Self-Control Induced Debt Aversion: Evidence from Interest-Free Student Loans *

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Abstract

This paper uses insights from behavioral economics to offer an explanation for a particularly surprising borrowing phenomenon: Nearly 20 percent of undergraduate students who are offered interest-free loans turn them down. We present a formal model of the financial aid process emphasizing that a rational agent would not reject interest-free student loans because doing so requires foregoing a significant government subsidy. A student with time-inconsistent preferences, however, may optimally choose to turn down subsidized loans to avoid excessive consumption during school. Thus, debt-averse behavior arises even among consumers who have no direct distaste for debt. Using the 2003-2004 wave of the National Post-Secondary Student Aid Study (NPSAS), we investigate students' financial aid situations and subsidized loan take-up decisions. We exploit an institutional detail of the financial aid process to identify a group of students who should be especially vulnerable to self-control problems. Our results suggest that consumers choose to limit their liquidity in economically meaningful situations, consistent with the predictions of the behavioral model.

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> "Although it may be tempting to use student loan money for college football tickets, midnight pizza while cramming for finals, or a Florida spring break trip, try to resist this lure....If you receive a larger loan than you need, the temptation to spend the extra money on "fun" things can be hard or even impossible to resist."
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> -Dara Duguay, "Spend Student Loans Only on College Expenses"
> youngmoney.com (money management website for young adults), 2003

I Introduction

This paper uses insights from behavioral economics to explain a particularly bizarre borrowing phenomenon: Nearly 20 percent of undergraduate students who are offered interest-free loans turn them down. The students we observe making these choices are not atypical. Our sample consists of full-time students enrolled at public or private non-profit four-year institutions who demonstrated sufficient financial need to qualify for aid sponsored by the federal government.

There are three principal reasons we should be surprised that one-fifth of eligible students turn down subsidized loans. First, these loans do not accrue interest while students are enrolled in school. These interest payments represent a direct transfer to the student, and the amount is non-trivial. If a student were to borrow the maximum each year, with an interest rate of four percent, the government subsidy would be worth more than $1500. The "free money" aspect of below-market interest rates on student loans has long been a part of conventional economic wisdom. One classic undergraduate textbook explains the benefits of a $1000 interest-free loan as follows: "You could at least take the money and put it in a savings bank, where you will earn at least 4 percent per year. Each year you can draw out the $40 interest and throw a big party. Finally...you can draw out the $1,000, plus the last year's interest; repay the $1,000; and have $40 for a last party" (Alchian and Allen 1964). We are unaware, however, of any work that has tried to systematically understand why students do not take advantage of this potential $1500 "gift" from the government.

Seeing students turn down interest-free loans is also surprising because government-sponsored loans help to make increasingly expensive educational costs more affordable. During a period when the return to higher education has dramatically increased, the rising costs of an undergraduate education have far outpaced the increase in the availability of grants and scholarships (Hoxby and Long 1999, Dynarski 2002, Avery and Hoxby 2003). In 1980, 41 percent of financial aid was provided through loans. Today, loans make up 59 percent of federal aid (Douthat 2005) and 29 percent of students borrow to finance their education (National Center for Educational Statistics 2000, National Center for Educational Statistics 2002). In the absence of these programs, students would find it costly to borrow against their future earnings due to informational asymmetries between students and private lenders. The federal government has recognized this potential market failure and offers students grants and loans through large-scale programs which provided 90 billion dollars in total aid during the 2004-2005 school year (The College Board 2005).[1] By rejecting their government-sponsored loans, students are effectively choosing to borrow at a significantly higher cost, if at all.

Finally, student aid offers are designed based on the presumption that students will accept all of their need-based aid. Students must actively reduce or reject any amount they do not wish to borrow. In fact, if a student has borrowed before, she needs to do nothing at all to receive the full amount of any subsidized loan awarded by her financial aid office. As other researchers have shown, there is a significant mental barrier to making decisions that deviate from the default, known as "default bias" (c.f. Choi, Laibson, Madrian and Metrick 2004). In the absence of competing forces, therefore, students should rarely deviate from the

[1]Several researchers have also recognized the importance of the changing nature of the financial aid system. One line of previous work focuses on the characteristics of students who default on their loans (Knapp and Seaks 1992, Dynarski 1994). Other authors examine whether the size and type of student loans affect whether and where students enroll (McPherson and Schapiro 1991, van der Klaauw 2002, Kane 2003, Epple, Romano and Sieg 2003). Field (2004) investigates an NYU law school experiment and finds that the decision to enter public-interest law in exchange for a lower debt burden is sensitive to the timing of incurring debt. See also Orfield (1992) for a summary of financial aid literature and the policy debate which led to the expansion of student loans in the 1990s.

default of accepting all of their need-based aid, including interest-free loans.

While the benefits of subsidized student loans are seemingly unambiguous, borrowing does increase a student's short-term liquidity. As the quotation at the beginning of this section suggests, interest-free loans are a double-edged sword in the hands of an impatient consumer. Despite the fact that these loans make it possible to smooth consumption over time, having such a large amount of liquidity can tempt an impatient consumer to overspend, i.e. consume more out of current income than a rational agent would desire.

We formalize this argument by modeling a college student choosing how much to borrow for her education. We show that a rational agent would not turn down interest-free student loans because doing so requires foregoing a significant government subsidy in addition to limiting future liquidity. We then prove that a student with time-inconsistent preferences may optimally choose to turn down subsidized loans as a commitment device to control her impatient future self. Time-inconsistent preferences have become increasingly popular modeling tools, especially because they nest standard rational-actor models as a special case.[2] Furthermore, they often provide an economic rationale for differences in behavior without relying on assumptions about underlying tastes.[3] In this application, debt-averse behavior emerges as the best choice a forward-thinking, or "sophisticated," student can make knowing that in the following period she will be tempted to overspend.

While our model presents a plausible explanation for students' borrowing behavior, there are other alternative reasons why a potential borrower could make the "wrong" decision. Certainly some students will reject the loan because they do not understand how the subsidy

[2]For a full discussion of how hyperbolic discounting was originally modeled, see (Laibson 1997, O'Donoghue and Rabin 1999). The economic theory of self-control began with Thaler and Shefrin (1981), followed by Loewenstein and co-authors (Loewenstein and Thaler 1989, Prelec and Loewenstein 1998).

[3]For a model of this variety, see Korniotis (2004), who allows for both a direct utility gain from savings and a direct utility cost of borrowing. While other researchers have recognized the relationship between self-control and debt aversion (Wertenbroch, Soman and Nunes 2001), we are unaware of other work that describes self-control induced debt-averse behavior.

works or do not analyze the decision closely enough.[4] Apart from these information problems, some students may reject their loans because of the hassle borrowing creates, such as having to keep track of the documents associated with a loan or being required to make a payment each month after graduation.[5] Still others may reject the loans because they have acquired an anti-debt ethic such that owing money to someone carries a psychological cost.[6] Because any of these factors can potentially explain the significant fraction of students who turn down their interest-free loans, we cannot simply interpret high rejection rates as evidence of a self-control motive.

To determine whether self-control plays an important role, the ideal quasi-experimental setting would fix the benefits of borrowing while varying students' exposure to increased liquidity. A feature of financial aid disbursement does *exactly* this: Although the value of the subsidy is unchanged, needy on-campus students have their loans automatically applied to their student accounts while needy off-campus students receive a portion of their aid in cash. Comparing the take-up rates of these two groups provides us with a means to test the implications of our model.

However, if students who reject their loans for other reasons tend to live in off-campus housing, this comparison may incorrectly attribute differences in take-up rates to differences in liquidity. To address these concerns, we form a difference-in-differences estimator, using students whose liquidity is unaffected by their choice of housing as a counterfactual. For these students, any loan funds will be applied directly to their tuition bill regardless of their housing location. Importantly, each member of the counterfactual group is also eligible for

[4]See Dynarski and Scott-Clayton (2006) for a discussion of the sometimes overwhelming complexity of the financial aid system. Students may also falsely believe that borrowing through student loan programs will hurt their credit score. In fact, each month while the student is in school, the lender reports that the loan account is being paid as agreed. This reporting helps to establish a solid credit history.

[5]Another potential reason to turn down student loans is that they are not dischargeable under current bankruptcy law.

[6]Survey research in the United Kingdom finds that students who are uncomfortable with debt are less likely to pursue a college education, although they do not attempt to determine the source of this discomfort (Callender and Jackson 2005).

the maximum subsidized loan. If students reject their loans to avoid excess liquidity, the difference between on- and off-campus rejection rates should be much larger for the group who potentially receive their loans in cash.

Our estimates from the 2003-2004 National Post-Secondary Student Aid Survey support a self-control explanation: Students who would have received cash from their loans turn down the subsidized loan seven percentage points more frequently than similarly needy students who live on-campus. Importantly, there is no significant difference in rejection rates across housing locations for students who would not receive cash regardless of where they live. As a further test, we estimate the effect of liquidity on take-up using the university's dormitory capacity (number of beds per student) as an instrument for the housing location decision. The instrumental variables specification continues to show a differential willingness to borrow across housing locations. These results are difficult to explain without self-control concerns affecting students' decisions.

We provide evidence that consumers choose to limit their available choices in a natural setting, i.e. one not generated by the researcher. Our results also reveal that some consumers are willing to pay a substantial amount of money in order restrict their future decisions.[7] These two features distinguish this study as particularly compelling evidence for the existence and importance of time-inconsistent preferences.

In the next section, we discuss the mechanics of financial aid and emphasize the case when impatient individuals might be most wary of taking out loans. In section III, we present a formal model of the financial aid process and show that in spite of the benefits, a student aware of her time-inconsistent preferences may rationally reject an interest-free loan. In section IV, we establish the phenomenon empirically, test the additional predictions suggested by the model, and address selection into off-campus housing. Section V concludes

[7]Most field experiments are explicitly designed to hold constant any differences between two choices except for the level of commitment. For example, Ashraf, Karlan and Yin (2006) are careful to note the equal interest rates paid in the experimental restricted bank account and the unrestricted account.

and discusses potential policy implications.

II Overview of the Financial Aid Process

This section presents a sketch of the process that determines the financial aid a student receives. Our discussion draws heavily from the Federal Student Aid Handbook published by the Department of Education for use by financial aid professionals (Department of Education 2003).

There are two primary components that determine a student's eligibility for all federal financial aid: a measure of the student's ability to pay, and the costs the student faces at the school where she is enrolled. A student interested in need-based financial aid must first file a Free Application for Federal Student Aid (FAFSA), which collects information on the student and her parents, including the value of their assets and their income(s) from the previous year.[8] These data are then entered into a federal formula that calculates the Expected Family Contribution (EFC), the dollar amount a family could reasonably be expected to pay for the student's educational costs in the upcoming school year.

In order to qualify for (need-based) aid, a student must have educational expenses in excess of her EFC.[9] Based on this level of need, the student may be eligible for grant money from the federal or state government or from the institution the student attends. The student may also receive merit-based institutional aid or private scholarships.[10]

If these grants and scholarships do not cover the student's entire need, she will be eligible for subsidized Stafford loans.[11] The federal government pays the interest on these loans as

[8]Individuals who have previously been convicted of drug-related felonies, or males over the age of 18 who refuse to register for Selective Service, are generally not eligible for federal financial aid.

[9]The definition of educational expenses is quite broad and includes tuition and fees, room and board, books and supplies, transportation, and other miscellaneous expenses.

[10]The student may also receive a work-study award which is a promise from the government to pay a portion of the student's wages if she obtains employment, thus making her more attractive to potential employers. Work-Study funds are usually limited to on-campus jobs or community service off-campus jobs.

[11]Students with exceptional need are also given access to Perkins loans. These loans are administered

long as the student is enrolled at least half-time, and for a period of six months after the student is no longer enrolled. Students can borrow through this program up to a grade-level specific cap: $2,625 for first-year students, $3,500 for second-year students and $5,500 for upper-year students. A student is thus eligible for the maximum loan amount when the difference between her total costs and the sum of the EFC and other grants is greater than the loan limit for her grade level.

After filing a FAFSA, the student receives an award letter from the college or university she is attending (or from the schools to which she applied if she is a first-time student).[12] The letter contains an itemized list of the amounts and types of aid the student has been awarded. Although students maintain the right to reject individual types of aid and even to change individual amounts if they desire, the default choice is to accept the amount of the interest-free loan awarded by the financial aid office.[13] Thus students must intentionally choose not to receive subsidized loans for which they are qualified.

Our identification relies on a feature of the loan disbursement process. Financial aid funds must first be applied to expenses billed directly by the school, including tuition and fees, dorm room rental, and cafeteria meal plans. Any aid funding in excess of the school's direct charges is then distributed to the student through a refund check. Because aid eligibility is determined based on the entire student budget and not just tuition, these refund checks are not uncommon.

Figure I presents the combination of circumstances required to be eligible for a refund check. Students living off-campus receive refund checks earmarked for room and board

by each college or university, and are also interest-free while the student is in school. Students who enter certain fields in the public interest may have these loans forgiven. Because the Perkins loan program affects far fewer students than the Stafford program, we choose to focus our attention on the larger program.

[12]Traditionally, this letter is sent to the student at her permanent address, although increasingly award notifications are sent electronically.

[13]In order to receive their loans, first-time borrowers must sign a Master Promissory Note and receive loan counseling related to borrowing through student loans. A student can currently fulfill both of these requirements online. In subsequent years, the student does not need to take any additional action beyond the normal application process to receive the entire amount of loan funds she has been offered.

whenever the sum of their financial aid funds exceeds the cost of tuition and fees. All else equal, students who attend schools with lower tuition or who receive larger grant awards are more likely to be eligible for refunds. On-campus students will never have direct control over the money because it is automatically applied to their educational expenses, including room and board when applicable. Thus, the disbursement process creates variation in the short-term liquidity to which students are exposed, even though the financial benefits of the loan are the same.

III Theoretical Model

With these institutional details in mind, we develop an intrapersonal model of the decision facing an enrolled student who receives an aid award that includes a subsidized Stafford loan. We begin by demonstrating that rejecting the loan cannot be the optimal decision for a student with stable, time-invariant preferences. We then demonstrate that rejecting a Stafford loan, and thus foregoing the government subsidy, can be utility improving if doing so serves as a constraint on the behavior of an impatient future self.

We model college students as living for three periods: prior to attendance, during school, and post-graduation. In the initial period, the student is offered a financial aid package, one component of which is a subsidized loan in the amount of $\bar{S}$. She decides whether to accept or reject the loan, and once she has chosen, no future actor can alter this decision.[14] We refer to the actor who makes these decisions as the "Borrower."

In the next period, during school, the student takes her previous loan-taking decisions as given, receives financial aid and other exogenous income (e.g. parental support), and pays tuition. We denote income available after paying tuition as I_2. The student then decides how

[14]We choose to model the choice as binary, despite the fact that students can choose to borrow only a fraction of the amount they are offered. Empirically, only a negligible fraction of students choose to reduce their loan. The structure of the award letter also frames the choice as an all-or-none decision, with the reduction option buried in the fine print.

much to consume while in school, c_2, and how much to save until the final period. Savings earn a (nominal) interest rate of r per period. We assume that, other than her access to student loans, the student cannot access alternative credit markets.[15] We refer to the actor who makes these decisions as the "Student."

In the final period, post-graduation, the student receives income I_3, repays the principal on any loan she has accepted (the government pays the interest), and she consumes the remainder of her income. We refer to this actor as the "Graduate."

The decision whether to borrow is equivalent to a choice between two in-school budget sets, shown in Figure II.[16] If the Borrower chooses to reject the loan, the Student will be faced with the budget set AB. Choosing to borrow provides the Student with budget set CD. Notice that borrowing has two effects on the choice set available to the Student. First, the loan relaxes the Student's credit constraint, allowing her to consume more than I_2 while in school by borrowing against future income, I_3. Additionally, the government pays the interest that would normally accrue on the loan, $r\bar{S}$. This increase in lifetime income results in a vertical shift upward in the budget set.

Proposition 1 *The rational student with time-consistent, locally non-satiated preferences must prefer to accept the interest-free loan.*

Proof The choice set available without borrowing is a proper subset of the choice set induced by taking the loan. Thus, the interest-free loan is strictly preferred if local non-satiation holds.

[15] While allowing for students to borrow from higher-cost private lenders would add a degree of realism, the intuition underlying this section would be unchanged. We maintain the assumption for expositional simplicity.

[16] For a more general discussion of how self-control concerns cause consumers to prefer a subset of choices to the entire set, see (Gul and Pesendorfer 2001).

A Time-inconsistent preferences

We model the time-inconsistency of the student's preferences in the following quasi-hyperbolic way. The Borrower discounts utility between the in-school period and the post-graduation period using discount factor δ, based on the market rate of interest so that $\delta = \frac{1}{1+r}$ (set for convenience). In contrast, she knows that during the in-school period the Student will discount post-graduation utility using a smaller factor, $\beta\delta$ with $0 \leq \beta \leq 1$. The within-period utility function $u(c_t)$ is increasing and concave, and takes consumption during the current period as its only argument.

In deciding whether to reject the loan, the Borrower knows that the Student solves the following problem:

$$\max_{c_2,c_3} u(c_2) + \beta\delta u(c_3)$$

subject to

$$c_2 \leq I_2 + S \tag{1}$$

$$c_2(1+r) + c_3 = I_2(1+r) + I_3 + rS \tag{2}$$

The Borrower's binary choice, therefore, is whether to set S to $\bar{S}$ (accept the loan) or instead to set it to zero (reject the loan). The tension results from the fact that in order to take advantage of the government interest payment $r\bar{S}$, the Borrower must increase the liquidity available to the Student who has different preferences over consumption in periods 2 and 3.

Before characterizing the optimal borrowing behavior, we first determine situations in which the Borrower should always accept the loan.

Proposition 2 *Rejecting the loan can only be optimal if doing so causes $c_2 \leq I_2$ to hold with equality.*

Proof See Appendix.

Proposition 3 *If* $u(I_2 + \bar{S}) + \delta u(I_3 - \bar{S}) > u(I_2) + \delta u(I_3)$*, the Borrower will not reject the loan for self-control reasons.*

Proof See Appendix.

The Borrower rejects the loan in order to limit the Student's consumption to I_2. If accepting the loan would not increase in-school consumption beyond I_2, she should accept the loan and take advantage of the government interest payment. Similarly, if the Borrower prefers shifting $\bar{S}$ in consumption from the post-graduation period to the in-school period over consuming out of current income in both periods, she should always accept the loan. This could occur, for example, if I_3 were significantly higher than I_2.[17]

We can now characterize the decision rule that determines whether the Borrower accepts or rejects the loan.

Proposition 4 *If* $u(I_2 + \bar{S}) + \delta u(I_3 - \bar{S}) < u(I_2) + \delta u(I_3)$*, there exists a unique* $\beta^* \in [0, 1]$ *such that* $u(c_2^*(\beta^*)) + \delta u(c_3^*(\beta^*)) = u(I_2) + \delta u(I_3)$*. The Borrower rejects the loan optimally iff* $\beta < \beta^*$*.*

Proof See Appendix.

When the Student is sufficiently impatient, the Borrower will reject the subsidized loan. Figure III demonstrates this cutoff rule and how β^* is determined. The solid line shows the utility the Borrower receives if she accepts the loan and allows the Student to allocate consumption according to her preferences. The dotted line shows the utility the Borrower receives if she rejects the loan and constrains the Student to consume out of current income.

[17] There are two factors that, in practice, attenuate the gap between I_2 and I_3. First, parental financial support after college is often significantly lower than while in school. Additionally, student loans must be repaid during the early years of a student's earnings trajectory.

When the Student is relatively patient (β relatively close to 1), it is not worth discarding the government subsidy to change her consumption behavior. The Borrower allows the Student access to the loan funds even though she knows the Student will consume more than she would like her to. For a sufficiently impatient future actor, however, rejecting the loan can be utility improving. In this case, the ability to prevent the Student from overindulging during school outweighs the loss of the government interest payment.

While we have described the model in the context of a within-person principal/agent problem rather than as a parent/child problem, the latter problem would have much the same flavor. In order to address concerns over parental influences, we will directly examine parental financial support data in the empirical section. Nonetheless, the primary point of this section is that seemingly irrational aversion to debt can be a rational response to a difference in the discount rates between the economic actor who makes the borrowing decision and the actor who makes the consumption decision.

IV Empirical Results

A Data

We use the 2003-2004 National Post-Secondary Student Aid Study (NPSAS) to investigate the predictions of the self-control model. This unique data source combines administrative financial aid data from the school and from the National Student Loan Data System (NSLDS), information submitted by students and parents on their aid applications, and survey responses from the students during the school year.[18] In addition, the NPSAS contains detailed school characteristics and individual student information, such as GPA, SAT scores,

[18]One additional advantage of the NPSAS is that the financial aid decisions of the students are made prior to being selected for the survey. There is no sense that they are being "watched" while choosing to accept or reject loans. Thus, there is no additional pressure to make the "right" decision as a result of being in the study.

school location and selectivity, and demographic characteristics.[19]

To focus our analysis on the individuals toward whom the financial aid system is most directly targeted, we restrict our sample to full-time, full-year undergraduate students enrolled at one four-year public or private non-profit institution for a full academic year. The sample includes only those students who applied for financial aid and whose unmet need exceeded the subsidized loan maximum.[20] Therefore, within a grade level, all students are eligible for the same interest-free loan amount.[21] These students are usually those considered "representative" needy college students, and those most likely to be burdened with loans upon completion of college.

The fact that nearly 20 percent of our (already significantly restricted) sample does not accept interest-free loans is striking. Table I provides a descriptive look at the data, emphasizing that a significant fraction of students in each demographic group do not take the loan.[22] The most dramatic differences in take-up rates are by race, where Hispanic and Asian students are nearly twice as likely to turn down the loan as white and African-

[19]We use the restricted version of the data for our analysis. A confidential data license agreement with NCES is required in order to obtain these data.

[20]Due to concerns regarding the quality of some responses in the NPSAS, we restrict our dataset further to exclude individuals whose values of student budget and Stafford loan amount were imputed. For similar accuracy concerns with the same variables, we also excluded individuals who were independent, students who lived at home with their parents, and students who were not born in the United States. Without these restrictions we risk making significant classification errors.

[21]Note that this sampling frame requires greater unmet need for upperclassmen to be included in the sample than for freshmen and sophomores. We have rerun our analysis using only students who have $5,500 in unmet need regardless of grade level, and the results are qualitatively unchanged.

[22]We refer to students who applied for financial aid and who were determined to be eligible for subsidized loans according to the federal formula but who do not receive any loan funds as having rejected the loan. Because this measure is all that our data allow, we were concerned that a significant fraction of this 20 percent might be the result of measurement error where we had incorrectly classified a student as eligible. We asked a financial aid administrator at the University of Michigan whether this number agreed with administrative data. She informed us that 18 percent of Stafford borrowers actively turned down their subsidized loans by logging on to the financial aid system and canceling the loans. Another significant fraction "passively" rejected the loans by failing to return the necessary paperwork for disbursal. This communication suggests that measurement error in eligibility does not comprise a large component of this descriptive statistic. Because we cannot distinguish between active and passive rejection in the data, we refer to all students who applied for aid and who qualified for loans but did not receive the loan as having turned it down.

American students. This could be due to persistent differences in distaste for debt by culture, differences in self-control, information, or other factors. These results serve as a reminder that while self-control may be an important determinant of the borrowing decision, it is certainly not the only one. Racial differences in loan rejection are not the emphasis of this paper; our preferred specifications will include indicators for race, so the differences in take-up will be within racial groups.

Students with high unmet need are much more likely to take the loan. This difference confirms that, on average, the loans are being used by those who need them most. Students from families that earn less than $50,000, roughly the median in our sample, are actually more likely to turn down the loan than are students from wealthier families. Recall, however, that these families are also likely to be eligible for larger grant awards and scholarships. Because family income and need are negatively related as a result of the federal aid formula, it is difficult to determine whether either factor independently drives this result. More generally, this table reveals that students of all types reject the interest-free loans at non-trivial rates.

B Evidence for a Self-Control Explanation

Less than full participation in the interest-free loan program is consistent with a number of hypotheses, including taste-based debt aversion, non-pecuniary "hassle" costs of borrowing, or a lack of information. The self-control model presented in section 3 provides a behavioral economic reason for rejecting subsidized loans. Unlike the other explanations, this model generates an additional testable hypothesis: Students should be particularly unwilling to accept their loans when doing so would lead to a large increase in short-term liquidity.

Recall that some students living off-campus will receive financial aid funds earmarked for room and board in cash which they must manage over the course of the semester, while others have funds applied directly to their student account. If students are turning down

loans solely because they dislike debt or because they do not understand the benefits, the form in which the loan funds are disbursed should make no difference. In contrast, if the self-control explanation is an important factor in take-up decisions, we should see students especially reluctant to accept the loans if doing so results in a refund check.

One approach would be to compare take-up rates between on-campus and off-campus students whose loan funds pay for room and board. The results of this type of analysis are shown in the first column of Table II. Students who live off-campus are 9.0 percentage points less likely to accept their loans than are students in the same financial situation living on campus.

We are concerned, however, that living off-campus may be associated with greater loan rejection for reasons other than the "refund check" effect. To address this issue, we create a counterfactual using the difference in take-up rates between on-campus and off-campus students whose financial aid, including subsidized loans, does not exceed tuition. Students in the counterfactual sample are also eligible for the maximum subsidized loan amount (see Figure I). Assuming that any omitted factors affecting both housing choice and take-up are similarly distributed across these two financial aid situations, this specification perfectly controls for differences in take-up not related to the "refund check" effect.

The results of a basic difference-in-differences specification are presented in the second column of Table II. We estimate linear probability models of the form

$$y_i = \alpha_1(OFFCAMPUS)_i + \alpha_2(ROOMBOARD)_i + \alpha_3(OFFCAMPUS * ROOMBOARD)_i + X_i\beta + \nu_i.$$

The dependent variable is a dummy variable for whether a student accepted his/her interest-free loan (1=accept). The independent variables are indicators for residence (1=off-campus) and for whether loan funds, if accepted, would pay for room and board (1=yes).[23] The

[23]We limit the sample to students who live either in on-campus housing or off-campus, but not with their parents. Students who live with their parents are typically given a much smaller housing allowance than

interaction of these two variables creates an indicator for whether the loans are distributed in cash (1=refund check). The coefficient on this variable, α_3, is our primary parameter of interest and our measure of the effect of a potential increase in liquidity on loan take-up.[24]

After netting out any on/off-campus differences unrelated to increased liquidity, the resulting coefficient remains strongly negative at 8.6 percentage points (Column 2). Adding controls for race, gender and year in school (and thus indirectly for the amount of loan eligibility) in column 3 reduces this "refund check" effect only slightly, by a little more than one half of one percentage point. Importantly, we find little empirical evidence to support a selectivity argument as there is no significant difference in take-up between housing locations for those students whose loans pay only tuition.

These results provide strong evidence that liquidity concerns play a role in determining loan take-up decisions. There are certainly other factors affecting the borrowing choice. In particular, students with a smaller immediate need for funding (accepted loan funds cover more than tuition) are 6.7 percentage points less likely to accept the loan. Nonetheless, students with similar funding needs are an *additional* 7.9 percentage points less likely to take the loans when they would receive cash.

To address parental influences and potential differential parental financial support we include indicators for whether parents help pay tuition or housing expenses in column 4, our preferred specification. While students whose parents help pay housing expenses are less likely to take the loan, the "refund check" result remains even after including measures of parental assistance. Students who would be exposed to additional short-term liquidity are 7.3 percentage points less likely to take the loan.

students living off-campus independently, and thus it is more difficult to determine their eligibility.

[24]We have run linear probability models because our primary parameter of interest is the interaction term, which can be difficult to interpret in probit and other MLE models. Most of the variables we include are categorical, and, as a result, none of the predicted values are greater than one or below zero. We model the exposure to liquidity as a binary treatment primarily for ease of exposition. Regressions that include a continuous liquidity measure suggest that the effect may be larger for larger refund checks, but the results we present better capture the essential features of the aid disbursement process.

Table III presents a series of additional robustness checks on our main result. One alternative explanation for these results is that housing decisions and neediness are serving as proxies for other characteristics of the school the student attends. The NPSAS provides school-level measures of a broad range of characteristics, which we add to our preferred specification from Table II. Our main results are largely unchanged; the point estimate on the "refund check" effect falls by 1.1 percentage points but remains significant at the five percent level.

The second column of this table addresses the question of whether the "loan funds in cash" effect can best be interpreted as evidence for a self-control or a parental control explanation. We exclude school attributes but include a full battery of parental assistance measures and parental characteristics. The additional parental assistance measures are insignificant, and whether at least one parent has some college experience is insignificant as well. That our result still holds suggests that self-control concerns are independent of the role of parents, though a student's parents may still influence her take-up decision. As a further test, we re-ran our preferred specification separately on the sample of students who received parental assistance, and then using only those who did not, and generated nearly identical results.[25]

The third column addresses the issue of whether our results are driven by students with different abilities to understand the particulars of the program. We include the student's college GPA, as well as indicators for each of 12 NPSAS-defined college majors, including one category for "undecided". Students who have a higher college GPA are actually less likely to take the full loan, as shown in column 3. The addition of these variables does not significantly affect our estimates of interest.

Column 4 includes all of the controls from the previous columns at the same time. This "kitchen sink" specification is the most demanding test of the data. The parameter of inter-

[25] All results not reported in the tables but mentioned in the text are available from the authors upon request.

est, the coefficient on the variable for whether the loan funds would be distributed in cash, is -5.9 percentage points, and significant at the 10 percent level. Even when controlling for a multitude of possibly confounding factors, our results remain economically and statistically significant, and are consistent with a self-control explanation.

C Selection on observables and unobservables

The stability of the point estimates when controlling for a host of potentially confounding factors suggests that the distribution of these covariates is roughly equal across the four housing location/financial situation categories. Table IV investigates this balance directly. Students from all demographic types can be found in each category, usually in roughly the same proportions. Most of the demographic variation across these categories can be attributed exclusively to housing location or to financial situation, rather than to the "refund check" interaction. These results lend further credibility to the difference-in-differences specification.

There are a few cases, however, where demographic variables differed systematically by refund check status. To address the possibility that these compositional differences were behind our results, we reran our preferred specification (Table II, column 4) under a number of sample exclusions. First, we excluded each racial group one at a time. The coefficient estimates are largely unchanged, fluctuating by roughly one percentage point and maintaining statistical significance. Similarly, we repeated our analysis separately for each year in school, and the results were qualitatively unaffected. These robustness checks provide further evidence that variation in take-up across these groups is driven by exposure to different levels of liquidity.

According to standard arguments, the well-balanced observed covariates suggest plausible balance for any unobservable covariates as well (c.f. Altonji, Elder, and Taber, 2005).

Nevertheless, it is still possible that differential selection into off-campus housing based on omitted factors drives the difference-in-differences results. To address this concern, we ran instrumental variables (IV) regressions using the fraction of undergraduates that the student's school could place in on-campus housing as an instrument for living off-campus.[26] This variable is an excellent candidate for use as an instrument. Students who attend schools with smaller housing capacities are certainly more likely to live off-campus. Additionally, there is little reason to think that a school's housing capacity will directly affect borrowing decisions.[27]

Table V shows the results of the IV regressions for the sample that would receive their loans in cash if they borrowed and for the sample that would not. The instrument clearly meets the test for relevance with a first-stage F-statistic over one hundred. The effect on loan take-up from living off campus is much stronger among the eligible sample than among the ineligible sample, and the coefficient can be statistically distinguished from zero only for the refund-eligible group. These results suggest that, if anything, endogenous selection into off-campus housing *attenuates* the OLS estimates of the effect of receiving aid funds in cash.

This somewhat surprising finding can perhaps best be understood by considering which students are likely to contribute to each specification. Suppose that students who voluntarily live off-campus tend to come primarily from two groups. The first group consists of responsible young adults who want to live in their own apartments in order to take more control of the choices they make. They want to cook for themselves, choose their own furniture, and be more independent. The second group consists of students who want to escape the confines of the dorm so that they can throw bigger parties with less oversight from housing staff. Both of these groups are more likely to accept their loans, but for different reasons. Using the

[26]These data do not appear in the NPSAS files. We obtained the data from http://nces.ed.gov/ipeds/, and merged them into our dataset using the school identifiers.

[27]Housing capacity may be a factor in students' enrollment decisions, but our IV approach will be consistent unless this sorting is correlated with the take-up decision for reasons other than self-control.

notation from section III, the first group of students are more likely to have $\beta > \beta^*$. In other words, they have the capacity to manage their aid funds responsibly and are thus willing to borrow. The second group is likely to consist of naive hyperbolic discounters who borrow and spend even when rejecting their loans would have been utility improving.[28] Thus the sample that contributes to the OLS estimate of the average treatment effect (ATE) tends to underrepresent sophisticated hyperbolic discounters who turn the loans down for self-control reasons.

In contrast, the sample of students who are induced to live off-campus by their school's housing capacity should be more representative of the general student population. That the local average treatment effect (LATE) estimated by the IV regressions exceeds the ATE is no longer surprising. In fact, the IV results rule out the possibility that the OLS estimates are an artifact of selection into off-campus housing. More likely, selection biases the OLS coefficient toward zero. Taken together, the results in this section provide strong evidence that endogenous selection into off-campus housing does not artificially generate differential take-up rates by housing status.

D Evidence of Planning Ahead

Thus far we have presented evidence that students who would receive a part of their loan funding in cash are less likely to accept the loan. Viewed through the lens of the hyperbolic discounting model, these empirical results support the hypothesis that students are rejecting their loans as a commitment device against overspending. These results, however, provide no direct evidence that students are rejecting their loans as an optimal forward-looking strategy. Table VI presents two separate tests to determine whether students are indeed planning ahead to reject these loans.

[28] It is straightforward to show that students who do not anticipate their own impatience will also accept the entire loan for the same reason the rational student does. That their impatience leads to overconsumption is a standard result, and is also easily shown.

When filing a FAFSA in the spring, aid applicants must report where they expect to live in the fall, as well as whether they would like loans included in their financial aid package. The residential choice and the preference for loans do not directly determine the aid package offered to students in most cases.[29] The first two columns of Table VI replicate columns 2 and 4 of Table II with the sample restricted to students who correctly anticipated whether they would live on or off campus. Our main result is even stronger and more significant when we restrict our sample to these individuals. Thus, our findings are driven primarily by students who could have correctly predicted whether they would receive a refund when making their borrowing decision.

Columns 3 and 4 provide further evidence that the rejection of loans by potential refund recipients is intentional. These regressions replicate the specifications in the first two columns, but use the student's desire for loans as a part of the aid package as the dependent variable. Students who would get a refund are more likely to report that they are not interested in loans than are other groups. Their desire to avoid borrowing reveals itself not only in their eventual behavior but also in their stated intentions before making any decisions. These results provide further support for the hypothesis that students' failure to receive interest-free loans is the result of the type of forward-thinking decisions made by sophisticated hyperbolic discounters.

[29]Further correspondence with the financial aid administrator at the University of Michigan confirmed this fact. The primary concern among administrators is that students will respond that they are not interested in loans in an attempt to secure more grant funding. As a result, most professionals will include subsidized loans in an aid package even if a student has reported not being interested. In addition, subsidized loans are an entitlement program (students demonstrating eligibility cannot be denied these loans), and this fact makes administrators especially leery of excluding the loans from aid packages. In our sample, more than half of the students who reported not being interested in loans eventually borrowed their entire grade-level maximum.

E Discussion of empirical results

Our analysis suggests that self-control concerns play a significant role in students' decisions to reject interest-free loans. Students choose not to borrow despite government subsidies, and they are particularly less likely to borrow when doing so provides them with a large amount of easy-to-spend cash. This behavior is consistent with the optimal choices of sophisticated impatient economic actors. Other theories can explain the descriptive results, but no competing theory predicts that students will be exceptionally averse to borrowing when the funding is distributed in cash.

It is likely that we have identified only a portion of the behavior induced by self-control problems. Our estimates omit any effect resulting from students choosing not to apply for aid at all to avoid being faced with the temptation of loan funds. Additionally, some students may choose not to enroll in college or to enroll at lower priced schools to avoid the additional liquidity. Nevertheless, the "refund check" effect identified by our approach suggests that self-control concerns play a significant role in the take-up decision.

V Implications for policy and further research

Our results have important implications for policy decisions related to subsidizing student borrowing. First, we find that a significant fraction of students who reject their loans would have used the money for living expenses rather than for tuition and fees. This finding suggests that the loans end up going to students who actually use the money for school rather than to those who are choosing the game the system. However, needy students, particularly from minority populations, do not reap the benefits of loans that our data suggest they would find unambiguously financially beneficial.

One policy consideration concerns the efficiency of the design of the current loan system. Recent work on the optimal choice of default rules reveals that setting the default far away

from decision-makers' true optima may be welfare improving (Choi, Laibson, Madrian and Metrick 2003). Accentuating the difference between the optimum and the default can cause a greater fraction of decision-makers to reject the default and choose their personal optimum. This consideration must be balanced with a desire to set the default close to the modal optimum to minimize the total costs of switching that agents must incur. In the case of subsidized loans, setting the default to the maximum accomplishes both goals of optimal default rules by making the default the mode and by maximizing the difference between the default and the optimum for those who wish to deviate.

There are also potential policy solutions that can directly reduce the burden of increased liquidity and increase student participation in this need-based program. For example, aid administrators could offer students access to educational spending accounts similar to flexible spending accounts currently used for medical expenses. Schools would place any aid in excess of tuition into these accounts, and students would need to provide evidence of approved education-related expenses in order to spend these funds. Account balances would earn interest. Upon leaving school, any remaining funds could be applied directly to the student's outstanding loan balances. In this way, all students could receive the benefits of the subsidized loans without needing to manage large increases in liquidity.[30]

The results presented in this paper suggest several avenues of additional research. While our data support an explanation for the surprisingly low take-up of interest-free student loans based on temptation and self-control, further survey work could directly confirm this channel. The shift from grant-based aid to loan-based aid may also affect educational decisions more broadly by influencing enrollment and school choice decisions, and the extent of these effects is certainly worthy of further research. Finally, by interacting hyperbolic discounting models

[30]Alternatively, financial aid offices could offer the "excess" aid in monthly installments. When we compared schools on the semester calendar (where students receive two checks each year) to schools on the quarter calendar, we found that our results were stronger (though not significantly so) when the checks were delivered less frequently. To our knowledge, no university currently offers either educational spending accounts or monthly aid checks.

with the particular features of this credit market, we have shown that impatience and a need for self-control can induce debt-averse behavior. We expect that this insight could help explain unresolved questions in other economic situations, such as repaying car loans or home mortgages ahead of schedule. Further research is needed to determine how important a role this phenomenon plays in other credit markets.

Appendix - Proofs of Lemmas and Propositions

The following lemma will be useful in proving the propositions from the text.

Lemma 5 *All else equal, a Student who is more patient consumes more later, i.e.* $\frac{dc_2^*}{d\beta} \leq 0$ *and* $\frac{dc_3^*}{d\beta} \geq 0$*. As a result, the Borrower always weakly prefers a more patient Student, i.e. a higher* β*. The Borrower strictly prefers a more patient Student whenever* $\frac{dc_2^*}{d\beta} < 0$*.*

Proof When the constraint from Equation (1) binds, the consumption decision does not change with small changes in β. Thus, when the constraint is binding $\frac{dc_2^*}{d\beta} = \frac{dc_3^*}{d\beta} = 0$. At interior solutions, however, the following Euler equation holds:

$$u'(c_2^*) = (1+r)\delta\beta u'(c_3) \tag{3}$$

Taking total derivates and rearranging yields

$$\frac{dc_2^*}{d\beta} = \frac{u'(c_3^*)}{u''(c_2^*) + (1+r)u''(c_3^*)} < 0 \tag{4}$$

The budget constraint implies that

$$\frac{dc_3^*}{d\beta} = -\frac{dc_2^*}{d\beta}(1+r) > 0 \tag{5}$$

When Equation (1) does not bind, therefore, more patient Students consume less during school and more after graduation.

The second part of the lemma follows from this result. Letting $U(\cdot)$ denote lifetime utility, and taking the derivative of the Borrower's lifetime utility function with respect to β yields

$$\frac{dU}{d\beta} = u'(c_2^*)\frac{dc_2^*}{d\beta} + \delta u'(c_3^*)\frac{dc_3^*}{d\beta} \tag{6}$$

Rearranging, and plugging in $-\frac{dc_2^*}{d\beta}(1+r)$ for $\frac{dc_3^*}{d\beta}$ yields

$$\frac{dU}{d\beta} = (u'(c_2^*) - u'(c_3^*))\frac{dc_2^*}{d\beta} \tag{7}$$

using the fact that $\delta(1+r) = 1$.

We have already established that $\frac{dc_2^*}{d\beta} \leq 0$; so determining the sign of $\frac{dU}{d\beta}$ now depends only on the sign of $u'(c_2^*) - u'(c_3^*)$. Recall that c_2^* and c_3^* conform to Equation (3) whenever $\frac{dc_2^*}{d\beta} \neq 0$. Because $0 \leq \beta \leq 1$, it follows immediately that $u'(c_2^*) < u'(c_3^*)$, and thus that

$$\frac{dU}{d\beta} \geq 0 \tag{8}$$

In particular, $\frac{dU}{d\beta} > 0$ when Equation (1) does not hold with equality. When the constraint does bind, $\frac{dU}{d\beta} = 0$ holds with equality. ∎

Proposition 2 Rejecting the loan can only be optimal if doing so imposes a binding constraint on the consumption of the in-school actor.

Proof If Equation (1) does not hold with equality, then c_2^* and c_3^* follow Equation (3). The only effect of taking the loan in this case is that doing so increases lifetime income. Taking the derivative of Equation (3) with respect to income yields:

$$u''(c_2^*)\frac{dc_2^*}{dI} = (1+r)\delta\beta u''(c_3^*)\frac{dc_3^*}{dI}$$

Because $u''(\cdot) < 0$, we know that $\frac{dc_2^*}{dI}$ and $\frac{dc_3^*}{dI}$ must be of the same sign. Because they also must sum to one (by Walras' Law), we know that each is positive. Therefore, consumption (and the utility level associated with consumption) increases in both periods when the Student is given access to the loan, and the Borrower will choose to accept the loan. ∎

Proposition 3 If $u(I_2 + \bar{S}) + \delta u(I_3 - \bar{S}) > u(I_2) + \delta u(I_3)$ the Borrower should never reject the loan for self-control reasons.

Proof Proposition 2 implies that turning down a loan optimally for self-control reasons gives the Borrower utility of $u(I_2) + \delta u(I_3)$. Turning down the loan is therefore optimal only when the consumption choices made by the Student will result in a lower utility. It is trivial to show that when $\beta = 0$, the Student will choose to consume all available income. When the Borrower accepts the loan, therefore, a Student with $\beta = 0$ will consume $(I_2 + \bar{S}, I_3 - \bar{S})$. Lemma 5 demonstrates that the Borrower (weakly) prefers the consumption choices of a Student with higher levels of β. Therefore, if $u(I_2 + \bar{S}) + \delta u(I_3 - \bar{S}) > u(I_2) + \delta u(I_3)$ the Borrower should accept the loan for any level of β. ∎

Proposition 4 If $u(I_2 + \bar{S}) + \delta u(I_3 - \bar{S}) < u(I_2) + \delta u(I_3)$, there exists a unique $\beta^* \in [0, 1]$ such that $u(c_2^*; \beta^*) + \delta u(c_3^*; \beta^*) = u(I_2) + \delta u(I_3)$. The Borrower rejects the loan optimally iff $\beta < \beta^*$.

Proof We prove this proposition in three parts, beginning with the first claim.

1. At $\beta = 0$, the Student will consume $I_2 + \bar{S}$ and leave $I_3 - \bar{S}$ for the second period. By assumption, this yields a lower utility than consuming (I_2, I_3). When $\beta = 1$, there is no disagreement between the Student and the Borrower, and the additional income of $r\bar{S}$ ensures that the Borrower prefers (c_2^*, c_3^*) to (I_2, I_3). Combining these results with the (weak) monotonicity results of Lemma 5, we can draw Figure III. This graph establishes the existence and uniqueness of β^*. ∎

2. We next address the claim that if $\beta > \beta^*$, the Borrower should accept the loan. This result follows directly from Proposition 2. Any optimal rejection leads to the consumption pair (I_2, I_3), which is, by the definition of β^*, inferior to the bundle selected by the Student given access to the loan when $\beta > \beta^*$. ∎

3. Next we prove that $\beta < \beta^*$ is a sufficient condition for rejection to be optimal. To do so, we prove that if the Borrower rejects the loan the Student will consume (I_2, I_3). Because, by the definition of β^*, the Borrower prefers (I_2, I_3) to (c_2^*, c_3^*) the optimal choice is to reject the loan.

   We proceed by contradiction. Suppose this claim is false, i.e. that $c_2^* < I_2$, but that the Borrower prefers (I_2, I_3) to (c_2^*, c_3^*). This preference implies that the Borrower would like to consume more in the first period than would the Student. Recall that for the Borrower, $\beta = 1$ and we have assumed that the Student's $\beta < \beta^* \leq 1$. A preference for more consumption in the first period with a higher β contradicts Lemma 5 which established that $\frac{dc_2^*}{d\beta} \leq 0$. $\Rightarrow\Leftarrow$ ∎

References

Alchian, Armen and William Allen, *University Economics*, Belmont, Calif.,: Wadsworth Pub. Co., 1964.

Altonji, Joseph G., Todd E. Elder, and Christopher R. Taber, "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *The Journal of Political Economy*, 2005, *113* (1), 151–184.

Ashraf, Nava, Dean Karlan, and Wesley Yin, "Tying Odysseus to the Mast: Evidence from a Commitment Savings Product in the Philippines," *Quarterly Journal of Economics*, 2006, *121* (2), 635–672.

Avery, Christopher and Caroline M. Hoxby, "Do and Should Financial Aid Packages Affect Students' College Choices?," 2003. NBER Working Paper 9482.

Callender, Claire and Jonathan Jackson, "Does the Fear of Debt Deter Students from Higher Education?," *Journal of Social Policy*, 2005, *34*, 509.

Choi, James J, David Laibson, Brigitte C Madrian, and Andrew Metrick, "Optimal Defaults," *American Economic Review*, 2003, *93* (2), 180–85.

__ , __ , __ , and __ , "For Better or Worse: Default Effects and 401(k) Savings Behavior," in David A. Wise, ed., *Perspectives on the economics of aging. NBER Conference Report series*, Chicago and London: University of Chicago Press, 2004, pp. 81–121.

Department of Education, "Federal Student Aid Handbook," 2003.

Douthat, Ross, "Does Meritocracy Work?," *The Atlantic Monthly*, 2005, *296* (4), 120.

Duguay, Dara, "Spend Student Loans Only on College Expenses," *www.youngmoney.com*, 2003.

Dynarski, Mark, "Who Defaults on Student Loans? Findings from the National Postsecondary Student Aid Study," *Economics of Education Review*, 1994, *13* (1), 55–68.

Dynarski, Susan, "The Behavioral and Distributional Implications of Aid for College," *American Economic Review*, 2002, *92* (2), 279–85.

Dynarski, Susan M. and Judith E. Scott-Clayton, "The Cost of Complexity in Federal Student Aid: Lessons from Optimal Tax Theory and Behavioral Economics," 2006. NBER Working Paper 12227.

Epple, Dennis, Richard Romano, and Holger Sieg, "Peer Effects, Financial Aid and Selection of Students into Colleges and Universities: An Empirical Analysis," *Journal of Applied Econometrics*, 2003, *18* (5), 501–25.

Field, Erica, "Educational Debt Burden and Career Choice: Evidence from a Financial Aid Experiment," 2004.

Gul, Faruk and Wolfgang Pesendorfer, "Temptation and Self-Control," *Econometrica*, nov 2001, *69* (6), 1403–1435.

Hoxby, Caroline M. and Bridget Terry Long, "Explaining Rising Income and Wage Inequality Among the College Educated," 1999. NBER Working Paper 9482.

Kane, Thomas J, "A Quasi-Experimental Estimate of the Impact of Financial Aid on College-Going," 2003. NBER Working Papers: 9703.

Knapp, Laura Greene and Terry G. Seaks, "An Analysis of the Probability of Default on Federally Guaranteed Student Loans," *The Review of Economics and Statistics*, 1992, *74* (3), 404.

Korniotis, George, "Rewards from Savings, Debt Aversion, and Mental Accounts," 2004. Manuscript, University of Notre Dame.

Laibson, David, "Golden Eggs and Hyperbolic Discounting," *Quarterly Journal of Economics*, 1997, *112* (2), 443–77.

Loewenstein, George and Richard H Thaler, "Intertemporal Choice," *Journal of Economic Perspectives*, 1989, *3* (4), 181–93.

McPherson, Michael S. and Morton Owen Schapiro, "Does Student Aid Affect College Enrollment? New Evidence on a Persistent Controversy," *The American Economic Review*, 1991, *81* (1), 309.

National Center for Educational Statistics, "Trends in Undergraduate Borrowing: Federal Student Loans in 1989-90, 1992-93, and 1995-96," *Statistical Analysis Reports*, 2000.

__ , "Student Financing of Undergraduate Education: 1999-2000," 2002.

O'Donoghue, Ted and Matthew Rabin, "Doing it now or doing it later," *American Economic Review*, 1999, *89* (1), 103–124.

Orfield, Gary, "Money, Equity, and College Access," *Harvard Educational Review*, 1992, *62* (3), 337.

Prelec, Drazen and George Loewenstein, "The Red and the Black: Mental Accounting of Savings and Debt," *Marketing Science*, 1998, *17* (1), 4–28.

Thaler, Richard H and H M Shefrin, "An Economic Theory of Self-Control," *Journal of Political Economy*, 1981, *89* (2), 392–406.

The College Board, "Trends in Student Aid 2005," 2005.

van der Klaauw, Wilbert, "Estimating the Effect of Financial Aid Offers on College Enrollment: A Regression-Discontinuity Approach," *International Economic Review*, 2002, *43* (4), 1249–87.

Wertenbroch, Klaus, Dilip Soman, and Joseph Nunes, "Debt aversion as self-control: Consumer self-management of liquidity constraints," 2001. INSEAD Working Paper.

Table I. Descriptive Statistics on Subsidized Stafford Loan Take-up

	% Reject loan	N
Full sample	17.8%	3805
Grade level		
Freshmen	16.5%	2151
Sophmores	22.5%	703
Juniors	16.4%	513
Seniors	18.5%	438
Race		
White	17.0%	2717
African-American	15.6%	564
Hispanic	26.7%	270
Asian	30.5%	105
Other (incl. multiple)	15.4%	149
Gender		
Male	18.5%	1688
Female	17.3%	2117
Parental support		
Parents do not pay tuition	17.6%	1499
Parents pay tuition	18.0%	2306
Parental income		
Below $50,000/year	19.5%	2215
Above $50,000/year	15.5%	1590
Cost of attendance after grants/scholarships		
Below median	20.7%	1920
Above median	14.9%	1885
Parental education		
HS degree or less	17.7%	977
Some college or higher	17.8%	2794
Standardized test scores		
Below median SAT / ACT	16.2%	786
Above median SAT / ACT	19.0%	751

Source: Authors' calculations using the NPSAS 03/04.

Note: We restrict the sample to full-year, full-time, US-born, dependent, undergraduate students at four-year public or private non-profit institutions who do not live with their parents, applied for financial aid, and demonstrated financial need exceeding their grade-level specific loan maximum. We additionally exclude students whose values of student budget and Stafford loan amount are imputed.

Table II. Linear Probability Models for Subsidized Stafford Take-up Rates by Direct Access

Dependent variable:	Eligible[a]	Full Sample		
Accept/reject interest-free loans	(1)	(2)	(3)	(4)
Loan funds distributed in cash (offcampus*room and board)[b]	-0.090**	-0.086**	-0.079**	-0.073*
	(0.023)	(0.030)	(0.030)	(0.030)
Lives off-campus, not with parents		-0.004	-0.007	-0.015
		(0.020)	(0.021)	(0.021)
Accepted loan funds pay room and board		-0.062**	-0.067**	-0.078**
		(0.014)	(0.015)	(0.015)
Female			0.013	0.014
			(0.012)	(0.012)
African-American			0.031+	0.027
			(0.017)	(0.017)
Asian-American			-0.126**	-0.126**
			(0.045)	(0.045)
Hispanic			-0.067*	-0.072**
			(0.027)	(0.027)
Other race			0.028	0.023
			(0.030)	(0.031)
Parents help pay tuition				-0.010
				(0.015)
Parents help pay housing				-0.045**
				(0.015)
Constant	0.801**	0.863**	0.860**	0.897**
	(0.012)	(0.008)	(0.012)	(0.015)
Controls for grade level (4 categories)	No	No	Yes	Yes
Observations	1690	3805	3805	3805
R-squared	0.01	0.02	0.03	0.03

Robust standard errors in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%
Source: Authors' calculations using the NPSAS 03/04.
a. The sample for the first column includes only students who would receive a refund check if they lived off-campus and accepted their loans. We maintain the sample restrictions from Table I.
b. Loan funds are distributed in cash when the student BOTH lives off-campus and accepted loan funds pay room and board. See Figure I.

Table III. Subsidized Stafford Take-up Rates by Direct Access - Robustness Checks

Dependent variable: Accept/reject interest-free loans	(1)	(2)	(3)	(4)
Loan funds distributed in cash (offcampus*room and board)[a]	-0.062*	-0.075*	-0.075*	-0.059+
	(0.031)	(0.030)	(0.030)	(0.031)
Lives off-campus, not with parents	-0.007	-0.012	-0.022	-0.013
	(0.021)	(0.021)	(0.021)	(0.021)
Accepted loan funds pay room and board	-0.075**	-0.078**	-0.078**	-0.074**
	(0.015)	(0.015)	(0.015)	(0.015)
Female	0.001	0.014	0.009	0.005
	(0.012)	(0.012)	(0.013)	(0.013)
African-American	0.022	0.026	0.010	0.004
	(0.017)	(0.018)	(0.018)	(0.018)
Asian-American	-0.096*	-0.131**	-0.124**	-0.102*
	(0.046)	(0.046)	(0.044)	(0.047)
Hispanic	-0.045	-0.077**	-0.077**	-0.054+
	(0.028)	(0.028)	(0.027)	(0.028)
Other race	0.024	0.021	0.016	0.011
	(0.030)	(0.031)	(0.031)	(0.031)
Parents help pay tuition	-0.009	-0.015	-0.032*	-0.014
	(0.015)	(0.016)	(0.013)	(0.016)
Parents help pay housing	-0.043**	-0.049**		-0.046**
	(0.015)	(0.016)		(0.016)
Parents help pay education expenses		0.018		0.016
		(0.014)		(0.014)
Parents help pay non-housing living expenses		-0.001		0.003
		(0.014)		(0.014)
Parent has at least some college		-0.006		0.011
		(0.014)		(0.014)
College GPA			-0.037**	-0.035**
			(0.009)	(0.009)
Student has credit card in own name			0.031*	0.029*
			(0.013)	(0.013)
Constant	0.820**	0.897**	0.939**	0.859**
	(0.023)	(0.018)	(0.033)	(0.041)
Controls for grade level (4 categories)	Yes	Yes	Yes	Yes
Selectivity dummies (3 categories)	Yes	No	No	Yes
Carnegie classification (5 categories)	Yes	No	No	Yes
Urbanicity index (7 categories)	Yes	No	No	Yes
Controls for college major (12 categories)	No	No	Yes	Yes
Observations	3754	3771	3805	3720
R-squared	0.05	0.03	0.04	0.06

Robust standard errors in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%
Source: Authors' calculations using the NPSAS 03/04.
a. Loan funds are distributed in cash when the student BOTH lives off-campus and accepted loan funds pay room and board. See Figure I. We maintain the sample restrictions from Table I.

Table IV. Balance of Control Variables

On-campus/off-campus?	On	On	Off	Off
Does loan cover some room&board expenses?	No	Yes	No	Yes
Borrower gets a refund check?	No	No	No	Yes
Female	54.9%	55.9%	54.9%	58.0%
African-American	10.4%	23.4%	10.1%	14.4%
Hispanic	5.0%	7.4%	5.7%	14.2%
Asian-American	2.9%	2.5%	1.4%	3.6%
Other race	3.4%	4.6%	3.5%	4.4%
Masters U.	29.1%	34.5%	39.4%	32.9%
BA U.	31.5%	21.1%	14.4%	8.5%
Assoc U.	1.0%	1.8%	2.4%	3.3%
Oth U.	5.2%	5.4%	9.2%	5.1%
Research U.	33.2%	37.2%	34.5%	50.2%
Highly selective	32.3%	21.1%	29.4%	19.2%
Moderately selective	64.6%	74.2%	63.2%	75.5%
Not selective	3.2%	4.7%	7.4%	5.3%
High parental education	79.5%	68.4%	72.1%	69.8%
High tuition	84.4%	47.9%	76.1%	27.1%
Any parental help with expenses	89.5%	79.3%	81.3%	70.7%
After grant cost of attendance above median	79.5%	9.2%	84.2%	14.7%
parental income above median	61.6%	17.9%	57.1%	18.2%
test scores above median	52.9%	45.3%	52.7%	42.6%
Demonstrated need above median	64.5%	29.8%	69.8%	35.1%
Has a credit card	43.3%	42.6%	66.3%	62.2%
Carries credit card balance	12.2%	17.6%	32.9%	33.3%
Average year in school (1= Freshman, 2=Sophmore, etc.)	1.52	1.70	2.46	2.47
Number of Observations	1747	1140	368	550

Source: Authors' calculations using the NPSAS 03/04.

Table V. OLS and IV Estimates of Liquidity Effect, by Refund Eligibility Status

	Eligible		Ineligible	
	(OLS)	(IV)	(OLS)	(IV)
Lives off-campus, not with parents	-0.067**	-0.237**	0.002	-0.077
	(0.025)	(0.087)	(0.022)	(0.095)
Female	-0.012	-0.014	0.011	0.009
	(0.021)	(0.021)	(0.015)	(0.015)
African American	0.059*	0.042+	-0.020	-0.021
	(0.024)	(0.025)	(0.026)	(0.026)
Asian American	-0.169*	-0.152*	-0.034	-0.038
	(0.073)	(0.073)	(0.058)	(0.058)
Hispanic	-0.046	-0.036	-0.035	-0.037
	(0.040)	(0.042)	(0.037)	(0.037)
Other Race	0.065	0.067	-0.016	-0.016
	(0.045)	(0.046)	(0.043)	(0.043)
Parents help pay tuition	0.002	-0.024	-0.021	-0.019
	(0.025)	(0.028)	(0.018)	(0.018)
Parents help pay housing	-0.032	-0.018	-0.047**	-0.055**
	(0.025)	(0.026)	(0.018)	(0.019)
First-stage F-test for instrument relevance		145.7		119.7
p-value from Hausman test of equality for off-campus coefficient		.02		.19
Observations	1655	1655	2093	2093
R-squared	0.05	0.02	0.05	0.04

Robust standard errors in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%
Source: Authors calculations using the NPSAS 03/04 and data from http://nces.ed.gov/ipeds/.
Note: Regressions also include controls for urbanicity, selectivity, Carnegie classification, and grade level listed in Table III. We maintain the sample restrictions from Table I.

Table VI. Linear Probability Models of Subsidized Loan Take-up and Stated Desire for Loans Among Students with Correct Housing Expectations

Dependent variable:	Accept/reject interest-free loans		Want loans in financial aid package?	
	(1)	(2)	(3)	(4)
Loan funds distributed in cash (offcampus*room and board)[a]	-0.164**	-0.145**	-0.078*	-0.078*
	(0.042)	(0.043)	(0.034)	(0.034)
Lives off-campus, not with parents	0.012	-0.002	0.026	-0.009
	(0.029)	(0.031)	(0.021)	(0.023)
Accepted loan funds pay room and board	-0.059**	-0.074**	-0.063**	-0.037**
	(0.016)	(0.017)	(0.014)	(0.014)
Female		0.021		-0.018
		(0.015)		(0.012)
African-American		0.014		-0.198**
		(0.022)		(0.024)
Asian-American		-0.148**		-0.052
		(0.052)		(0.038)
Hispanic		-0.058+		-0.092**
		(0.033)		(0.030)
Other Race		0.055+		-0.034
		(0.032)		(0.032)
Parents help pay tuition		0.009		0.003
		(0.019)		(0.017)
Parents help pay housing		-0.059**		-0.000
		(0.018)		(0.016)
Constant	0.867**	0.892**	0.917**	0.956**
	(0.009)	(0.017)	(0.007)	(0.015)
Controls for grade level (4 categories)	No	Yes	No	Yes
Observations	2710	2710	2673	2673
R-squared	0.03	0.05	0.02	0.07

Robust standard errors in parentheses.
+ significant at 10%; * significant at 5%; ** significant at 1%
Source: Authors calculations using the NPSAS 03/04.
Note: The sample is limited to individuals who CORRECTLY predicted whether they would live on or off campus, in addition to sample selection outlined in the notes of Table I.
a. Loan funds are distributed in cash when the student BOTH lives off-campus and accepted loan funds pay room and board. See Figure I.

Figure 1: Student circumstances and refund eligibility

Housing location:	Accepted loan funds: Do not pay room and board	Accepted loan funds: Pay room and board
On-campus	Not eligible	Not eligible
Off-campus	Not eligible	Eligible for refund check

Figure II: Choosing to borrow results in a larger choice set.

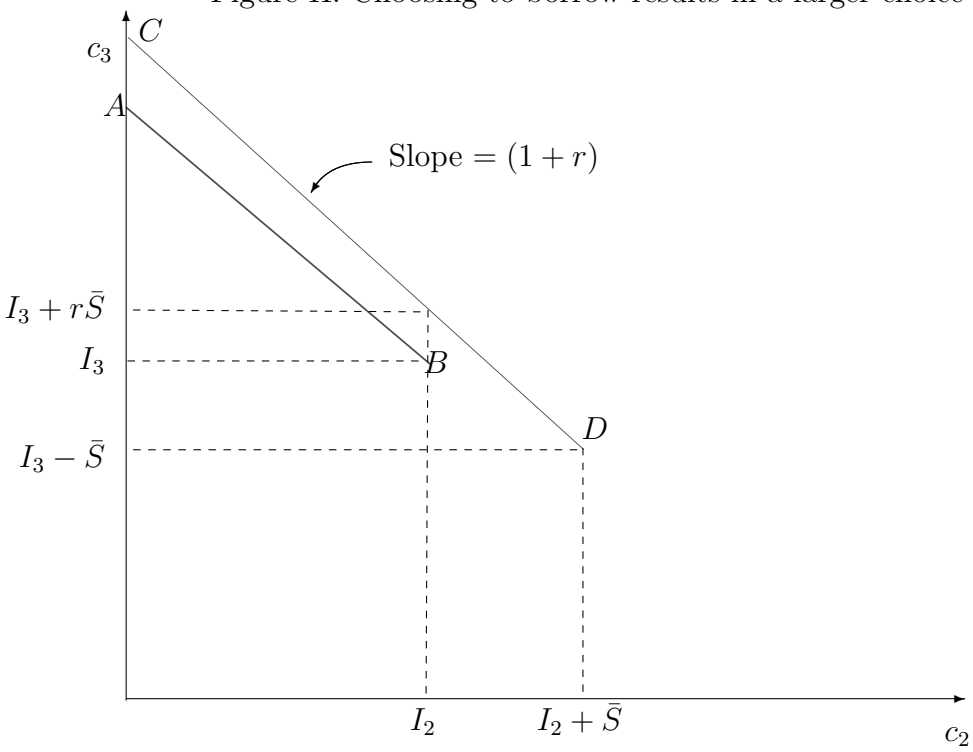


Figure III: The optimal borrowing decision follows a cutoff rule.

