The Housing Crisis and the Rise in Student Loans

Gene Amromin * Janice Eberly † John Mondragon ‡§

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Abstract

The flow of new student loans increased by 50% between 2007 and 2010, and the amount borrowed per student also rose by about a third. This shift occurred during the Financial Crisis, while credit markets were disrupted, and home prices fell by about a third nationwide. In this paper, we explore whether these two phenomena are linked, and in particular, whether the decline in home equity caused households to shift the responsibility for education financing to students in the form of loans. Student loans were one of the few forms of credit that remained accessible throughout the crisis. We estimate that for every dollar of home equity lost, households increase student loan debt by forty to sixty cents. This substitution appears to be driven primarily by households with low levels of liquid assets. We extend our analysis using credit bureau data to trace longer-run effects of this leverage on students. Our results show that constrained households generally continued to enroll in college, but switched to student loan financing. Our quantitative estimates suggest that the 30% average decline in house prices resulted in $1300 in additional student borrowing on average, per student, though the estimated effects are larger for liquidity-constrained and less-educated households. This channel explains 38% of the change in student loan debt within our sample.

Keywords: Student loans, household finance, house prices, home equity credit, education.

JEL Codes: D12, D14, E21, E44, G20, I22, I24.

*Federal Reserve Bank of Chicago: *gamromin@frbchi.org*.

†Northwestern University, NBER: *eberly@kellogg.northwestern.edu*.

‡*Corresponding author* Northwestern University: *john.mondragon@kellogg.northwestern.edu*.

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1 Introduction

We study if the dramatic changes in home prices over the 2000s affected how households financed college and how changes in how college is financed may have affected student outcomes. While house prices and credit supply were elevated, households were able to borrow against home equity and use relatively inexpensive mortgage debt to pay college tuition. As house prices collapsed and the financial crisis spread, households could no longer easily access home equity credit. In response parents may have shifted the burden of financing college enrollment to students through student loans. Consistent with this view, SallieMae [2013] reports a decline in the share of college costs covered by the students' families from 50% between 2003 and 2007 to 43% between 2007 and 2012. At the same time, student loans were the only type of consumer credit to increase throughout the financial crisis and recession. A shift in the financial burden of funding college from parents to students could have large ramifications for individuals' educational attainment, wealth accumulation, financial stability, entrepreneurship, and household formation (Ambrose, Cordell and Ma [2015], Bleemer, Brown, Lee and Van der Klaauw [2014], Brown and Caldwell [2013], Cooper and Wang [2014], and Rothstein and Rouse [2011]). Additionally, Eberly and Amromin [2016] argue that changes in who funds college enrollment, parents or students, can have important aggregate implications on savings and welfare. Given these potential effects, it is important to understand the extent to which the collapse in the access to home equity affected how much students had to borrow to finance their post-secondary education.

Student loan borrowing increased significantly during the housing crisis and subsequent recession and much of this increase is unexplained. Figure **??** plots aggregate trends in house prices, enrollment, and student loans over the 2000s. Panel A shows that aggregate flows of federal student loans jumped by almost $30 billion per year from 2007 to 2010 as house prices fell. Some of this increase was likely due to the collapse in the private student loan market, but this market is too small to account for the total increase in federal loans. One potential explanation for this trend in aggregate student loan flows is the increase in enrollment over the 2000s, shown in the second panel. While enrollment rates increased by 4 to 6 percentage points from 2000 with much of this coming during the recession, the same panel shows that average student loan flows also increased sharply by about $2,000. Another potentially explanation is that federal loan limits increased to $31,000 for dependent students and $57,500 for independent students in 2008 (marked by the vertical red line). Panel B shows that average student loan borrowing was increasing significantly prior to this change in loan limits. Panel C reports median federal student loan balances upon repayment reported by Looney and Yannelis [2015] according to the type of school the student attended. These data show that cohorts that entered postsecondary education during the crisis started carrying significantly higher balances of student loans, irrespective of the type of institution. Critically, this picture also shows that even borrowers far from the federal loan limits increased student loan balances, indicating that changes in the limits do not account for these increases in borrowing.

Another way to examine this increase in debt is to decompose the change in total student loan balances from 2006 to 2010 into a change in the number of students and a change in borrowing per student. If average debt balances were held to 2006 real values, the implied increase in enrollment would fall $170 billion short of the actual aggregate debt balance of $790 billion in 2010. This ignores the potential impact of increases in tuition and net costs. However, the implied net cost of public school tuition only increased by about 2 percent annually after 2006 with costs at private non-profits essentially flat.[1] If we assume the average net cost increased at 2 percent, then the unexplained gap falls to about $120 billion in 2010 and $200 billion in 2011. So much of the increase in student loans is unlikely to be explained by either of these factors. The increase in student loans took place at a point in time when student loans actually became more expensive relative to home equity. Figure 2 plots the interest rates on four types of household debt that might be used to finance college: subsidized and unsubsidized student loans, PLUS loans (parent student loans), and home mortgage debt. After 2005, the average interest rate on mortgage debt was lower than the rates on any kind of education loan except subsidized federal student loans, which are need-based and limited. While the decision between student or mortgage debt would also have to incorporate differences in default penalties and bequest motives, this suggests households with equity may have had access to a relatively inexpensive way to finance college during these years. However, there is no clear evidence that households substituted home equity for student loans or if changes in access to home equity drove students to borrow more or alter their enrollment decision.

[1]See the College Board average net price trends `https://trends.collegeboard.org/college-pricing/figures-tables/average-net-price-over-time-full-time-students-sector`. Reliable for-profit figures are not available and those may have been higher than the two percent number used here, but as Panel C of Figure 1 shows growth in borrowing is almost uniform across types of school.

Brown, Stein and Zafar [2015] use credit bureau data and find little evidence that declines in house prices and home equity borrowing caused households to take on more student debt, although they limit their analysis to the relationship between student loans and house prices in the same area.[2] Lovenheim [2011], Lovenheim and Reynolds [2013] and Stolper [2014] provide evidence that home equity affects both the intensive and extensive margins of college enrollment decisions, but it is not clear if this driven by wealth effects or liquidity and if declines in home equity access have symmetric effects. In general, a large literature has found conflicting evidence on the extent to which financial constraints affect student enrollment decisions (see Carneiro and Heckman [2002], Cameron and Taber [2004], Field [2009], and Stinebrickner and Stinebrickner [2008]). In contrast, Charles, Hurst and Notowidigdo [2015] showed that house price movements affected enrollment decisions through effects on labor markets and the opportunity cost of education.

Our paper focuses on how households respond to a shock to one particular type of college-financing, home equity credit, and the long-run implications of this shock. We do so by tracking the dynamics of debt between parents and students over time. Our baseline analysis relies on data from the Panel Study of Income Dynamics (PSID) including the Transition to Adulthood Survey (TAS) supplement. These data have extensive information on household composition and balance sheets. Critically, they allow us to link changes in the value of a household's home to that household's equity extraction, student loan debt, and college enrollment decisions. By observing these outcomes together we can determine if changes in access to home equity credit affect the extent to which student loans are used to finance college enrollment. To the best of our knowledge, this is the first time the links provided by the TAS data have been used to answer these questions. We supplement this work with individual-level credit bureau data from the New York Federal Reserve-Equifax Consumer Credit Panel (CCP) aggregated to form households and identify likely students. Because we only observe individuals if they have a credit report this sample is inherently selected, but it gives us a much larger sample and so the ability to observe longer run outcomes for many more individuals than are available in the TAS data.

To identify the effects of access to home equity credit we exploit changes in individual house

[2] Pence [2015] reports figures from the Michigan Survey of Consumers suggesting 3 percent of all households getting a cash-out refinance used the proceeds for education or medical expenses. Roughly 10 to 15 percent of homeowners have a child enrolled in college, so multiplying this number by 6 gives a rough estimate of 18% for the number of households financing college with home equity. We also provide an estimate using the PSID.

prices as exogenous movements in home equity credit access (similar to Lovenheim [2011]). The primary advantage of this approach is that much of the variation in house prices over this period is likely to be outside of the control of households and so is appropriately considered a shock. Additionally, by studying these house price movements over the 2000s we exploit very large movements in house prices in a period when home equity extraction was relatively common (Bhutta and Keys [2016], Greenspan and Kennedy [2008]). While it is plausible that changes in home values are outside the control of a household, it is still likely that they are correlated with other local factors that could affect enrollment or financing, so we also check if our results are driven by house prices or alternative mechanisms.

We first document that equity extraction is a relatively common way to fund college enrollment in our sample. After conditioning on a broad set of controls, including having a college-age child, we find that households with a member enrolled in college are about four percentage points more likely to extract equity and take out over $3,000 of equity on average relative to households not enrolling a member in college. Conditional on extracting equity, we find that households extract an additional $14,000 of equity over two years. This is a sizable effect considering that in our sample households with a member enrolled in college have a 40 percentage points higher probability of having student loans and report a balance of about $9,000. These magnitudes suggest it is plausible that changes in home equity credit access might significantly affect the financing of college enrollment.

Our central result is that changes in the ability to extract home equity driven by house prices cause households to substitute between parents' mortgage debt and students' loans. Using only variation in home equity access driven by house prices, we estimate that for every dollar of home equity extracted to finance college enrollment a household borrows between fifty and sixty cents less in student loans. Our estimates suggest households use this funding to at least partially pay for tuition and that as this support declines students are more likely to enter the labor force while enrolled. Our results are robust to an extensive set of controls including various levels of fixed effects. Consistent with the results in Charles et al. [2015], we also find some evidence that declines in house prices reduce enrollment in college, which suggests any effect of financing on the enrollment decision is secondary to the labor market effects during this period. We check if the substitution between home equity and student loans is the result of local labor market changes and household income changes at both the state and county level and we consistently find that house prices, and so movements in equity, are the dominant driver of substitution. Finally, our result that students are less likely to be in the labor force as house prices increase is consistent with house prices operating through increased support from their parents and not through house prices being correlated with local labor market conditions.

Using a standard measure to identify households likely to be liquidity constrained (Cooper [2013], Zeldes [1989]), we find that our results are primarily driven by households with low levels of liquid wealth. Liquidity-constrained households respond to increases in the value of their home by increasing equity extraction and reducing student loan borrowing, while household likely to be unconstrained do not respond to house price growth by extracting equity. While this suggests that liquidity constraints are the central mechanism driving the observed substitution, we also find that unconstrained households reduce their dependence on student loans as house prices increase. However, as house prices rise, unconstrained households cut student loan borrowing and finance college enrollment by reducing non-housing wealth accumulation instead of extracting equity. This behavior is consistent with wealthier households behaving in a buffer stock fashion (Carroll [1997]) where the increase in housing wealth allows households to divert income to financing college instead of accumulating non-housing wealth. These results are consistent with house prices affecting student loan borrowing through both liquidity and wealth effects.

While we document the presence of substitution between home equity and student loans, the extent to which this is economically important depends on whether or not this substitution affects real outcomes for households. If the household behaves dynastically so that parents later assume the debt burden from the students, then the distribution of the debt between household members is largely irrelevant (notwithstanding differences in default behavior or interest rate differentials). To answer this question we rely on the CCP to examine longer-run effects of redistributing the financing burden between parents and students. We estimate how variation in student loans driven by declines in house prices and equity extraction affect the likelihood that a student takes out a mortgage, takes out a car loan, and the likelihood that a student moves across cities. (IN PROGRESS)

To summarize, we present the first evidence that households relied on home equity to fund college enrollment and so, when access to home equity fell, they turned to student loans. Our results suggest the degree of substitution was large enough that the deep decline in house prices is likely to have caused a significant shift in the financial burden of paying for college from parents to students. Our estimates imply that the 30% decline in house prices from their peak in 2006 caused the average college student to take on more than $1300 of additional student loans. This increase is equal to about 10% of the median student loan balance in 2011 or to over 30% of the within-sample increase in the median student loan balance from 2009 to 2011. Since most households do not use home equity to finance enrollment, these results likely understate the size of the effect on households for whom this was a critical component of financing enrollment. Our estimate suggests that if parents were unable to borrow $60,000 of equity to pay for college enrollment, then students took on between $30-36,000 more student debt. Because liquidity-constrained households were driving this substitution, the higher financing cost falls on households that are likely to be least able to absorb the additional cost.

2 Methodology and Data

Our aim is to understand how changes in access to home equity credit affects the way a household finances college and potentially enrollment itself. To identify shocks to home equity access we use changes in the value of a household's home. In our baseline analysis we estimate the following types of difference-in-differences models

$$y_{it} = \alpha_{1i} + \beta_{1,1}1(\text{College Age})_{it} + \beta_{1,2}\%\Delta HP_{it} + \beta_{1,3}1(\text{College Age})_{it} * \%\Delta HP_{it} + \sigma_1 X_{it} + e_{1it}, \quad (1)$$

$$y_{it} = \alpha_{2i} + \beta_{2,1}1(\text{Enrolled})_{it} + \beta_{2,2}\%\Delta HP_{it} + \beta_{2,3}1(\text{Enrolled})_{it} * \%\Delta HP_{it} + \sigma_2 X_{it} + e_{2it}. \quad (2)$$

Let y_{it} be an outcome like the amount equity extracted for household i at time t. The variable $1(\text{College Age})_{it}$ indicates if the household has a member of college age (between, inclusively, 18 and 22) and $1(\text{Enrolled})_{it}$ is an indicator for whether or not the household has a non-parent member who has been enrolled in college within the last two years. $\%\Delta HP_{it}$ is the measured growth for a household's home values, and X is a vector of controls.

The coefficients $\beta_{n,3}$ are the parameters of interest as they measure how changes in house prices affect the relevant outcome for households with college-age or enrolled members. Intuitively, we compare two households with college age members, but one household experienced a decline in house prices while the other experienced an increase in home values. The coefficient $\beta_{1,2}$ nets out the effect of differential house price growth on households without college-age members. Similarly, Equation 2 compares two households enrolling a member in college who experienced different house prices growth.[3] The extent to which movements in home values are exogenous is critical to the validity of these estimates, but there are at least two important risks in this dimension. First, households may take actions to determine the value of their home and second, changes in the value of the home might be correlated with other shocks affecting the outcome of interest. Large investments in houses or significant neglect do give households some dimension along which to alter the value of their home (Melzer [2010]). While we cannot control explicitly for these possibilities, we can observe if large (greater than $10,000) home improvements are correlated with the interaction. A more problematic possibility is that changes in the value of a home are correlated with local or aggregate shocks to labor markets, particularly the health of the local construction sector. We check for this by including interactions of college age or enrollment with local conditions, particularly employment conditions.

Even if we assume that house price movements are completely exogenous, a second identification concern is that the households being compared with the college age or enrollment indicator are dissimilar in some additional dimension. For example, households with college age children are typically older and so will typically be wealthier (similarly with households enrolling a member in college). If house price movements affect wealthier households differently then we might estimate a difference in the outcome that has nothing to do with having a college age member or enrolling a member in college, but is instead the result of wealth differences. To address this concern we identify the set of household observables that are significantly different between the treated households and the untreated households (for example, enrolling and not enrolling) and then include these observables as additional interactions with house price movements. This should soak up any variation in outcomes driven by the interaction of house prices with these observable differences.

Even if house price movements are perfectly exogenous there is still a key question regarding

[3] An alternative to relying on movements in house prices as a measure of home equity credit access would be to exploit household loan-to-value (LTV) ratios. These ratios, even if they are lagged, have the clear drawback that they are endogenous. In particular, past borrowing behavior might be correlated with the probability that a household goes to college or the cost of that college. So to avoid these issues, we rely on variation in how much a household can borrow against home equity that is driven only by movements in the value of the home (changing the "V" in LTV). This still might affect aid packages, but it would not be as a result of household borrowing behavior.

the mechanism by which house prices affect behavior. In addition to effects on liquidity constraints, house prices might also have a wealth effect that would not necessarily involve any actual extraction (Campbell and Cocco [2007], Carroll, Otsuka and Slacalek [2011]). We take an approach similar to Hurst and Stafford [2004] and exploit differences in responses between households likely to be liquidity constrained and households unlikely to be liquidity constrained to help distinguish between these mechanisms.

There are advantages and disadvantages to estimating the two distinct models set out above. While college enrollment is endogenous, estimating a model conditioning on enrollment (equation 2) is our primary specification. Model 1 gives the average effect of house price movements net of any enrollment decision and so can help inform the extent to which house price movements affect enrollment. Since being of college age is almost certainly exogenous with respect to house price movements, the resulting estimates are not subject to endogeneity concerns along that dimension. However, not conditioning on the enrollment decision will bias our estimate of substitution towards zero because we include households who are not financing college enrollment. By estimating model 2, we only use information on households who actually have to fund college enrollment. However, if selection into enrollment does respond to house prices then the estimated effects from model 2 will reflect this selection bias. For example, if only very wealthy households continue to enroll in college as house prices fall and they finance college with non-housing wealth, we might estimate a negative substitution with student loans as all types of debt-financing fall. This is somewhat related to a broader concern that households enrolling a member in college differ along some other dimension that potentially interacts with house price movements (for example, wealth). To the extent those concerns can be addressed, the estimate conditional on enrollment will answer the question of how households enrolling members in college relied on student loans as equity levels changed.

The coefficients from these models provide useful evidence on the effects of house prices on households financing college enrollment, but we are also interested in the direct substitution between home equity credit and student loans. So we provide instrumental variable estimates from the following model where we use the enrollment indicator interacted with house prices as an instrument for equity extraction

$$\text{EquityExtracted}_{it} = \alpha_{1i} + \gamma_1 1(\text{Enrollment})_{it} * \%\Delta HP_{it} + \sigma_1 X_{1it} + e_{1it}$$

$$\text{StudentLoans}_{it} = \alpha_{2i} + \beta\text{EquityExtracted}_{it} + \gamma_2 1(\text{Enrollment})_{it} + \eta\%\Delta HP_{it} + \sigma_2 X_{2it} + e_{2it}, \quad (3)$$

The coefficient β gives how much a change in an additional dollar of equity affects the dollar amount of student loans. The exclusion restriction for this model is that for households enrolling members in college movements in house prices do not affect student loans other than through their effect on equity extraction. It is important to note that this does not mechanically imply that β should be equal to negative one. The exclusion restriction does not preclude margins other than student loans from also adjusting to the shock to home equity access. For example, households might choose to go to a less expensive school, work more, or draw down other savings. So long as these other changes are driven by access to home equity credit, β gives a consistent estimate of the dollar rate of substitution between home equity and student loans net of other margins of adjustment. This allows us to answer the question of whether or not the boom and bust in home equity borrowing drove some of the rise in student loans, even after households respond to the shock along other available margins.

2.1 Data

We rely on two distinct datasets for our analysis. We use data from the Panel Survey of Income Dynamics (PSID) for our baseline results. The PSID is particularly useful because its longitudinal structure lets us observe if a household contains a college-age member, college enrollment decisions (from 2005 onwards), and the household balance sheet including measures of equity extraction and student loans.

While the PSID data allow us to examine the basic mechanisms we are interested in, it is limited by a relatively small sample and low frequency (biennial in the years studied). This limits our ability to track student outcomes for longer horizons. Consequently, we extend our analysis with the New York Federal Reserve-Equifax Consumer Credit Panel (CCP). These data are a very large random sample of individuals with credit records and have been used extensively to study household debt behavior in recent years. While the CCP data are not constructed to measure household outcomes, we have the advantage of replicating the estimates in the PSID in order to quantify the extent of measurement error that we introduce.

2.1.1 Panel Survey of Income Dynamics

We restrict the PSID sample to homeowners with the same head of household from 1999 to 2013. This helps reduce noise by ensuring households are seasoned enough to have children and likely to have non-trivial levels of home equity. To this end, we exclude any households that were renting at any point in our sample, but we do include households that move from one owned home to another so long as they did not move within the last four years. We keep households as they age beyond typical retirement age. This structure provides us with a sufficiently large number of continuous observations so that we can remove household fixed effects, which takes care of a large amount of potentially important but unobserved heterogeneity. As a result of these exclusions we are left with a sample of approximately 1,600 households.

Along with information from the baseline individual and family files, we import data from the Supplemental Wealth Files and the Transition into Adulthood Survey (TAS), which is only available from 2005 onwards. The TAS supplement interviews members of a PSID household who are at least 18 years old and who also participated in the Child Development Supplement (up to two children per family were initially covered). These data provide critical information on whether or not a child who left the household went to college, took on student debt, and other related outcomes. Prior to the TAS, college enrollment could only be inferred if the student lived at home or once they formed a new household (Lovenheim [2011]). The TAS fills this critical gap in coverage as over 50% of PSID children do not form a household covered by the PSID by the time they turn 24.[4] Students living away from home in college dormitories were recorded as "institutionalized" with no information about their borrowing behavior recorded. The TAS data allow us to correct for all of these gaps in coverage.

Tables 1 and 2 provide summary statistics for our sample in each year excluding 1999. Note that we will only be using the years including and following 2005 in our regressions as the TAS is not available earlier and it contains the student outcomes of interest. We do not weight our estimates as we are interested in estimating causal effects and applying the PSID longitudinal weights does not affect our estimates other than slightly reducing the precision (Solon, Haider and Wooldridge [2015]). We aggregate all quantities to the household level so that multiple members enrolled in

[4] See the user guide to the TAS `https://psidonline.isr.umich.edu/CDS/TA05-UserGuide.pdf`.

college only counts once, but if each member borrows some in student loans the entire amount across both students is counted. While this introduces some measurement error when interpreting the indicator variables it simplifies the estimation framework and the Unless otherwise noted all quantities are in thousands of real dollars, adjusted by the PCE deflator with 2009 as the base year.

Because of the structure the age of the household head gradually increases and household size declines. About 24% of households have a college age member, which we define as having a member between 18 and 22. This number declines as the sample continues and households age. We record an individual as enrolled if they claim to be currently enrolled in college or have been enrolled in college in the last two years. Between 9 and 16% of households report having a member enrolled in college and roughly 59% of households with a college-age member someone enrolled in college, similar to enrollment numbers reported in Lovenheim [2011]. We do not count college enrollment of non-traditional students such as the parents or older adults. Between 2 and 9% of households report having a member with a student loan and, conditional on having a student loan, the median household reports a balance of $15,000 worth of student loans in 2009.

The median gross household income is relatively high at $80,000, which follows from the sample conditioning. The median household is carrying about $50,000 in mortgage debt in 2001 and this declines to $30,000 by 2013, but the range here is around $120,000. Households tend to carry large sums of liquid (cash, savings and checking accounts, stocks and bonds) and illiquid (vehicle, retirement, and secondary real estate) wealth at $20,000 and $40,000 respectively. The median household starts the sample with about $80,000 of home equity, which peaks at about $140,000 in 2007 and then falls to $100,000 by 2013. To calculate the value of the household's home we rely on the self-reported prices in the PSID. While households might make mistakes with these numbers, Lovenheim [2011] documents that they do not significantly differ from the FHFA repeat sale index for the years 1980 to 2005. Even if households do consistently make mistakes, for a household to extract equity they must at some point have an accurate idea of their home's current value if only from the loan officer. By relying on self-reported values we will necessarily only be using information shared by the household, which should improve precision and the plausibility. LTVs are generally low, starting out at about 40% in 2001 and declining to 23% in 2013, consistent with about one-third of households owning their homes outright.

Given these high levels of home equity it is plausible that households might extract equity in response to large liquidity shocks such as financing college. While the PSID collects some information about equity loans and HELOCs it does not explicitly address if a household extracted equity through refinancing nor does it directly ask about the amount of equity extracted or its usage. To measure equity extraction, Cooper [2010] defines an equity extraction event as when a household either (1) increases its mortgage debt and does not move or (2) reduces its equity and does move. The resulting quantity of equity extracted is then the respective difference in debt or equity. We adopt this definition except we drop equity extraction through moving and we require the household's current loans to contain at least one refinanced loan or some type of home equity loan. According to this definition between 15 and 20% of households in our sample extract equity with the median amount of equity extracted between $20-$30,000 across the years. These numbers are similar to those reported in Cooper [2010] for a different set of PSID households for the years 1999 to 2007, but they are smaller than the numbers reported by Bhutta and Keys [2016]. Since the frequency of our data is significantly lower it is plausible that our numbers are somewhat attenuated. Finally, the boom and bust in house prices are clearly visible in the self-reported home values. Through 2007 the median house price had growth 13% relative to 2003 with a very large dispersion. After 2007 the average house was declining in value and the dispersion in house price growth fell significantly.

2.1.2 Consumer Credit Panel

The Federal Reserve Bank of New Yorks Consumer Credit Panel (CCP) is a longitudinal dataset of key fields from individual credit reports. The dataset is comprised of a 5% random sample of individuals with valid credit files collected by Equifax Inc. The individuals are drawn into the sample if their Social Security numbers end in one of five pre-determined digit pairs. Each quarter, Equifax Inc. provides data on these individuals liabilities and payment status, as reported to the credit bureau. These randomly selected individuals represent the primary sample of CCP households.[5] Lee and van der Klaauw (2010) provide an extensive summary of CCP sample design.

Importantly for our study design, the CCP is not limited to the primary sample. The dataset attempts to construct household identifiers by linking credit reports of each primary individual with

[5]The panel of primary CCP households is refreshed each quarter. That is, each quarter starting in 1999:Q1 all households with the five pre-determined SSN digit pairs are drawn into the sample. This assures that deceased individual exit the sample and individuals with newly established credit files enter the sample.

all other reports associated with the same physical billing address in a given quarter. For instance, a 50-year old individual in the primary sample has the same billing address as another 52-year old and 18-year old individuals in a given quarter. These three individual borrowers are then assigned to the same household identifier. This linkage substantially increases the overall CCP dataset as it brings in individuals beyond the 5% primary sample. Crucially, it also allows one to form a fuller picture of household-level liabilities and potential reallocation of these liabilities within households over time.

However, constructing household-level debt dynamics is quite challenging. The household ID that is assigned to household members in a given quarter is not time invariant, although individual borrower IDs are permanent. Identifying a household over time thus requires proceeding from quarter to quarter, pooling together all records that share a household ID with the primary member and then assessing whether this association is real or spurious. For instance, a student-aged household member that moves out to attend college may change their billing address to that of their college dorm and appear with dozens of other household members sharing this address. In practice, we use the following algorithm to construct our sample.

Another key problem with CCP is that individuals that are associated with the primary sample member are tracked only for as long as they are estimated to reside in the same household. Thus, if the primary sample member is an adult, we would observe their non-primary student only while they share the same billing address. Conversely, if the primary member is a student, we observe their parents only for part of the students credit bureau timeline. Since we are interested in tracking down long-term outcomes of both parents and students, we chose to restrict our sample to those households in which both the adult- and the student-aged members are a part of the primary sample.

We start by randomly selecting 20% of all primary credit records in the CCP for which the borrower is between the ages of 18 and 22 in 2005:Q1. We then pull all additional credit records that are ever associated with the primary student borrower by virtue of sharing the same household ID in a given quarter. These records are then jointly assigned a time-invariant household ID keyed off each primary borrower. This produces a sample of 106,326 households.

We then flag instances where there is a college-aged primary person (ages 18-22) and an adult-aged primary person (ages 40-65) in the household. For such "double-primary" households, we identify other non-primary adults that are observed for at least as many quarters. Doing so allows us to track non-primary adults (e.g. spouse of the primary adult) as well. These individuals are together designated as the "core household". For many analyses, only the debt associated with members in this core are included in aggregate household debt portfolios. By construction, each core household consists of a primary student borrower, primary adult borrower and possibly one or more non-primary adult borrowers. There are 6,736 double-primary households in the 2005 draw cohort.

To build a sample that covers the entire range of housing market experiences, we then draw another sample of primary student borrowers between the ages of 18 and 22 in 2006:Q1. After eliminating those primary students who were already sampled in 2005, we repeat the steps above. We follow the same process for all of the remaining years in 2005-2015 period. Altogether, we identify 54,915 double-primary core households.

Finally, we supplement the double-primary households with a control sample of CCP households. For each of the double-primary (treated) households, we find a primary-adult household of the same age that did not have student-age household members for at least a 5-year period centered on sample entry year. To illustrate, this algorithm would pair a double-primary sample household with a 55-year-old adult and a 20-year-old student who was drawn into the sample in 2005 with a household that contains a 55-year-old primary adult and that had no student-aged members between 2003 and 2007. This does not guarantee that these households do not have students, but it likely reduces this chance.

3 Empirical Results

In this section we first characterize how households in our PSID depend on home equity and student loans to finance college enrollment. We then quantify how house prices affect substitution between home equity and student loans and check for robustness. Finally, we estimate the effects of additional student loan debt on long-run student outcomes.

3.1 Financing College Enrollment

All specifications, unless otherwise noted control for a quadratic in the age of the head of household, household size, four-year lags of loan-to-value ratio (LTV), home value (level), total wealth (level), two-year lags of liquid wealth (defined as non-retirement holdings of stocks, bonds, and cash or checking accounts), log income, and year fixed effects. All specifications also include either state or household fixed effects as noted in the table. We restrict the sample to the years 2005 onwards, which is when we can observe the TAS data. All standard errors are clustered at the state level.

Table 3 reports estimates of how college enrollment is related to student loans and equity extraction. Column 1 reports that a household with a college-age member is about 51 percentage points more likely to have a member enrolled in college. This is larger than estimates of the current fraction of 18- to 24-year olds enrolled in college over this time that range between 37 to 41 percent, but is consistent with our sample being wealthier than average.[6] Column 2 shows that households with members enrolled in college are about three percentage points more likely to extract equity relative to households without a member enrolled in college. Column 3 checks that this is actually driven by enrollment by controlling for the presence of college-age members. Households with college-age members who do not enroll in college are not more likely to extract equity and the estimated effect of enrollment on equity extraction is essentially unchanged. Columns 4 and 5 report estimates of the dollar amount of equity extracted as a function of enrolling in college and so reflect both the intensive and extensive margins. Both estimates suggest households extract over $3,100 more equity on average with none of this effect coming from households with college-age members not enrolling a member in college. Column 6 examines the intensive margin directly by including an indicator for equity extraction and interacting this indicator with enrollment. This coefficient then recovers how much more equity households extract to finance enrollment conditional on already extracting equity. Households that are both extracting equity and enrolling a member in college withdraw $14,000 more equity, a significant effect relative to the average of $40,000.

Columns 7-10 report the relationships between the enrollment decision and student loans in the same fashion. Households enrolling a member in college are about forty percentage points more likely to report a student loan and carry about $9,000 more in student loan debt. These estimates

[6] Digest of Education Statistics 2013 `http://nces.ed.gov/programs/digest/d13/ch_3.asp`.

show that the households in the sample rely on both home equity and student loans to finance college enrollment. Consistent with Pence [2015], equity borrowing is less frequently used, but when utilized the quantities are large enough to be a primary form of financing enrollment for some households. Since both types of financing are prevalent in the data and in comparable quantities, some margin for substitution between the types of credit is possible.

We now turn to testing if movements in house prices affect the way households finance college enrollment, conditional on actually enrolling a member in college. Later we examine the enrollment decision itself and Table A1 reports specifications conditioning only on the household having a member of college age with similar results. We expect that as house prices increase and households have access to more home equity they will rely more on equity extraction to finance college enrollment given its relatively low cost. In turn, this might result in households relying less on student loans.

Table 4 reports our difference-in-difference estimates where we interact four-year house price growth with the indicator for whether or not the household has a member enrolled in college. We include state- or household-level fixed effects to check the robustness of the results to household unobservables. Columns 1 and 2 examine the probability of equity extraction and show that a household enrolling a member in college is more likely to extract equity as house prices increase: a 10% increase in house prices increases the probability of equity extraction by about 1 percentage point, with the regression controlling for household fixed effects somewhat larger. Notice that the effect of house prices interacted with enrollment is substantially stronger than the effect of house price growth alone. This suggests households rely on home equity to respond directly to a specific demand for liquidity such as financing education. This is also consistent with the estimates in Cooper [2010]. Columns 3 and 4 of Table 4 shows that households with college-enrolled members do extract significantly more equity in response to house price increases. For these households the same 10% increase in house prices results in \$900 to \$1000 more dollars of extracted equity on average. As with the probability of extraction, the response of household enrolling a member in college to house price growth is much higher than the response of a household not enrolling a member in college, who extract an additional \$250 to \$300 on average in response to the same house price change. These regressions suggest that when households are faced with financing college enrollment additional equity available leads to a greater reliance on equity extraction.

In contrast to the results on equity extraction, columns 5 and 6 show that as house prices increase, households with a member enrolled in college are less likely to have a student loan. The magnitudes are slightly larger than those for the probability of equity extraction: a 10% increase in house prices reduces the probability of a student loan by about 1.2 percentage points. However, the relative effect is smaller given the high propensity to carry student loans. Columns 7 and 8 turn to student loan balances and show that these same house price movements result in over $500 less student loan debt on average. All of these estimates are robust to the inclusion of household fixed effects, suggesting household-level heterogeneity is not driving our results.

These results show that movements in house prices affect how households finance college enrollment. As the amount of equity available to households increases, households are more likely to depend on equity extraction and less likely to rely on student loans and the differences are economically large. Taking the coefficients from columns four and eight, the 30% decline in house prices from 2006 to 2010 resulted in an average increase in student loans of $1,500 while causing equity extraction to fall by about $3,000 among homeowners enrolling a member in college.

These estimates suggest a rate of substitution on the order of -0.5, but to get a direct estimate we turn to the instrumental variable model (equation 3). In the first stage we instrument for the amount of equity extracted with the interaction of college enrollment and house price growth. We then regress the balance of student loans reported on the instrumented amount of equity extraction. Thus, the estimated coefficient on equity extraction will only pick up movements in student loans correlated with movements in equity extraction driven by house prices. This reduces the chance that pure wealth effects not resulting in equity extraction are driving our results. Column 9 in Table 4 regresses the level of student loan debt on the amount of equity extracted without instrumenting and recovers a precise zero relationship. This is expected as most equity extraction is unrelated to financing education. Columns 10 and 11 isolate the variation in equity extraction driven by individual house prices and households enrolling a member in college. Consistent with the difference-in-difference estimates, we find an economically and statistically significant negative relationship between equity extraction and student loan debt. Column 10 indicates that for every dollar of home equity intended to finance college enrollment that is foregone, households carry an additional sixty cents of student loan debt. Column 11 controls for a household fixed effect which reduces the estimated rate of substitution to fifty cents but increases the precision of the estimate. That this coefficient is not exactly negative one could result from several factors. First, complications in measuring equity extraction relative to student loan balances might reduce the apparent substitution due to missing the timing of the substitution. Focusing on substitution between the flow of equity extracted and the balance of student loans helps to alleviate this concern, but may not solve it entirely. Second, households are capable of adjusting along margins other than student loans as they respond to the change in equity extraction. These margins include not enrolling in college, enrolling in a cheaper university, having the student work, relying on household savings, and alternative types of debt. We examine these additional outcomes below, but the central takeaway from Table 4 is that even with these alternative ways to respond to the home price shock, each lost dollar of home equity translates into a substantial amount of student loan debt. These estimates provide direct evidence that the collapse in access to home equity increased the amount of student debt used to finance college enrollment. However, the distribution of this effect is far from uniform across households. Not all students come from parents that own their homes, not all homeowners finance college enrollment with equity, and potentially not all equity extracted when a household has a member enrolled is used to finance college. In our sample the average household extracting equity while enrolling a member in college in 2007 withdrew about $60,000 of equity. If all of the equity was intended to finance college our estimates imply this would result in the student borrowing $30–36,000 in student loans, enough to push a student well above the median debt load. To get a sense of the size of our effect within our sample, we calculate for each household the change in equity extraction driven by house prices and enrollment from our reduced form estimate and then multiply this number by the substitution estimate. Our estimates imply the average household in our sample enrolling a member in college in 2011 carried an additional $830 in student loans due to changes in equity extraction, which is about 38% of the average increase within the sample between 2009 and 2011.

We can also provide an aggregate back-of-the-envelope calculation using the implied changes in equity extraction due to house prices, the aggregate change in house prices, and the fraction of students likely to be financing college with home equity. According to the Department of Education, an average of 20 million students were enrolled in college for each academic year 2009-2010 and 2010-2011. At the same time the average four-year decline in aggregate house prices (to match our estimation framework) was about 30%. According to the TAS data, about 70% of households that enrolled a member in college in our sample are homeowners and according to the Department of Education between 60 and 70% of students enrolled in college match the age range of our TAS sample.[7] If we apply the 30% decline in house prices along with our estimated rate of substitution of -0.5 to the 20 million students times 0.7 (homeowners) times 0.65 (young), this implies that across these two years households extracted $26 billion less in equity, which then resulted in an additional $13 billion dollars in student loan balances. Across these same years we calculate that the increase in student loans not explained by enrollment or cost increases totals about $127 billion dollars. Therefore, our estimates imply the collapse in house prices was responsible for about 10% of the aggregate increase in student loan balances from 2009 to 2011. However, this calculation ignores any loss of equity access due to credit supply movements apart from house price movements, which may also contribute to the increase in student loans.

3.1.1 Liquidity and Robustness

Economic theory and evidence suggest that movements in house prices and home equity are likely to be more important for households that are liquidity constrained, unless wealth effects are very large (Cooper [2013], Zeldes [1989]). Following this literature, we measure liquidity constraints using the sample average of a household's liquid wealth-to-income ratio and then distinguish between households according to the median of this ratio. We then re-estimate our difference-in-difference regressions on each of these samples. If liquidity constraints are driving our results then we expect households with a high liquidity ratio to respond less to movements in house prices while households likely to be liquidity constrained will be more responsive to house price movements.

Table 5 reports the estimated effects for equity extraction and student loan debt in columns 1-8. We find that the two types of households behave very differently when it comes to how house prices affect the financing of college enrollment. Liquidity-constrained households enrolling a member in college are significantly more likely to extract equity as house prices increase relative to unconstrained households (columns 1 and 2) and they appear to extract over two times as much additional equity (columns 3 and 4). This is consistent with evidence in Hurst and Stafford [2004] and Cooper [2013] that changes in credit access are more important for households that are otherwise liquidity constrained.

[7] http://nces.ed.gov/programs/digest/d09/tables/dt09_191.asp

In contrast to the equity extraction results, both types of households behave similarly when it comes to the relationship between house prices and student loans (columns 5 through 8). Liquidity-constrained households are more likely to rely on student loans (36% relative to 26%) and typically borrow more when enrolling in college ($6,700 relative to almost $4,200). However, their dependence on student loans varies with house price growth at almost the same rate (potentially lower) as unconstrained households. However, because unconstrained households do not adjust their equity extraction with house prices, house prices are affecting their behavior through another mechanism.

One possibility is that house prices have a wealth effect on unconstrained households that makes them more likely to finance college enrollment with alternative types of wealth. This type of behavior would be consistent with a buffer stock model of household savings motives (Carroll [1997]) where the additional housing wealth provides households with a pool of potentially liquid wealth accessible in the event of a negative shock. This might then allow households to reduce their rate of saving in order to finance enrollment. To check for this columns 8 and 9 places the log of non-housing wealth (essentially liquid wealth plus retirement savings) plus one in our estimation framework.[8] While non-housing wealth for constrained households has no significant relationship with housing, unconstrained households appear to reduce non-housing wealth as house prices increase and the household has a member enrolled in college. Quantitatively, the effect is large: as house prices increase by 10% unconstrained households accumulate about 6% less non-housing wealth. It is unlikely that this effect is driven by unconstrained households actually drawing down or borrowing against retirement savings as survey evidence suggests these methods are relatively unusual. Instead, it is likely that as house prices increase these households simply redirect income that would have gone to savings and instead pay for college enrollment.[9]

Overall, the liquidity splits suggest that movements in house prices drive a trade-off between equity extraction and student loans for constrained households, but that house price growth also affects student loan borrowing for unconstrained households through a wealth effect. This points to a potential "hierarchy" of financing sources where constrained households largely rely on stu-

[8]We take the log of non-housing wealth because it is extremely skewed, and in contrast to student loans and home equity, most of the households in our sample have non-zero holdings.

[9]We also cannot rule out the possibility that both types of households adjust unobserved enrollment decisions in response to house price increases, although it seems unlikely that increased house prices would induce a reduction in school expenses given the results in Lovenheim and Reynolds [2013]. We are currently extending these results using the restricted PSID data that allow us to quantify school quality and so check for this kind of effect.

dent loans, the relatively more expensive but generally accessible option, unless the household has sufficient equity. Wealthier households rely substantially less on student loans in general, and when house prices increase they cut their use even further. However, instead of substituting into home equity, these households reduce savings directly, consistent with the increase in house prices providing a useful buffer stock in the event of surprise shocks.[10]

The variation driven by liquidity constraints is strong evidence in favor of house prices affecting college financing through access to equity and wealth effects. However, an important alternative is that movements in house prices, while largely outside the control of households, are merely picking up other correlated shocks driving household behavior. Of particular concern is that movements in local labor markets, likely correlated with house price movements, could be drawing students into or out of college enrollment as in Charles et al. [2015]. One a priori factor in favor of our results being driven by the effect of house prices on the financing decision is that our sample is restricted to higher income and wealthier households, whose enrollment decisions are less elastic (Lovenheim [2011]). For these households with relatively inelastic enrollment decisions, it is plausible that the direct effect of home value on equity is significantly more important than the indirect effect of local house price growth on foregone labor market wages. We also check if there is an observable difference in the effects of house prices once we control for state-level changes in unemployment rates.[11] Table 6 includes the interaction of our enrollment indicator with the unemployment difference for all of our relevant outcomes in columns 1-4 as well as the instrumental variable specifications in column 5. The results all suggest that house prices are the primary driver our results with no appreciable effect on our results. We do find some evidence that increases in unemployment rates increase student loan dependence for enrolling households, perhaps reflecting less access to income that might finance enrollment. Additionally, in column six we include interactions of house price growth with observables that are statistically different between enrolled and non-enrolled households (see A3). This specification addresses the concern that house prices might be operating

[10]We also check if our results vary substantially with the education-level of a household in the appendix, see Table A2. In general, we find some difference in equity extraction behavior with the equity extraction of less-educated households being slightly more responsive to house price movements but similar behavior in student loans. While we do not have the power to precisely distinguish between the role of education versus the effects of liquidity constraints, that the effects of house prices on equity extraction vary so starkly with liquidity constraints suggests that they are central to the mechanism.

[11]Here we report specifications using the four-year change in unemployment rates to be consistent with house price change horizon. Using the growth rate of unemployment gives similar results, but with less precision.

through interactions with wealth or income. Overall we find that controlling for these additional factors has essentially no effect on our results.

3.1.2 Additional Outcomes

Given that our results appear to be driven by the effect of house prices on access to home equity, we now turn to additional outcomes that might be also be affected or additional margins of adjustment other than We first shed some light on these additional responses and other possible uses for the extracted equity in table 7 using the PSID data. Column 1 reports the effects on the probability that a household with a college-age member actually enrolls a member in college. Consistent with Charles et al. [2015], we see a slight negative effect with a 10% decline reducing the probability of enrollment by 0.5 percentage point. The magnitude of this effect might be relatively small due to our wealthier sample. In column 2 we find the probability that an enrolled student takes out a credit card has a credit card or other loan. While this probability seems to decline slightly with house prices, the effect is relatively small and statistically insignificant. Column 3 examines the probability that the student reports working or looking for work. Households with a member enrolled in college are about 45 percentage points more likely to report a student in the labor force, and this probability is strongly declining with individual house price growth. A 10% increase in house prices reduces the probability the student is working by a little more than one percentage point. This relationship is consistent with the primary effect of house prices on these households being on equity access and student support and not through job market opportunities since this would suggest a positive relationship.

We also examine in table 7 how three potential uses of home equity covary with enrollment and individual house prices as additional checks on the plausibility of the mechanism. Column 4 looks at the probability that the parents in the household cover some fraction of a student's tuition. Almost half of the households with a member enrolled in college pay some portion of the student's tuition with the average amount of tuition covered annually at about $12,000. Consistent with home equity financing college enrollment, households enrolling a member in college are more likely to cover tuition as house prices increase with a 10% increase in house prices increases the probability of covering tuition by almost one percentage point. Column 5 checks the probability that the student has taken out a personal loan from their immediate family or relatives. This event is quite rare with households enrolling a member in college reporting only a seven percentage points higher probability of using such a loan. This probability does not increase significantly for households enrolling a member in college as local house prices increase. This might suggest that as households use their equity to finance college they treat this additional financing as an intra-household transfer or bequest. Finally, we check if these households are more likely to undertake large home improvement projects when house prices increase.[12] If households took advantage of a member leaving the household to renovate their home then we might find the same relationship between house prices, enrollment, and equity extraction but the causality would run in the opposite direction of the one we propose. Column 6 shows that this does not happen. In general there is a slightly lower probability of home improvements when a household enrolls a member in college and these households do not seem to respond to house prices. If households had been either using increased equity to finance improvements or generating increased home value with home improvements we would expect the interaction term to be positive and significant. While increased home values are positively correlated with home improvement, this is not the case for households enrolling a member in college, suggesting the two actions are unrelated.

The long-term panel structure of CCP data allows us to examine the effect of student loan borrowing driven by fluctuations in house prices on a variety of economic outcomes for both students and their parents. Before examining these long-run outcomes, we first report the CCP-based estimate of the rate of substitution using the same regression approach taken in the PSID data. Table 8 reports these estimates in columns 1 and 2 where the difference comes from how we define the control group (see Section 2). These estimates are remarkably close to those recovered in the PSID even though we introduce some measurement error when identifying students and households in the CCP. Given the robustness of this substitution result in the CCP, we turn to using movements in student loans driven by house prices to understand how student leverage might affect long-run outcomes. This is done by first computing the cumulative change in HPI in the parents zip during the period their student was between the ages of 18 and 22 and then using this to estimate changes in student loans while controlling for a home county fixed effect. We then regress outcomes of interest on this quantity.

[12] To measure home improvement I rely on the definition used by the PSID, which asks if the household has undertaken any additions or improvements to the home of at least $10,000.

The first long-term outcome of our analysis is the propensity of students to become homeowners by the time they turn 30. To measure this, we flag all of the primary students in our sample who turn 30 by 2016 and whose credit bureau record indicates having a residential mortgage at any point in time. We drop any student who has not turned 30 by 2015, which reduces the size of the sample significantly.[13] This measure of home ownership is then regressed on the instrumented value of student loans, controlling for indicators of other debt types (auto, credit cards) and student age. The regressions also control for local housing demand by including MSA dummies for student residence at age 30. The results, shown in the third column of Table 8 suggest that student loans indeed have a measurable effect on home ownership. A $10,000 HPI-driven increase in student loans decreases the likelihood of home ownership in early adulthood by 2.9 percentage points. This is a sizable effect relative to the baseline ownership rate of 36% and consistent with results in Brown et al. [2015]. In contrast, we find no discernible effect of student loans on car ownership. The estimated coefficient is nearly zero and quite noisy. This finding is not altogether surprising, given the fact that autos themselves serve as easily-repossessed collateral for lenders so that there is little personal information for the borrower that enters into the underwriting decision. This is underscored by the very high auto ownership rates in our sample (73%) and by proliferation of subprime auto lending.

Finally, we evaluate students propensity to form their own households. We define a new household when a primary student no longer shares the same household ID as their primary adult at some point after turning 22. In addition, we require that a primary student identified as a separate household not appear again in the households of their primary adult by the end of the sample frame in 2016. The results in the rightmost column of Table 8 suggest student loans have essentially no effect on new household formation. Together, these preliminary results suggest that large student loan balances can delay the purchase of a home, potentially due to a debt-servicing burden, but this leverage does not seem to affect other expenditures or student mobility, broadly measured as starting a new household.

Overall, these results paint a consistent picture. Some households use home equity credit to help finance students' college enrollment, so when access to home equity falls with house prices some students take out more debt in order to continue financing enrollment. While we find that

[13] We are currently weakening this restriction to show results over the age of the student.

this has some effects on student labor force participation while enrolled and on the propensity to have a mortgage later in life, we do not find evidence that this additional leverage is a substantial drag on other measures of student activity.

4 Conclusion

Using household-level panel data that allow us to observe outcomes for parents and children, we evaluate the effects of access to home equity credit on student loan debt and college enrollment. We find that as parents are unable to borrow against home equity, they push the burden of financing college enrollment onto students through student loans. The magnitude of substitution that we estimate is large: for each dollar of home equity credit that parents do not take out students borrow between forty and sixty cents. These effects are strongest for households that are liquidity constrained, although we do find evidence that unconstrained households also reduce dependence on student loans, likely due to a wealth effect and buffer stock behavior. We find little evidence that individual house prices affect the extensive or intensive margin of college enrollment, but local house price growth is negatively correlated with enrollment, consistent with a labor market substitution effect.

Our results show that the collapse in house prices over the late 2000s contributed to a significant intergenerational shift in the financial burden of paying for college. This shift could have far-reaching consequences for housing market activity, we leveraged students do appear to be less likely to purchase a home. However, broader concerns might not be warranted as we see little evidence of effects on auto expenditures and household formation. However, our results also imply that access to student loans avoided some of the effects on enrollment that might have been expected from the large-scale disruption to home equity credit that occurred over the crisis.

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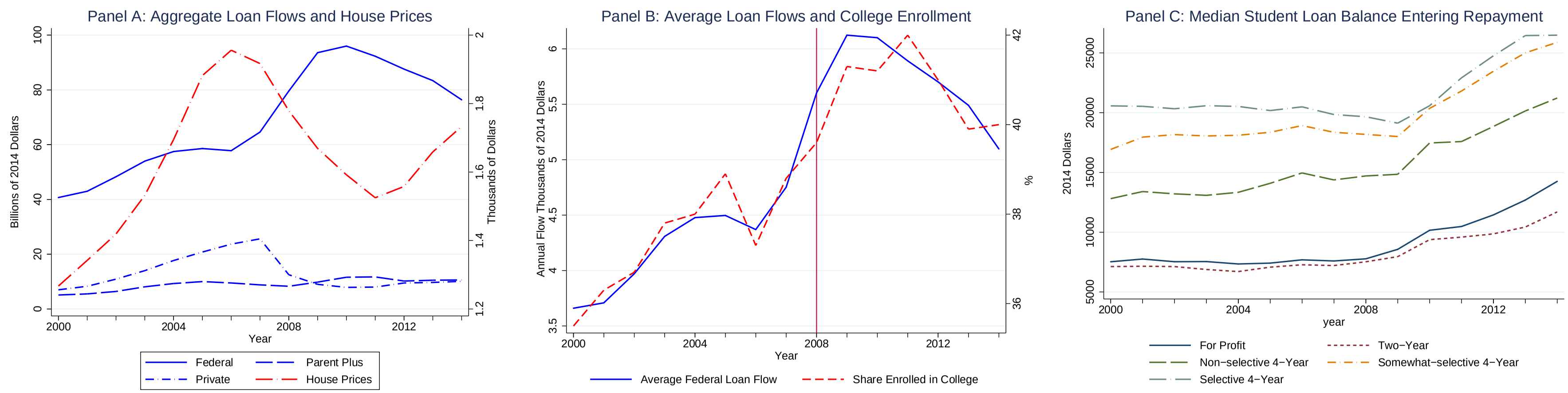
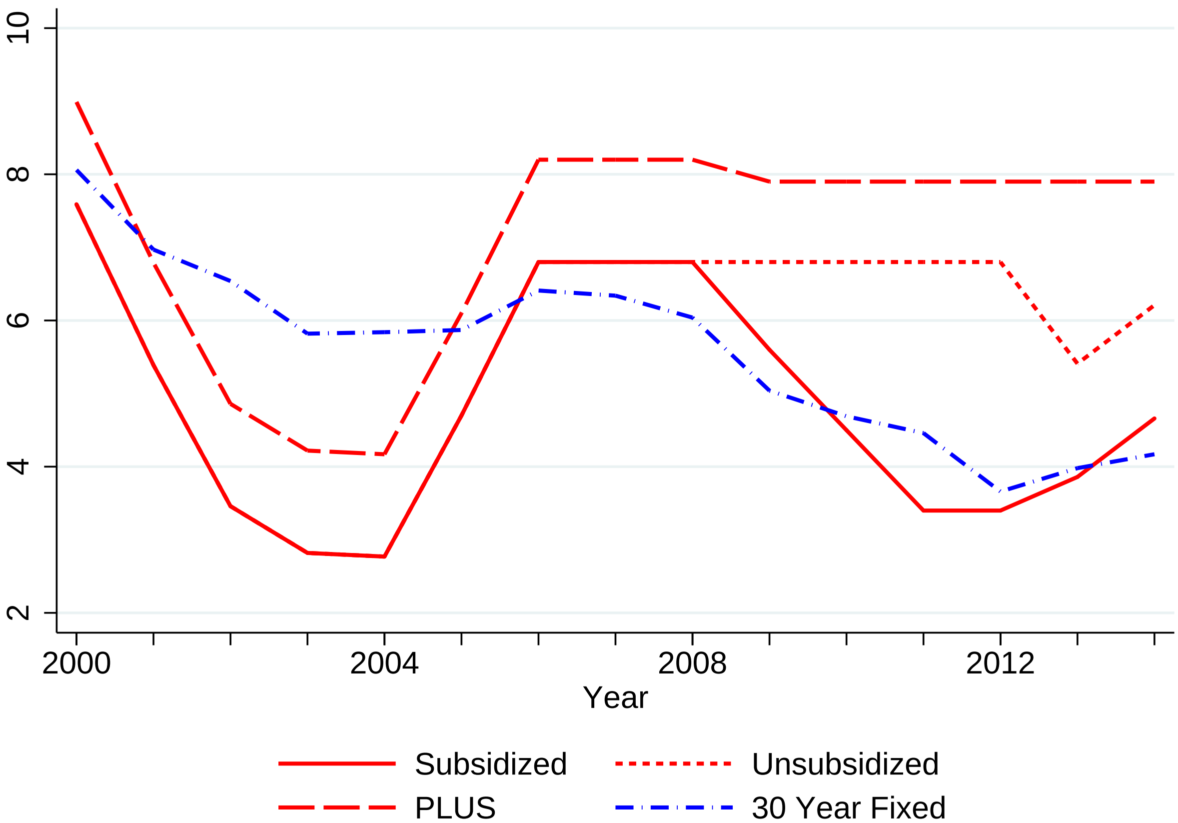
5 Figures

Figure 1: Student Loans and the Housing Crisis



Note: This figure gives plots of trends in student loans, house prices, and enrollment to show that the increase in student debt has been large and broad based. The left figure plots the aggregate annual flow of total federal subsidized and unsubsidized loans, parent PLUS loans, non-federal loans, and the national hosue price index from Zillow. The figure shows a sharp increase in the flow of federal student loans from 2006 to 2010. At the same time, the private student loan market fell and parent PLUS loans increased slightly. The middle figure shows the average flow of federal student loans (subsidized and unsubsidized) per full-time equivalent student as well as the enrollment rate of 18-24 year olds in any degree-granting postsecondary institution. Enrollment does increase significantly, but the average flow of student loans also increased by almost $2,000 from 2006 to 2010. Finally, the figure on the reports median federal student loan balances upon entering repayment reported in Looney and Yannelis [2015] broken out by type of institution attended. The figure shows that cohorts who entered college during and after the collapse in the housing market entered repayment with larger student loan balances across all types of institutions. Student loan numbers are constructed by the College Board and are based on various sources. See `http://trends.collegeboard.org/sites/default/files/trends-student-aid-web-final-508-2.pdf` for more details. The aggregate loan flow numbers are taken from figure 5 and the average flow is from figure 6. The enrollment numbers are available from the National Center for Education Statistics here `http://nces.ed.gov/programs/digest/d15/tables/dt15_302.60.asp?current=yes`.

Figure 2: Interest Rates on Student Loans and Mortgages



Note: This figure plots the market interest rates on four types of household debt used to finance college enrollment: subsidized federal loans, unsubsidized federal loans, 30-year fixed rate mortgage debt, and PLUS loans. Starting in 2006, extracting equity is cheaper than student loans and PLUS loans. While subsidized student loans do track mortgage debt somewhat, these loans are need-based and have strict annual and total limits. Data are from the Department of Education and FRED.

6 Tables

Table 1: PSID Summary Statistics (1)

	2001 p50/iqr	2003 p50/iqr	2005 p50/iqr	2007 p50/iqr	2009 p50/iqr	2011 p50/iqr	2013 p50/iqr
Age of Head	49.0	51.0	53.0	55.0	57.0	59.0	61.0
	(13.0)	(15.0)	(15.0)	(15.0)	(16.0)	(15.0)	(16.0)
Size of Household	4.0	3.0	3.0	3.0	2.0	2.0	2.0
	(3.0)	(3.0)	(2.0)	(2.0)	(2.0)	(2.0)	(1.0)
School Expenses	1.8	1.8	2.7	2.0	2.7	3.8	4.6
	(5.4)	(7.8)	(10.3)	(9.9)	(11.5)	(10.9)	(14.1)
Student Loans	.	.	5.4	10.2	14.9	14.3	14.8
	(.)	(.)	(10.2)	(13.2)	(28.2)	(24.8)	(21.3)
Gross Income	85.3	80.2	78.8	80.5	81.6	76.2	77.1
	(73.0)	(69.5)	(72.6)	(78.2)	(80.9)	(75.4)	(75.9)
Mortgage Debt	53.0	53.3	48.2	45.8	41.6	36.2	27.8
	(106.0)	(113.5)	(113.4)	(120.0)	(120.9)	(114.3)	(101.8)
Home Value	147.2	170.2	181.4	203.5	198.1	190.6	180.4
	(142.5)	(181.6)	(215.6)	(234.0)	(203.1)	(171.5)	(175.8)
Liquid Wealth	17.7	20.4	19.3	21.4	21.8	19.1	18.5
	(78.9)	(86.9)	(90.5)	(112.9)	(98.1)	(92.4)	(99.0)
Illiquid Wealth	41.2	39.7	42.8	46.8	39.6	42.9	46.3
	(113.1)	(113.6)	(138.6)	(156.7)	(124.9)	(173.1)	(175.8)
Home Equity	86.0	102.1	116.6	142.4	115.9	107.7	111.0
	(104.5)	(130.5)	(158.4)	(183.1)	(158.5)	(148.6)	(151.7)
LTV	38.3	34.0	28.1	23.4	25.0	23.2	20.0
	(62.7)	(59.7)	(55.6)	(51.7)	(58.0)	(57.1)	(55.7)
Equity Extracted	23.6	28.1	28.4	34.0	29.8	24.8	26.9
	(28.8)	(34.9)	(41.4)	(40.7)	(51.8)	(57.6)	(31.9)
4-Year House Price Growth (%)	.	15.4	13.6	13.2	-3.6	-13.2	-6.7
	(.)	(39.4)	(42.9)	(42.7)	(27.6)	(24.7)	(20.3)

Note: This table reports medians and interquartile ranges for relevant observables from our baseline sample of households in the PSID. Each household has one observation per year. For student loans and equity extraction we only compute the relevant amount across non-zero observations. Missing values are due to data availability or sample construction. See the text for more details.

Table 2: PSID Summary Statistics (2)

	2001	2003	2005	2007	2009	2011	2013
College Age (%)	24.1	21.8	23.1	22.4	19.7	20.6	18.2
Enrolled in College (%)	.	.	8.9	13.7	15.6	16.1	15.2
Has Student Loans (%)	.	.	2.4	5.0	8.5	8.5	7.2
Extract Equity (%)	16.3	22.2	19.2	16.2	15.0	12.1	10.8

Note: This table reports means for relevant observables from our baseline sample of households in the PSID. Each household has one observation per year. Missing values are due to data availability. See text for more details.

Table 3: College Enrollment and Source of Funding

	P(Enrolled in College)	P(Extract Equity)		Equity Extracted			P(Has Student Loans)		Student Loans	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
College Age	0.510***		-0.007		-0.406	-0.109		0.009		-0.752
	(0.022)		(0.016)		(1.055)	(0.714)		(0.011)		(0.467)
Enrolled in College		0.034**	0.039**	3.157***	3.417**	-1.074**	0.399***	0.394***	9.018***	9.498***
		(0.014)	(0.018)	(1.157)	(1.311)	(0.455)	(0.024)	(0.025)	(0.837)	(0.915)
Equity Extracted						40.413***				
						(2.775)				
Enrolled*Extracted						14.427***				
						(4.163)				
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6386	6386	6386	6386	6386	6386	6386	6386	6386	6386
Clusters	51	51	51	51	51	51	51	51	51	51
R2	0.456	0.062	0.063	0.064	0.064	0.557	0.373	0.373	0.179	0.180

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Note: This table reports OLS estimates of college enrollment and types of borrowing as functions of college age and enrollment indicators. These estimates show in column 1 that households with college age members enroll members in college. In columns 2 and 3 we show that households enrolling members in college are more likely to extract equity (by three to four percentage points) and in columns 4 and 5 we show that these this results in an additional $3,100-3,400 in extracted equity. Column 6 conditions on an indicator for equity extraction explicitly and interacts this indicator with the indicator for enrollment in college. This shows that equity extraction averages to about $40,000 on average, but households enrolling a member in college withdraw about $14,000 more equity from their home. In columns 7 and 8 we also show these households are much more likely to report student loans and in columns 9 and 10 that they carry $9,000-9,500 more in student loans. Each specification includes a state fixed effect, a quadratic in the age of the head of household, the household size, lags of mortgage loan-to-value ratio, log income, home equity, and liquid wealth, and year fixed effects. Standard errors are clustered at the state level. See the text for more details.

Table 4: The Effect of House Prices on How Households Finance College Enrollment

	P(Extract Equity) (1)	(2)	Equity Extracted (3)	(4)	P(Has Student Loans) (5)	(6)	Student Loans (7)	(8)	(9) OLS	(10) IV	(11) IV
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
Amount Equity Extracted									0.008	-0.631**	-0.568***
									(0.007)	(0.288)	(0.202)
Enrolled in College	0.030**	0.038	2.792**	2.604	0.405***	0.320***	9.234***	5.755***	8.994***	10.995***	7.234***
	(0.014)	(0.028)	(1.175)	(2.546)	(0.023)	(0.032)	(0.828)	(0.918)	(0.823)	(1.367)	(1.506)
Enrolled in College * %Δ HP	0.113**	0.136***	9.122***	10.661***	-0.154***	-0.150***	-5.753***	-6.053***			
	(0.042)	(0.049)	(2.626)	(2.800)	(0.047)	(0.048)	(1.664)	(1.731)			
%Δ HP	0.049***	0.061***	4.380***	3.727***	0.007	0.002	0.398***	0.372		3.161**	2.487***
	(0.012)	(0.014)	(0.926)	(1.057)	(0.005)	(0.006)	(0.148)	(0.241)		(1.520)	(0.805)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	–	Yes	–	Yes	–	Yes	–	Yes	Yes	–
Household FE	–	Yes	–	Yes	–	Yes	–	Yes	–	–	Yes
N	6386	6386	6386	6386	6386	6386	6386	6386	6386	6386	6386
Clusters	51	51	51	51	51	51	51	51	51	51	51
R2	0.067	0.335	0.073	0.359	0.378	0.621	0.186	0.528	0.167	-2.309	-2.590
Robust F-stat										12.068	14.495
Weak ID P-value										0.014	0.018

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Note: The first eight columns report the difference-in-difference estimates of home equity and student loan borrowing as functions of college enrollment and the interaction of these indicators with house price growth. As house prices increase households are significantly more likely to extract equity and less likely to depend on student loans. Column 9 reports an OLS estimate of the effect of equity extraction on student loan borrowing and shows no relationship. Columns 10 and 11 instrument for equity extraction with the interaction of house price growth and college enrollment and we find a negative relationship: an addition dollar of extracted equity reduces student loan debt by fifty to sixty cents. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Standard errors are clustered at the state level. See text for more details.

Table 5: Sample Splits by Liquid Wealth Ratio

	P(Extracts Equity)		Equity Extracted		P(Has Student Loans)		Amount of Student Loans		Log Non-Housing Wealth	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Low	High	Low	High	Low	High	Low	High	Low	High
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
Enrolled in College	0.045	0.031	1.015	4.954	0.363***	0.255***	6.730***	4.198***	0.096	0.058
	(0.042)	(0.045)	(2.761)	(3.969)	(0.044)	(0.040)	(1.273)	(1.088)	(0.237)	(0.180)
Enrolled * %Δ HP	0.165**	0.072	13.053***	5.261	-0.108**	-0.232***	-5.382**	-6.976**	0.154	-0.638**
	(0.074)	(0.085)	(4.250)	(6.035)	(0.050)	(0.081)	(2.399)	(3.163)	(0.340)	(0.299)
%Δ HP	0.057***	0.056***	4.248***	3.045**	-0.003	0.003	0.238	0.336	0.117	0.229
	(0.018)	(0.017)	(1.435)	(1.362)	(0.012)	(0.008)	(0.264)	(0.306)	(0.195)	(0.145)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	3198	3188	3198	3188	3198	3188	3198	3188	3198	3188
Clusters	46	47	46	47	46	47	46	47	46	47
R2	0.328	0.340	0.367	0.354	0.630	0.615	0.558	0.472	0.716	0.630

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Note: This table reports OLS estimates of borrowing behavior as functions of college enrollment and the interaction of this indicators with house price growth. The sample is split by measures of household liquidity constraints. The estimates show that constrained households are driving equity extraction while both types of households reduce their dependence on student loans. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Standard errors are clustered at the state. See text for more details.

Table 6: Financing College Enrollment: Robustness (PSID)

	P(Extract Equity) (1)	Equity Extracted (2)	P(Has Student Loans) (3)	Student Loans (4)	(5)	(6)
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
Amount Equity Extracted					-0.486**	-0.506**
					(0.193)	(0.202)
Enrolled in College	0.038	2.535	0.309***	5.438***	6.670***	6.568***
	(0.028)	(2.545)	(0.032)	(0.901)	(1.410)	(1.501)
Enrolled in College * %Δ HP	0.138***	10.860***	-0.125**	-5.280***		
	(0.050)	(2.878)	(0.047)	(1.753)		
Enrolled in College * Δ UR	0.002	0.245	0.031***	0.954**	1.073***	1.086***
	(0.006)	(0.453)	(0.011)	(0.434)	(0.375)	(0.373)
%Δ HP	0.061***	3.726***	-0.000	0.290	2.102***	9.561***
	(0.013)	(1.042)	(0.006)	(0.232)	(0.702)	(3.522)
Δ UR	0.002	0.054	-0.001	-0.046	-0.020	-0.013
	(0.004)	(0.261)	(0.002)	(0.099)	(0.127)	(0.125)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
State FE						
Household FE	Yes	Yes	Yes	Yes	Yes	Yes
Additional Interactions	–	–	–	–	–	Yes
N	6386	6386	6386	6386	6386	6386
Clusters	51	51	51	51	51	51
R2	0.335	0.359	0.627	0.533	-1.873	-2.025
Robust F-stat					14.244	10.515
Weak ID P-value					0.018	0.013

Note: This table reports difference-in-difference and instrumental variable estimates of home equity and student loan borrowing as functions of college enrollment and its interaction with individual house prices and state-level changes in unemployment rates. The estimates show that controlling for unemployment rates has almost no effect on the estimated effects. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Unemployment rates are from the BLS. Standard errors are clustered at the state level. See text for more details.

Table 7: Effect of House Prices on Enrollment and Other Outcomes

	(1) P(Enroll) β /(se)	(2) P(Credit Cards) β /(se)	(3) P(Student Working) β /(se)	(4) P(Tuition Covered) β /(se)	(5) P(Personal Loan) β /(se)	(6) P(Home Improvement) β /(se)
College Age	0.387***					
	(0.022)					
College Age * %Δ HP	-0.050*					
	(0.025)					
Enrolled in College		0.308***	0.451***	0.473***	0.072***	-0.022
		(0.030)	(0.032)	(0.039)	(0.021)	(0.021)
Enrolled in College * %Δ HP		-0.068	-0.147***	0.109**	0.008	0.017
		(0.045)	(0.049)	(0.052)	(0.045)	(0.026)
%Δ HP	0.019	0.008	0.018*	0.007	0.002	0.054***
	(0.011)	(0.010)	(0.009)	(0.007)	(0.005)	(0.017)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes
N	6386	6386	6386	6386	6386	6386
Clusters	51	51	51	51	51	51
R2	0.777	0.585	0.632	0.663	0.342	0.356

Note: This table reports OLS estimates for the younger household members enrolling in college, having credit cards, joining the labor force, for the family covering tuition, the student taking out a personal loan from relatives, and the household undertaking home improvements. The estimates show that individual house prices reduce the likelihood of enrolling in college, significantly reduce the likelihood that an enrolled member is in the labor force and increase the likelihood that the family covers some tuition. There are no significant effects on the probability of having a credit card, a personal loan, or home improvement. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Standard errors are clustered at the state level. See text for more details.

Table 8: Substitution and Long-run Outcomes (CCP)

	(1) Student Loans-Never β /(se)	(2) Student Loans-2 Year β /(se)	(3) P(Has Mortgage) β /(se)	(4) P(Has Auto) β /(se)	(5) P(Formed Household) β /(se)
Equity Extracted	-0.435***	-0.571***			
	(0.107)	(0.190)			
Student Loan Amount			-2.870**	0.012	0.162
			(1.33)	(1.22)	(1.30)
Controls	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	–	–	–
Home County FE	–	–	Yes	Yes	Yes
N	252,345	252,345	10,365	10,365	10,365
R2			0.254	0.267	0.172

Note: This table reports instrumental variable estimates of substitution and student loan effects using the CCP data.The estimates show both that our substitution results are robust to changing datasets and that student loan debt significantly reduces the probability a former student has taken out a mortgage. However, student loans do not seem to affect any of the other long-run outcomes. Each specification includes a controls for credit score, household debt, home county fixed effects, and year fixed effects. Standard errors are clustered at the county level. See text for more details.

A Appendix Tables

Table A1: The Effect of House Prices on Financing College Enrollment: College Age

	P(Extract Equity) (1)	(2)	Equity Extracted (3)	(4)	P(Has Student Loans) (5)	(6)	Student Loans (7)	(8)
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
College Age	0.021*	0.014	1.268	0.159	0.218***	0.144***	4.288***	2.118***
	(0.012)	(0.019)	(0.983)	(1.390)	(0.016)	(0.016)	(0.570)	(0.618)
College Age * %Δ HP	0.091***	0.076**	4.554**	4.750**	-0.115***	-0.105***	-2.905***	-3.200***
	(0.034)	(0.033)	(2.158)	(2.187)	(0.027)	(0.029)	(0.956)	(0.946)
%Δ HP	0.044***	0.054***	4.566***	3.766***	0.016**	0.013*	0.410**	0.502*
	(0.015)	(0.017)	(1.002)	(1.326)	(0.006)	(0.007)	(0.158)	(0.264)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	Yes	–	Yes	–	Yes	–	Yes	–
Household FE	–	Yes	–	Yes	–	Yes	–	Yes
N	7454	7454	7454	7454	6386	6386	6386	6386
Clusters	51	51	51	51	51	51	51	51
R2	0.070	0.307	0.069	0.315	0.209	0.580	0.097	0.512
Robust F-stat								
Weak ID P-value								

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Note: This table replicates our baseline difference-in-difference estimates but uses an indicator for the household having a college-age member instead of an indicator for the household enrolling a member in college. All of our results hold in this specification. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Standard errors are clustered at the state level. See text for more details.

Table A2: The Effect of House Prices on Financing College Enrollment:
Sample Splits by Head Education

	P(Extracts Equity)		Equity Extracted		P(Has Student Loans)		Amount of Student Loans	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	No College	College	No College	College	No College	College	No College	College
	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)	β /(se)
Enrolled in College	0.044	0.037	3.904	2.422	0.319***	0.318***	6.574***	5.531***
	(0.066)	(0.030)	(5.478)	(2.416)	(0.061)	(0.035)	(1.917)	(1.079)
Enrolled in College * %Δ HP	0.141*	0.100	10.382**	5.514	-0.139*	-0.123	-5.368**	-5.029*
	(0.077)	(0.075)	(4.617)	(5.172)	(0.082)	(0.074)	(2.632)	(2.666)
%Δ HP	0.028	0.098***	1.908	5.506***	0.001	0.016	-0.190	1.010**
	(0.019)	(0.026)	(1.249)	(1.658)	(0.007)	(0.012)	(0.190)	(0.414)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Household FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	2618	3768	2618	3768	2618	3768	2618	3768
Clusters	47	47	47	47	47	47	47	47
R2	0.387	0.342	0.447	0.350	0.666	0.625	0.613	0.532

Note: This table reports OLS estimates of borrowing behavior as functions of college enrollment and the interaction of this indicator with house price growth. The sample is split by whether or not the head of the household has some college education. The estimates show that both sets of households behave similarly, although equity extraction of less-educated households does appear to be more sensitive to house prices. Each specification includes a quadratic in the age of the head of household, the household size, lagged loan-to-value ratio of the household, log income, and year fixed effects. Standard errors are clustered at the state level. See text for more details.

Table A3: Differences in Observables between Households not Enrolling a Member in College and Enrolling Households

	2005		2007		2009		2011		2013	
Age of Head	3.449**	(3.10)	4.313***	(4.68)	5.825***	(6.74)	7.455***	(8.84)	8.727***	(10.24)
Home Value	-57.63*	(-2.04)	-62.44*	(-2.41)	-66.37**	(-3.08)	-50.48*	(-2.29)	-69.54**	(-3.09)
Gross Income	-42.44***	(-6.14)	-48.18***	(-7.77)	-51.28***	(-9.01)	-42.70***	(-8.52)	-49.54***	(-8.92)
Income Growth	-0.118*	(-2.54)	-0.0503	(-1.39)	-0.0628	(-1.83)	0.0336	(0.94)	-0.0947**	(-2.66)
Liquid Wealth	-27.67	(-1.11)	-12.21	(-0.54)	-32.86	(-1.58)	-2.409	(-0.12)	11.59	(0.51)
Total Wealth	-13.57	(-0.31)	-31.33	(-0.72)	-47.41	(-1.29)	-10.82	(-0.29)	-32.26	(-0.81)
Size of Household	-2.199***	(-13.00)	-1.674***	(-13.17)	-1.647***	(-15.76)	-1.402***	(-15.05)	-1.430***	(-16.83)
N	1304		1316		1366		1381		1393	

* p < 0.1, ** p < 0.05, *** p < 0.01.

Note: This table checks for differences between observables for households not enrolling a member in college and households enrolling a member in college. All the differences that are statistically significant are then used as additional interaction terms with house prices in our regression estimates.