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

In the next three subsections (B.1, B.2, B.3) we examine whether differences exist by constraint status in 1) ability, 2) beliefs about earnings conditional on particular levels of completion and academic performance, and 3) preferences which indicate how much utility a person would receive over his lifetime given particular schooling and earnings paths. The implicit assumption is that the variables being compared are not influenced by the constraint.

B.1. Differences in academic ability by constraint status

Given previous evidence that a student's cumulative grade point average is often the strongest predictor of whether a person stays in school (Stinebrickner and Stinebrickner (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.

In Columns 1 and 2 of Table Suppl.1 we regress a student's first semester college grade point average on *ACT* and *HSGPA*, respectively. The coefficients (tstats) are .065 (5.338) and .736 (7.854) respectively in the two specifications and these two variables explain .082 and .172 of the variation in college GPA, respectively, when included separately. Although not shown in the table, the two variables explain .193 of the variation when included in a specification together.

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. The answer conditional on studying three hours a day determines the *GPA_study3* variable in Table 1. With respect to questions of motivation and work ethic, the BPS asks a student how many hours he spent studying per week in high school (*StudyHS*) and how many hours he plans to spend studying per day in college (*StudyC*). With respect to questions that combine motivation and work effort with ability, the BPS includes the following two questions which, respectively, 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? _____________

The answer on the first line of the former question determines the variable *Pr_GPA3.5* in Table 1. The answer to the second question determines the variable *Pr_forced_leave*.

In Columns 3-7 of Table Suppl.1 we regress first semester college grade point average on the 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 jointly increases the R^2 of the linear specification by approximately 30 percent 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 percent over the specification that contains only *HSGPA* and *ACT*. A test of the null hypothesis that the effects of the new variables are jointly zero is rejected at significance levels greater than .019.

Thus, the evidence suggests that we have access to a variety of traditional and non-traditional variables that are related to ability and motivation at the time of entrance. What is important for this study is that the descriptive statistics in Table 1 show no evidence of a systematic relationship between any of the new variables and a person's constraint status.

B.2. Differences in beliefs about earnings conditional on particular levels of completion and academic performance by constraint status

At the time of college entrance and at the end of the first year, we elicited 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). 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.

At the time of college entrance, one of the schooling scenarios involves leaving school immediately. The first row of Table Suppl.2 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 involve 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. The latter three scenarios provide information about the distribution of earnings conditional on ability. Rows 2-5 of Table Suppl.2 indicate that, on average, the median earnings associated with these scenarios are also similar across constrained and unconstrained individuals. We reach the same conclusions when we examine, in the second part of Table Suppl.2, the answers to these questions at the end of the first academic year.

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 are related to 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.

R1=Log(Median earnings age 28 if graduate)-Log(Median earnings age 28 if leave school immediately)

R2=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 R3 and R4. As expected given the previous results in Table Suppl.2, the measures R1, R2, and R4 are similar across constrained and unconstrained individuals.[1]

Column 1 of Table Suppl.3 shows the results obtained by regressing the drop-out indicator on a dummy variable which has a value of unity if R1 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 Suppl.3 are similar but include dummy variables that are constructed using R2-R4 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 R1-R4 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 mean drop-out probability by 44, 75, 122, and 121 percent, respectively relative to the case where the returns to schooling are large. We use the variable R2 as our *Return_to_schooling* variable in Table 1.

B.3. Differences in preferences which indicate how much utility a person would receive over his lifetime given particular schooling and earnings paths

In Section B.3.a we take advantage of recent innovations in survey methodology by Barsky et al. (1997) to directly examine whether some of the basic properties associated with

[1] A test of the null hypothesis that the population value of R1 is the same for constrained and unconstrained individuals has a pvalue of .952. p values for R2 and R4 are .807 and .292 respectively. It does not make sense to compare R3 across constraint status because the constraint may influence a person's grades by influencing their effort.

utility, such as risk aversion, intertemporal elasticity of substitution, and rate of time preference, differ across constrained and unconstrained individuals.[2] In B.3.b we take 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. In B.3.c we take a final, direct approach.

B.3.a. Risk aversion, intertemporal elasticity of substitution, and the discount rate

Risk Aversion

The first general 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 percent). 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 percent)." 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 percent)." Thus,

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

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 Suppl.4 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. Unfortunately, our data do not contain information about risky activities that would be useful for examining the explanatory power of these questions. However, we do find that sample members in the two least risk averse classes (*Risk_aversion_low*) are more than 50 percent more likely to leave school than sample members in the two most 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.

Intertemporal elasticity of substitution and the discount factor

Our survey questions eliciting time preference and intertemporal substitution were provided by the authors of Barsky et. al (1997). As in their work, the behavioral equation motivating the design of the questions is

(B.1) $\Delta\log(c)=\gamma\ (r-\beta)$

where c is consumption, r is the real interest rate, and β is the subjective discount rate. γ is the elasticity of intertemporal substitution which can be written as

(B.2) $\gamma=d\log(c)/d\log(1+r)$.

Equation B.1 shows that a person's consumption path depends on both γ and β. This motivates our identification strategy which is the same as described in Barsky et. al (1997):

> "...we first posed a hypothetical set of circumstances that are meant to control for heterogeneity in economic and demographic conditions... Then the respondents were shown charts with different profiles of consumption with constant present value at a zero interest rate and were asked to choose the preferred path. In subsequent questions they were asked to choose among constant present value consumption paths with interest rates of 12 percent and 24 percent. From the slopes of the preferred paths and how the slopes change when the interest rate changes, one can estimate the rate of time preference and the elasticity of intertemporal substitution."[3]

A practical issue that arises because the number of consumption profiles is finite is that a person's optimal consumption path may lie somewhere between the paths offered. One option is to note that the person's choice implies bounds on the person's optimal consumption profile and

[3] The interest rates used in Barsky et al. (1997) are different than those used here.

to use this information to construct bounds for a person's γ and β. Given that our primary interest is to examine whether constrained and unconstrained individuals are similar, the approach we follow here is to use the zero and twelve percent interest rate questions and to assume that the chosen profile in each case is the person's optimal profile. The responses of 30 of the 307 respondents are inconsistent with theory because they indicate that the slope of the consumption profile would decrease when the interest rate is increased. Two other respondents have unusable responses. Table Suppl.4 shows the distribution of γ for the remaining 275 students in the sample. Consistent with the findings of Barsky et al. (1997), the modal (and in our case median) person chose consumption paths at the zero interest rate and the twelve percent interest rate that had the same slope. Under the assumption that the person's choice is his optimal choice, this would imply that $\gamma=0$. It is probably most reasonable to simply interpret these patterns as evidence that the elasticity of substitution is low for these people. This is what we find more generally; consistent with Barsky et al. (1997) we find that most people have elasticities of intertemporal substitution close to zero and very few people have elasticities as high as one (i.e., consistent with log utility). Of particular interest to this paper, we find no evidence of differences between constrained and unconstrained individuals.

Equation B.1 indicates that it is not possible to compute the discount factor for the 158 individuals who do not vary the slope of their consumption profile when the interest rate changes. This implies that the number of constrained students for which a discount factor can be computed is small when only the zero and twelve percent interest rates are used. In an effort to increase this number, we examined the consumption profile associated with the twenty-four percent interest rate for the 158 individuals who did not vary the slope of their consumption profile between the zero and twelve percent interest rates. Forty-five of the 158 increased the slope of their profile at twenty-four percent, while 6 of the 158 violated economic theory by decreasing their profiles. Thus, we were able to compute discount factors for 127 unconstrained and 29 constrained individuals and the results are shown in Table Suppl.4. The responses indicate that people care a lot about the future in the sense that many would choose an upward sloping consumption profile at a zero interest rate (i.e., $\beta<0$). While the sample sizes of constrained and unconstrained individuals are much smaller than ideal, we find no evidence of differences by constraint status.

B.3.b. Differences in personal characteristics/situations potentially related to 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 1. 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 .099 of the former and .059 of the latter indicating at the time of college entrance that they are in poor or fair health (*Health_bad*).

Another factor that could influence whether a student leaves school is whether he (she) has a boyfriend (girlfriend) that does not attend Berea. As seen at end of Table 1, although we find that beginning college with a boyfriend/girlfriend elsewhere is quite common (*Bfriend/Gfriend*), 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 is "Assume that you graduate from Berea. What is the percent chance (number of chances out of 100) that in 10 years you will be living within 100 miles of your hometown." The second question asks person to assume that he does not graduate from Berea. As can be seen in Table 1, we find no evidence of a difference between constrained and unconstrained individuals in the resulting variables *Home_grad* and *Home_dropout*.

B.3.c. A direct approach

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 (*Sch_enjoyable*), 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

(*Sch_unenjoyable*), and a test of the null hypothesis that the difference in the population proportions is zero has a t-statistic of approximately .8.[4]

[4] 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. However, 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.

Table Suppl.1: Regressions of first semester grade point average on various measures of ability and motivation

	(1) N=307	(2) n=297	(3) n=296	(4) n=280	(5) n=307	(6) n=307	(7) n=306	(8) n=292	(9) n=297	(10) n=283
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/10,000									.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*					-.0009*		-.0009*
			(.0003)					(.0003)		(.0002)
StudyC				-.005				.122		-.001
				(.211)				(.130)		(.125)
StudyC*StudyC				.0001				-.015		-.003
				(.028)				(.013)		(.013)
Pr_GPA3.5					.004*			.004*		.001
					(.0018)			(.001)		(.001)
GPA_study3						.210*		.181*		.080
						.069		(.081)		(.078)
Pr_forced_leave							-.008*	-.006*		-.003
							(.003)	(.003)		(.003)
R-squared	.085	.172	.031	.000.	.012	.030	.020	.10	.215	.280

* significant at 5 percent

Table Suppl.2 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	53.896	50.904	N
	(23.362)	(24.276)	(18.475)	
9. Median earnings age 28 if graduate GPA=3.0	50.418	50.901	48.119	N
	(22.214)	(22.973)	(18.234)	
10. Median earnings age 28 if graduate GPA=2.0	46.181	46.483	44.779	N
	(22.020)	(22.302)	(20.849)	

R1 - Return to schooling - measure 1	.623	.623	.619	N
	(.365)	(.372)	(.332)	
R2 - Return to schooling - measure 2	.685	.682	.698	N
	(.373)	(.377)	(.358)	
R3 - Return to schooling - measure 3	.461	.476	.599	N
	(.499)	(.505)	(.391)	
R4 - Return to schooling - measure 4	.776	.763	.832	N
	(.417)	(.420)	(.405)	

The last column shows the results from a test of the null hypothesis that the mean value of the variable in a particular row is the same for constrained students as it is for unconstrained students. If the p-value from the test is less than .1, the p-value is shown in the last column. If the p-value from the test is greater than .1, an "N" is shown in the last column.

Table Suppl.3

Linear Probability Model - The relationship between drop-out 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)*
R-squared	.007	.015	.022	.022

Linear probability model of drop-out on discretized versions of beliefs about returns to schooling variables R_1, ...,R_4.

* significant at 5 percent

Table Suppl.4 Other information related to preferences 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 below
Risk Aversion	(n=307)	(n=245)	(n=62)	
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
Elasticity of Intertemporal Substitution	(n=275)	(n=217)	(n=58)	
0.0	.574	.566	.603	N
.333	.309	.318	.275	N
.667	.086	.078	.086	N
1	.025	.032	.000	N
>1	.109	.046	.344	N
The Discount Factor, β	(n=156)	(n=127)	(n=29)	

<0	.429	.440	.379	N
=0	.237	.252	.172	N
>0	.327	.308	.448	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 Suppl.5

Estimates of $E(D_1 - D_0 |C=1)$ from Probit Model

Regression of Drop-out indicator, $D(t_1)$, on variables of relevance given theoretical model

	(1)	(2)	(3)	(4)	(5)	(6)
	(n=307)	(n=307)	(n=283)	(n=284)	(n=291)	(n=252)
C (constrained) estimate of $E(D_1 - D_0 \|C=1)$	.131 (.060)**	.124 (.060)**	.114 (.063)**	.116 (.063)**	.109 (.062)*	.099 (.064)*
Male		.054 (.043)	.022 (.044)	.063 (.044)	.058(.046)	.013 (.045)
Black		-.032 (.056)	-.095 (.039)*	-.051 (.054)	-.033 (.060)	-.097 (.034)**
Faminc/10,000		.008 (.006)	.008 (.006)	.007 (.007)	.008 (.009)	.007 (.009)
ParentEd		-.065 (.043)	-.087 (.043)*	-.046 (.045)	-.064 (.046)	-.054 (.045)
ACT		-.003 (.006)	-.007 (.006)	-.007 (.006)	-.004 (.004)	-.014 (.007)*
HSGPA			-.140 (.048)**			-.137 (.050)**
StudyHS			-.002 (.005)			-.0034 (.005)
*StudyHS*StudyHS*			.0001 (.0001)			.0001 (.0001)
StudyC			.076 (.076)			.043 (.076)
*StudyC*StudyC*			-.013 (.009)			-.009 (.009)
Pr_GPA3.5			-.0004 (.0008)			.00002 (.0008)
GPA_study3			-.006 (.037)			-.025 (.040)

Pr_forced_leave	-.003 (.002)			-.002 (.002)
Ret_to_schooling <sample median		.091 (.050)*		.052 (.049)
Health_bad			.077 (.105)	.118 (.122)
Bfriend/Gfriend			.062 (.050)	.027 (.044)
Home_grad			-.002 (.001)**	-.002 (.0009)**
Home_dropout			.0009 (.001)	.001 (.0009)
Risk_aversion_low			.060 (.047)	.022 (.042)
Sch_enjoyable			.022 (.050)	.022 (.048)
Sch_unenjoyable			.211 (.171)	.178 (.167)

*significant at .10

**significant at .05

Table shows marginal effects on probability of drop-out.

Sample sizes vary across columns because some variables cannot be constructed for some individuals in the sample because of, for example, item non-response or non-valid response.