Student Loans, Financial Aid, and College Retention Rates

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October 30, 2019

Abstract: Colleges and universities have an interest in increasing their retention rates, both because it is socially desirable for students to complete their educations, and because college rankings are substantially affected by retention rates. Retention of individual students is affected by the way they finance their educations, so it is natural for colleges to ask whether changing their aid policies could affect their retention rates. We examine the relationship between institutional aid, loans, and retention using a panel data set for 8 years and 1292 four-year US colleges. Comparisons to the student-level literature suggest that including fixed and period effects substantially controls for endogeneity arising from non-random assignment of students to schools and cohorts. We find heterogeneous effects of aid and loans on retention for different schools, which is not surprising since the student-level literature often finds heterogeneous effects on students. At selective schools, more institutional aid increases retention, though the effect is small. There is no effect at less selective schools. With loans, we find a reverse pattern; more students with loans has no effect on retention at selective schools but decreases it at less selective schools. Institutions that want to know how changes in institutional aid policies will affect their retention rates need to consider their own circumstances carefully, thinking about both how the changes will affect the particular students they currently enroll and how changes in aid policy will affect the mix of students that attends the institution.

Preliminary draft - Please do not quote without permission of the authors. We thank Derek Zuckerman of Union College for helpful discussions about the institutional approach to increasing retention, and participants in the Union College economics seminar for helpful discussion and suggestions. All remaining errors are the responsibility of the authors.

Increasing retention and graduation rates is critical for American colleges and universities. Nationwide, only 61.6% of students who enter college are still enrolled one year later; another 12.3% have transferred to a different college and 26.1% are no longer enrolled. Six years later, only 56.4% of those who enrolled at four-year colleges have completed a degree at their starting school; 11.4% have a degree from a different school, and 32.2% have no degree.[1] Without degrees, students find it difficult to earn salaries that will allow them to cover the cost of their education; if they have loans they may be unable to repay them. In addition, schools are judged in part on their retention and graduation rates; colleges with low rates may find it more difficult to attract applicants, and may attract critical attention from accreditors and the Federal government. Thus, it is important both to society as a whole, and to institutions specifically, to increase their retention and graduation rates.

Students drop out of college for many reasons, but financial issues are among the most common causes of non-persistence for students. Students who struggle to find the money to pay college costs may be forced to drop out if they lose eligibility for assistance, have a family event that takes money or time or both away from their studies, or find that they cannot balance the demands of school and working a job to pay for it (Goldrick-Rab 2016). On the one hand, a college or university that makes more money available to students through aid may improve the chances that its students will be able to complete its academic programs. On the other hand, colleges that admit more students who need aid, or need to take out loans to pay for college, may have more students with a relatively high risk of dropping out, which may reduce their retention and graduation rates. Thus, changing financial policies may have a series of complex effects that make it difficult for colleges to predict exactly how their retention and graduation rates will respond. The effects may be very different at different colleges,

[1] Data from National Student Clearinghouse Research Center, Summer 2018 Snapshot Report and Signature Report 16 (December 2018).

because aid and loans affect different students in different ways, and different colleges have different mixes of students in their student bodies.

In this paper, we examine the relationship between financial aid and student loans on the one hand, and first-year retention rates on the other, at four-year American colleges and universities. We use panel data and both college fixed effects and time fixed effects to identify the relationship between finances and retention rates only from variation with individual schools across time. Variation across schools is subject to serious endogeneity problems because students are not randomly assigned to schools, and variation across time periods can be distorted by labor market effects. Including both fixed and period effects reduces this problem and produces results that are consistent with the literature that analyzes persistence at the individual student level. We then break down the sample of schools into different categories to test whether the relationship between finances and retention rates is different for different categories of schools.

We find some substantial differences in the relationship between financial variables and retention rates at different types of schools. At selective schools, defined as those that accept 60% or fewer of their applicants, schools with a higher percentage of students receiving institutional aid have higher retention rates, and loans have no effect on retention; while at less selective schools, schools with a higher percentage of students with loans have lower first-year retention, and aid has no effect. Having more students with Pell grants has no effect on retention at selective schools but significantly reduces retention at less selective schools. The amount of aid and loans has no significant effect for either type of school.

This heterogeneity implies that studies of the effects of financial policies done at a single school may not generalize to other schools, particularly when those schools are of different types than the one where the study was performed. It also implies that studies of cross-sections of schools should not

assume that financial variables have the same effects on retention at all schools; they need to allow for heterogeneous responses by the schools in their samples. Schools that are trying to improve their retention rates will need to consider carefully how changes in admissions and aid policies will affect students in the context of each particular school, and be careful about applying lessons learned at other schools to their own situations.

The rest of this paper is organized as follows. Section 2 reviews the literature on the effects of financial policies on retention and explains how this paper contributes to that literature. Section 3 presents the data and empirical methods used in the research. Section 4 presents findings and interpretations; section 5 concludes.

Section 2 – Finances and Student Retention

A school's decisions about which students to admit, and how much financial assistance to give them, can affect its retention rate in two ways; by changing the probability that individual students will complete the school's academic programs, and by changing the composition of the student body. Offering aid helps reduce the financial burden on individual students, while students who have to take on more debt to stay in college may be reluctant to return for a second year if they are not doing well. However, more aid can draw students to a school who have a relatively high risk of withdrawing. The connection between financial variables and retention rates is a combination of these effects. Both effects have been studied in the past literature. Most of the research has focused on the effects of aid and loans on student outcomes. There has been less study of the effects of aid and loans on outcomes at the institutional level, and not all of that research has used panel data methods to deal with unobserved heterogeneity of institutions.

2.1. Early studies of student effects

Prior to about ten years ago, endogeneity of aid and loans was not a major analytical concern. Hossler et. al. (2009) review the literature up to that date on the effects of how student financial aid and loans affect persistence, which can mean either completion of the first year, or re-enrollment for the second year. Depending on data availability, it may refer to persistence at a specific college, or persistence at any college; the latter includes students who transfer while the former does not. Some studies use the amount of aid a student receives as a variable, others only have information about whether the student is receiving aid or not, but not the amount. Some studies distinguish between need-based aid and merit aid, though most do not. In general, that literature shows that financial aid has a small but positive effect on student persistence; in contrast, loans appear to have no effect on persistence, and what effect there may be tends to be negative. However, there is significant variation in findings between different studies, some of which show very different effects of aid and loans on persistence. Some of the difference may be explained by differences in methodology, in particular how studies accounted for endogeneity of receiving aid. It may be that students who receive aid are more likely to persist, but that this is because better (or perhaps weaker) students are selected to receive aid and/or loans, with the aid or loans having little or no subsequent effect on their persistence. It may also be due to differences in data. Data sets on students at single institutions have more information about student capability, but the results they produce may not generalize to other institutions. National data sets have less information about individual students but exploit variation across college environments and raise fewer concerns about external validity.

Long (2008) also reviews the broader literature on aid, loans, and persistence to that time. She finds that programs that attempt to target aid to the students with the greatest need for them are more complex than simpler programs, and that this complexity may deter the students with the greatest need

for aid from applying in the first place. Programs work better when they target enrollment for low-income students. Other types of programs devote much of their funding to students who would complete college without assistance and hence are not cost-effective. Grants are more effective than loans, because they do not create the debt burdens that loans do. Eroding value of Federal student aid programs that forces low-income students to rely more on loans does real harm to the probability that those students will enroll in, and complete, college. Aid is associated with greater persistence though some of this may be due to selection effects rather than a causal relationship. Loans are much less effective at increasing persistence. Tax credits and college savings programs are also ineffective at changing persistence because the benefits go mostly to higher-SES students who are likely to attend and persist even without aid.

2.2. Studies of students at single schools

A few papers have used data from single institutions to look at aid and retention. Using data from a single school allows the use of application and administrative data to try to control for heterogeneity that is observable at that level, and hence reduce endogeneity concerns. DesJardins, Ahlburg, and McCall (2002) use a hazard model that allows for unobserved heterogeneity among students to investigate the effect of converting all student loans to grant aid (as Princeton University had actually done in 2000). They used institutional data on the University of Minnesota. They found that all forms of aid improved survival rates but that some forms of aid – particularly scholarships – had larger impacts than other types of aid. In particular, loans have a small effect on persistence. SImulation based on their results show that switching from loans to grants would increase persistence, by as much as 10% in later years, but by lesser amounts in the first two years.

Singell (2004) was one of the first papers to take endogeneity into account. He used data from the University of Oregon to jointly model enrollment and retention. He found that both need-based aid and

merit aid increased retention, but that sample selection had important effects and that responses were heterogeneous with respect to both need and ability. Singell and Stater (2006) used a similar design and data from three large public schools to examine the effects of aid on graduation. They found that the primary effect of aid was to select stronger students into the schools; it had little or no causal effect on graduation. Both papers conclude that increased use of unsubsidized loans and merit aid reduced the achievement of needy students.

2.3. Studies of students at multiple schools

Subsequent research exploited data sets available at the university system, state, or national level to study the possibility that aid and loans could change which institutions students chose to attend. Many of these studies were able to use sophisticated econometric techniques to address the issue of endogenous awarding of aid. However, because these techniques depend on analysis at the student level, they make it hard for the results to say much about how an institution is affected by changes in its aid policies.

Goldrick-Rab et. al (2016) used a true randomized trial of need-based scholarships in Wisconsin funded by the Fund for Wisconsin Scholars. Eligible students were randomly assigned to control and treatment groups, and only those in the treatment group were invited to participate in the scholarship. The scholarships could be used at any of Wisconsin's public universities, so outcomes could be tracked with state administrative data. Students who received scholarships were more likely to graduate in four years. The program helped close the gap in graduation rates between high-need (Pell-eligible) students and other students, helping to reduce income inequality. However, the scholarship was more useful for students with college-educated parents, probably because they had knowledge about the college process that helped them take better advantage of the scholarship.

Similarly, Angrist et. al. (2016) use a randomized experiment in which a private donor (the Susan Thompson Buffett Foundation) funded scholarships for Nebraska students. As in Goldrick-Rab et. al. (2016), the scholarships had to be used at an in-state public college. Receiving a scholarship increased both enrollment in college and persistence in college. It also moved students from two-year to four-year colleges. However, scholarships delayed graduation, probably because students without loans had less pressure to graduate on time (the scholarships were good for five years). The effects were heterogeneous; groups with historically low college attendance had stronger enrollment effects.

Alon (2011) uses a regression discontinuity approach to measure the causal effect of Pell grants on persistence. The Pell grant formula for eligibility varies with the number of siblings of the recipient that are attending college which provides exogenous variation in need-based aid. Using a national data set, Alon finds a heterogeneous effect; aid improves persistence for students in the bottom half of the income distribution but not those in the top half. She recommends that funds should be redistributed to low-income students for whom it does the most good.

Bettinger (2015) takes advantage of a natural experiment created by a change in Ohio college need-based aid that affected persistence. The change in the funding formula increased aid for most students but reduced it for some. Using difference in difference estimation, Bettinger finds that aid increases reduced drop-out rates, increased attendance at 4-year colleges rather than 2-year colleges, and increased first-year GPAs. However, the program did not target funds to the students with the greatest benefit from them and hence may not have been a cost-effective use of state money.

Castleman and Long (2016) use regression discontinuity in the Florida Student Access Grant to examine the effect of aid on persistence. Only students attending college in Florida are eligible for the grant. Being eligible for the grant makes students more likely to attend college, particularly 4-year

colleges, and increases persistence and graduation rates. The effects are fairly large – students near the cutoff are 22% more likely to complete a bachelor's degree in six years.

Kim (2007) uses national BPS data to look at the effect of student loan debt on graduation rates. Higher loan debt reduces degree completion for both low-income students and African-American students, but not among high-income students or white students. Hispanic and Asian-American students showed some effects of loan debt on completion but were not significantly different from the results for white students. Students at more selective colleges were more likely to complete degrees. Both of these results may be driven by selection of students into loans/schools rather than due to causal effects.

One effect that aid may have on students is that it allows them to reduce their use of other types of education funding, such as loans and work-study, that may harm their academic efforts. Evans and Nguyen (2019) look at how increases in student aid affect students' use of other forms of education financing. They use regression discontinuity based on the formula for expected family contribution in the Pell grant program to identify causal effects of aid from a national data sample. They find that students who receive aid reduce both paid work and borrowing in response, with a larger response in reducing paid work than in reducing borrowing. There are differences in response between genders. The overall effect of grant aid on post-college outcomes is limited.

2.4. Studies of institutional characteristics and student-level retention

In order to get at the question of how institutional policies affect retention, a number of papers have merged data on student-level results with data on institutional characteristics, seeing whether institutional decisions like how much to spend on student services, or how to provide information about aid to students, affect student-level outcomes. These studies bring institutional questions to the analysis but, because the data are still at the student level, they do not directly address the question of how the policies affect the institution as a whole.

Chen (2012) uses the Beginning Postsecondary Students (BPS) national dataset to look at the relationship between college characteristics and individual student persistence. Dropout rates are highly correlated with socioeconomic status of students, with low-SES students much more likely to drop out. Colleges which spent more on student services (as defined by IPEDS) had lower dropout rates than those which spent less. However, this may be due to selection of students into such colleges rather than due to a causal effect.

Webber (2012) uses administrative data from public universities in Ohio to look at the effects of student services expenditures vs. instructional expenditures on graduation rates. He uses a competing risks framework and includes institution-level fixed effects. Student services expenditures have a larger impact on students with low SAT scores, while instructional expenditures have more effect on high-score and STEM students.

Stoddard, Urban, and Schmeiser (2017) look at the way colleges provide financial information to students and its effect on retention. They use data from one school which conducted a natural experiment by sending information about financial aid only to students whose debt needs exceeded a set threshold. Providing the additional information didn't change borrowing behavior but did increase both persistence and academic outcomes.

2.5. Studies of institutional level observation

A few studies have used observations on retention and graduation at the institutional level rather than the student level. These studies can directly address the effect that policies have on institutions, but have a harder time dealing with endogeneity concerns because the sophisticated techniques used in the student-level literature are generally not applicable to institutional-level data. Many, though not all, of the papers in this literature use panel data to address problems of unobserved heterogeneity, without being very directly concerned with endogeneity.

Webber and Ehrenberg (2010) is one of the first papers to examine persistence using panel data on institutions. They are primarily interested in the effect of non-instructional expenditures, which grew at a much faster rate than instructional spending during the period of their analysis, on retention and graduation. They did not use fixed effects due to low variation in expenditures by category within institutions. They found that student services expenditures increased graduation rates. The effects were heterogeneous and largest at institutions with lower test scores and more high-need students. At those institutions, reallocating expenditure from instruction to student support could improve persistence. They used Pell grant expenditure per students as a control, and found a significant negative effect of Pell grant expenditure on graduation, almost surely due to selection effects.

Zhang (2009) looks at the effect of state funding on graduation rates using an eight-year panel of four-year public institutions. She finds that without fixed effects, state funding is positively correlated with graduation rates, but that the effect disappears when institution-level fixed effects are included in the model. She does not include measures of aid or loans in her analysis.

Flores and Hansen (2015) examine the effect of employment conditions on first-year retention at four-year public universities, using a six-year panel data set. They include results both with and without fixed effects and random effects, and also regress retention on lagged variables to help control for endogeneity due to reverse casuality. They find substantial differences when fixed effects are use, suggesting that unobserved school-specific effects that are correlated with retention are important. They find that higher unemployment raises retention rates, because the opportunity cost of remaining in school is lower in a down job market. Their only financial variable is percent Pell recipients at a school; in the pooled regression it is significant and negative, but in the fixed effects regression it is not. This is consistent with sorting of high-need students into schools with relatively low retention rates.

Pike and Graunke (2015) estimate a model of retention rates using a six-year panel on US four-year colleges and universities, including fixed effects and time effects to control for unobserved heterogeneity. They also include the proportion of students receiving Pell grants, and no other financial controls. They found significant differences between fixed-effect and random-effect estimates. They tested for time variation among the parameters but found no significant differences in parameter values between years. Inclusion of fixed effects tends to remove significance from time-varying institutional characteristics, consistent with the idea of selection of schools by students of varying abilities. Characteristics of students matter much more for explaining retention rates. Pike and Robbins (2019) conduct a similar analysis for graduation rates. They also find that time-varying institutional characteristics have little effect on graduation rates once unobserved heterogeneity is controlled for with fixed effects.

Section 3 – Model and Data

In this study, we use institutional level data to examine the causal effect of a college's financial aid policies on its retention rate. The effect is ambiguous if more aid will increase a particular student's chance of persisting, but the aid will draw in students who are high need and may be less likely to successfully complete the first year. Empirical analysis will give us a sense of how these two effects balance out. We also want to examine whether the balance of the two effects is different for different types of schools, since there is known to be heterogeneous response at the student level, and different colleges have different mixes of students depending on their cost, selectivity, and other factors.

We are interested in estimating equations of the form

$$Retention_{it+1} = \beta_0 + \beta_1 * Aid_{it} + \beta_2 * Loans_{it} + \beta_3 * X_{it} + \varepsilon_{it} \quad (1)$$

to determine whether spending more money on financial aid or loans at time t will affect retention rates for college i at time t+1. The primary difficulty with doing this is that students are not randomly assigned to colleges, and therefore ε_{it} is likely to be correlated with Aid_{it} and $Loans_{it}$. Students with relatively high ability are likely to attend schools with higher aid, and so high aid and high retention will be correlated with each other even in the absence of a causal effect between aid and retention.

Our first step in addressing this problem is to include fixed effects for colleges in the model:

$$Retention_{it+1} = \beta_0 + \beta_1 * Aid_{it} + \beta_2 * Loans_{it} + \beta_3 * X_{it} + \delta_i + \varepsilon_{it} \quad (2)$$

This holds constant time-invariant effects on retention. Thus, if schools which offer a lot of aid tend to also have other characteristics which students desire, such as a strong academic reputation or an extensive network of alumni, then as long as those other effects are time-invariant, the fixed effects will absorb them. In the fixed-effects framework, the effect of aid and loans on retention the following year is being identified only by variation of those variables over time within a given schools. To the extent that students sort into colleges in ways that are (at least approximately) constant over the time period of the data, the fixed effects will prevent this sorting from biasing the estimates of the effect of aid and loans on retention.

However, there may be time-varying factors that also sort students into schools. In particular, during recessions, students are relatively likely to remain in college (because jobs are harder to come by) but colleges, especially public ones, have less money to spend on aid. If so, then there will be a negative correlation between aid and retention even in the absence of any causal relationship between the variables. To address this, we also include period effects in the model:

$$Retention_{it+1} = \beta_0 + \beta_1 * Aid_{it} + \beta_2 * Loans_{it} + \beta_3 * X_{it} + \delta_i + \tau_t + \varepsilon_{it} \quad (3)$$

In this equation, the relationships between a college's aid and loans policies and its subsequent retention rate are identified only by variation among those variables that is idiosyncratic to both the school and the year. This could still create a bias if some common factor affected both the amount of aid and loans a school could offer in year t (but only that school) and also affected the retention rate of that school in year t+1 by some channel other than the effect of the aid and loans on the composition of the student body or the decisions of students to re-enroll for their second year. There may be such common factors. For example, a college made a substantial increase in spending on student support, or did other things that might alter its retention rate, it might have to fund those changes by reducing financial aid. Or if a school had a substantial income loss, it might have to cut both aid in a given year and in the subsequent year cut instructional spending or other things that would lower retention. However, most schools do not have substantial events of that type in most years, nor would it be common to fund them by substantially reducing financial aid spending. We believe that the inclusion of fixed and time effects will substantially reduce the endogeneity problem even if it does not completely eliminate it. If the results we get when we include fixed and period effects are consistent with the student-level literature, which has been able to do a better job of controlling for selection effects, then we can have some confidence that the endogeneity problem has been substantially reduced even if not eliminated entirely. Also, the change in coefficient estimates from including the fixed and time effects will give us a sense of the magnitude and direction of the selection effects.

We then estimate these models separately for various subgroups of the data set, testing for heterogeneity of responses for different types of schools. In particular we are interested in differences between selective schools (defined as those admitting 60% or fewer of applicants) which have some ability to reject applicants who they do not think are likely to persist, and non-selective schools who are more likely to accept marginal applicants into their student body.

Data come from the Integrated Postsecondary Education Data System (IPEDS) database, provided by the National Center for Education Statistics (NCES). We use a nine-year panel from 2008 to 2016. Retention rates are the rate for the following year, so those are taken from 2009 to 2017 and merged with other variables from the previous year. We use data on all four-year institutions in the database; we use 1292 institutions in the regressions.

Our dependent variable is the institution's first-year retention rate, measured as the percentage of students who returned for their second year. We also include the college's admission rate, yield rate, SAT score, student-faculty ratio, and four and six year graduation rates as measures of selectivity, attractiveness, and prior history of completion. Our key financial variables are the percentage of students receiving aid from the college and the average amount of aid that recipients get, and the percentage of students with loans and the average amount that students with loans borrow. Unfortunately the aid variable includes both need-based aid and merit aid; IPEDS does not distinguish between the two types of aid, so we cannot either. We also include the percent of students receiving Pell grants as an indication of outside aid to high-need students, and tuition and fees as a measure of the college's financial requirements. Last, we include number of students and number of undergraduates, in logs, to control for possible scale effects. The means and standard deviations of all variables are found in Table 1.

Section 4- Results

We start by estimating our basic equation on the whole sample, first pooled, then adding fixed effects, then period effects. The equation is:

$$\text{Retention}_{it+1} = \beta_0 + \beta_1*\text{PctAid}_{it} + \beta_2*\text{AmountAid}_{it} + \beta_3*\text{PctLoans}_{it} + \beta_4*\text{AmountLoans}_{it} +$$
$$\beta_5*\text{PctPell}_{it} + \beta_6*\text{TuitFees}_{it} + \beta_7*\text{SFRation}_{it} + \beta_8*\log(\text{UGrads})_{it} + \beta_9*\log(\text{Enroll})_{it} +$$
$$\beta_{10}*\text{SAT75th}_{it} + \beta_{11}*\text{Grad6}_{it} + \beta_{12}*\text{Grad4}_{it} + \beta_{13}*\text{AdmitRate}_{it} + \beta_{14}*\text{Yield}_{it} + \varepsilon_{it} \qquad (4)$$

Results are shown in Table 2. Column 1 shows results with no effects; column 2 adds the institution fixed effects; column 3 includes both institution and period fixed effects.

On the financial variables, the pooled model shows that both a higher number of students receiving aid, and a higher amount of aid per student, both reduce first-year retention. However, when fixed effects are used, the percent of students receiving aid has a positive significant effect, and the amount of aid has no effect. Adding the period effects does not change the results. This is consistent with a model in which high-need students are more likely to select into schools with relatively low retention rates. However, including institutional fixed effects controls for these effects, and shows, consistent with the student-level literature, that receiving aid increases retention rates. The effect of the amount of aid is positive but not significant, which may be a result of relatively low variation in the amount of aid within a given institution. This would be true if institutions that give extra aid in a particular year do so by giving aid to more students, rather than by giving more aid to the same students.

Having more students with loans also seems to reduce retention rates; the amount of loans per student is not significant though its point estimate is also negative. Adding institution fixed effects produces a positive effect for amount of loans but no effect for percent loans; and adding period effects eliminates all effects. This is consistent with a model in which students take on more loans to go to college when the job market is poor, and are also more likely to remain in college due to the poor employment alternatives. This creates a positive selection correlation between loans and retention, which is eliminated when period effects are used. It is also consistent with the student-level literature which finds loans having little effect on retention.

Percentage of students that are Pell eligible, by contrast, has a positive effect on retention in the pooled model that becomes negative when fixed effects are included, and is not changed by adding the period effects. The difference between Pell grants and institutional aid is that Pell grants can be used by the student at any college, so they do not influence choice of college. Instead, colleges that have high number of Pell recipients have other characteristics that increase retention (which attract the Pell recipients) but when these effects are controlled for, the results show that high need students are less likely to persist. This difference between this and the finding for institutional aid may be because institutional aid recipients are not necessarily very needy (merit aid recipients may not be needy at all) but Pell recipients necessarily are from low-income backgrounds.

As for other variables: Schools with students with higher SAT scores consistently have better retention regardless of effects treatment. There is a consistent negative effect of number of undergrads but a positive effect of total enrollment, which suggests that having large number of graduate students on campus helps retention, perhaps because they contribute to teaching. Most of the other variables are significant in the pooled regression but not in the other two, suggesting that their effects are due to correlation with unobserved heterogeneity of schools and not causal. This is consistent with other papers in the literature that find including fixed effects tends to reduce the significance of institution characteristics.

These results assume that the effects of aid and loans on retention are the same for all schools. The many findings of heterogeneous effects in the student-level literature suggest that the same might be true of colleges; different institutions may see different effects of changing their aid policy because their student mixes are different. In particular, we check to see if selective schools, which can turn down applicants they do not think likely to succeed and hence have a stronger student body, may have different results from policy changes than less selective schools, who may gain more marginal students if they make enrollment more attractive.

To do this, we re-estimate equation (4) on the subsamples of selective schools (defined by admission rates below 60%) and less selective schools. We eliminate variables that are not significant when fixed effects are included; the variables eliminated are not the same in the two subsamples. Results are found in Table 3. The amount of aid and the amount of loans are not significant in the whole sample or in either subsamples; SAT scores increase retention in the whole sample and both subsamples. All the other variables are significant in only one of the two subsamples; there is considerable difference between what explains retention for selective schools and what explains it for less selective schools.

Giving students more aid increases retention, but only at selective schools; there is no significant effect at less selective schools. The student level literature has found that aid is most effective for high-need students; selective schools may be doing a better job of directing aid to students with high need and the ability to use it effectively. Conversely, loans have a significant negative effect on retention only at less selective schools, not at selective schools. This is consistent with loans having a stronger negative effect on students from lower income families who also have a harder time securing admission to selective schools. Similarly, higher percentage of Pell grant recipients and higher tuitions and fees have a negative effect on retention only at less selective schools, where there are likely to be more marginal students. Higher student-faculty ratios increase retention at less selective schools. Conversely, scale effects matter only at selective schools.

From a school policy perspective, the effects of financial policies are different at the two types of schools, probably because of student-level heterogeneity and different mixes of students at different types of institutions. In particular, at selective schools, offering more aid to students can improve retention rates, but this does not appear to happen at less selective schools. Conversely, selective schools need not worry about increased debt of their students affecting their retention rates, but this is very important for less selective schools. Administrators looking to increase retention rates at their own institutions need to think carefully about the precise mix of students they have in their student bodies

and how financial changes will affect both the students they already have, and the types of students they might attract (or lose) as a result of such changes.

Section 5 – Conclusions

Whether a school can use financial aid policies to affect its retention rate depends on what type of school it is and what types of students it has in its student body. Changing its aid policies will both affect the results for the students it already has, and change the mix of students who attend. We examine the relationship between institutional aid and retention rates with a panel data set on 1292 four-year colleges in the US, using fixed and period effects to address selection problems. We find that increased institutional aid increases retention rates at selective schools, but not at less selective schools. High numbers of students with loans reduces retention at less selective schools but not at selective schools. Even at selective schools the aid effect is not large; increasing the number of students receiving aid by 5% would increase retention by only about a 0.1%, and similarly, 5% more students using loans would reduce retention by about 0.1%. Thus, financial aid decisions, while important for individual students, are unlikely to have major effects on aggregate retention for institutions.

We find that the heterogeneity of student responses to aid and loans is reflected in heterogeneity of institutional effects on retention, with many significant asymmetries between selective and less selective schools. There are no simple and accurate statements about how student financing affects an institution's retention; the effects depend on the mix of students a school has, and on how changing financial policies will affect that mix. Institutions that are contemplating changes to their aid and admissions policies will need to look carefully at their individual circumstances to understand what effects those changes will have on their retention rates.

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Table 1: Means and standard deviations of variables

Variable	Mean	Std. Dev.	Min	Max	Units
Retention	76.630	11.098	19	100	Percent
AmntAid	10.771	7.767	0.07	47.043	$ thousands
PercentAid	71.281	28.533	0	100	Percent
AmountLoans	6.837	1.719	0.2	20.824	$ thousands
PercentLoans	63.025	19.436	0	100	Percent
PercentPell	36.138	16.266	0	99	Percent
TuitFeesOut	24.771	9.257	0.866	55.056	$ thousands
SFRatio	14.717	4.379	3	134	students per faculty
logUGrads	8.104	1.066	4.564	11.147	
logEnroll	8.175	1.104	4.990	11.261	
SAT75score	1170.094	138.262	776	1600	points
GradRate6	55.827	17.629	1	98	Percent
GradRate4	39.140	21.094	1	93	Percent
AdmitRate	0.643	0.186	0.048	1	Fraction
Yield	0.335	0.145	0.042	1	Fraction
Year	2012.112	2.520	2008	2016	Year

Table 2. Results of basic equation, full sample, pooled, fixed effects, and time effects

Variable	Pooled	Fixed effects	Fixed and period effects
AmountAid	**-0.0738**	0.0387	-0.0020
	(0.0175)	(0.0281)	0.0284
PercentAid	**-0.0210**	**0.0242**	**0.0141**
	(0.0029)	(0.0053)	0.0054
AmountLoans	-0.0162	**0.0836**	-0.0047
	(0.0403)	(0.0411)	0.0425
PercentLoans	**-0.0560**	-0.0013	-0.0020
	(0.0045)	(0.0064)	0.0064
PercentPell	**0.0155**	**-0.0284**	**-0.0474**
	(0.0057)	(0.0087)	0.0098
TuitFeesOut	**0.0841**	**0.0948**	-0.0483
	(0.0154)	(0.0246)	0.0312
SFRatio	-0.0112	0.0374	**0.0614**
	(0.0188)	(0.0238)	0.0238
logUGrads	-0.0951	**-1.9393**	**-2.3753**
	(0.1966)	(0.7033)	0.7007
logEnroll	**1.3501**	***1.3463***	***1.3649***
	(0.1892)	(0.7712)	0.7693
SATsum75score	**0.0142**	**0.0095**	**0.0102**
	(0.0009)	(0.0012)	0.0012
GradRate6	**0.4129**	0.0016	-0.0042
	(0.0086)	(0.0097)	0.0097
GradRate4	**-0.0201**	0.0022	-0.0003
	(0.0071)	(0.0093)	0.0092
AdmitRate	**0.8077**	-0.2036	-0.0069
	(0.3725)	(0.4701)	0.4692
Yield	**-2.4224**	**-1.6813**	-0.4001
	(0.4689)	(0.6265)	0.6441
Intercept	**31.1919**	**66.2491**	**72.9290**
	(1.3188)	(3.7367)	3.8358
Fixed effects?	No	Yes	Yes
Period effects?	No	No	Yes
N	9557	9557	9557

Standard errors in parentheses. Estimates in **bold** are significant at the 5% level; ***bold italics*** are significant at the 10% level but not 5%.

Table 3. Subsample regressions: selective and less selective schools

Variable	All schools	Selective	Less selective
AmountAid	-0.0024	-0.0036	0.0365
	(0.0282)	(0.0390)	(0.0374)
	-0.09	-0.09	0.98
PercentAid	**0.0140**	**0.0198**	0.0111
	(0.0054)	(0.0086)	(0.0072)
	2.59	2.3	1.54
AmountLoans	-0.0058	-0.0560	-0.0331
	(0.0425)	(0.0721)	(0.0533)
	-0.14	-0.78	-0.62
PercentLoans	-0.0020	0.0146	**-0.0201**
	(0.0064)	(0.0104)	(0.0080)
	-0.31	1.41	-2.51
PercentPell	**-0.0474**		**-0.0620**
	(0.0098)		(0.0123)
	-4.84		-5.03
TuitFeesOut	-0.0494		**-0.1183**
	(0.0311)		(0.0412)
	-1.59		-2.87
SFRatio	**0.0556**		**0.0850**
	(0.0235)		(0.0305)
	2.37		2.78
logUGrads	-2.4087	**-4.2223**	
	(0.7001)	(1.1103)	
	-3.44	-3.8	
logEnroll	***1.4250***	**2.8800**	
	(0.7651)	(1.3028)	
	1.86	2.21	
SATsum75score	**0.0102**	**0.0082**	**0.0109**
	(0.0012)	(0.0021)	(0.0015)
	8.8	3.81	7.51
Intercept	**72.4160**	**77.4587**	**65.1426**
	(3.8032)	(7.4730)	(2.0743)
	19.04	10.37	31.4
Fixed effects?	Y	Y	Y
Period effects?	Y	Y	Y
N	9558	3409	6156

Standard errors in parentheses. T-statistics below standard errors. Estimates in **bold** are significant at the 5% level; ***bold italics*** are significant at the 10% level but not 5%.