Credit Constraints and College Attrition

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Abstract: We examine the effect of credit constraints on college attrition using unique data from the Berea Panel Study. We find that, while short-run liquidity constraints likely to play an important role in the outcomes of some students, the percentage of attrition that is caused by constraints is small.

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"I'm tired of living survey to survey."
A participant in the Berea Panel Study describing a lack of spending money
when asked why he was dropping out of college.

I. Introduction

Children from low income families are much less likely than other students to attend and graduate from college.[1] Recent literature has emphasized the importance of understanding the extent to which short-term credit constraints contribute to this reality. Short-term credit constraints could play an important role by making it difficult for students to pay tuition or other direct costs of school. They could also operate by making it difficult for students to find money to pay for consumption during school. The potential importance of the latter avenue arises because, while grant, loan, and work-study programs exist to help students pay the direct costs of college, these types of programs are not typically designed to help students pay the consumption costs associated with foregone earnings.

A serious difficulty in determining the importance of short-term credit constraints arises because standard data sources do not provide a direct way of identifying which students are credit constrained. This has forced researchers to adopt a variety of indirect approaches. These approaches, which are critically surveyed in Carneiro and Heckman (2002), include: 1) comparing Instrumental Variable (IV) estimates and Ordinary Least Squares (OLS) estimates of the wage returns to schooling; 2) examining whether the sensitivity of college enrollment to tuition varies by family income; 3) examining educational attainment and rates of return to school after adjusting for long-term family factors such as ability and parental background; 4) comparing the rate of return to human capital to that of physical capital. Because the validity of these approaches relies on different and often debatable underlying assumptions, they have produced different conclusions, and a lack of consensus about the importance of liquidity constraints has emerged in the literature.

In this paper we take a much different and direct approach for examining the importance of credit constraints in higher education. The approach centers around the use of a carefully worded survey question which was created with the explicit objective of identifying whether particular students face short-term credit constraints. Roughly

[1]For example, using the High School and Beyond (HS&B) survey, Manski (1992) finds that only 11% of students from the lowest family income quintile graduate from college within five years after high school graduation. By contrast, 11% of students in middle income quintile and .39 in the highest income quintile graduate from college within five years after high school graduation.

speaking, this survey question elicits whether a person would accept a loan in order to increase consumption during school if it were made available. Thus, the appeal of this approach is that students who are identified as being constrained fit a definition that would be suggested by economic theory. While one can reasonably question the extent to which responses to the survey question would mirror what would happen if individuals were given the opportunity to obtain the hypothetical loan, a number of consistency checks indicate that students answer this question in a conscientious manner and that the responses to these questions contain valuable information. The approach taken in this paper is consistent with the general message in recent work such as Dominitz (1998) and Dominitz and Manski (1996, 1997) who suggest that carefully worded survey questions can often be used to directly elicit important information in contexts where the alternative involves making non-trivial assumptions in order to justify proxies for the information.

The credit constraint question is administered to a sample of college attendees. Thus, while much of the literature has focused on the effect of credit constraints on college entrance, this paper examines the effect of credit constraints on college drop-out. There are good reasons to expect that credit constraints affect both the college entrance and college drop-out decision. However, the avenues through which constraints influence the college drop-out decision are perhaps more subtle and worth discussing. Manski (1989) and Altonji (1993) emphasize the importance of learning in understanding the drop-out decision. In such models, it is clear that credit constraints can play an important role in affecting college drop-out decisions if individuals learn after arriving at college about their constraint status or the effect that being constrained has on how enjoyable it is to be in school. However, it is important to stress that a person's constraint status can also play an important role even if students fully anticipate (at the time of college entrance) their constraint status and its effect on utility. This is because the constraint serves to push some individuals who choose to enter college closer to the margin of indifference, in which case they are more likely to leave school when they learn about other dimensions (e.g., ability or labor market prospects) which influence the benefits of finishing college.[2] As discussed later in this paper, there is a strong connection between the effect of credit constraints on the drop-out decision and the effect of constraints on the college entrance decision, and theory does not suggest which effect is likely to be more important. Further, understanding the importance of

[2]Of course, constraints may also push some individuals not to enter college.

credit constraints for the drop-out decision is important from the standpoint of understanding established stylized facts. Manski and Wise (1983) and Manski (1992) show that differences in college attrition by family income are at least as important as differences in college entrance by family income from the standpoint of determining overall differences in college graduation rates by family income.[3] Thus, the role of credit constraints in the drop-out decision may explain much of the well-known differences in overall graduation rates by family income. However, if constraints are not important determinants of drop-out, then, regardless of their role in the college entrance decision, large differences in college graduation rates between income groups would remain even if any existing credit constraints were relaxed.[4]

The survey question is administered as part of the Berea Panel Study (BPS) which is ongoing at Berea College. Located in Central Kentucky, Berea College operates with a mission of providing an education to students who have "great promise but limited economic resources." While studying a particular school may limit the generality of results, there are important reasons that studying outcomes at Berea College is worthwhile. First, as described in detail later, the mission of the school implies that the students at Berea are from the types of backgrounds that are specific concern to policymakers interested in the impact of liquidity constraints in education.

Second, certain institutional details at Berea are useful for our study. Of particular importance, the school is unique in that it provides a full tuition subsidy (and room and board subsidies) to all entering students. Stinebrickner & Stinebrickner (2003a) found that approximately .50 of the students who entered Berea between 1989 and 1997 failed to graduate (and few transferred) even though the direct costs of schooling are zero (or perhaps negative). In that paper, the fact that the drop–out rates at Berea were found to be similar to the drop-out rates of students from similar family income backgrounds who attended schools where direct costs are not zero suggested

[3]Manski (1992) indicates that between 51% and 71% of the HS&B college graduation gap between students in the lowest and highest income quintiles and between 48% and 65% of the HS&B college graduation gap between students in the lowest and middle income quintiles can be attributed to differences in college attrition rates between groups rather than to differences in college entrance rates between groups. The exact percentages depend on the treatment of individuals who enter two year schools after high school graduation. Low income students are substantially less likely than other students to enter four-year institutions but are approximately equally likely to enter two-year institutions. Thus, counting individuals who enter two-year institutions when computing college entrance rates (and assuming that these students drop-out if they do not receive degrees from four-year institutions) increases both the college entrance rates and attrition rates of low income students relative to higher income students and leads to the higher number in each pair.

[4]Restuccia (2003) suggests that credit constraints may play an important role by influencing pre-college human capital accumulation.

that difficulties paying direct costs do not play a particularly important role in determining attrition rates of college attendees. But this need not imply that credit constraints are unimportant since students may still be unable to borrow enough to satisfy their consumption demands. The absence of direct costs at Berea implies that, if it is possible to determine the extent to which the drop-out decision is influenced by difficulties borrowing money to smooth consumption between schooling and working periods, then it will be possible to provide direct evidence about the aggregate importance of the reasons for college attrition that are unrelated to financial difficulties associated with college attendance. Understanding the extent to which the drop-out rates of students from low income families would remain "high" under the most generous conceivable policy, in which all direct costs of college are removed and all credit constraints related to the smoothing of consumption are addressed, is of substantial usefulness given the important role typically attributed to liquidity constraints in current education policy discussion.

Perhaps the most important reason to study outcomes at Berea is that the ongoing Berea Panel Study (BPS) provides new and unique longitudinal information about students at the school. This project surveys members of two cohorts of Berea College students approximately ten times each year with the explicit objective of providing information about student experiences and outcomes that is substantially more detailed than what is available from other survey sources that typically have contact with survey respondents at most once a year. The BPS was initiated with the goal of understanding outcomes in higher education and was designed with economic theory explicitly in mind. Thus, in addition to containing questions that allow us to characterize the extent and nature of liquidity constraints, the data provide detailed information about many other dimensions that could influence the drop-out decision.

In Section II we present a simple theoretical discussion related to the college entrance decision and college drop-out decision. In Section III, we provide some general information about the structure of the BPS and a simple descriptive view of students at Berea. We show that students at Berea are poor and spend very little on consumption while in school. Thus, it would seem that there is substantial scope for short-term credit constraints to play an important role.

The main results are presented in Section IV. There are three parameters in which we are interested. The first parameter of interest is the proportion of students who are constrained. The second parameter of interest is the

effect that being constrained has on the drop-out probability of constrained students. The third parameter of interest is the amount of attrition that is caused by credit constraints. The third parameter of interest is the product of the first two parameters. It is of particular interest because the amount of attrition that is caused by reasons that are unrelated to short-term credit constraints is the difference between the total amount of attrition and this parameter. It is worth noting that, while the proportion of low income students who are constrained may be different at other schools where direct costs are higher, it seems reasonable to believe that the types of non-constraint reasons that influence outcomes at Berea would also be of importance for low income students enrolled elsewhere. In this case, establishing that a large amount of attrition would remain at Berea if all possible credit constraints were addressed would imply that a large amount of the attrition elsewhere is being caused by reasons unrelated to credit market considerations.[5]

With respect to the first parameter of interest, in Section IV.1 we detail the survey question that we primarily use to identify which individuals are constrained. In support of the value of this question, we find that differences in financial characteristics of constrained and unconstrained students seem to generally be consistent with the presence of a constraint. For example, the average savings of unconstrained students is approximately four times as large as the average savings of constrained students, and the median constrained student has only $50 in savings at the beginning of the second semester. Our results indicate that, despite the fact that students at Berea spend very little on consumption, only 20% of students are constrained (i.e., they would like to borrow more money to increase consumption).

With respect to the second and third parameters of interest, we begin by considering whether informative upper bounds can be generated. A trivial upper bound for the effect of the constraint on constrained students (the second parameter of interest) comes from assuming that all of the attrition of constrained students is caused by the constraint. This bound is not informative. However, multiplying this bound by the proportion of students that are constrained, .20, produces an upper bound for the amount of attrition that is caused by credit constraints (the third parameter of interest) that is informative. In particular, we find that at most 32% of all attrition at Berea should be

[5]If the presence of direct costs elsewhere implies that attrition rates are higher elsewhere, then the *proportion* of attrition caused by credit constraints may be higher elsewhere even if the amount of attrition caused by credit constraints is the same. However, Stinebrickner and Stinebrickner (2003a) show that attrition rates at Berea are very similar to those elsewhere which suggests that direct costs do not have a particularly large effect on attrition.

attributed to credit constraints. Given the large amount of attrition at Berea, this suggests that a large amount of attrition is caused by reasons that are unrelated to financial difficulties.

While the bound on the third parameter of interest is informative, examining whether it is possible to compute a credible estimate of the second parameter is worthwhile for two related reasons. First, even if the upper bound on the third parameter establishes that the amount of attrition that is caused by credit constraints is relatively small, it is of interest to understand whether constraints play an important role in the decisions of some students (i.e., it is of interest to determine whether the second parameter is non-zero). Second, while quite small, the upper bound on the third parameter is likely to be quite conservative since it is computed under the unrealistic assumption that the drop-out outcomes of constrained students are caused entirely by the constraint. In general, obtaining a credible estimate of the second parameter is difficult. However, we note that, if constrained and unconstrained individuals have different financial situations but are identical in all other respects that influence the drop-out decision, then the difference between the drop-out rates of constrained and unconstrained students represents the effect of the constraint. Theory can be used to identify the factors that could influence the drop-out decision. Whether differences exist in these factors between constrained and unconstrained students can be viewed as an empirical question. While answering this question is undoubtedly very difficult, we are willing to approach this problem because, as will be detailed throughout the paper, the Berea Panel Study was designed with the explicit goal of providing the type of information that is necessary for this task. It is in this sense that our data allow a strong connection between economic theory and our empirical work.

Our empirical results provide striking evidence that constrained and unconstrained individuals differ significantly in financial dimensions but are very similar in other respects; while many of the financial variables are found to vary by constraint status, there is no evidence that non-financial variables vary by constraint status. While, in practice, it would never be possible to entirely resolve uncertainty about whether constrained and unconstrained individuals may differ in some dimension of importance, the features of the Berea Panel Study data allow a very detailed comparison of constrained and unconstrained students. As such, our findings suggest that credit constraints are likely to have a substantial causal effect on the outcomes of the constrained students, and we are able to provide independent evidence in support of this conclusion using unique survey questions in the BPS. Nonetheless, our estimate of the second parameter of interest is substantially smaller than what was used earlier to generate the upper

bound on the amount of attrition caused by credit constraints (the third parameter of interest). Thus, as expected, our upper bound on the amount of attrition appears to be quite conservative - using our estimate of the second parameter, we find that only 15% of all attrition is caused by short-term constraints.

As discussed in Section V, the main conclusion of our paper is that, while short-run liquidity constraints are likely to play an important role in the outcomes of some students at Berea, the amount of attrition caused by liquidity constraints at Berea is quite small in the specific sense that the availability of loans that would allow low income individuals to smooth consumption would have little effect on outcomes. Given substantial drop-out rates at Berea, this implies that much attrition at Berea should be attributed to reasons that are unrelated to credit constraints. It seems reasonable to believe that the type of non-financial factors that influence the low income students at Berea would affect low income students more generally. Thus, as discussed in detail in Section V, under seemingly reasonable assumptions about the importance of direct costs elsewhere, it is natural to believe more generally that the large majority of attrition for low income students is caused by reasons unrelated to credit constraints.

II. A simple theoretical model

Assume that partial college completion has no effect on earnings, students do not fail out of school, and individuals do not attend graduate school. Consider first a world in which there exists no uncertainty at the end of high school about any aspects that influence the costs or benefits of post-secondary educational attainment. In this case, after graduating from high school, individuals either choose to receive a college degree or choose to obtain zero post-secondary education. This binary decision is made by comparing the discounted lifetime utility associated with entering the workforce immediately after high school with the discounted lifetime utility associated with obtaining four years of college and then entering the workforce with a college degree. The lifetime utilities associated with the two options are determined by a person's discount rate, β, how much consumption the person has in each period of his lifetime, and by preference parameters θ_S and θ_N. Given a general form of the utility function we think of θ_S and θ_N as capturing everything that determines the amount of utility that a person receives at particular levels of consumption while in school and while in the workforce, respectively. Thus, θ_S and θ_N include information about properties such as risk aversion and the intertemporal elasticity of substitution and also include

information that summarizes a person's preferences about the non-pecuniary benefits of being in school and being in the workforce, respectively.

Individuals who enter the workforce without a college degree work in unskilled jobs. Earnings in these jobs depend on a person's unskilled human capital which we assume is fully determined at the time of the college entrance decision. Individuals who enter the workforce with a college degree work in skilled jobs. Earnings in these jobs depend on a person's skilled human capital which is accumulated during college. Skilled human capital is accumulated more efficiently by individuals of high academic ability. Hereafter, we refer to academic ability simply as ability, A.

Individuals allocate lifetime earnings to consumption across schooling and working periods subject to a standard lifetime budget constraint. In addition, the credit constrained person is faced with the reality that he cannot borrow against future earnings during school. Thus, the consumption of the constrained person during school depends on, for example, his personal savings at the time of college entrance, contributions from parents during school, and labor income during school. The reality that a constrained person would like to borrow to increase his consumption during school implies that his lifetime consumption path will not be "smooth enough" in the sense that the marginal utility of consumption during school is higher than the discounted marginal utility of consumption during his working years. Thus, a relaxation of the short-term credit constraint would lead to a reallocation of consumption across periods. The constraint has a causal effect because constrained individuals who do not find entering college to be optimal, but are sufficiently close to the margin of indifference, would be induced to enter college if the constraint was relaxed.

In reality, as recognized in Manski (1989) and Altonji (1993), substantial uncertainty is likely to be present at the time of the college entrance decision. In this case, the college entrance decisions entails comparing the discounted expected utility, or value, of starting school, V_S, to the discounted expected utility, or value, of entering the workforce immediately after high school, V_N. Individuals may be uncertain about any of the factors that influence the value of S or the value of N. Specifically individuals may be uncertain about ability, the distribution of earnings in skilled jobs at a particular level of skilled human capital (which depends on ability), the distribution of earnings in unskilled jobs, whether they will face short-term credit constraints during school, and θ_S and θ_N which, among other things, help determine how being constrained will influence how enjoyable it is to be in school. For

the sake of discussion, we assume that, while individuals may be uncertain about factors that influence V_N, all of the learning that takes place during college is related to the factors that influence V_S.

When learning takes place about one or more of the factors in the previous paragraph, a drop-out rate that is different than zero can arise as part of a rational decision-making process even if partial completion has no effect on earnings. This is the case because time in school allows a person to resolve uncertainty about V_S and to retain the option of remaining in school after learning takes place. Clearly, the more favorable is the information that a person learns about a particular factor that influences V_S, the more likely he will be to remain in school. However, it is important to note that a factor can also have a causal effect on the drop-out rate even if no uncertainty exists about the factor at the time of college entrance. If an "unfavorable" value of this factor causes a person to be closer to the margin of indifference at the time of college entrance, then the factor will have a causal effect by implying that the person will be more likely to leave school when he learns about other aspects that are relevant to the decision. Thus, credit constraints can have a causal effect on outcomes if individuals learn about their constraint status after matriculation (or the effect that being constrained has on how enjoyable it is to be in school) or if certainty exists about constraint status (and the effect of being constrained on enjoyability) and this knowledge implies that constrained individuals are closer to the margin of indifference at the time that the college entrance decision is made.

The implications of the previous discussion can be illustrated by considering Figure 1. Figure 1A shows the effect of credit constraints on the college entrance decision. The curve in the figure represents the density of V_S at the time of the college entrance decision for the group of all constrained high school graduates *under the counterfactual that these individuals are not constrained* (hereafter referred to simply as "the counterfactual"). Here we use "constrained" high school graduates to identify those high school graduates who will be constrained in college, regardless of whether this is fully anticipated at the time of the college entrance decision. For ease of exposition, Figure 1A assumes that V_N is constant across all constrained people. Thus, since individuals enter college if $V_S > V_N$, Figure 1A shows that the college entrance rate of the constrained high school graduates would be $1-\alpha_1$ *under the counterfactual*. Suppose that δ_1 represents the decrease in V_S that occurs at the time of the college entrance decision as a result of being constrained. The size of δ_1 depends on both the person's beliefs about the probability that he will be constrained during college and the person's beliefs about how being constrained will

influence how enjoyable it is to be in school. In this case, the effect of being constrained on the college entrance decision is α_2.[6]

Taking into account that the impact of the constraint on V_S for constrained students is δ_1, it follows directly from Figure 1A that the density of V_S at the time of college entrance for the constrained individuals who enter college is given by the solid portion in Figure 1B. (Note that, in order to make comparisons across figures easier, we do not adjust the height of the density in 1B or the subsequent figures to make them integrate to one). We assume that learning and the drop-out decision take place very quickly after students arrive at school so that the value of V_N that is relevant for the drop-out decision is the same as it was for the entrance decision in Figure 1A and that the value of V_S that is relevant for the drop-out decision differs from Figure 1A by only the amount that the person learns after matriculation.[7] Suppose that all individuals learn unfavorable information about some non-financial factor, say ability, and this unfavorable information leads the person to realize that V_S is smaller by ε than was anticipated at the time of college entrance. If individuals learn only about ability, then the drop-out rate for the constrained students is α_3. However, if uncertainty exists at the time of college entrance about a person's constraint status (or the effect that being constrained has on utility) and resolving this uncertainty leads the person to realize that V_S is smaller by δ_2 than was anticipated at the time of college entrance, then the total drop-out rate of the constrained group is given by $\alpha_3+\alpha_4$. To understand the effect that the constraint has on the drop-out rate of constrained students that enter college, we must know what the drop-out rate would be for these students if they were not constrained. For these students, removing the constraint would lead to to a density of V_S at the time of the college entrance that is shown in Figure 1C.[8] Removing the constraint would also imply that $\delta_2=0$ under the assumption that the unconstrained individuals face no uncertainty about their constraint status. The drop-out rate in the absence of the constraint is given by α_5 and $(\alpha_3+\alpha_4)-\alpha_5$ represents the effect of the constraint on the drop-out rate.

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[6]All constrained people who would have a value of V_s that is less than δ_1 above V_N if they were not constrained would have $V_S<V_N$ when constrained.

[7]If learning takes longer, then the discussion would have to describe how V_N and V_S change in response to, for example, a shorter horizon.

[8]This density is obtained by adding δ_1 to each V_S in Figure 1B, or equivalently, finding points in Figure 1A that are more than δ_1 above V_N.

Figures 1A-1C indicate that there is a direct connection between the effect of constraints on the entrance decision and the effect of constraints on the drop-out decision. Further, an implication of Figures 1A-1C that helps motivate our work is that, although most previous work has examined the college entrance decision, theory tells us nothing about whether credit-constraints should have larger effects on the college entrance decision or the college drop-out decision (i.e., whether α_2 is smaller or larger than $(\alpha_3+\alpha_4)-\alpha_5$. This depends on the size of δ_1, δ_2, ε, and the shape of the density function. It is easy to construct cases in which credit constraints would have a larger effect on the drop-out decision than on the college entrance decision. For example, one trivial case arises if learning about constraint status or the effect that being constrained has on utility takes place primarily after beginning college.

The data directly deliver the drop-out probability of the constrained students, $\alpha_3+\alpha_4$. The difficulty in identifying the effect of the constraint arises because the data provide no direct evidence about α_5, the drop-out probability of constrained students under the counterfactual. One possible approach is to use the drop-out probability of unconstrained college attendees as a proxy for α_5. We are interested in whether theory suggests that it might be reasonable to believe that the bias from this approach would be small. As a starting point, Figure 1D shows the density for unconstrained college attendees under the assumption that the density of V_S at the time of college entrance is the same for unconstrained high school graduates as it would be for constrained high school graduates under the counterfactual in which the constraint was removed (as shown in Figure 1A). Under this assumption, the drop-out rate of unconstrained students who enter college is given by $\alpha_5+\alpha_2$ which overstates the drop-out rate of constrained students by α_2 and implies a downward bias of α_2 in the estimator of the effect of the constraint on the drop-out rate.[9] This bias would be small if being constrained leads to a small effect on V_S at the time of college entrance (i.e., δ_1 is small) or the shape of the density function implies that few people are less than δ_1 above V_N.[10] In addition, while the previous discussion has focused on the entrance decision, the reality that our

[9]Under this assumption, the density of V_S for unconstrained high school graduates would be as given in Figure 1A. All unconstrained students with $V_S>V_N$ in Figure 1A enter college. The bias associated with using the drop-out rate of unconstrained students as a proxy (for the drop-out rate of constrained students under the counterfactual) comes from the fact constrained students will only enter college if they have values of V_S that are δ_1 above V_N under the counterfactual. Thus, even if distribution of V_S for unconstrained high school graduates is the same as distribution of V_S for constrained students under the counterfactual, the density for constrained students who enter college will be a left truncated version of the density for unconstrained students who enter college.

[10]Our results suggest that this is quite plausible, because, at least among those who enter college, the effects of being constrained appear to be largely unanticipated.

sample is also influenced by the decisions at Berea about which students to admit may also work to reduce the size of the bias in this case.[11] Students are only eligible to attend Berea if they have family income that is less than an income cutoff which is roughly $60,000. Among the pool of eligible applicants, admission decisions are made without respect to family income with the goal of admitting students with the greatest promise. The school attempts to admit well-rounded students who are gifted academically and also wish to take advantage of the non-pecuniary benefits of college. As a result, it does not seem unreasonable to think that, to a rough approximation, this admission policy serves to admit students with higher values of V_S. Consider a case where the admission decisions imply that Berea admits only students with values of V_S greater than $V_N+\delta_1$. In this case, under the density assumption in Figure 1D, the bias would be zero.[12]

Thus, theory suggests conditions under which the bias from using the drop-out rate of unconstrained students as a proxy for the counterfactual drop-out rate of constrained students is zero. However, not surprisingly, theory is not able to guarantee that the bias would be small even if one imposes the illustrative density restriction in Figure 1D. Further, theory does not suggest that this density restriction is correct. Without guidance about the shape of the density function in Figure 1D, not only is it not possible to determine the size of the bias, but the direction of the bias also becomes uncertain.

The approach we take in Section IV is to view the question of whether constrained and unconstrained college attendees are similar in non-financial aspects as an empirical issue. It is not possible to observe V_S directly for unconstrained individuals and for constrained individuals under the counterfactual. Instead, we examine whether constrained and unconstrained individuals differ in any non-consumption dimensions that the theory at the beginning of this section suggests could influence V_S, and, hence, the drop-out rate. Thus, the approach relies heavily on the fact that the BPS was designed with the explicit goal of providing this type of information.

III. An overview of the Berea Panel Study and descriptive view of students at Berea

[11]Clearly, our sample also depends on which students want to attend Berea.

[12]It seems likely that, among the population of all high school graduates, the right tail of the density of V_S will differ between constrained and unconstrained students since high income students are less likely to be constrained and also tend to have higher ability at the time of college entrance. In this sense, the income cutoff at Berea is likely to make it more likely that the constrained and unconstrained individuals are similar in respects other than the constraint.

In response to unavoidable data limitations associated with surveys that typically contact college-age students at most once a year, Todd Stinebrickner and Ralph Stinebrickner began the Berea Panel Study with the explicit objective of collecting the type of detailed information that is necessary to provide a comprehensive view of the decision-making process of college students. The reality that college attrition and other decisions are best viewed as processes that begin at the time of college entrance motivated a longitudinal survey design in which students would be followed from the time of entrance until (at least) the transition into their first post-college activity.

Two cohorts were chosen with baseline surveys being administered to the first BPS cohort (the 2000 cohort) immediately before it began its freshman year in the fall of 2000 and baseline surveys being administered to the second BPS second cohort (the 2001 cohort) immediately before it began its freshman year in the fall of 2001. In addition to collecting detailed background information about students and their families, the baseline surveys were designed to take advantage of recent advances in survey methodology (see e.g., Barsky et al., 1997, Dominitz, 1998, and Dominitz and Manski, 1996 and 1997) in order to collect information about students' preferences and expectations towards uncertain future events and outcomes (e.g., academic performance, labor market outcomes, non-pecuniary benefits of school, marriage and children) that could influence decisions. Substantial follow-up surveys that are administered at the beginning and end of each subsequent semester have been designed to document the experiences of students and how the various factors that might influence decisions change over time. We note that our surveys emphasize the collection of information in a probabilistic form which is important given our desire to characterize the sources of uncertainty that potentially influence decisions. Shorter surveys that are administered at multiple times each year have been designed to provide information about how students are using their time. Using these time-use data, S&S (forthcoming) concluded that incorporating information about time-use is necessary if one hopes to provide a comprehensive view of college decision-making.

The baseline surveys were completed in the presence of survey administrators after students received classroom instruction which included information related to the decision to collect certain information in a probabilistic form. Subsequent surveys are distributed in paper-form to members of our sample who are still enrolled at Berea. Students return completed surveys in person to survey administrators who immediately review the surveys to ensure that students are able to comprehend all questions and that all questions have been completed

in a conscientious manner. As a result, the survey data quality has been found to be very high and very little data are missing. Survey data can be merged with administrative data that contain detailed background information about students (including information from the Free Application for Federal Student Aid (FAFSA)) as well as information about outcomes that take place at Berea.

The financial module used in this paper was administered for the first time during the 2001-2002 academic year. Thus, while the 2001 cohort answered the financial questions during their first year at Berea, the 2000 cohort did not answer these questions until their second year at Berea. Given our specific interest in college attrition and the reality that much attrition takes place during the first year, we concentrate here on the 2001 cohort.

The 2001 cohort was surveyed ten times during their first year with six of these surveys being shorter time-use surveys. The financial module shown included in Appendix A was included on the sixth survey of the year which was taken at the beginning of the second semester. As a result, we focus on individuals who returned for the second term, and, therefore, answered the financial questions while still enrolled at Berea.[13] The first, fifth, and tenth surveys are the other substantial surveys (i.e., they contain information other than time-use information) and were administered at the time of college entrance, the end of the first semester, the beginning of the second semester, and the end of the second semester respectively. When it is necessary to provide a clarification about when a particular survey question was answered, we refer to the survey number from which the question was taken and show the question in either the text or in Appendix A. The total amount of compensation received by a person who answered all surveys was $133. The 2001 cohort had an initial participation rate of .89 with 375 out of the 420 entering students at Berea responding. We concentrate on domestic students and exclude the 21 foreign students. Twenty-seven of the remaining students (.076) left school before the beginning of the second semester. This leaves 327 students who were eligible to complete the sixth survey. Our sample consists of the 307 eligible students (.939) who completed this survey.

[13]In the context of health and retirement, Bound (1991) stresses the importance of considering the possibility that individuals' answers to self-reported questions of this type may be biased by a desire to rationalize behavior. Although an exit survey was used to collect the financial information used here for individuals who had left school before the survey date (i.e., had left before the second semester), the potential problems highlighted by Bound (1991) influenced our decision to focus on a sample of individuals who returned to Berea for the second semester, and, therefore, answered all questions while still at Berea.

Some basic demographics of the overall sample are shown in the first column of Table 1. Forty-four percent of students are male and .19 of students are black. As expected given the mission of Berea, students at the school are quite poor with an average family income of $26,510. Although not shown in Table 1, the first quartile, median, and third quartile are $12,500, $27,000, and $39,500 respectively. In addition to having low income, students' families have little wealth. Rows 5 and 6 show that, on average, a student's family has total cash, savings, and checking account balances of $1241 and total investments (excluding the family residence) of $1855. Roughly half of students do not have at least one parent that graduated from college.

To get a sense of how much students at Berea spend on consumption outside of academic expenses and the room and board they pay to live on campus, students were asked the following question about yearly consumption

QUESTION 6.A. How much money do you expect that you will spend this year (September 2001-August 2002) ***not including college related costs*** (term bills, books, class-related supplies)? Please include expenses for things such as clothing, travel, telephone, cars, recreation, entertainment, and food and snacks not included in the college food plan. $_____

While this question is undoubtedly answered with substantial error and includes both the academic year and the summer after the first academic year, the answers leave little doubt that these low income students spend little on consumption while in college, and, as a result, suggest that there may be substantial scope for short-term constraints to operate. The average answer to this question at the beginning of the second semester was $957. However, this number contains three values which increase the mean by approximately ten percent and the median response is less than $600. This evidence is entirely consistent with what we have informally observed during the collection of the surveys where individuals regularly stress that the compensation received for participating in BPS represents an important portion of the money that they use to cover consumption expenses such as telephone bills during school.

In terms of outcomes, many students do not graduate. The drop-out rate before the second year for the individuals in our sample (who all started the second term) is .169. Taking into account the drop-out rate in the first term, the overall first-year drop-out rate from Berea for the 354 domestic participants in the BPS survey is .228. As discussed in detail in S&S (2003a), the drop-out outcomes of students at Berea are generally similar to those of students with comparable backgrounds who attend other schools.[14] What is likely to be of interest to policymakers

[14]As some rough evidence of this, S&S (2003a) found that the probability that a person with $40,000 in family income will complete more than three semester in college is .72 for individuals in the National Educational Longitudinal Study: Base Year Through Third Follow-Up (NELS-88).

is whether students graduate from Berea or any other college. While it is too early to have evidence on this matter for this sample, Stinebrickner and Stinebrickner (2003a) discuss the reality that very few students who left Berea during 1989-1997 transferred to other four year schools.

IV. Results

In this section we examine the three parameters of interest that were described in the introduction: 1) the proportion of students who are constrained; 2) the effect that being constrained has on the drop-out probability of constrained students; 3) the amount of attrition that is caused by credit constraints.

IV.1. Are students credit-constrained? Evidence about the first parameter of interest.

We identify a person as being credit-constrained if he/she answers in the affirmative to the first part of the following survey question:

Question 6.E.1 Suppose that someone offered to loan you money this year so that you could increase the amount of money that you would have for spending money during this year. Suppose that the loan is made at a fair interest rate and that you would not have to begin repaying the loan until after you leave Berea.
Would you accept the loan? YES NO

Question 6.E.2 If you answered YES,

> You would like to borrow money to increase your spending at Berea during this year. Remember, you will have to pay back the loan and any interest after leaving Berea. How much money would you choose to borrow this year in order to increase your spending money this year?
> $ _____.

Sixty-two of 307 (.202) students in our sample are identified as being credit constrained using this criteria. Thus, while students spend very little on consumption while in school, the results indicate that relatively few individuals are constrained by a lack of access to credit.

It is natural to question the exact extent to which the answers to our survey question would mirror what would happen in reality if the loan was actually made available to our respondents. Our intuition a priori was that, if a response bias does exist, it would arise because the proportion of students who answer affirmatively to the survey question would tend to overstate the proportion of students that would accept the loan if it was actually made available. The primary reason for this intuition was that it would seem that students might have a mentality that "of course I want more spending money" and that survey responses would not fully take into account the reality that there are future costs of borrowing money which would likely become more apparent if the individual actually

began the process of applying for the loan. The reality that there are future consumption costs of borrowing was made explicit in question 6.E.2 in an attempt to minimize this effect. Another reason for this intuition was that it seems likely that, when answering the survey questions, students would not fully take into account the time and transactions costs associated with applying for such a loan. If this intuition is correct, then it guarantees that the bound on the amount of attrition caused by the constraint that is computed in Section IV.2 is indeed an upper bound.

In addition, confidence in the responses to the survey question can be obtained indirectly by examining whether constrained students differ from unconstrained students in ways that would be generally consistent with the presence of a constraint. For example, if constrained and unconstrained students are similar in non-financial dimensions that theory suggests influence the drop-out decision, then individuals who wish to borrow money should be observed to have less resources that could be used for consumption during college than students who do not wish to borrow money.[15] In an effort to provide some evidence that the responses to the constraint question are generally reasonable, we provide information about differences in financial resources here. We leave the examination of non-financial differences to Section IV.3, but note in advance that we find no evidence that these types of differences exist between constrained and unconstrained students.

Students at Berea pay no tuition. The student's term bill, which is the total amount that is paid for room, board, and academic fees, depends on a student's expected family contribution which is calculated from information on the FAFSA. The average amount paid is $2595 and the average amount paid differs by less than $100 for constrained and unconstrained students in the sample. Recall that our financial questions were collected at the beginning of the second semester of students' first year. At the time that the survey was collected, students are "expected" to have paid their term bills for both the first and second semester and any loans that had already been approved from formal sources would have been sent directly to the college as part of this payment. In this case, an individual's sources of consumption for the second semester would consist of personal savings, spending money received from parents after the start of the second semester, new loans from parents or formal sources (including credit cards), and earnings from paid employment during the semester. With respect to the last source, each student

[15]If constrained and unconstrained individuals are different in non-financial dimensions, then it is difficult to know what to expect from a comparison of financial resources. For example, if constrained individuals discount the future more than unconstrained individuals, then constrained individuals might wish to have higher amounts of consumption than unconstrained individuals. In this case, constrained individuals might legitimately indicate that they wish to borrow money even if they have the same or more financial resources as unconstrained individuals.

at the school is required to be involved in a work-study program in which he has some flexibility in how many hours he works, and a student is not permitted to hold off-campus jobs. As a result, our data contain all labor income for individuals in the second semester. Information on these sources is shown in Table 2.[16]

The data suggest very strongly that liquidity constrained individuals have only a trivial amount of money that could be used for consumption. Most striking is the fact that the constrained individuals report having an average personal savings of only $246 and the median constrained individual has less than $50 in savings at the beginning of the second semester. With respect to the second possible source of consumption income, constrained individuals report on question 6.F (Appendix A) that, on average, they will receive a total of $649 in grants from their parents during the first academic year. However, this is the total amount that is received to assist with both a person's term bills and spending money. Given that this number is small combined with both the likelihood that a large proportion of parental money will go directly towards the payment of college bills and the likelihood that the majority of the parental amount that is devoted to spending money will already have been received by the time the student returns to college for the second semester, it seems that very little of the $649 will be received for spending money after the beginning of the second semester. Further, on question 6.B.2 (see Appendix A), only 14% of constrained individuals report that their parents (or friends) would be willing and able to grant them more money to increase consumption. Similarly, any loans from parents during the current academic year are likely to have already been received by the beginning of the second semester and this issue is by and large irrelevant since only .016 of constrained individuals report that they are borrowing money from their parents during the current academic year. Constrained individuals are also not optimistic about receiving new loans from parents or other formal sources. Only 9% of constrained individuals report on 6.B.2 that they could get a new loan from parents or friends to increase consumption and only 3% of constrained individuals report on 6.B.4 that they could obtain a loan from a formal source to increase consumption beyond its current level. With respect to paid employment, on average, constrained individuals earned approximately $450.

[16]Despite the fact that students are expected to have paid their term bill by the beginning of the second semester, for some students some of the income from these sources may end up going to the college for payment of the term bill. Students with particular financial difficulties can request a payment plan. In this case, half of all labor earnings are taken directly by the college and the student is given an extension for the remainder of the term bill.

Unconstrained students are certainly not wealthy but indications are that they are better off than the constrained students. This shows up most clearly in the fact that unconstrained individuals report having average savings of $940 and the median unconstrained individual has approximately $300 in savings. A test of the null hypothesis that the average savings of constrained and unconstrained individuals is identical is rejected at all traditional levels of significance with a t-statistic of 5.405. As a result, unconstrained individuals in the sample are roughly five times as likely as constrained individuals to report that they could use personal savings to increase consumption above what they currently are planning to spend during the year. Unconstrained individuals in the sample report receiving $930 on average from their parents during the academic year which is somewhat more than that received by constrained individuals, although, as the previous discussion suggests, this is not likely to translate into significant differences in second semester consumption. However, unconstrained individuals in the sample are roughly twice as likely as constrained individuals in the sample to be able to increase spending money through gifts from parents (or friends) with 27% of individuals reporting that this would be possible. Like unconstrained individuals, borrowing from parents or other formal sources does not seem like a strong possibility with 12% and 5% reporting these possibilities respectively. The average labor income of unconstrained individuals in the sample is similar to that of constrained individuals.

Thus, while neither constrained or unconstrained individuals have large amounts of resources at their disposal for consumption, it appears that constrained students have virtually no sources of income that could be used for consumption, whereas constrained students report that they are somewhat better off. These findings from self-reported questions are consistent with the financial information from the Free Application for Student Financial Aid (FAFSA). For example, Row 5 of Table 1 indicates that the average savings of parents of constrained students in our sample is smaller than the savings of parents of unconstrained students in our sample by a factor of 3.7, and this difference is statistically significant at a 5% level.

It is worth noting that, while the survey questions in the financial module (Appendix A) could be used to construct alternative definitions for identifying which students are constrained, these definitions tend to be less than ideal. For example, one possibility would be to identify students as constrained if they indicate in question 6.B that they could not increase the amount of spending money beyond what they currently plan to spend during the year. Unfortunately, this question does not provide information about whether individuals would like to have more

spending money. One reason that students may not have resources that can be used to increase spending is that they have already borrowed money or allocated money in an effort to get close or meet their desired amount of spending. As a result, we believe that is is most reasonable to focus on our definition from question 6.E which is consistent with the notion that students are not credit constrained if they do not wish to borrow money.[17]

IV.2 Drop-out rates by constraint status and a bound on the amount of attrition caused by constraints (the third parameter of interest)

Given our sample of students who are enrolled at the beginning of the second semester, the outcome we examine is whether individuals in our sample drop-out before their second year at Berea conditional on starting the second semester.[18] We find that there exist quantitatively large differences in this outcome between those that are credit constrained and those that are not constrained. The proportion of constrained students who drop-out is .274. The proportion of unconstrained students who drop-out is .142. A test of the null hypothesis that the population drop-out rates of constrained and unconstrained students are equal is rejected at significance levels greater than .013.

The amount of attrition that is caused by short-term credit constraints is bounded below by zero. Given information about the proportion of students that are constrained, .202, an upper bound on the amount of attrition that is caused by short-term credit constraints can be found by assuming that the attrition of the constrained students is caused entirely by the constraint. The upper bound is .202*.274=.055. Given the overall second semester attrition rate of .169, at most 32% of the attrition is caused by short-term liquidity constraints. Thus, even under the extreme assumption that all of the attrition of constrained individuals should be attributed to credit constraints, our bound is informative in the sense that it indicates that the large majority of attrition that remains after removing the direct costs of college is unrelated to short-term constraints that might influence students' ability to smooth consumption. Taken together with evidence in S&S (2003a) that attrition is primarily caused by factors other than the direct costs

[17]An ideal definition may be that a person wants to borrow and has no other resources that will allow him to do so. This is very close to the definition we use. Only .20 of constrained individuals say that they have any financial resources that could be used to increase consumption. Further, the survey question does not contain information about the amount that could be obtained. Thus, for some of these .20, the amount of money that could be obtained for consumption may be quite small. Regardless, results in the paper change very little if the .20 are excluded from the constrained group.

[18]As shown in S&S(2003a), this is the period with the highest drop-out rate. In a particular year, the majority of exits take place after the start of the second semester, and yearly drop-out rates decline after the first year.

of schooling, the bound suggests that the majority of attrition of students from low income families is unrelated to credit considerations.[19]

IV.3 Evidence about the effect of the constraint on constrained students (the second parameter of interest) and further evidence about the total effect of constraints (the third parameter of interest)

While the bound on the amount of attrition caused by constraints in the previous section is informative, examining whether it is possible to compute a credible estimate of the effect of the constraint on constrained students is worthwhile for two related reasons. First, it seems likely that the upper bound is likely to be quite conservative since it is computed under the assumption that the drop-out outcomes of constrained students are caused entirely by the constraint. Second, it is of interest to understand whether constraints play an important role in the decisions of some students even if the overall amount of attrition caused by constraints is quite small.

As discussed in Section II, while identification of the effect of the constraint on constrained students is generally difficult, an estimate can be obtained in the case where constrained and unconstrained individuals differ in the resources that are available for consumption but are the same in all other dimensions that theory suggests might influence the drop-out decision. In this case, the drop-out rate of unconstrained students provides information about the drop-out rate of unconstrained students under the counterfactual in which they are not constrained. In Section IV.1 we established that constrained and unconstrained individuals have different financial resources that can be used for consumption. Here we turn to the detailed information in the BPS to examine whether it is reasonable to believe that constrained and unconstrained students are similar in other dimensions that theory suggests are important.

Our theoretical discussion in Section II suggests that differences in outcomes can be driven by 1) differences in ability, 2) differences in beliefs about earnings conditional on particular schooling outcomes, and 3) differences in preferences θ_S, θ_N, and β, which indicate how much utility a person would get over his lifetime given a particular path of schooling decisions and consumption levels. Our interest is in examining whether differences in these factors exist because this might imply that differences in the drop-out outcome between constrained and unconstrained individuals might remain even if credit constraints were removed. Thus, we must be cautious when

[19]It is not clear whether students who wish to borrow money to help support parents or other family members would answer in the affirmative to our constraint question. If not, then to the extent that students leave school to support parents or other family members, this financial reason for exit would not be captured within our bounds.

comparing across the constrained and unconstrained groups any information that could have been influenced by the constraint itself. We avoid comparisons in cases where this issue is likely to be problematic. For example, it would not seem to make sense to look for evidence of differences in ability across constraint groups by comparing college grade point averages across constraint groups because being less happy at school could potentially lead to lower grade performance through its effect on a person's focus or study effort during school. In other cases where it is less clear whether the issue is problematic, we describe the assumptions that would be necessary for the comparison to be valid. In the interest of space considerations, we summarize our findings related to the three non-consumption factors here and present more detail in Appendix B. It is worth noting that it would be desirable to examine whether the joint distribution of all relevant information is the same for constrained and unconstrained students. Here we focus on whether means of variables are the same across constrained and unconstrained groups, but note in advance that, for the large majority of the variables we examine, a test of the of null hypothesis that the population variance is the same across constrained and unconstrained groups is also not rejected at traditional significance levels.

With respect to the first of the three non-consumption factors that theory suggests could influence outcomes, Manski (1989) stresses the important role that ability is likely to play in the college attrition decision. Given that evidence from our sample is consistent with the notion that a student's cumulative grade point average is by far the strongest predictor of whether a person stays in school (S&S, 2003a), it seems particularly important to pay careful attention to whether differences exist in determinants of college grade point average such as ability and motivation.[20] In terms of observable characteristics that are typically available in administrative data, we find that, although a student's score on the American College Test (ACT) and the student's high school grade point average (HSGPA) are strongly related to college grade performance, these variables do not vary by constraint status. While this provides some evidence that the academic ability of constrained and unconstrained individuals is similar, one worries that the portion of ability and motivation not captured by these administrative variables may still be

[20]S&S(2003a) find that increasing college grade point average by 1 full point decreases the drop-out hazard by a factor of 5. For this sample, Table 3 shows that the t-statistic associated with College GPA is greater than 5.0 and the effect of this variable dominates that of all other variables including a student's college entrance exam scores and high school grade point average. As discussed in S&S (2003a), College GPA could be endogenous to the exit decision if individuals to some extent decide whether to leave school before the production of college grades in a semester is completed.

somehow related to constraint status. While removing uncertainty about this issue is a very difficult task, our data allow us to examine this issue in more detail than is typically possible because, in addition to having access to the standard administrative data of the sort described above, we have used the BPS to collect a variety of additional information at the time of college entrance that helps to characterize a person's academic ability, motivation, and beliefs about the importance of college. As shown in Table 4, we examine information about anticipated grade performance, anticipated grade performance conditional on study effort, study effort in high school, anticipated study effort in college, and beliefs about the probability of being suspended from school in the future due to poor academic performance. Our results in Table 4 and Table 5 and described in detail in Appendix B show that, although these new variables have statistically significant correlations with college grade performance and have explanatory power when added to a specification that includes standard administrative variables, the new variables do not vary by constraint status. In short, while it will never be possible to resolve all of the uncertainty associated with whether the ability and motivation of constrained and unconstrained individuals are different, the reality that no differences are observed in any of six measures that are individually related to GPA and presumably capture somewhat different aspects of ability and motivation seems to provide some evidence that, at the very least, any existing ability differences are not large between constrained and unconstrained individuals.[21]

With respect to the second of the three non-consumption factors that theory suggests could influence outcomes, at the time of college entrance and at the end of the first year we elicited individuals' beliefs about earnings using a survey approach that follows in the general spirit of the work by Dominitz (1998) and Dominitz and Manski (1996 , 1997) who found evidence that individuals are able to provide sensible answers to questions

[21]Earlier we noted that we did not want to make comparisons of information that could be influenced by constraint status. Comparisons of a student's anticipated grade performance (unconditional on effort), beliefs about being suspended for poor academic performance, and anticipated study effort during college would be only be problematic if constrained individuals both realize at the time of college entrance that their consumption situation will make them less happy at school and believe that being unhappy at school will influence their effort or focus on academics. If this was the case, the effect of comparing the answers to these questions would be to understate the ability of the constrained students relative to the unconstrained students. Thus, the fact that we find no evidence of differences by constraint status can be used to support the notion that the ability of constrained individuals is not lower than that of unconstrained individuals. In this case, our calculations of the amount of attrition caused by constraints would tend to be accurate or conservative.

aimed at characterizing the entire distribution of future uncertain events.[22] Specifically, for each of a number of schooling scenarios involving attainment and grade performance, we ask each individual to report the first, second, and third quartiles associated with the future earnings that he would receive at several future ages given the scenario. We construct measures of the returns to schooling using median earnings information at age 28 for various graduation and non-graduation scenarios.[23] We find that, although the constructed returns to schooling measures have statistically significant and quantitatively important relationships to the drop-out decision, there is no evidence that differences in beliefs about earnings exist by constraint status.

With respect to the third non-consumption factor that theory suggests could influence outcomes, a causal interpretation of the relationship between constraint status and outcomes would not be justified if constrained and unconstrained individuals would receive different levels of lifetime utility from the schooling and/or non-schooling options even if consumption paths were identical. Our approach for examining whether these differences exist is threefold. The first approach we take to examine this third factor is to use recent innovations in survey methodology by Barsky et al. (1997) to directly examine whether some of the basic properties associated with utility, such as risk aversion, intertemporal elasticity of substitution, and rate of time preference, differ across constrained and unconstrained individuals.[24] The risk aversion questions we use ask respondents about their willingness to gamble on lifetime income. We find that students are generally quite risk averse with .60 of students having risk aversion of greater than 2.0 under the assumption that utility follows a constant relative risk aversion form. While we find some evidence that risk aversion is related to outcomes, we find no evidence of differences in risk aversion by constraint status. Measures of the intertemporal elasticity substitution and rate of time preference are elicited by asking respondents to choose consumption profiles implicitly associated with different rates of return. As with risk

[22]Our approach differs somewhat in practice from the work of Dominitz and Manski due to the necessity of collecting our information using a written survey. All individuals received classroom training before answering the survey.

[23]The individual was also asked about earnings in the first year after leaving school and at the age of 38. We examine the age of 28 here in part because earnings in the first year after leaving school may be influenced by whether a person is in graduate school.

[24]We thank the authors of Barsky et al. (1997) for providing the questions that we used in the survey.

aversion, we find no differences by constraint status. The second approach we take to examine this third factor is an indirect approach of examining whether differences in particular personal or family situations, which might make school less enjoyable relative to being out of the workforce at a given level of consumption, exist between constrained and unconstrained individuals. We find no evidence of differences by constraint status. As one example, we find that .93 of all students report that they are in good or excellent health at the time of college entrance and we find no evidence of differences in health between constrained and unconstrained students. As another example, we find that, although beginning college with a boyfriend/girlfriend that is not attending Berea is quite common, there is no evidence of a difference between constrained and unconstrained individuals in this respect. As a third example that is meant to provide additional information about a student's attachment to his family and hometown, we find no evidence that students' beliefs that they will eventually return to their hometown after leaving school (conditional on graduating or not graduating) vary by constraint status.

The final approach we take to examine the third factor is more direct. At the beginning of the academic year, we asked individuals the following question about their beliefs regarding how enjoyable school will be relative to being out of school.

Question 1.A. Circle the one answer that best describes your beliefs at this time
1. I believe that being in college at Berea will be much more enjoyable than not being in college.
2. I believe that being in college at Berea will be somewhat more enjoyable than not being in college.
3. I believe that I will enjoy being in college at Berea about the same amount as I would enjoy not being in college.
4. I believe that being in college at Berea will be somewhat less enjoyable than not being in college.
5. I believe that being in college at Berea will be much less enjoyable than not being in college.

At the time of college entrance, we reject the null hypothesis that beliefs about how enjoyable school will be are different for constrained and unconstrained individuals. For example, .645 of constrained students and .699 of unconstrained students indicate that being in school will be much more enjoyable than not being in school, and test of the null hypothesis that the difference in the population proportions is zero has a t-statistic of less than one. Similarly, .064 of constrained students and .025 of unconstrained students indicate that being in school will be somewhat less enjoyable or much less enjoyable than not being in school, and a test of the null hypothesis that the difference in the population proportions is zero has a t-statistic of approximately .8.

We are interested in whether differences in answers to this question would exist by constraint status if constrained and unconstrained students had the same consumption. Our answers deviate from this "consumption held constant" situation if constrained individuals believe at the time of entrance that they will have less money for consumption and believe that having less money for consumption will make them less happy in school relative to being out of school. If this was the case, the effect of comparing the answers to this question across constraint groups would be to understate how enjoyable constrained students would find school relative to the unconstrained students if the feasible consumption set were the same across groups. However, because constrained students have such positive beliefs about how enjoyable school will be, the responses imply that this understatement is necessarily small. For example, the proportion of constrained students who would feel that being in school would be somewhat less enjoyable or much less enjoyable than not being in school if they had the same consumption as unconstrained students is overstated by at most .064. Even if this proportion was zero, it would be very similar to that of the unconstrained individuals, .025. Therefore, it seems reasonable to conclude that, at the time of college entrance, constrained and unconstrained students have very similar views about how enjoyable school would be at a given level of consumption.

A summary of the differences between constrained and unconstrained can be seen by examining the last column of Tables 1, 2, 4, and 6. In each table, the last column shows the p-value from the test that the average value of the variable in a particular row is the same across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" otherwise. The results provide striking evidence that constrained and unconstrained individuals differ significantly in financial dimensions but are very similar in other respects; while many of the financial variables in Table 1 and Table 2 are found to vary by constraint status, the only non-financial variable in the tables that is found to vary by constraint status is the Male variable. If constrained and unconstrained students differ only in the resources that they have available for consumption, then an estimate of the effect of constraints would be given by the difference between the drop-out probabilities of the constrained and unconstrained students, .274-.142.=.132, which has a p-value of .013. Thus, the results indicate a quantitatively important effect of constraints. At the new estimate, the amount of attrition due to the constraint is .026=.202*.132. This implies that

15% of all attrition is caused by short-term liquidity constraints. As expected, the upper bound of 33% computed earlier was quite conservative.[25]

1V.4 Some additional evidence and discussion related to the presence of a causal effect

It is worthwhile to provide some additional evidence in support of the conclusion that credit constraints play an important causal role in the decisions of some students. The effect of liquidity constraints should operate most directly through how much a person enjoys school. Recall that our question 1.A which asks individuals about how enjoyable they believe school will be relative to not being in school found no difference between constrained and unconstrained individuals at the time of college entrance. While this is what one would expect if individuals are indeed similar in ways other than their feasible consumption choices and constrained individuals either learn about the lack of consumption income after the time of college entrance or do not believe that a lack of consumption income will have much of an effect on how enjoyable school will be, it seems that differences should exist at later times if liquidity constraints are causally related to exits. We find evidence that this is the case. At the end of the first semester we repeated question 1.A and found that .561 of unconstrained individuals but only .387 of constrained indicate that being in school is much more enjoyable than not being in school.[26] A test of the null hypothesis that the difference in the population proportions is zero has a t-statistic of 2.25. Similarly, .075 of unconstrained students and .184 of constrained students indicate that being in school is somewhat less enjoyable or much less enjoyable than not being in school and a test of the null hypothesis that the difference in the population

[25]Statistically significant differences were not found in non-consumption dimensions between the two groups. To make sure that any existing differences do not matter in the aggregate, we estimated regressions of the drop-out outcome on a large variety of specifications which included different combinations of the observable characteristics that appear in Tables 1, 2, 4, 6, and 7. In many cases, these specifications included highly correlated variables and the specifications were not informed by economic theory. As such, our motivation for this exercise was not to attempt to provide an interpretation of the effect of any of the observable characteristics, but, rather, to examine whether we could find any specification in which the effect of being constrained no longer had an important effect after controlling for other observable characteristics. In all specifications that we tried, the effect of being constrained continued to have an significant and quantitatively large effect. Given that it is not possible to show all specifications and that there is no natural way to choose between specifications, we simply show in Table 9 a specification in which a set of "traditional" characteristics, {MALE, BLACK, FAMINC, PARENTED, ACT, HSGPA}, are included along with an indicator of whether a person is constrained. The estimated effect of the constraint in this specification is .121 with an associated t-statistic of 2.188.

[26]Compared to 1.A, the question was modified slightly to take into account that students were now in school. For example, the first answer was worded 1. I believe that being in college at Berea is much more enjoyable than not being in college.

proportions is zero has a t-statistic of 1.88. The question was asked at the end of the year and the results are virtually identical to those obtained at the middle of the year.[27]

Thus, there is evidence that constrained individuals find school less enjoyable although they did not anticipate initially that this would be the case. In an effort to examine whether direct evidence exists that financial circumstances are the primary factor for differences in how much students enjoy school, we turn to question 10.A (see Appendix A) which was asked at the end of the year and was also asked at the end of the first term in a slightly different form. Motivated by the basic idea that whether a person remains in school is influenced by what he learns after arriving at school, Question 10.A lists an exhaustive set of 13 possible reasons that students could have found school to be less beneficial than expected at the time of college entrance. Table 10 shows whether the proportion of constrained students that indicate that they found a particular reason to be true is different than the proportion of unconstrained individuals that found the reason to be true. Reasons a, b, and c were modified between the end of the first term and the end of the first year.

The three reasons, f, g, and h, focus on whether financial problems made school less enjoyable than expected. At the middle of the academic year (survey 5), a test of the null hypothesis that the constrained and unconstrained proportions are the same is overwhelmingly rejected for reasons f and g with the test having p-values of .008 and .003 respectively. At the end of the year (survey 10), the test if rejected for all three reasons related to financial circumstances with the test having p-values of .008, .006, and .028 respectively.

Further, at the middle of the academic year, similar tests are rejected for only two of the other ten reasons (e and j) and at the end of the year similar tests are rejected for only four of the other ten reasons (b, c, i, and j). Reason j, which indicates that "personal health problems have made school less enjoyable," is found to be important at both the middle and end of the year. This is consistent with the fact that our self-reported health questions indicate that health is the same across constraint groups at the beginning of the year but is not the same at the end

[27]The proportions for the "much more enjoyable" category are .363 (constrained) and .541 (unconstrained) with a t-statistic of 2.22. The proportions for the "somewhat or much less enjoyable" category are .182 (constrained) and .077 (constrained) with a t-statistic of 1.72.

of the first semester or end of the year.[28] Recall that both constrained and unconstrained individuals report having very good health at the beginning of the year. Given that individuals of college age are unlikely to suffer major medical problems in a year conditional on being in good health at the beginning of the year, it seems likely that the health problems reported by the constrained students at the middle and end of the year may be of the nature that could be caused by problems such as stress that would potentially be related to how enjoyable school is in general and worries about financial problems in particular. In this case, differences in reported health would be caused to some extent by the constraint. Reason b and c relate to the effect that worse than expected grade performance has on the probability of failing out of school and on future job prospects respectively. As discussed below, it seems quite possible that the higher proportion of worse than expected grade performance for the constrained individuals may also be related to the constraint if individuals who are unhappy in school do not perform as well academically.[29] Part e, which is related to physical or emotional harassment, appears to be important at the middle of the year but is no longer important at the end of the year. The only reason that is important at the end of the year and is seemingly unrelated to financial considerations is reason i that "non-financial problems or health problems of family or friends at home have made school less enjoyable." When viewed as a whole, question 10.A provides evidence that the main difference between constrained and unconstrained individuals is related to the students' financial situations. To the extent that differences in what constrained and unconstrained individuals learn during school drive differences in outcomes, this evidence supports the notion that constraint status has an important causal effect.

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[28]At the beginning of the year, .94 of constrained and .90 of unconstrained students report being in good or excellent health. At the end of the first semester, .873 of unconstrained but only .720 of constrained individuals report being in poor or fair health. At the end of the academic year, .884 of unconstrained and .75 of constrained individuals report being in poor or fair health. A test that the population proportions of constrained and unconstrained individuals that are in good or excellent health is not rejected at traditional significance levels in the first case, is rejected at significance levels of greater than .007 in the second case, and is rejected at significance levels greater than .019 in the last case.

[29]In addition, although the difference is statistically significant, the importance of this reason in determining differences in outcomes between constrained and unconstrained individuals is likely small since only .113 of constrained individuals indicate that it is true.

A reasonable question is whether in practice we should expect this to translate into non-trivial differences in drop-out rates between constrained and unconstrained individuals, and, if so, through what channels should the non-pecuniary aspects be expected to influence the drop-out decision. One possible scenario is simply that credit constrained students are more likely to leave school because they believe that the lower non-pecuniary benefits that they experience will persist throughout their college experience because of continued difficulties of borrowing money. However, while students from low income families may find it difficult to increase consumption in the short-run (e.g., they may not have parents that are able and willing to immediately put money in their bank account), it seems likely that these students may be able to find some avenue which allows them to increase consumption in the future. For example, a student without a credit-card at the time of college may be able to eventually obtain a credit card or a student's family who has very few resources may be able to eventually find some manner to borrow some money. While these types of borrowing possibilities are likely to occur at high interest rates, the overall additional interest cost of borrowing at these interest rates may tend to be relatively small if, at the time of college entrance, the student has not substantially miscalculated the amount of utility that he will receive from consumption during college.

The previous paragraph simply suggests that a student who finds school to be less enjoyable than expected due to borrowing constraints may not be likely to leave school if he believes that he can fix this problem in future semesters at a relatively low overall cost. Thus, in order for liquidity constraints to be quantitatively important, it would seem to be necessary that either constrained students truly cannot find even high cost methods of borrowing or that the initial decrease in non-pecuniary benefits has an effect on beliefs about aspects of the future that the individual does not think would be influenced by finding a source of future (possibly high-interest) loans. One possible scenario is that credit-constrained students who are initially unhappy at school are not able to completely determine to what extent this unhappiness is due solely to reasons related to consumption rather than reasons that are permanent in nature and would influence future utility even if credit problems are resolved.

Another explanation stems from the possibility that students who are generally unhappy in school may be less likely to focus intently on academic matters. In this case, liquidity constrained students may perform worse academically in the short run. This poor initial academic performance may have an influence on future outcomes

for multiple reasons including the fact that grade performance in the first semester makes a permanent contribution to the student cumulative GPA and the fact that grade performance in the first semester may influence what a person believes about his/her future grade performance. If students are not fully aware of the effect on grades of being distracted or are not focused on academics, the lower grade performance may lead to lower beliefs about academic ability. Although the results are not shown, we find some evidence that the latter is true by adding a constraint indicator to the specification in the last column of Table 5. Conditional on a large number of observable characteristics which describe a variety of aspects of a person's ability and motivation, individuals in our sample who are credit constrained receive first semester grades that are lower by .313 and the estimated effect has a t-statistic of 2.874. Further some evidence that this worse academic performance may be due to a lack of focus comes from our time-use information. Using the eight time-use surveys that we collected during the year, we find that both the weekly amount that a person studied in high school (STUDYHS) and the weekday amount that a person expects to study in college (STUDYC) are related to the amount that a person actually studies during college.[30] Thus, there is some evidence that the STUDYC and STUDYHS variables contain valuable information. Nonetheless, despite the fact that, as shown in Rows 3 and 4 of Table 4, constrained students studied as much as unconstrained students during high school and report that they expect to study as much during college, we find that their actual study amounts are significantly smaller and the difference is quantitatively large. Specifically, on average, constrained students report studying 2.791 hours pers day during the first semester and unconstrained students report studying 3.415 hours per day during the first semester and a test of the null hypothesis that constrained and unconstrained individuals study the same amount is rejected at significance levels greater than .006. The examination of the relationship between time-use and grade performance in S&S(2003b) and

[30]In a regression of first semester GPA on a constant, STUDYHS and STUDYHS*STUDYHS, the estimated effects and t-statistics associated with STUDYHS and STUDYHS*STUDYHS are .102 (5.253) and -.001 (-3.192) respectively. In a regression of first semester GPA on a constant, STUDYHS and STUDYHS*STUDYHS, the estimated effects and t-statistics are .527 (3.315) and -.040 (-2.621) respectively. See Stinebrickner & Stinebrickner (forthcoming) for a detailed look at the time-use data and the relationship between study-effort and grade performance.

S&S(forthcoming) suggests that it is plausible that the poorer than expected grade performance of constrained students can be attributed largely to the smaller than predicted amounts of effort.[31]

V. Conclusion

At Berea, the direct costs of college have been removed. Thus, the effect of credit constraints must operate through the fact that school may be less enjoyable if a person has little spending money after paying the subsidized room/board and college fees. Our results suggest that there exists a group of students whose outcomes are likely to suffer substantially for this reason. Further, answers to question 6.E.2 suggest that a policy to help these students would not be particularly expensive. For example, the average constrained person indicates that he would like to borrow only $889 for the current academic year and the median amount is $500.

Nonetheless, this paper suggests that a policy that addresses difficulties that students have smoothing consumption would have a relatively small effect on the drop-out rate at Berea. An upper bound on the amount of attrition that is caused by the constraint implies that at least 68% of attrition would remain at Berea if a policy that made loans available to students was implemented. Using an estimate of the effect of credit constraints on constrained students, we estimate that 85% of attrition would remain.

A large amount of attrition at Berea is due to reasons unrelated to direct costs and difficulties smoothing consumption. It seems reasonable to believe that a similar amount of attrition elsewhere is caused by reasons unrelated to constraints since the types of non-financial reasons that affect students at Berea would seemingly also be relevant for low income students elsewhere. The percentage of attrition of low income students that is caused by constraints elsewhere depends on the total amount of attrition that exists at other schools where direct costs are not zero. S&S (2003a) finds that attrition of low income students who attend schools where direct costs are not zero is very similar to attrition at Berea. This is perhaps not surprising since marginal students from low income families

[31] S&S (forthcoming) estimate a relationship between study-time and grade performance with a specific focus on the measurement issues related to study-hours. The estimates of the descriptive relationship indicate that increasing study effort from 2 hours to 3 hours per day is related to a .37 increase in semester GPA. S&S(2003b) take advantage of random assignment of jobs in the Berea College labor program to establish that working an additional hour in paid employment has a strong, negative, causal effect on GPA.

typically attend state schools where direct costs are quite low. As a result, it seems reasonable to conclude more generally that the majority of attrition of students from low income families is caused by reasons unrelated to credit constraints.

The relatively small overall impact of making loans available to students who desire them arises largely because only .20 of students indicate that they would accept a loan if it was made available. It is important to understand why the remaining .80 do not wish to borrow money. If the unconstrained .80 do not wish to borrow money because their current consumption represents the choice that would be optimal given an unconstrained decision, then the .026 represents the overall impact of not having resources available that allows one to smooth consumption. On the other hand, if individuals do not wish to borrow money for other reasons, then the effect of not being able to smooth consumption might be larger. For example, if some of the remaining .80 do not wish to borrow money simply because they believe that borrowing is wrong for religious reasons, then a portion of the drop-out rate of constrained students might be attributed to the consumption smoothing mechanism, even though this portion would not be reduced by the presence of a loan.

We are able to provide some information about this issue using question 6.E.3. We find that the majority of individuals are happy with their current consumption amounts; sixty-four percent of unconstrained students answer that they do not want to borrow money because they are "happy with the amount I am currently spending and would not choose to increase spending now because I would have less to spend later when I had to repay the loan and interest ." Thus, our findings suggest that, even in an entirely unconstrained world, individuals would choose to spend substantially less money during school than they would after leaving school. This is not surprising if one believes that the college environment is one where many services and recreational activities are either provided by schools or are of a low cost nature and where it may be acceptable to go without consumption goods, such as televisions and cars, that might be deemed necessary or more important later.

Thus, our results indicate that the drop-out rate for these types of students would remain high even if all direct costs of schooling were removed and if students were given loans to address difficulties smoothing consumption during school. It is important to stress that this paper does not provide any direct information about the role that liquidity constraints play in the college entrance decision. Nonetheless, given the important role that college

attrition plays in determining overall differences in graduation rates by family income, the results of this paper imply that substantial differences in college graduation rates by family income would likely remain even under very generous programs aimed at addressing liquidity constraints in post-secondary education. Finally, the paper establishes that non-financial reasons for college attrition are very important in the aggregate. More research is needed to understand the manner in which the individual non-financial reasons interact to create the process by which individuals make college decisions. Altough the Berea Panel Study provides an opportunity to examine this issue, we leave this for future work.

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Table 1 Demographic and parental characteristics for entire sample and by constraint status

	Entire Sample mean (std. dev.) n=307	Not Constrained mean (std. dev.) n=245	Constrained mean (std. dev.) n=62	pvalue if <.10 See note below
1. Male	.442	.416	.548	.062
2. Black	.188	.171	.258	.N
3. ParentEd - at least one parent has college degree	.511	.534	.419	N
4. Faminc - total family income from FAFSA	26510 (17153)	27146 (16895)	24006 (18056)	N
5. Total Parental Savings from FAFSA (cash, savings, and checking accounts)	1241 (3671)	1460 (4077)	392 (658)	.046
6. Total Parental Investments from FAFSA	1855 (6680)	2117 (7106)	857 (4629)	N

The last column shows the p-value from the test that the average value of the variable in a particular row is the same across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" if the p-value is greater than .1.

Table 2 Student financial information for entire sample and by constraint status

	Entire Sample mean (std. dev.) n=307	Not Constrained mean (std. dev.) n=245	Constrained mean (std. dev.) n=62	pvalue if <.10 See note below
1. total student savings as of second semester	800 (1589) median 200	940 (1734) median300	246 (510) median 50	.0000
2. first-year grants from parents for term bill and spending money	874 (1305)	930 (649)	649 (1087)	.097
3. have a loan from parents or friends	.033	.036	.016	N
4. have a credit card	.250	.249	.258	N
5. amount of debt on credit card that will not be paid off this month	78	47	201	.003
6. labor income second semester	453 (72)	453 (72)	450 (81)	N
7. could increase spending money using personal savings	.263	.314	.064	.0001
8. could increase spending money using new grants from parents, friends, relatives	.247	.273	.145	.036
9. could increase spending money through loans from parents, friends, relatives	.114	.118	.096	N
10. could increase spending money through loans from other sources at fair interest rates	.045	.049	.032	N
11. could increase spending money from one or more source in previous 4 rows	.371	.412	.209	.003

The last column shows the p-value from the test that the average value of the variable in a particular row is the same across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" if the p-value is greater than .1.

Table 3 - Relationship between drop-out and college grade point average
Linear probability model of the drop-out indicator on observable characteristics.
Standard errors in parentheses below the point estimates.

E(Drop-out) =.863 -.161 CollegeGPA - .0003 ACT - .061 HSGPA + .016 MALE
(.212)* (.028)* (.006) (.051) (.043)

-.119 Black -.085 ParentEd + .010 Faminc/10000
(.059)* (.042)* (.003)*

Table 4 Measures of ability and motivation for entire sample and by constraint status

	Entire Sample mean (std. dev.) n=307	Not Constrained mean (std. dev.) n=245	Constrained mean (std. dev.) n=62	pvalue if <.10 See note below
1. ACT - American achievement test	23.247 (3.606)	23.551 (3.717)	22.822 (3.118)	N
2. HSGPA - high school grade point average	3.301 (.753)	3.323 (.720)	3.215 (.698)	N
3. StudyHS - hours studied per week in high school	10.584 (10.471)	10.339 (11.576)	11.576 (11.556)	N
4. StudyC - expected study hours per weekday during college (at college entrance)	3.605 (3.644)	3.644 (1.594)	3.449 (1.555)	N
5. Pr3.5 - probability of first semester grade point average being 3.5 or higher (at college entrance)	39.178 (25.606)	38.474 (25.341)	41.959 (26.660)	N
6. GPAStudy3 - expected grade point average if studied three hours a day during college	3.106 (.660)	3.13 (.642)	2.987 (.723)	N
7. PrForcedleave - probability of being forced to leave school at some future point because of bad academic performance	7.453 (13.041)	6.887 (13.501)	9.679 (10.859)	N

The last column shows the p-value from the test that the average value of the variable in a particular row is the same across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" if the p-value is greater than .1.

Table 5: Estimates from regressions of GPA on measures of ability and motivation

Constant	1.296* (.289)	.330 (.319)	2.703* (.090)	2.869* (.361)	2.685* (.084)	2.172* .219	2.893* .0529	1.794* (.428)	.478 (.440)	.132 (.585)
Male									-.172 .090	-.181 (.092)
Black									-.225 (.124)	-.169 (.126)
Faminc									.005 (.007)	.002 (.007)
ParentEd									.084 (.087)	.107 (.089)
ACT	.065* (.012)								.021 (.014)	.015 (.014)
HSGPA		.736* (.093)							.561* (.104)	.582* (.103)
StudyHS			.029* (.012)					.032* (.012)		.037* (.011)
StudyHS*StudyHS			-.0009* (.0003)					-.0009* (.0003)		-.0009* (.0002)
StudyC				-.005 (.211)				.122 (.130)		-.001 (.125)
StudyC*StudyC				.0001 (.028)				-.015 (.013)		-.003 (.013)
Pr3.5					.004* (.0018)			.004* (.001)		.001 (.001)
GPAStudy3						.210* .069		.181* (.081)		.080 (.078)
PrForcedleave							-.008* (.003)	-.006* (.003)		-.003 (.003)
R-squared	.085	.172	.031	.000.	.012	.030	.020	.10	.215	.280

* significant at 5%

Table 6 Earnings expectations for entire sample and by constraint status

	Entire Sample mean (std. dev.)	Not Constrained mean (std. dev.)	Constrained mean (std. dev.)	pvalue if <.10 See note
Survey 1 - Time of College entrance	**n=307**	**n=245**	**n=62**	
1. Median earnings age 28 if leave school immediately	29.586 (19.253)	29.576 (18.512)	29.626 (22.118)	N
2. Median earnings age 28 if graduate	51.795 (21.576)	51.100 (20.948)	54.601 (23.932)	N
3. Median earnings age 28 if graduate GPA=3.75	55.463 (22.828)	55.300 (23.253)	56.145 (21.147)	N
4. Median earnings age 28 if graduate GPA=3.0	49.598 (21.000)	49.807 (21.342)	48.739 (19.684)	N
5. Median earnings age 28 if graduate GPA=2.0	43.753 (20.415)	43.571 (19.885)	44.487 (22.587)	N
Survey 2 -End of First year	**n=249**	**n=205**	**n=44**	
6. Median earnings age 28 if leave school immediately	27.883 (14.154)	27.927 (14.237)	27.681 (13.924)	N
7. Median earnings age 28 if graduate				
8. Median earnings age 28 if graduate GPA=3.75	53.375 (23.362)	53.896 (24.276)	50.904 (18.475)	N
9. Median earnings age 28 if graduate GPA=3.0	50.418 (22.214)	50.901 (22.973)	48.119 (18.234)	N
10. Median earnings age 28 if graduate GPA=2.0	46.181 (22.020)	46.483 (22.302)	44.779 (20.849)	N
R1 - Return to schooling - measure 1	.623 (.365)	.623 (.372)	.619 (.332)	N
R2 - Return to schooling - measure 2	.685 (.373)	.682 (.377)	.698 (.358)	N
R3 - Return to schooling - measure 3	.461 (.499)	.476 (.505)	.599 (.391)	N
R4 - Return to schooling - measure 4	.776 (.417)	.763 (.420)	.832 (.405)	N

The last column shows the p-value from the test that the average value of the variable in a particular row is equal across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" otherwise.

Table 7
Linear Probability Model - The relationship between drop-out outcomes and beliefs about returns to schooling.

Constant	.138 (.028)*	.126 (.026)*	.084 (.031)*	.085 (.029)*
R_1 Low	.061 (.043)			
R_2 Low		.094 (.045)*		
R_3 Low			.103 (.043)*	
R_4 Low				.103 (.043)*
Goodness of Fit R^2	.007	.015	.022	.022

Linear probability model of dropout on discretized versions of beliefs about returns to schooling variables R_1, ...,R_4
* significant at 5%
#significant at 10%

Table 8 Other information for entire sample and by constraint status

	Entire Sample mean (std. dev.) n=307	Not Constrained mean (std. dev.) n=245	Constrained mean (std. dev.) n=62	pvalue if <.10 See note below
Section 7 - Risk Aversion				
Risk Aversion Category 1 - Least Risk Averse	.150	.154	.133	N
Risk Aversion Category 2 - 2nd Least Risk Averse	.244	.246	.233	N
Risk Aversion Category 3- 3rd Least Risk Averse	.270	.252	.333	N
Risk Aversion Category 4 - Most Risk Averse	.334	.343	.300	N
Section 8 - Other personal factors that could influence enjoyment of school				
Health - Good or Excellent at time of college entrance	.933	.941	.901	N
Boyfriend/Girlfriend at Home at time of entrance	.322	.314	.354	N
Probability of living within 100 miles of home if graduate	.487	.495	.458	N
Probability of living within 100 miles of home if do not graduate	.672	.676	.655	N

The last column shows the p-value from the test that the average value of the variable in a particular row is the same across constrained and unconstrained groups if this p-value is less than .1 and shows an "N" if the p-value is greater than .1.

Table 9
Relationship between drop-out and whether a person is constrained.
Linear probability model of the drop-out indicator on observable characteristics.
Standard errors in parentheses below the points estimates.

E(Drop-out) =.716 + .121 CONSTRAINED – .005 ACT - .128 HSGPA + .035 MALE
(.223)* (.055)* (.007) (.052)* (.045)

-.093 Black -.089 ParentEd + .009 Faminc/10000
(.061) (.044)* (.004)*

Table 10. Answers to Question 10.A by constraint status at end of first semester and end of year

Reason from Question 10.A	Survey 5 Unconstrained n=214	Survey 5 Constrained n=50	p-value diff means Survey 5	Survey 10 Unconstrained n=207	Survey 10 Constrained n=44	p-value diff means Survey 10
a* (see note)	.327	.420	.213			
b* (see note)	.131	.200	.214			
c* (see note)	.560	.500	.437			
a				.512	.568	.498
b				.028	.113	.012*
c				.154	.409	.0001*
d	.366	.300	.378	.287	.309	.771
e	.056	.140	.038*	.096	.136	.432
f	.339	.540	.008*	.376	.590	.008*
g	.355	.58	.003*	.434	.659	.006*
h	.425	.440	.849	.470	.658	.028*
i	.300	.360	.435	.326	.545	.006*
j	.149	.326	.003*	.199	.545	.0000*
k	.373	.460	.260	.388	.454	.813
l	.037	.060	.471	.072	.045	.517
m	.149	.220	.224	.077	.068	.835

The first column corresponds to the reasons that a person finds school to be less valuable than expected. The first three reasons changed between Survey 5.A (end of first semester) and Survey 10.A (end of first year) The second and third (fifth and sixth) columns show the proportion of constrained and unconstrained individuals that found each reason to be true at the end of the first (second) semester. The fourth (seventh) column shows the pvalue from a test that the proportions of constrained and unconstrained students that found a particular reason to be true are equal at the end of the first (second) semester. The first three reasons differ between

Figure 1A Density V_S constrained HS graduates under counterfactual

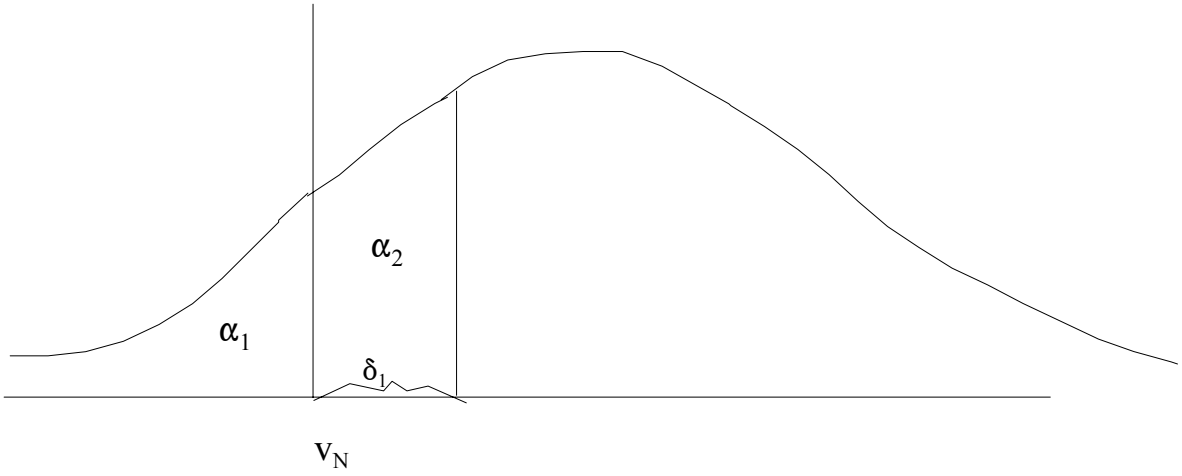


Figure 1B Density V_S constrained HS graduates who enter college

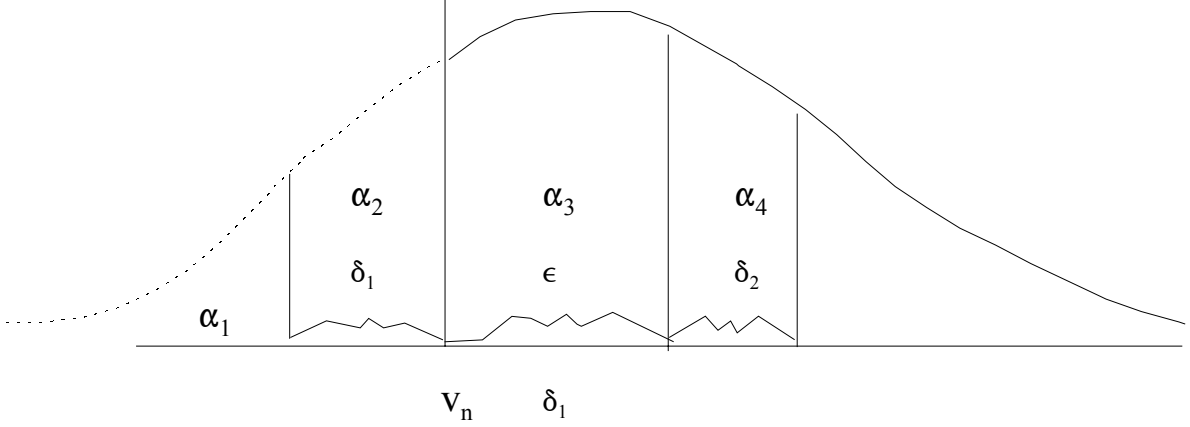


Figure 1C Density V_S constrained HS graduates who enter college under counterfactual

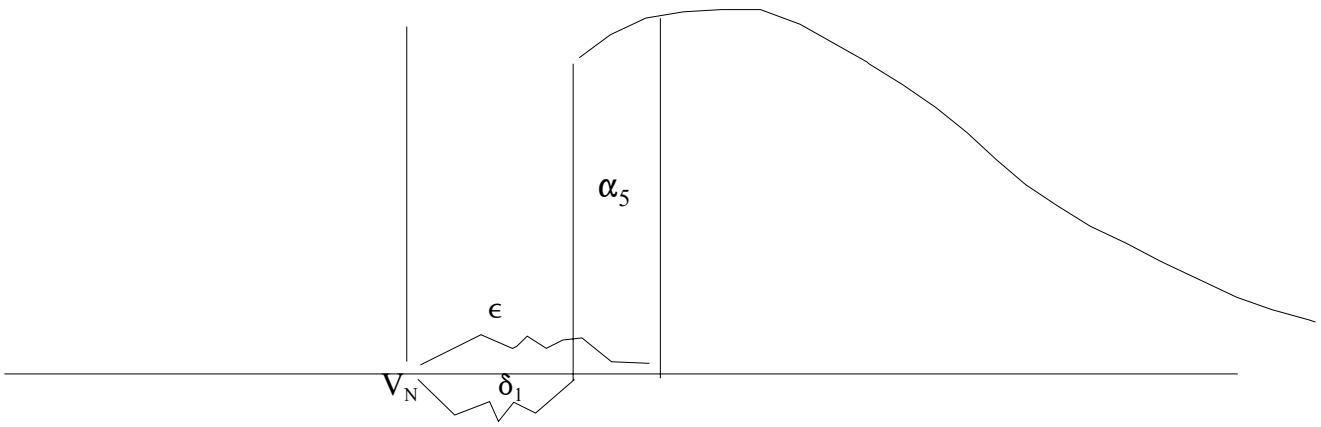
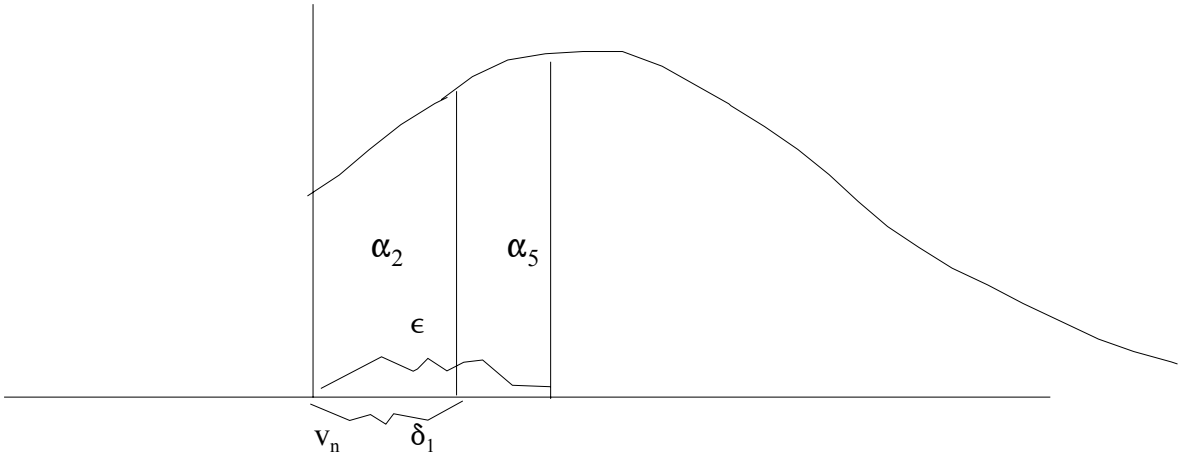


Figure 1D Density V_S unconstrained HS graduates under assumption



Appendix A: Survey questions not included in text.

Financial Question survey 6

Question A We are interested in how much spending money you have compared to what you thought you would have when you arrived at Berea.

A.1 When you arrived at Berea in September, approximately how much money did you expect that you would spend during the next year (September 2001-August 2002) **not including** college related costs (term bills, books, class-related supplies)? Please include expenses for things such as clothing, travel, telephone, cars, recreation, entertainment, and food and snacks not included in the college food plan. $_____

A.2 You may have found out that you would like to spend more or less spending money than you expected when you arrived at Berea. You may also have found out that the amount of spending money that you have available after paying for college costs is more or less than you expected when you arrived. How much money do you now expect that you will spend this year (September 2001-August 2002) **not** including college related costs?
$_____

Question B. After taking into account what you need to pay your term bill and other college costs in the future, do you have savings or other financial resources that would allow you to increase the amount of spending money that you have during the current academic year beyond the amount you have written in Question A

B.1 YES (could increase spending if wanted) NO (cannot increase spending)

B.2. If you circled YES, please check any of the following ways that you could increase your spending money at the present time if you decided that you wanted to.

1. I have personal savings that I could use to increase spending money _____
2. Parents, friends, or relatives would be able and willing to give me more spending money _____
3. Parents, friends, or relatives would be able and willing to loan me money _____
4. I am able to borrow money from other sources at fair interest rates _____

Question C. How much savings do you personally have? Include money in savings accounts, checking accounts, or other investments. $_____?

Question D. Do you have one or more credit cards? YES NO

If YES, how much money do you owe on your credit cards? Please include any current balances that you will not pay off this month. $_____

Question E. Suppose that someone offered to loan you money this year so that you could increase the amount of money that you would have for spending money during this year. Suppose that the loan is made at a fair interest rate and that you would not have to begin repaying the loan until after you leave Berea.
E.1 Would you accept the loan? YES NO

E.2 If you answered YES,
You would like to borrow money to increase your spending at Berea during this year. Remember, you will have to pay back the loan and any interest after leaving Berea. How much money would you choose to borrow this year in order to increase your spending money this year? $ _____

E.3 If you answered NO,

Why would you not accept the loan?

1. I am happy with the amount I am currently spending and would not to choose to increase spending now since I would have to pay the money back with interest later_____
2. I don't like the idea of borrowing money _____
3. Other (please explain)_____

Question F.

Approximately, what is the total amount of money that your parents, relatives, and friends are paying towards your college costs and the spending money described in question A for the current school year. Please do not include loans. $_____

Approximately, what is the total amount of money that you are currently borrowing this year to help pay for your college costs and the spending money described in question A for the current school year? $_____

If you are borrowing money, please describe who you are borrowing it from.

Question 10.A. We are interested in how certain factors during your time at Berea may have influenced whether you think it is worthwhile to remain at Berea in the future. For each letter, first indicate whether you found the given factor to be **True** or **False**. (Circle **True** or **False** for each part.)

a. Classes have been more difficult than I expected. This has made being in school more stressful or made school less enjoyable because I had to spend more time studying and less time relaxing or doing other things. **True False**

b. Given academic difficulties, I feel it is unlikely that I will eventually graduate and this makes returning to Berea in the future seem less worthwhile. **True False**

c. My grades have been lower than what I expected and this has made me realize that the type of jobs I will get if I graduated from Berea will be worse than I expected. **True False**

d. It has been harder to meet new friends than expected or I have missed family/old friends/boyfriend/girlfriend more than expected or I have found that activities at Berea College and in Berea are less exciting than expected.
True False

e. Physical or emotional harassment has made me feel uncomfortable at Berea **True False**

If True, please circle any that contributed to this feeling: **roommate teacher college staff other students**

f. Worries about financial problems related to my family have made school less enjoyable than expected. **True False**

g. Worries about my own personal financial situation have made school less enjoyable than expected. **True False**
Briefly explain why you have needed more money (for example, to pay term bill, to buy books, etc.)

_____ _____

h. Concerns about not having enough money for items that would make my life more pleasant (for example, a car, entertainment, dates, and social activities) have made school less enjoyable than expected. **True False**

i. Non-financial problems or health problems of family or friends at home have made school less enjoyable.
True False

j. Personal health problems or illness have made school less enjoyable. **True False**

k. I have realized that I am not as interested as expected in the material that is covered in classes. **True False**

l. Berea wasn't academically challenging enough. **True False**

m. Berea didn't provide the types of majors or career opportunities I was interested in. **True False**

n. During the academic year I have found a new and attractive job (in my hometown or somewhere else) that I could take
if I left Berea College. This makes leaving Berea seem more desirable than before. **True False**

o. In the space below, comment on any other things that have influenced how you feel about remaining at Berea.

Note: Questions A-C are different on survey 10 (question 10.A) than on survey 5 (question 5.A). On survey 5.A. Reasons a-c are as follows

a*. Classes have been more difficult than I expected and worries about the possibility of failing out of school at some time in the future have made being in school more stressful/less enjoyable than I expected. **True False**

b*. My grades at Berea have been lower than I expected and this has made me realize that the type of jobs I will get **if I graduate from Berea** will probably be worse than what I had expected. **True False**

c*. I have had to study more than expected so I haven't had as much time as expected to relax or do other things. **True False**

Appendix B: Details of other sources of heterogeneity between constrained and unconstrained students

B.1 Differences in academic ability by constraint status

A natural starting point for examining ability differences by constraint group is college entrance exam scores and high school grade point averages (HSGPA) which are the observable characteristics typically available in administrative data that are presumably most closely related to ability, motivation, or beliefs about the importance of a college degree. Columns 1 and 2 of Table 5 show the estimates from two linear probability models that relate a student's first semester college grade point average to the student's score on the American Achievement Test (ACT) and to the student's HSGPA respectively. The coefficient (tstat) associated with ACT and HSGPA are .065 (5.338) and .736 (7.854) respectively and these two variables explain .082 and .172 of the variation in college GPA respectively when included separately. Although not shown in Table 5, the two variables explain .193 of the variation when included in a specification together. Of importance to our study, as indicated by rows 1 and 2 of Table 4, we find no evidence that these variables vary by constraint status.

We have used the BPS to collect a variety of additional information at the time of college entrance that helps to characterize a person's academic ability, motivation, and beliefs about the importance of college. For example, with respect to academic ability at the time of college entrance, the BPS asks a student what grade point average he would expect to receive conditional on particular amounts of study time during college. With respect to questions of motivation and work ethic, the BPS asks a student how much time he spent studying per week in high school and asks a student how much time he plans to spend studying per day in college. With respect to questions that combine motivation and work effort with ability, the BPS includes the following questions which ask an individual to express his beliefs about the probability that his grade point average in the first semester will fall into each of a set of mutually exclusive and collectively exhaustive intervals and asks an individual about the probability that he will be suspended from school at some point because of poor grade performance.

We realize that you do not know exactly how well you will do in classes. However, we would like to have you describe your beliefs about the grade point average that you expect to receive in the first semester. Given the amount of study-time you indicated in question H, please tell us the percent chance that your grade point average will be in each of the following intervals. That is, for each interval, write the number of chances out of 100 that your final grade point average will be in that interval. **Note: The numbers on the six lines must add up to 100.**

Interval **Percent Chance (number of chances out of 100).**

[3.5, 4.00] _____

[3.0, 3.49] _____

[2.5, 2.99] _____

[2.0, 2.49] _____

[1.0, 1.99] _____

[0.0, .99] _____

What do you think is the percent chance (number of chances out of 100) that you will be forced to leave school (that is, suspended by the college) in the future due to poor academic performance? _____

In Columns 3-7 of Table 5 we regress first semester college grade point average on these new variables separately and find that four of the five new variables are statistically related to grade performance. The ninth and tenth columns show that adding these additional variables increases the R^2 of the linear specification by approximately 30% over a specification which contains HSGPA and ACT as well as MALE, BLACK, PARENTED, and FAMINC. Although not shown, adding these variables increases the R^2 by approximately 50% over the specification that contains only HSGPA and ACT. A test of the null hypothesis that the new variables in the last column are jointly zero is rejected at significance levels greater than .019. Of importance to this study, rows 3-7 of Table 4 show that, like the previous findings for HSGPA and ACT there is no evidence of a systematic relationship between any of the new variables and a person's constraint status.

B.2 Beliefs about financial benefits of college

The simple theoretical model suggests that differences in beliefs about earnings can lead to differences in drop-out rates. At the time of college entrance and at the end of the first year, we elicited individuals' beliefs about distributions of earnings using a survey approach that follows in the general spirit of the work by Dominitz (1998), and Dominitz and Manski (1996 , 1997) who found evidence that individuals are able to provide sensible answers to questions aimed at characterizing the entire distribution of future uncertain events. Specifically, for each of a number of schooling scenarios, we ask each individual to report the first, second, and third quartiles associated with

the future earnings he would earn at several future ages given the scenario. Here we concentrate on answers associated with earnings at the age of 28.[32]

At the time of college entrance, one of the schooling scenarios involves leaving school immediately. The first row of Table 6 shows that, on average, the median income associated with this scenario is $29,576 and $29,626 for the constrained and unconstrained groups respectively. Although not shown, the average first quartile and third quartile are also similar across the constrained and unconstrained groups. At the time of college entrance, other schooling scenarios involved graduating from college (unconditional on grade performance) and graduating with a 3.75 grade point average, a 3.0 grade point average, and a 2.0 grade point average respectively[33]. The latter three scenarios provide information about the distribution of earnings conditional on ability. Rows 2-5 of Table 6 indicate that, on average, the median earnings associated with these scenarios are also similar across constrained and unconstrained individuals. The answers also show generally that what a person learns about ability is likely to matter in terms of decisions since individuals see a non-trivial effect of better grades on median earnings. Similar questions were answered at the end of the first academic year by respondents who answered Survey 10 (the last survey of the year) and the responses are shown in the second part of Table 6. As with the answers to questions taken at the beginning of the academic year, the evidence suggests that the answers to these questions do not differ significantly between constrained and unconstrained individuals.[34]

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[32]The individual was also asked about earnings in the first year after leaving school and at the age of 38. We examine the age of 28 here in part because earnings in the first year after leaving school may be influenced by whether a person is in graduate school.

[33]Although not examined here, we also ask about scenarios involving partial college completion.

[34]Note that, under our model assumption that individuals do not learn in the first year about the distribution of C_{UN} or the distribution of C_{SK} conditional on ability, the end of the year questions associated with leaving school immediately and graduating with specific levels of grade performance would essentially yield a second set of observations of the same information as the beginning of the year questions. Further, even if individuals do learn about the distribution of C_{UN} or the distribution of C_{SK} conditional on ability during the year, it would be reasonable to compare the responses to these questions because it seems unlikely that what a person learns during school would depend on consumption during school. By contrast, it may be problematic to compare survey 10 responses to the graduation question that does not condition on grade performance since a person's grade performance may be endogenously influenced by constraint status if being constrained influences the non-pecuniary aspects of school and individuals who are less happy at school tend to perform worse academically. Similarly, while it seems less problematic, it would not make sense to compare the beginning-of-the-year responses to the earnings question that does not condition on college grade performance if it was believed that individuals know the extent to which they will be constrained at the time of college entrance and believe that the constraint will affect their grade performance.

Thus, if the answers to our questions truly reflect beliefs, the evidence suggests that constrained and unconstrained individuals do not differ in their beliefs about the financial returns to college. Given the newness of the types of questions being used here, it makes sense to look for evidence of whether the answers contain valuable information. If the questions contain useful information, one could reasonably expect to see a relationship between beliefs about the returns to schooling and the drop-out decision. For the earnings questions that are answered at the time of college entrance, we construct two measures of the returns to schooling.

R_1=Log(Median earnings age 28 if graduate)-Log(Median earnings age 28 if leave school immediately)

R_2=Log(Median earnings age 28 if graduate 3.0 GPA)-Log(Median earnings age 28 if leave immediately)

We compute the same two measures using data from the end of the school year and call these measures R_3 and R_4. As expected given the previous results in Table 6, the measures R_1, R_2, and R_4 are similar across constrained and unconstrained individuals.[35]

Column 1 of Table 8 shows the results obtained by regressing the drop-out indicator on a dummy variable which has a value of unity if R_1 is less than a median value, and, therefore indicates that a person's beliefs about the returns to schooling are "small." Columns 2-4 of Table 8 are similar but include dummy variables that are constructed using R_2-R_4 respectively. We find evidence that individuals that believe that the returns to schooling are small are significantly more likely to drop-out of school; the t-statistics associated with the dummy variables constructed from R_1-R_4 are 1.40, 2.06, 2.35, and 2.30 respectively. In addition, the effects are quantitatively large; the estimates of having beliefs that the returns to schooling are small increases the drop-out probability by 44%, 75%, 122%, and 121% respectively relative to the case where the returns to schooling are large. Thus, our work suggests that there is information in these types of questions. A benefit of the methods proposed by Dominitz and Manski is that collecting distributional information allows one to characterize uncertainty about outcomes. In terms of providing some validation of these data, we leave the examination of the importance of this uncertainty to future work.

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[35] A test of the null hypothesis that the population value of R_1 is the same for constrained and unconstrained individuals has a pvalue of .952. p values for R_2 and R_4 are .807 and .292 respectively. It does not make sense to compare the R_3 across constraint status because it may depend on the effect of the constraint itself through the constraint/performance scenario described earlier.

B.3 θ_S, θ_N, and β

Risk aversion, intertemporal elasticity of substitution, and the discount factor

The first property of utility functions that we examine is risk aversion. We are able to provide some direct evidence using a set of survey questions suggested by Barsky et al. (1997) which involve asking individuals about hypothetical gambles involving income. At the beginning of the year, individuals were asked the following question:

Suppose in the future you have a job which is guaranteed to give you a certain amount of income every year for life. You are given the opportunity to take a new and equally good job, with a 50-50 chance it will double your income and a 50-50 chance it will cut your income by one-third (33%). Would you take the new job? YES NO

If the answer to the question was YES, the person was asked whether he would still accept the job if "The chances were 50-50 that the new job would double your income, and 50-50 that it would cut it in half (50%)." If the answer to the question was NO, the person was asked whether he would take the new job if "The chances were 50-50 that the new job would double your income, and 50-50 that it would cut it by twenty percent (20%)." Thus, each person answers two questions and the two answers separate respondents into four risk preference categories. These categories can be ranked in order of risk aversion without making a functional form assumption for the utility function. Bounds on the risk aversion associated with each of the categories can be obtained with a functional form assumption. For example, if one is willing to assume a constant relative risk aversion form for the utility function, an answer sequence of NN would imply that a person has risk aversion greater than 3.76, an answer sequence of NY would imply that a person has risk aversion between 2.0 and 3.76, an answer sequence of YN would imply that a person has risk aversion between 1.0 and 2.0, and an answer sequence of YY would imply that a person has risk aversion less than 1.0.

Table 8 indicates that individuals are quite risk averse and that constrained and unconstrained individuals have similar levels of risk aversion. For example .60 and .63 of constrained and unconstrained individuals respectively fall into one of the 2 most risk averse categories (risk aversion greater than 2.0 under the CRRA assumption).

As some evidence that these experimental questions contain some useful information, Barsky et al. (1997) find that answers to these types of questions are related to risky activities for respondents in the Health and Retirement Study. However, as with the self-reported beliefs about the returns to schooling, given the newness of these questions it is worth examining whether the questions have explanatory power here. We find some evidence that this is the case. Sample members in the two least risk averse classes are more than 50% more likely to leave school than sample members in the two least risk averse classes (.220 vs. .143). A test of the null hypothesis that the two population proportions are equal is rejected at significant levels greater than .087.[36]

Intertemporal elastity of substitution?

Differences in personal characteristics/situations potentially related to relative enjoyment of school

Information on certain other family and personal factors that might influence how much a person enjoys being in college relative to not being in college is shown at the end of Table 8. One personal factor that seemingly could influence the drop-out decision is personal health or the health of individuals in a person's family. We ask specifically about student health on the initial survey and find no evidence of a difference between constrained and unconstrained individuals with .901 of the former and .942 of the latter indicating at the time of college entrance that they are in good or excellent health. Our survey does not contain a direct question about the health of a student's family. However, in Section IV.4 we provide some evidence about this from a question that mixes prevalence of family health problems with the effects of these problems.

Another factor that could influence whether a student leaves school is whether he (she) has a boyfriend (girlfriend) that does not attend Berea. Although we find that beginning college with a boyfriend/girlfriend elsewhere is quite common, we do not find differences between constrained and unconstrained individuals in this respect. To some extent, this variable measures a student's attachment to his/her hometown. We can measure this directly using two survey questions in the BPS. The first question was worded "Assume that you graduate from

[36]Our question asks about risk aversion as a set of gambles over lifetime earnings. A person who stays in school will have very low earnings for several years and then good earnings for the remaining years that matter given his discount factor. A person who does not enter school and obtains a good job may have better discounted lifetime earnings because he does not have to incur the years of low earnings while in school. However, if the person who does not enter school does not obtain a good job he may have very low lifetime earnings. In this sense, not entering school may represent a larger gamble than entering school.

Berea. What is the percent chance (number of chances out of 100) that in 10 years you will be living within 100 miles of you hometown." The second question was identical except that the person was asked to assume that he does not graduate from Berea. We find no evidence of a difference between constrained and unconstrained individuals. Specifically, on average, constrained and unconstrained individuals believe that the chances of living near their hometown is .46 and .50 respectively if they graduate from Berea and is .68 and .66 if they do not graduate from Berea.