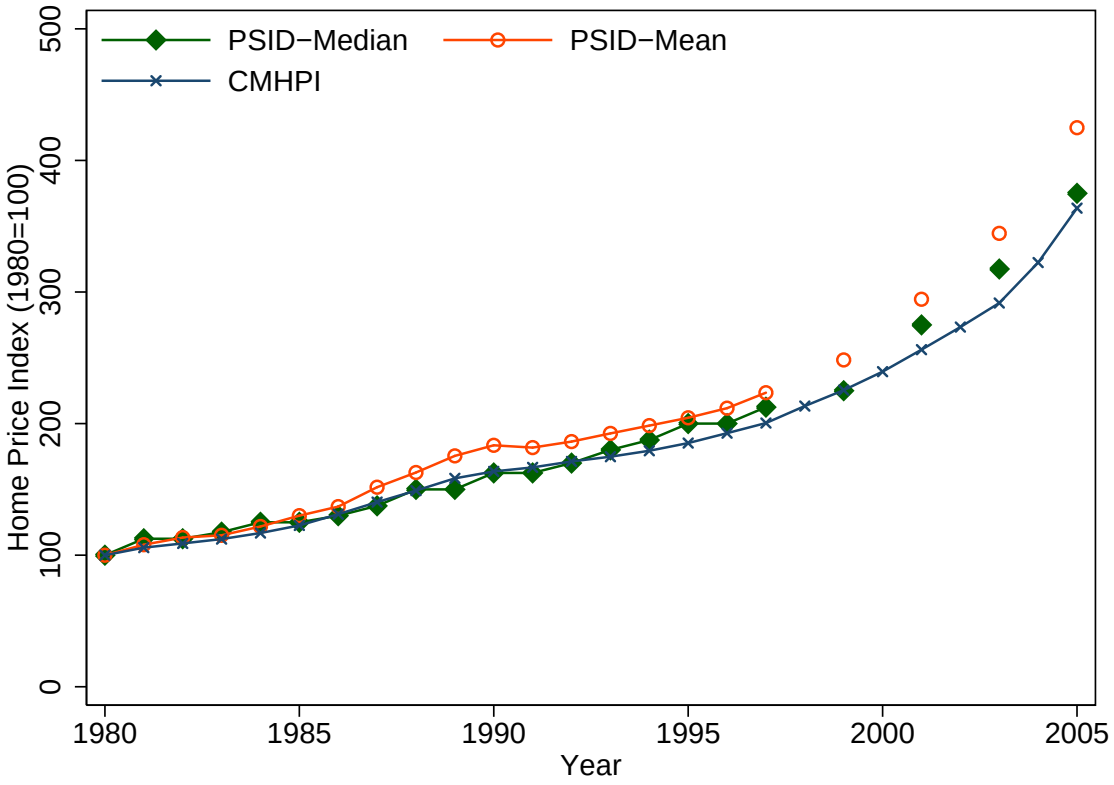
Sources: Estimates of gross equity extraction are taken from Table 1 in Greenspan and Kennedy (2005). Average per-capita income comes from "personal income" estimates calculated by the U.S. Bureau of Labor Statistics. The "Percent Adjusted for Growth in Housing Prices" is calculated by adjusting the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

Figure 3: Trends in the Cost of College and Federal Financial Aid, 1980-2005



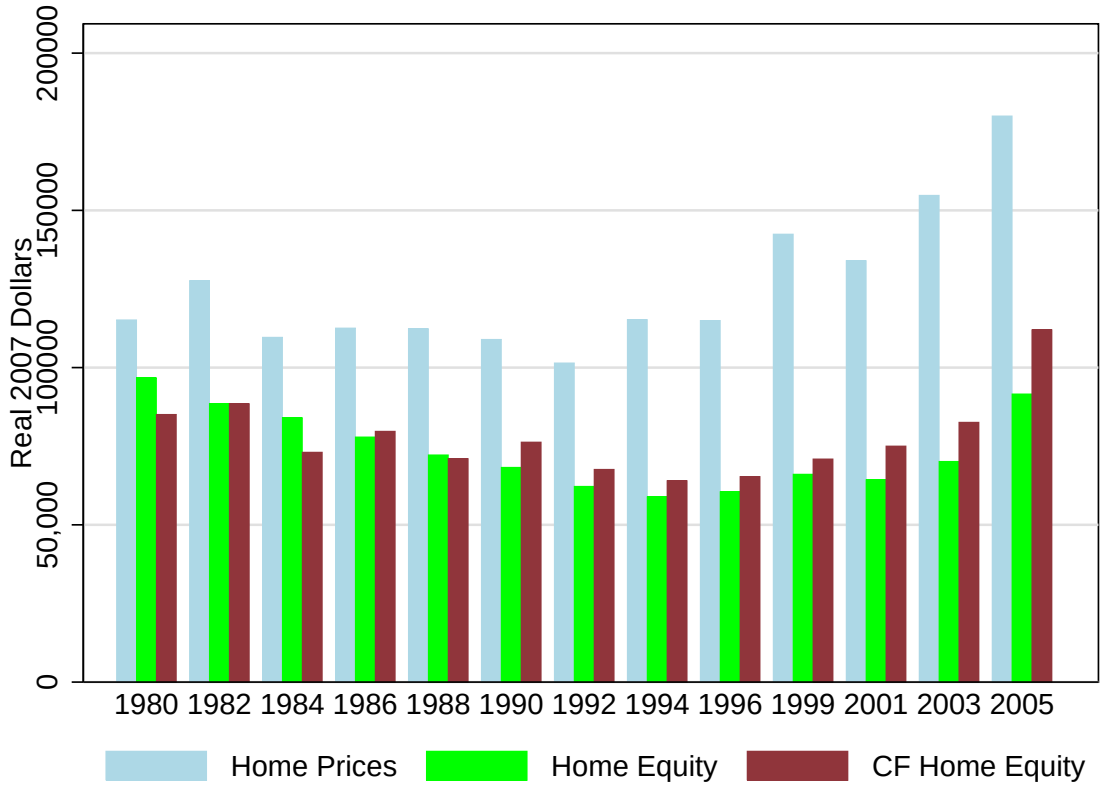
Sources: Net and total 4-year costs are taken from the *College Board's 2007 Trends in Pricing* compilation. Net costs are total published price minus average grant aid and tax benefits per full time student. Maximum Pell Grant and Stafford Loan amounts are taken from the FinAid website: http://www.finaid.org/loans/historicallimits.phtml. Calculations of four-year cumulative Stafford values are completed by summing the value of the maximum freshman award in the matriculating year, the maximum sophomore award in the second year, the maximum junior award in the third year, and the maximum senior award in fourth year. All other values represent sums over the four years starting in each given year on the x-axis. All costs include tuition, fees, room and board.

Figure 4: Comparison of Home Price Indices Constructed from Self-Reported PSID Home Prices and the Published CMHPI



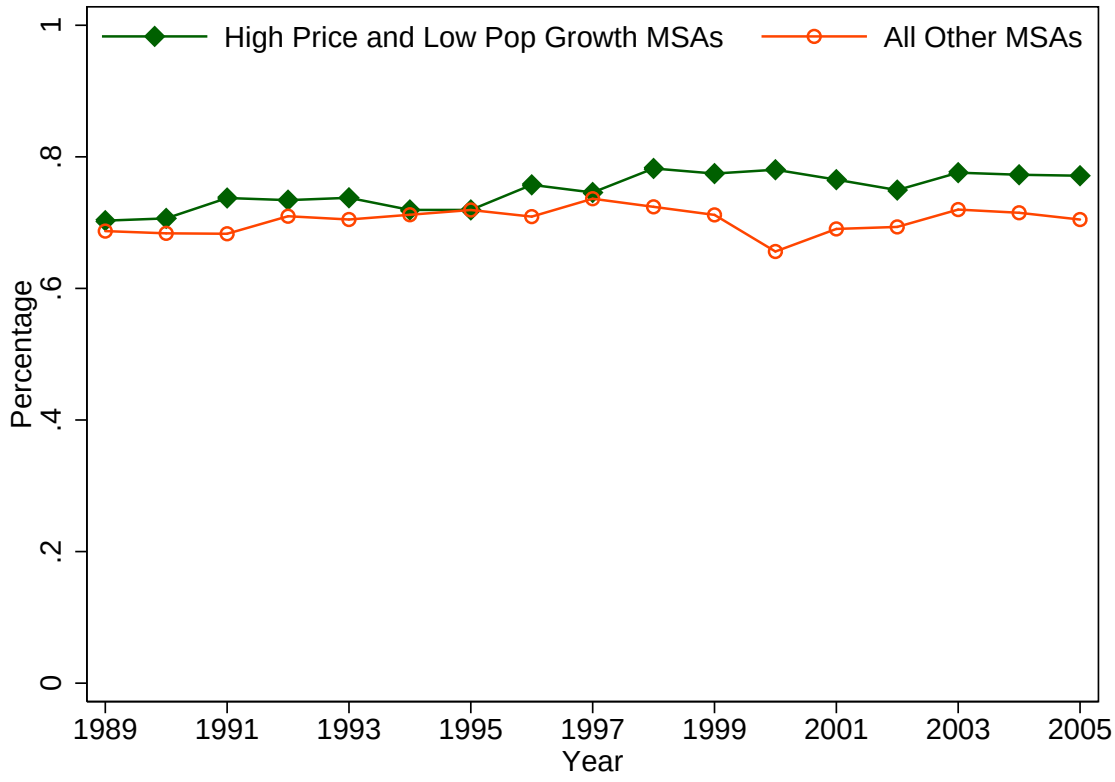
Source: The PSID indices are the respective reported mean and median home prices in each year for the full PSID sample, rescaled such that year 1980=100. The Conventional Mortgage Housing Price Index (CMHPI) is reported by Fannie Mae for single-family repeat sale homes and appraisals.

Figure 5: Trends in Average Home Values, Housing Equity and Counterfactual Housing Equity



Source: Author's calculations from the PSID sample of home-owning families with 18 or 19-year olds in each survey year as described in the text. All means are deflated to real 2007 dollars using the CPI-U. Counterfactual housing equity is the estimated equity each homeowner would have accumulated if he did not tap any equity in his home in the four years prior to the survey year.

Figure 6: Trends in College Attendance Rates Across Different MSA Housing Price and Population Growth Types from the October CPS



Source: Author's calculations from the October CPS. The sample includes high school graduates who live in an identified MSA. Low population growth MSAs are those with 2000-2005 annualized population growth below the median. High price growth MSAs are those with above median 2000-2005 annualized housing price growth rates, calculated from the MSA-level CMHPI. All other MSAs are all MSAs with above-median population or below-median housing price growth.

Table A-1: IV Estimates of Probability of Enrollment as a Function of Home Equity Levels, Instrumenting Home Equity Level With Housing Price Change and Equity Change Measures

	Dependent Variable: Dummy=1 if Enroll in College			
		Home Equity Level Instrumented With:		
Independent Variable	OLS (i)	Equity Change (ii)	Price Change (iii)	CF Equity Change (iv)
I(1980s)*I(Homeowner)	0.024	0.056	0.046	0.026
	(0.038)	(0.040)	(0.042)	(0.041)
I(1990s)*I(Homeowner)	0.106**	0.119**	0.107**	0.101**
	(0.031)	(0.033)	(0.032)	(0.031)
I(2000s)*I(Homeowner)	0.141**	0.108**	0.632**	0.104**
	(0.040)	(0.041)	(0.043)	(0.042)
I(1980s)*Real Home Equity ($10,000)	0.000	-0.003	-0.002	0.001
	(0.002)	(0.002)	(0.003)	(0.003)
I(1990s)*Real Home Equity ($10,000)	0.000	-0.002	0.000	0.001
	(0.001)	(0.002)	(0.002)	(0.002)
I(2000s)*Real Home Equity ($10,000)	-0.001	0.002	0.004*	0.005**
	(0.001)	(0.002)	(0.003)	(0.002)
I(1980s)*Real Family Income ($10,000)	0.002**	0.003**	0.003**	0.002*
	(0.001)	(0.001)	(0.001)	(0.001)
I(1990s)*Real Family Income ($10,000)	0.008**	0.009**	0.008**	0.008**
	(0.002)	(0.002)	(0.002)	(0.002)
I(2000s)*Real Family Income ($10,000)	0.003**	0.002*	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Number of Observations	7,071	7,000	7,006	7,017
First-Stage F-Statistics:				
I(1980s)*Home Equity		58.63	28.24	34.52
I(1990s)*Home Equity		18.04	11.91	20.41
I(2000s)*Home Equity		26.69	10.98	18.13

[1] Source: Author's estimation of equation (9) using the Panel Study of Income Dynamics repeated cross-section of 18-19 year olds as described in the text.

[2] All financial variables are in real 2007 $10,000, adjusted using the CPI. All models include decade-by-state and year fixed effects as well as controls for household head's education level, age, sex and marital status, respondent's age, sex and race, the number of other dependents in the household, state-level unemployment, real per capita income and 18-22 year old population. The regressions are weighted by the family weights in the PSID.

[3] Heteroskedasticity-robust standard errors are in parentheses: * indicates significance at the 10 percent level and ** indicates significance at the 5 percent level.

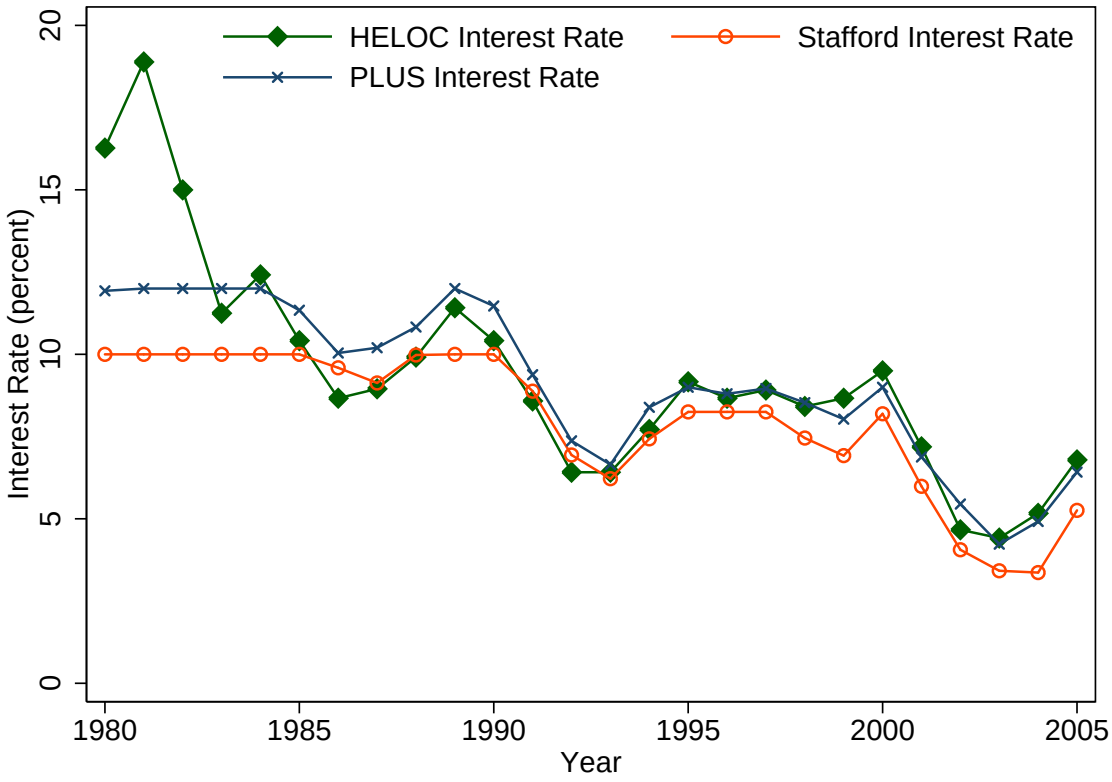
Table A-2: MSAs With High Housing Price and Low Population Growth Rates

Annualized Growth Time Period			
1990-2005		2000-2005	
MSA Name	State	MSA Name	State
Fresno	CA	Los Angeles	CA
Los Angeles	CA	Oakland	CA
Oakland	CA	San Francisco	CA
San Diego	CA	San Jose	CA
San Francisco	CA	Santa Barbara-Santa Maria-Lompoc	CA
San Jose	CA	Santa Rosa	CA
Santa Barbara-Santa Maria-Lompoc	CA	Vallejo-Fairfield-Napa	CA
Santa Rosa	CA	Bridgeport	CT
Ventura	CA	Danbury	CT
Vallejo-Fairfield-Napa	CA	Hartford	CT
Bridgeport	CT	New Haven	CT
Danbury	CT	New London-Norwich	CT
Macon	GA	Macon	GA
Davenport-Moline-Rock Island	IA	Honolulu	HI
Dubuque	IA	Waterloo-Cedar Falls	IA
Chicago	IL	Champaign-Urbana	IL
Peoria-Pekin	IL	Chicago	IL
Lafayette	LA	New Orleans	LA
New Orleans	LA	Shreveport-Bossier City	LA
Fitchburg	MA	Boston	MA
Baltimore	MD	Barnstable-Yarmouth	MA
Ann Arbor	MI	Brockton	MA
Flint	MI	Lowell	MA
Detroit	MI	New Bedford	MA
Lansing-East Lansing	MI	Worcester	MA
St. Louis	MO	Baltimore	MD
Duluth-Superior	MN	Duluth-Superior	MN
Biloxi-Gulfport-Pascagoula	MS	St. Louis	MO
Bismarck	ND	Bergen-Passaic	NJ
Bergen-Passaic	NJ	Jersey City	NJ
Jersey City	NJ	Middlesex-Somerset-Hunterdon	NJ
Middlesex-Somerset-Hunterdon	NJ	Newark	NJ
Newark	NJ	Ocean City	NJ
Trenton	NJ	Trenton	NJ
Nassau	NY	Nassau	NY
Newburgh-Middletown-Poughkeepsie	NY	New York	NY
New York	NY	Syracuse	NY
Akron	OH	Eugene-Springfield	OR
Canton-Massillon	OH	Harrisburg-Lebanon-Carlisle	PA
Eugene-Springfield	OR	Lancaster	PA
Charleston	SC	Philadelphia	PA
Philadelphia	PA	Scranton–Wilkes-Barre–Hazleton	PA
Salt Lake City-Ogden	UT	Providence	RI
Virginia Beach-Norfolk-Newport News	VA	Lynchburg	VA
Eau Claire	WI	Burlington	VT
Janesville	WI	Bremerton	WA
Milwaukee	WI	Milwaukee	WI
Sheboygan	WI	Racine	WI
Racine	WI		
Casper	WY		
Cheyenne	WY		

[1] The table shows MSAs with annualized population growth below median and housing price growth above median. The first two columns use annualized growth rates between 1990 and 2005, and the second two columns use annualized growth rates between 2000 and 2005.

[2] Annualized housing price growth is calculated using the MSA-level CMHPI, and annualized population growth is calculated using U.S. Census Bureau MSA-level population estimates.

Figure A-1: Changes in HELOC, Stafford, and PLUS Loan Interest Rates, 1980-2005



Sources: HELOC interest rates are indexed to the prime rate using a constant markup of 0.39 percent over prime. 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.