Consumption Value and the Demand for College Education

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Abstract: The author estimates student demand for college education as a function of expectations of future earnings and consumption value using a detailed measurement of the non-financial consumption value of college education. Consumption value drives the educational plans of high school students more than does future earnings. Student responses to direct experiential utility and the avoidance of psychic costs are especially strong, but background and social encouragement are also important. Investment-focused economic models of educational choice focus on a relatively small part of the decision.

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JEL Codes: I23, J22, J24, D84

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Introduction

The United States educational system allows for a large amount of choice on the part of students, and so the incentives that drive individuals to seek further education tell us how shifts in the labor market or policy interventions will affect labor supply. A working understanding of student demand is instrumental to understanding the supply of skilled labor.

In this study, I estimate student demand for different levels of college education as a function of financial incentives and consumption value. Consumption value is the immediate utility gained while receiving an education, in contrast to benefits (financial or otherwise) gained as a result of completing some amount of education. Students enjoy going to school and prefer to fulfill social expectations. Stated preference data allows for a multidimensional measure of consumption value. Relative to previous work, this approach allows a comparison between the relative importance of different aspects of consumption value.

Economic studies of educational choice often treat the pursuit of financial reward as the primary reason to attend college. However, financial incentives are not the only reason to attend. Consumption value can take the form of enjoying particular programs or amenities (Beffy et al., 2012; Wiswall & Zafar, 2015; Jacob et al., Forthcoming), following social norms and responding to encouragement (Akerlof & Kranton 2002; Sandefur, Meier, & Campbell 2006), experiencing the "psychic costs" and mental strain of education (Jacob 2002; Heckman et al. 2006; Stinebrickner & Stinebrickner 2014), and as a general concept (Lazear 1977; Eckstein & Wolpin 1999).

Recent developments in the literature on the choice of college major show how important these different incentives are in student choice. Is student choice driven largely by financial incentives, or are other considerations more important? These studies suggest that student response to financial incentives is weak, and preference for the experience offered by a particular program may be a stronger predictor. These results offer an explanation for the poor alignment between which majors are popular and which lead to lucrative jobs (Arcidiacono 2004; Alstadsæter 2011; Beffy et al. 2012; Wiswall & Zafar 2015). This literature has recently expanded into the choice over college matriculation (Bleemer & Zafar 2015).

There is room both for more study of the relative influence of these incentives to attend college at the matriculation (rather than college major choice) level, and room to expand the understanding of consumption value using detailed, multivariate measures of consumption value. Detailed measurement is made possible in this paper by the use of subjective preference and expectations data. Subjective data have several attractive properties in educational choice analysis because expected counterfactual payoffs can be directly observed. Recent interest in the use of subjective expectations data in educational research (e.g. Zafar 2008; Jensen 2010; Arcidiacono et al. 2011; Stinebrickner & Stinebrickner 2014; Attanasio & Kaufmann 2014; Kerr et al. 2015; Wiswall & Zafar 2015) has arisen because the data can be used to estimate choice functions (Zafar 2011; van der Klaauw 2012) and to consider expectations themselves as a policy lever (Jensen 2010; Fryer 2013; Kerr et al. 2015). Subjective expectations data have tended to perform well in validation studies (Dominitz & Manski 1996; Botelho & Pinto 2004; Delavande et al. 2011; Zafar 2011; van der Klaauw 2012). Alongside subjective expectations, subjective preference data are subject to measurement error (Bertrand & Mullainthan 2001) but allow for detailed student-varying information about consumption value, and can be tied to future behavior (Ajzen & Fishbein 2005).

This detailed measurement allows me to estimate student demand as a function of these inputs using a model of student choice. I test whether or not the investment returns to college explain student plans better than consumption value. They do not. Consistent with existing literature, students do pursue financial returns, but their response is small compared to other incentives. Elasticity of demand for education with respect to wages ranges from .033 to .089 depending on education level.

Among consumption value inputs, expectations of ease and how enjoyable the academic experience will be have the strongest influence on student plans, although background and social pressure are also important. The relative importance of these factors of consumption value back up the focus of some of the literature on how students enjoy the college experience (Jacob et al. Forthcoming), as well as a focus on psychic costs (Heckman et al. 2006). I also use these results about plan formation to simulate student response to several potential college matriculation policies.

These results speak to the general understanding of college choice. The importance of human capital accumulation is overstated as an incentive for high school students. Researchers attempting to understand choice without reference to consumption value will see only a small part of the picture. Policies built on student response to financial incentives are likely to lead to behavioral change, but that change will be small compared to what could be achieved by emphasizing consumption value incentives.

Model and Estimation

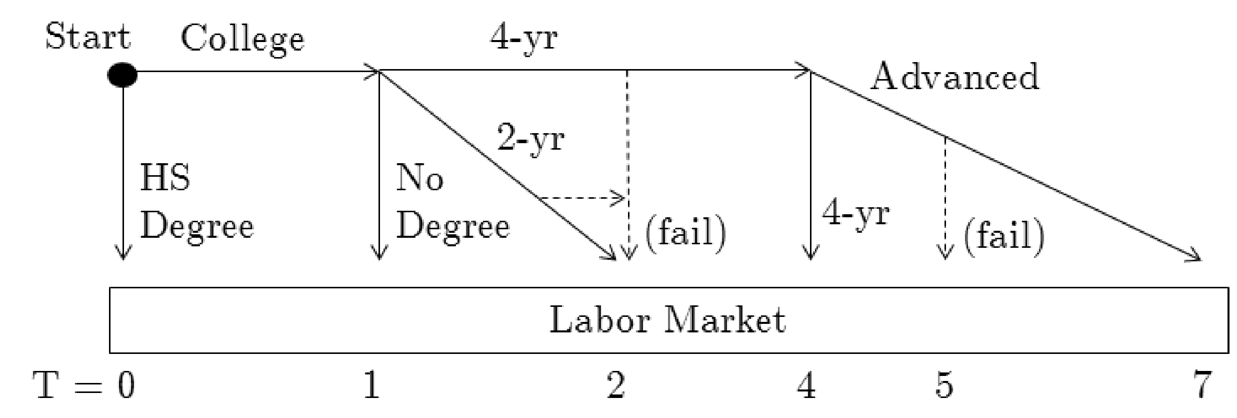
In this section I present a simple estimable model of college education choice. At the end of their high school education (time $t = 0$), each student i is faced with the decision of how much further schooling he or she plans to attain: attend no further schooling past high school ($S_i = 0$ years of college), attend college with no plans to complete a degree ($S_i = 1$),[1] earn a two-year degree ($S_i = 2$), earn a four-year degree ($S_i = 4$), or earn an advanced degree ($S_i = 7$).

The student plans for three decisions. First, they decide whether or not to enter college. Second, if the student plans to enter college, they must decide whether to plan to leave college without a degree, attempt a two-year degree, or attempt a four-year degree. Third, if they chose to attempt a four-year degree, they must decide whether or not to continue on to an advanced degree. Graduation is not guaranteed. Students who attempt to finish a degree but fail leave after their second year in undergraduate studies or their first year in graduate school. This simplified structure of choice in higher education is illustrated in Figure 1.[2]

[1] This option represents an intentional plan to attend college and leave without attaining a degree. Students who initially plan to earn a degree but end up not completing college are handled separately.

[2] The model restricts degree completion times. This assumption is restrictive if students expect to take a non-standard amount of time to finish the degree.

Figure 1. Model Structure of Higher Education Choice



The labor market is an absorbing state. $V_{it}^{w}(X_i, S_i)$ is the present discounted value of student i entering the labor market at time t with the schooling level S_i and observable characteristics and beliefs X_i.

$$
\begin{aligned}
V_{it}^{w}(X_i,S_i) = \gamma_0^{w} + \gamma_1^{w} \sum_{\tau=t}^{47} \delta^{\tau-t} I(JobEd_i = S_i) \\
+ \gamma_2^{w} \ln\Big[\sum_{\tau=t}^{47} \delta^{\tau-t} \left(E_i(X_i,S_i) W_{it}(X_i,S_i)\right. \\
\left. - S_i L_i(X_i,S_i) \frac{(1+\Psi)^{\Omega}}{\Omega} I(\tau \leq S_i + \Omega)\right) \Big] + \varepsilon_{it}^{w}
\end{aligned}
\tag{1}
$$

While in the workforce, indirect utility depends on two factors. One is the utility gained from goods consumption, which I refer to as "net earnings" to avoid confusion with "consumption value." Expected earnings is a function $E_i(X_i, S_i)W_{it}(X_i, S_i)$ of the probability of employment in a given year $E_i(X_i, S_i)$ and expected wages conditional on employment $W_{it}(X_i, S_i)$.[3] Wage expectations are recorded at one age (age 30) and assumed to follow a growth path $W_{it}(X_i, S_i) = W_{i,12}(X_i, S_i) \exp(\Phi_{S_i 1}(t-12) + \Phi_{S_{i2}}^{2}(t-12))$, where $\Phi_{S_{i1}}$ and $\Phi_{S_{i2}}$ vary by education level and are determined outside the model.[4]

[3] The use of $E_i(X_i, S_i)W_{it}(X_i, S_i)$ assumes that the risk of unemployment is uncorrelated with risk over earnings.
[4] $\Phi_{S_{i1}}$ and $\Phi_{S_{i2}}$ are estimated using a regression of log annual earnings on quadratic age variable for each educational group for full-year, full-time workers 18-65 from the 2008-2010 American Community Survey . $\Phi_{S_{i1}}$ is .028, .037, .032, .041, and .044, and $\Phi_{S_{i2}}$ is -.0007, -.0009, -.0007, -.0011, and -.0011 for each level of education, respectively.

Net earnings is expected earnings net of annual loan repayment $S_i L_i(X_i,S_i)\frac{(1+\Psi)^{\Omega}}{\Omega}I(\tau \leq S_i+\Omega))$, a function of years spent in college S_i, the annual loan burden $L_i(X_i,S_i)$, the interest rate Ψ, and the repayment period Ω.[5]

Since all decisions are made at the beginning of the time period, the log of the perceived discounted lifetime stream of net earnings enters directly into the value function. The response to future net earnings is modeled as a response to a log transformation of total lifetime net earnings, rather than a sum of log transformations of annual net earnings. This emphasizes the entirely prospective nature of the decision. The γ_2^w term then does not have an interpretation as a contemporaneous utility parameter, but this is not of particular importance for this paper.

Schooling affects utility while in the labor market in ways other than through earnings, such as one's chances on the marriage market. Not accounting for these other labor market returns will overstate the direct student response to earnings, since other returns should be positively correlated with earnings returns. The model does not account for all alternate incentives, but it accounts for the achievement of educational goals and "fitting in," - recording whether education level matches that of the expected workplace ($I(JobEd_i = S_i)$, where $I(\cdot)$ is an indicator function).

δ is the discount factor.[6] γ_0^w is an intercept collecting averages of omitted components of utility in the workplace. ε_{it}^w is a random taste shifter at time t. The retirement age is set at 65, for up to 47 post-high school working years.

The model illustrates one benefit of using subjective expectations. Beliefs can affect expected wages and employment through the student's unobservable perception of their own ability A_i, which I here separate from other beliefs for clarity:

$$W_{it} = W_{it}(X_i,A_i,S_i) \tag{2}$$
$$E_i = E_i(X_i,A_i,S_i) \tag{3}$$

Typically, education models predict future wages, and so the inability to directly observe A_i is a problem. However, here, student-reported future wages W_{it} already incorporate the student's perception of their own ability. Similar arguments apply to other unobserved variables that mediate the returns to education, such as the choice of college major.

$V_{it}^w(X_i,S_i)$ can be compared to the present discounted value of the schooling option(s) available.While in college, human capital accumulates, and flow utility depends on the consumption value of education.

Consumption value is measured by variables suggested by the literature. Experiential taste-for-education variables T_i (Heckman et al. 2006; Stinebrickner & Stinebrickner 2014; Wiswall & Zafar 2015; Jacob et al. Forthcoming), include direct enjoyment of the academic and non-academic parts of the college experience and the psychic cost of education. Student academic ability enters into T_i, since students with higher academic ability face lower mental

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[5] $\Psi = .05$ and $\Omega = 10$, standard federal Perkins loan terms. As reported in Appendix B, results are robust to the use of Stafford or direct federal loan rates instead.

[6] Choices are all prospective, reducing the influence of "present bias" and justifying the use of exponential discounting rather than hyperbolic. In Appendix B I find no evidence of present bias.

costs of attending college.[7] Social expectations surrounding the education they are to receive are recorded in the vector F_i^E (Akerlof & Kranton 2002; Sandefur et al. 2006). F_i^B allows for differences in consumption value according to demographic and socioeconomic background.

$$u_t^s = \gamma_0^s + \gamma_1^s OwnTuition_i + \gamma_2^s T_i + \gamma_3^s F_i^E + \gamma_4^s F_i^B + \varepsilon_{it}^s \quad (4)$$
$$u_t^{s'} = \gamma_0^{s'} + \gamma_1^s OwnTuition_i + \gamma_2^{s'} T_i + \gamma_3^s F_i^E + \gamma_4^s F_i^B + \varepsilon_{it}^{s'} \quad (5)$$

where γ_0^s is average flow utility generated by any omitted components, including average financial support for goods consumption while in college. $OwnTuition_i$, indicating whether he student expects to have to pay the majority of tuition themselves by working, modifies average goods consumption while in college.. Since high school students may expect graduate and undergraduate studies to be very different experiences, $\gamma_0^{s'}$ and $\gamma_2^{s'}$ differ for graduate school utility $u_t^{s'}$.

The probability of unplanned degree incompletion $1 - P_i$ is a component of directly reported student beliefs. P_i is assumed to be the same for two-year, four-year, and advanced degrees.

For each of the three decisions in Figure 1, the present discounted value of each option (calculated using backwards induction) is entered into a logit function. The product of three logit functions, for three decisions, is estimated by maximum likelihood.

Identifying variation for college flow utility relies on between-student variation in consumption value inputs and the length of time students spend attending college.

Identification of the preference for future earnings relies on within-student comparisons of returns between education levels, and between-student variation in those returns. One concern for identification is that respondents may update expectations to justify a choice they have already made. I follow Attanasio & Kaufmann (2014) in testing for this reverse causality. If students change their beliefs to rationalize choices, then as juniors become seniors, those who choose more schooling should shift their beliefs in favor of schooling, and vice versa, leading to a distribution with more extreme values and a hollowed-out middle. I fail to find that seniors exhibit a wider spread than do juniors for beliefs and stated preferences at all levels. This test fails to support reverse causality. Details of this test are in Appendix B. A second concern is that, as suggested by Hastings et al. (2015a), those without college experience in the family may have little incentive to form correct beliefs and thus give high reported expectations of returns. This concern should be addressed by the inclusion of background control variables.

Identification of the discount factor depends on the restrictive assumed timing of education in Figure 1. As such, while the estimated discount factor allows future returns to be properly discounted in the model, the point estimate of the discount factor may be biased. If it is biased, the behavioral results remain, since the behavioral predictions take into account both consumption value and discount parameters, although the interpretation in this case would be that students do not respond to earnings because they discount heavily, rather than because they truly care little about earnings.

[7] Academic ability, socioeconomic status, race, or gender may mediate the financial returns to college. As outlined earlier, this is already handled by direct estimates of W_{it} and E_i.

The model assumes that preferences are constant across all students. This assumption is weakened by allowing for heterogeneity in preferences.

I allow the coefficients on F_i^E, F_i^B, job/education match (γ_1^w), and future net earnings (γ_2^w) to vary over the sample.[8] Following Fox et al. (2011), the parameter vector follows a distribution with fixed points of support, each of which represents a student preference type. I allow for 9 preference types. The "central" type is the parameter vector is estimated without heterogeneous preferences. The other eight preference types span 5 standard deviations from the "center," using the variance/covariance matrix of the parameters.[9]

Using these preference types, I calculate the estimated probability that each subject chooses each level of education. I regress a binary indicator for the student's choice on the nine estimated probabilities, with one observation per student per potential outcome. The coefficients on each preference type give the population weight of the preference type.

The model relies heavily on student expectations data as well as student-level reports of anticipated consumption value from college-going. In the next section, I discuss the data set collected to estimate the model.

Data

This paper makes use of the Assessing Perceived Costs and Benefits of Post-High School Opportunities Survey (APCAB) dataset. The data include1,224 high school juniors and seniors at thirteen high schools in three districts in King County, Washington area covering both urban and suburban, and high- and low-income areas. For information on survey administration and a detailed description of question wordings, see Web Appendix C.

Table 1 contains summary statistics of all variables used in analysis that do not vary by schooling level.[10] Many of these variables are on a discrete scale of 1-5. For example, Enjoy Academics asks "How much do you think you would enjoy attending college classes?" and gives the options "I would (hate it/dislike it/neither like it nor dislike it/like it/love it)." 5 indicates the strongest preference for college, or highest share for share variables. In analysis, variables on a scale of 1-5 are treated linearly. In Appendix B I show that results are robust to a saturated specification.

The vector T_i includes direct stated taste measures about the expected enjoyment of the academic (Enjoy Academics) and non-academic (Enjoy Non-academics) parts of the college experience. Self-reported high school GPA (HS GPA) and the expectation of ease (Expect Easy) of performing well in college are measures of psychic costs. Students report expecting to heavily enjoy college - for both Enjoy variables, more than 65% of answers are 4 or 5.

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[8] Direct experiential variables in vector T_i are not allowed to vary over the sample because variables already represent heterogeneity in preference for the college experience.

[9] The coefficient on future net earnings is constrained to be positive, and the discount factor is constrained between 0 and 1. These constraints do not bind in the one-type model, but ensure the furthest-from-center preference types are reasonable.

[10] Missing values for all variables are filled in using multiple imputation. Details on imputation are in Web Appendix C.

Table 1. Summary Statistics

Panel A: Distributions of variables rated 1-5					
Enjoy Academics	.023	.064	.232	.433	.248
Enjoy Non-academics	.035	.070	.164	.302	.428
Expect Easy	.077	.261	.377	.198	.087
Family to College	.097	.265	.179	.291	.167
Friends to College	.069	.192	.194	.391	.154

Panel B: Means			
Parent has BA	.554	Grad. Rate (P_i)	.617
College is Important	.794	HS GPA	3.20
Female	.485	FRPL	.455
Black	.158	White	.570
Hispanic	.183	Asian	.198
Pay own Tuition	.167		

The norms and family expectations vector F_i^E includes the share of family (Family to College) and friends (Friends to College) who have gone or are going to college, whether the student has a parent with a Bachelor's degree (Parent has BA), and whether a parent thinks college is the most important thing to do after high school (College is Important).

F_i^B includes demographics - gender, socioeconomic status proxied by receipt of free or reduced price lunch (FRPL), and race or ethnicity. The race and ethnicity terms are not mutually exclusive, but White is dropped from analysis to avoid near collinearity.

The anticipated six-year graduation rate is P_i (Grad. Rate), and $OwnTuition_i$ (Pay Own Tuition) is whether or not the student expects to pay the majority of their own tuition by working. The average expected graduation rate is 61.7%. This average is fairly accurate - the actual six-year graduation rate in Washington state is 63.3%.[11]

Variables dependent on education level are in Panel A of Table 2. Comparable estimates from Washington state residents 29-31 in the 2008-2010 American Community Survey (ACS) are in Panel B.

Workplace utility includes =Ed. Level at Work, the level of education the student thinks the typical person has in the job they expect to hold at age 30. 92 students selected “I don't know”; these students are included in analysis with Ed. Level at Work set to 0 for all levels.

$W_{i,12}$ (Annual Wage) is what the student expects to earn if they find themselves 30 years old in Washington State working a full-time, full-year job with the given level of education. E_i (Employment Rate) is the expected percentage of 30-year-old Washington residents with a given level of education who are employed. L_i (Loans/yr.) is the expected annual loan burden. L_i averages expected loan amounts for four specific Washington public colleges - three four-year

[11] Beginning Postsecondary Students Longitudinal Study 2003/04-2009 cohort.

colleges and one two-year college.[12] Loan burdens associated with two-year degrees use the estimate of loans at the two-year school, and similarly for other schooling levels.

Table 2. School Level-Varying Summary Statistics

$S_i = \cdots$	HS	Some Coll.	2-Year	4-Year	Advanced
Annual Wage ($W_{i,12}$)	\$30,000	\$39,000	\$49,500	\$67,500	\$94,500
Loans/yr. (L_i)	\$0	\$3,692	\$1,884	\$4,068	\$4,068
Employment Rate (E_i)	.60	.69	.75	.80	.92
Distributions:					
Ed. Level at Work ($JobEd_i$)	.071	.056	.130	.400	.267
Expected Education	.145	.037	.107	.437	.274
Panel B: Observed Comparative Data					
Annual Salary (Med.)	\$30,000	\$32,000	\$35,600	\$46,400	\$52,100
Employment Rate	.67	.75	.80	.83	.90
Distributions:					
Education Outcomes	.258	.269	.116	.251	.107

Employment figures are reported with two digits of precision because the APCAB question elicited whole numbers on a scale of 0-100.

Compared to the ACS, college wage premia are high. It is not necessarily the case that the personal expectation *should* match a population median. Still, the use of observed wages in estimation would misstate the students' expected wage return to college. Expectations of employment probability are pessimistic.

Expected Education is the level of education that the student thinks is the most likely outcome for them, and is rather optimistic.[13] However, a student may expect a degree to be the most likely outcome, even knowing success is not certain. Roughly, a .617 graduation rate (as above) applied once to two-year and four-year degrees, and twice to advanced degrees (to account for failure in four-year and advanced degree programs) gives proportions .066, .270, and .102 ending with two-year, four-year, and advanced degrees, respectively. This roughly matches the observed data. Accounting for graduation rates, ex-ante levels of educational attainment are fairly close to those observed in the labor market.

As outlined in the introduction and the previous section, the subjective expectations and preferences data in APCAB are well suited for the estimation of student demand. I use the APCAB data set to estimate the parameters of the model.

[12] University of Washington, Washington State University, Western Washington University, and Seattle Community College. The elicited variable covers loans and grants. Loans are assumed to be 50% of this variable, similar to observed population averages. The use of numbers other than 50%, or allowing the percentage to vary by FRPL status, does not alter results.

[13] Stated plans can be taken as indicative of future behavior, although predictions of actual behavior should be taken as probabilistic, and ideally stated plans should be elicited in a probabilistic manner (Manski 1990).

Results

Estimated model coefficients are in Table 3. Direct interpretation of magnitudes is difficult, but the signs are informative. A positive coefficient on any variable that enters directly into in-school utility means that an increase in that variable increases planned attainment. A positive coefficient on a variable that enters into workplace utility means that an increase in that variable for a particular schooling level attracts more students to that schooling level.

Table 3. Estimated Parameters

	One-Type		Multiple-Type (Means)	
	Coef.	Std. Err.	Coef.	Std. Err.
Discount Factor (δ)	.880***	(.014)	.881***	(.015)
Log Lifetime Net Earnings (γ_2^w)	.126***	(.022)	.126***	(.022)
Ed. Level at Work (γ_1^w)	.129***	(.012)	.134***	(.022)
Pay Own Tuition	.032	(.042)	.038	(.054)
F_i^E: Family Expectations and Norms				
Family to College	.034***	(.007)	.033***	(.010)
Friends to College	.048***	(.007)	.046***	(.010)
Parent has BA	.016	(.026)	.018	(.031)
College is Important	.189***	(.020)	.189***	(.020)
F_i^B: Background				
FRPL	.057*	(.031)	.055	(.035)
Female	.038*	(.022)	.042	(.030)
Black	.185***	(.077)	.186	(.079)
Asian	.099	(.051)	.105	(.064)
Hispanic	.083*	(.048)	.090	(.062)
T_i and intercept (Undergraduate):				
Enjoy Academics	.177***	(.008)	.177***	(.008)
Enjoy Non-academics	.037***	(.007)	.037***	(.007)
Expect Easy	.122***	(.008)	.122***	(.008)
HS GPA	.656***	(.027)	.656***	(.027)
Intercept	-1.951***	(.142)	-1.951***	(.142)
T_i and intercept (Graduate):				
Enjoy Academics	.066	(.047)	.066	(.047)
Enjoy Non-academics	-.162***	(.041)	-.162***	(.041)
Expect Easy	.002	(.038)	.002	(.038)
HS GPA	.146	(.076)	.146	(.076)
Intercept	-.610*	(.334)	-.610*	(.334)

* Statistically significant at the .10 level; ** at the .05 level; *** at the .01 level.

Encouragement and norm coefficients (F_i^E) have the expected positive signs, although the effects are small relative to other categories. One exception to this is College is Important, which has a coefficient comparable to other consumption value inputs.[14]

In background (F_i^B), race and ethnicity coefficients are positive. These groups do not necessarily attain more schooling than whites. Rather, these positive signs suggest that, with other consumption value inputs and financial returns held constant, minority students expect to receive a higher level of utility from a year of education than do white students. Coefficients on FRPL and gender are small.

Importantly, because parental income is only weakly controlled for in the model, effect sizes for variables that are positively correlated with the unaccounted-for part of parental income represent upper bounds of the effect, while coefficients on variables that are negatively correlated with parental income (such as FRPL) represent lower bounds. Most of the affected variables are likely negatively related to income, except for Parent has BA, which has a small effect. I suggest that these biases are unlikely to overstate the aggregate contribution of consumption value.

Taste parameters T_i are positive and large relative to the other consumption value coefficients during undergraduate education. The exception here is Enjoy Non-academics; students who expect lots of consumption value from the non-academic college experience plan for more education, but not extensively so. These students are also less likely to continue on to graduate school, and coefficients on other T_i variables shrink for graduate school. From the point of view of high school students, variables in T_i have less to do with plans to get an advanced degree than with other levels of education.

Consumption value coefficients can be compared to the .126 coefficient on Log Lifetime Net Earnings. The similar magnitude of the net earnings and consumption value coefficients is striking, given that a one-unit increase in Log Lifetime Net Earnings represents more than a doubling of discounted lifetime net earnings. In Appendix B, I find that this low relative emphasis on earnings is robust to leaving out the job match variable, leaving student loans out of the earnings calculation, varying the structure of heterogeneous preferences, and other tests.

Keeping in mind the earlier discussion about the interpretation of the discount factor, the estimated discount factor is .881. This figure is similar to some other estimates of constant discount factors in a lifetime model (Samwick 1998; Laibson et al. 2007). However, as Laibson et al. (2007) point out, standard exponential discount factors estimates in lifetime models are often closer to .95.

The coefficient on Pay Own Tuition is positive, although insignificant. This positive coefficient suggests that the other variables control adequately for financial support while in college, leaving Pay Own Tuition as an indicator for motivation. Given two students with similar levels of financial support, the one who values college more strongly will be more willing to work in order to afford it.

The right column of Table 3 shows average parameters taking heterogeneous preferences into account. While nine preference types were allowed, all weight in estimation was put on

[14] The small coefficient on either parent having a bachelor's degree is unexpected. However, other forms of family education, background, and income are also controlled for here. This suggests that the influence of parental education on education plans is indirect.

three types. The parameter vector from the single-type model was given a weight of .717. The adjacent preference types, most similar to the single-type model, were given weights of .025 and .259, respectively. The parameters of these three types are displayed in Table D1 in Web Appendix D.

Model Fit

In this section compare the fit of the model to alternate, simpler models. These comparisons are intended to show that multidimensional consumption value is a meaningful addition to the model. If simpler models report similar error rates, then the focus on multidimensional consumption value does not add much.

Table 4 shows the difference between the proportion of students predicted to choose an option minus the proportion who chose that option, in effect the error in the model's prediction.

Table 4. Errors in Model Predictions

Model	HS	Some Coll.	2-Year	4-Year	Adv.	Sum
Full (One Type)	0	-.004	.021	-.016	0	.041
Full (Multiple Type)	.001	-.004	.021	-.015	-.003	.044
Net Earnings Only	.192	.068	.090	-.346	-.003	.699
College Preference	.110	.029	.077	-.225	.099	.450
Standard Predictors	.006	-.002	.045	-.026	-.023	.102

Error is the predicted proportion of students choosing that option in the given model minus the actual proportion of students choosing that option. A positive value indicates that the model overpredicts how popular that option is.

For the full model, the fit is quite good. The summed absolute difference between observed and predicted proportions in the multiple-type model is .044. Much of this error comes from overestimation of the popularity of 2-year degrees relative to 4-year degrees.

Also in Table 4 are three simpler models that demonstrate the advantage of the multidimensional consumption value approach.

First, I present Net Earnings Only, a reductively simple illustration, in which the only predictors are financial: future net earnings and Pay Own Tuition.[15]

Since this Net Earnings Only model has fewer predictors than the full model, it is not surprising that fit deteriorates. However, the degree of misprediction is extremely large. The summed absolute error is .699. Interestingly, simulated student response to changes in earnings, as will be discussed more fully in the next section, were about three times as strong as in the full model.[16]

Second, I estimate a model with consumption value, but without any data on consumption value (College Preference). I repeat the analysis of the Net Earnings Only model, but allow heterogeneous preferences for college. The undergraduate and graduate utility

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[15] With less variation in time-varying payouts, the identification of the discount factor δ is weakened in each of the simpler models. As such, δ is set to the estimate from the full single-type model. Allowing the discount factor to be estimated does not improve fit.

[16] In the Net Earnings Only model, the elasticity of demand for education ranges from .05 to .39, depending on education level.

intercepts vary over nine types each, for a total of 81 preference types. The absolute error of .450 improves significantly on Net Earnings Only, but still falls far short of the full model.

Third, I use the predictors that would be used in a standard educational choice model: the net earnings variables as well as the demographic characteristics in F_i^B (Standard Predictors), with nine preference types as in the full model. An error of .109 is in a more acceptable range. However, this is still twice the error of the full model. The explicit treatment of consumption value inputs offers a real improvement. Student response to future earnings is similar here as in the full model.

To test whether overfitting tilts the scales towards the full model, I use ten-fold cross-validation. I randomly split the sample into ten subsamples and estimate the full model ten times, each time leaving out one subsample. Estimated (one-type) parameters predict choices for the omitted subsample. The minimum, mean, and maximum summed absolute error over the ten iterations are .046, .065, and .093, respectively. The worst out-of-sample fit is superior to the in-sample fit for the Standard Predictors model. Overfitting is not driving the predictive power of the full model.

The Influence of Consumption Value and Net Earnings

In this section, I use simulations to show the extent to which student demand for education is driven by consumption value or perceived net earnings. I focus first on net earnings, and then consumption value inputs.

Simulated elasticities and cross-elasticities of planned educational level with respect to wages are in Table 5. I increase the wage of each level of schooling in turn by 10% and simulate the change in the proportion of students who plan to have each level of schooling. Own-wage and cross-wage elasticities are very low.

Table 5. Elasticity of Educational Demand with Respect to Wage

		Elasticity of demand for this schooling level...				
	$S_i =$	HS	Some Coll.	2-Year	4-Year	Advanced
With respect to the wage of this schooling level	HS	.089	-.029	-.020	-.014	-.013
	Some Coll.	-.012	.084	.003	-.002	-.003
	2-Year	-.024	-.011	.048	-.003	-.003
	4-Year	0	-.030	-.033	.041	-.044
	Advanced	0	-.000	-.000	-.021	.033

The strongest response is to an increase in the high school wage, suggesting that the margin at which financial returns are the most influential is the margin between no higher education and some. However, even this response is inelastic at .089. Other elasticities are lower, around .04.

Other papers, using longitudinal and geographic variation in the wage premium, find small elasticities in actual choice (Acemoglu & Pischke 2001; Jacob 2002) although exact estimates vary by sample and by demographics. Results in Jacob (2002) suggest elasticities of

.117 for men and .160 for women.[17] In Appendix B I also find that men have stronger responses, and, similar to Beattie (2002), as do non-FRPL students. Elasticities here are also similar to those calculated for the college major choice. Beffy et al. (2012) find an elasticity of about .1, depending on major. Wiswall & Zafar (2015) find elasticities of about .04.

To evaluate the influence of consumption value inputs, Table 6 Panel A reports the increase in the planned number of years of higher education, or the increase of the proportion of students planning to attain any college degree, in response to a one-unit increase in consumption value incentives (or a .1 increase in the graduation rate). The increase in the number of years of higher education gives a better sense of the importance of that input in the model, since it allows for improvement at all margins. The increase in the proportion of students planning for a college degree, predicted to be .821 before any simulated changes, may be a more realistic measure of behavioral response since it focuses on the margin most immediately relevant for students.

Table 6. Educational Influence of Inputs

Panel A: Single Input Changes Association between a one-unit increase and additional average years of school (S_i) or proportion of degree attainers (Degree)					
F_i^E (Expectations):	S_i	Degree	F_i^B (Background):	S_i	Degree
Family to College	.065	.006	FRPL	.109	.011
Friends to College	.093	.009	Female	.083	.008
Parent has BA	.035	.003	Black	.372	.034
College is Important	.375	.038	Asian	.211	.020
			Hispanic	.178	.017
T_i (Tastes):	S_i	Degree		S_i	Degree
Enjoy Academics	.245	.032	Expect Easy	.130	.023
Enjoy Non-academics	-.104	.007	HS GPA	.725	.098
Other:	S_i	Degree			
Grad. Rate (.1 increase)	.079	.005			

Panel B: Aggregate Changes Additional years of school (S_i) or proportion of degree attainers (Degree) associated with a one standard deviation increase in the index		
Variable Group:	S_i	Degree
Family Encouragement (F_i^E)	.248	.023
Background (F_i^B)	.195	.018
College Experience (T_i)	.685	.087
Net Earnings with any Degree	.008	.005
Labor Market Utility with any Degree	.002	.016

[17] Elasticity estimates are calculated from published results in Jacob (2002) using average levels of college attendance and published coefficients from regressions of college attendance on the college wage premium and controls. Similar estimates can be derived from Acemoglu & Pischke (2001) or Beattie (2002).

For a number of consumption value inputs, responses are strong. One-unit increases in Enjoy Academics or Expect Easy are predicted to increase college degree attempts by 3.2 and 2.3 percentage points, respectively. College is Important is similarly influential. Perhaps unsurprisingly, if students received the college consumption value of those with a high school GPA one unit higher, they would attempt a much higher educational level. In the F_i^E vector, variables outside of College is Important have relatively little effect.

Enjoyment of non-academics leads to an overall simulated decrease in years of education, but most of this is along the margin of those who would have gone to graduate school instead entering the labor market with only a bachelor's degree; more students attempt degrees overall in this simulation.

For some inputs, it is not obvious how to interpret the meaning of a one-unit increase. Results for race and ethnicity do not indicate that these groups are necessarily expected to attain more schooling. Here, given that perceived earnings and graduation probability are already controlled for, the effect is the result of giving the entire sample the additional consumption value enjoyed by that group. Of course, these values do not offer a policy lever.

Some estimated effects may be driven towards zero by correlation with other inputs. In Panel B I simulate the response to a one standard deviation increase in indices of the variables and estimated parameters in the college experience (academic enjoyment, non-academic enjoyment, expected ease, and high school GPA), family expectations (share of family and friends that went to college, parental education, and parental encouragement) and background (gender, race, ethnicity, and FRPL) vectors.[18] This allows a comparison between the characterized *types* of consumption value inputs in terms of how they are valued as a group and how they relate to education options.

In Panel B, the direct experience index generated from T_i dominates. A one standard deviation increase in this index raises the proportion of students planning to attempt degrees from .821 to .908. Leaving out HS GPA, the T_i index is still predicted to increase planned years of schooling by .395 years per student and the proportion of degrees by .041, much larger than the other two indices, although all three types of consumption value have considerable influence. The importance of T_i is especially notable given that the interpretation of the coefficients in T_i as working through consumption value is stronger than the interpretation for F_i^E and F_i^B, for which the reduced form influence is still strong but which also represent a family income effect.

In Panel B I also simulate the response to standard-deviation increases in net earnings with a degree and total labor market utility with a degree, which also includes job-education level match. A one standard deviation increase in the expected wages for degree holders translates into a simulated increase of only .008 years of education, or a half-percentage point increase in planned degree attempts. This effect size is extremely small compared to the consumption value inputs. For example, a one standard deviation increase in the F_i^E index leads to a simulated increase of 2.3 percentage points in the planned attainment rate, almost five times as much.

[18] Estimated coefficients are used to create indices. In simulation, the standard deviation of each index is added to college flow utility.

I emphasize the low response of college enrollment to financial incentives for two reasons. First, the small student response to wage returns, backed up by similar results in the literature, casts doubt on the use of a model of college choice relying entirely or largely on finances. Second, the small wage response serves as a contrast to the much larger influence of consumption value inputs. Even if the response to net earnings were four or five times larger, the effect of a rather large change in earnings would be comparable to a one standard deviation increase in the family normalization or background indices, but still would not match direct experience, or consumption value as a whole.

Although financial returns to education do play a part in educational plans, they are dwarfed by the pursuit of consumption value. Additionally, direct experiential consumption value (T_i) is the most valued and appears to have more to do with plans than background, norms, and encouragement. Policy makers interested in influencing student planning for college should consider their capacity to alter these consumption value inputs.

Policy Simulation

In this section I simulate changes in certain policy-malleable inputs to the education decision and how student plans change in response.

A fair amount of recent policy and research attention has been given to interventions that aim to correct student perceptions of labor market outcomes (Wiswall & Zafar 2011; Oreopoulos & Dunn 2013; Hastings et al. 2015b) or available financial aid (Hoxby & Turner 2013). The Obama administration has recently made this sort of information more available to students in the form of “scorecards” for colleges. Wage information-provision interventions are low-cost ways of addressing student misperceptions thought to lead to less education. In terms of actual behavioral change, results are mixed. Some, such as Hoxby & Turner (2013) and Jensen (2010) find large positive effects on behavior. Other laboratory and intervention studies (Wiswall & Zafar 2011; Oreopoulos & Dunn 2013; Bettinger et al. 2012; Fryer 2013; Kerr et al. 2015; Hastings et al. 2015b) find small, localized, or no behavioral effects of information-only interventions, even when perceptions are changed.

This can be compared to interventions that target other perceptions of college. Perceived consumption value is not immutable; there are already policies that target perceived and actual consumption value. Some of these policies, like the amenity-building mentioned in Jacob et al. (Forthcoming), directly increase the actual academic and non-academic enjoyability of college. More generally, there is a long history of outreach programs that work to increase parental encouragement, familiarize students with the college experience, and build students’ confidence in their ability to perform well in college (Swail & Perna 2002). These sorts of outreach programs have the potential to change perceptions of consumption value, and as this section will show, push for meaningful change in student plans.

The top two rows of Table 7 show the response of student plans to manipulations of perceived labor market returns to college. In Accurate Earnings, market wages and employment levels projected using observed data are substituted for student estimations, simulating a policy that teaches students about labor market premia.[19] The observed data exhibits a lower wage

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[19] Separate regressions for each level of education, regressing labor market outcomes on gender, race, and ethnicity are used to predict “accurate” earnings and employment rates. Analysis uses Washington residents 25-35 in the

return to education and a higher overall probability of employment than the subjective data. The Higher Return to Degree policy simulates an additional successive expected earnings increase of 10% for each level of education.

Responses are modest. Accurate Earnings increases planned years of higher education by only .010, and planned degree attempts by .2 percentage points. Encouraging higher perceived returns to college degrees has similarly small effects, keeping with prior estimates of responsiveness to wage.

Table 7. Simulated Response to Policy Interventions

Model	HS	Some Coll.	2-Year	4-Year	Adv
Accurate Earnings	-.002	0	0	.001	.001
Higher Degree Return	-.003	0	.001	.003	.001
College is Normal	-.006	-.001	-.-001	-.005	.013
College is Enjoyable	-.025	-.006	-.006	.036	.001
Encouraged and Confident	-.024	-.006	-.006	.012	.024
	Addl. Years		Addl. Degrees		
Accurate Earnings	.010		.002		
Higher Degree Return	.016		.004		
College is Normal	.070		.007		
College is Enjoyable	.132		.031		
Encouraged and Confident	.196		.029		

Top panel shows predicted proportion choosing each option under the givens simulation minus the predicted proportion choosing that option in the base model. Additional Years of school simulation assumes that HS, Some Coll., 2-Year, 4-Year, and Advanced degrees take 0, 1, 2, 4, and 7 years of schooling, respectively. Additional Degrees shows the predicted proportion of students choosing 2-Year, 4-Year, or Advanced degrees under simulation minus predicted proportion in base model.

Also in Table 7 are predicted educational plans resulting from manipulations of a few select aspects of consumption value.

College is Normal examines the effects of further family normalization of college. By setting all students to have a parent with a bachelor's degree and increasing the share of the extended family that went to college (by one unit on a five unit scale, unless they already reported the maximum), the planned number of years of education increases by .070, and planned degree attempts by .007. This reduced-form effect, which captures both consumption value and an income effect, is not monumental but is quite large compared to perceived-earnings manipulations. Actually enacting such a policy would be very difficult.

College is Enjoyable increases the perceived enjoyability of college, which is likely more malleable and a more realistic policy lever. I increase the perceived enjoyment of both the academic and non-academic aspects of a college education by one unit on a five-unit scale, unless they already reported the maximum. A policy with these effects would increase planned attainment by .132 years, with a share of planned degrees .031 higher.

2008-2010 American Community Survey. This predictive model does not correct for selection or ability, but proposed and actual interventions do not perform such a correction either.

Encouraged and Confident examines parental encouragement and student confidence. Socialization and encouragement from those around the student significantly shapes plans (Bozick et al. 2010). Policy may target student expectations of their ability to succeed in college or target parents to improve the encouragement given to students. This simulation increases the ease with which students expect to get good grades in college by one unit on a five-unit scale, unless they already responded with the maximum, and sets all students to have parents who suggest that college is the most important thing to do after high school. This policy increases planned years of schooling by .196 years, and planned degree attempts by .029. With encouragement alone, and no manipulation of perceived ease, the average planned attainment increases by .077 years, or .009 more planned degrees.

Correcting or improving perceptions of financial costs or benefits has relatively little impact compared to manipulations of more “soft” variables such as perceptions of college difficulty. Without prior literature on policy effectiveness or cost, it is difficult to directly compare these policies. However, the scale of difference is impressive. The .002 increase in planned degrees from Accurate Earnings could also be achieved by approximately a .08 unit increase, instead of a unit increase, for each of the consumption value policies. In each case a .08 unit increase is also about .08 of a standard deviation. These simulations suggest the further development of policies that target consumption value.

Relatively small changes in consumption value inputs are capable of generating large changes in student plans. There is clear value in understanding this relationship, and in designing and increasing emphasis on policy that takes advantage of it.

Discussion

Using a model of educational choice estimated with stated preference and expectations data, I find that consumption value is an important determinant of educational choice. Consumption value explains more than differences in earnings expectations. Researchers and policymakers intending to understand student choice must look at student attitudes towards education and other non-financial incentives in order to understand more than a small amount of the variation in educational choice.

Several individual elements of consumption value, such as the expectation of ease (both directly elicited and proxied by high school GPA), the encouragement of parents, and the stated enjoyment of academics, are important predictors of educational plans. In general, direct experiential components of consumption value (taste for educational experience and psychic costs) are the most valuable and relevant aspects of consumption value; family encouragement is also valuable, but less so.

These results pertain to our understanding of choice in higher education, and thus our understanding of labor supply. While some results on major choice already show that the consumption value of education has a very large monetary equivalent (Alstadsæter 2011; Beffy et al. 2012; Wiswall & Zafar 2015), this study shows that it is possible to break down that value into individual observed or reported components and compare them. This adds important detail to the generalized high valuation of consumption value.

There are several limitations to the validity and usefulness of these results not yet discussed. First, while the use of subjective expectations data is well-supported, support for stated preference data is less robust. However, without the use of stated preference variables, other schooling utility variables still make the case for the importance of consumption value. Second, I focus on student plans, but parents and school officials have control or influence over some part of the choice. Future earnings may influence students indirectly in the model through the variable for parental encouragement. It is also possible that credit constraints affect choice in a manner that students may not take into account in their reported data. Third, it is difficult to reconcile the low response to net earnings with the financial aid literature that finds stronger responses of college enrollment to tuition and grants (Dynarski 2003). The APCAB data is not well-suited to replicate these results, since behavioral response to college cost is likely highly dependent on parental preference. I acknowledge that the use of a general response to financial incentives, rather than allowing costs and benefits to enter separately, may understate the response to costs.

Despite these limitations, the general qualitative result that the influence of consumption value outweighs that of financial incentives is both reflected in other studies and heavily supported here. Consumption value must be carefully considered in the study of educational choice. Models that omit student-varying consumption value are likely to misunderstand student plans, and in this paper are found to overestimate the degree of student response to financial incentives.

Attempts to increase educational plans among students should consider working to improve the perception of the college experience or the social rewards to attending. Interventions and policies along these lines exist, and deserve attention (Swail & Perna 2002). Convincing students that, for example, college is not as difficult as they fear is likely to have larger effects than convincing them the financial reward is greater than they thought. Even if the incentives used by these prospective policies, such as the college experience, do not directly contribute to social welfare, they may be worthwhile targets for policy as an incentive to encourage students to earn a degree that improves the stock of human capital in the economy.

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Appendix B. Alternate Assumptions and Specifications

Tests are chosen attempting to refute the result that future earnings matter little. For that reason, I will focus on changes to the coefficient on future net earnings, γ_2^w.

(1) I first attempt several alterations to the specification for labor market utility.

(1A) I remove $I(JobEd_i = S_i)$ from labor market utility, since it is correlated with expected wages. This causes γ_2^w to drop, but the estimated discount factor to rise. Holding the discount factor at the main model estimate, γ_2^w increases to .168, not enough to contradict main findings.

(1B) Data on expected loans may be less trustworthy given a lower item response rate, so I set $L_i = 0$ for all students. γ_2^w rises to .129. This does not significantly change any results.

(1C) In the paper, the interest rate is .05, as per Perkins loan terms. Here, I set the interest rate to .068 as per federal Stafford loans, which drops γ_2^w to .110. I then set the interest rate to .068 only for non-FRPL students, which raises γ_2^w only slightly to .129.

(1D) I allow for 51 different preference types, between which only the coefficient on future net earnings varies from .02 to 1.02, since the nine types may not capture very high γ_2^w values. The highest group (with a coefficient of 1.02) has a weight of .012. There is also a total weight of about .099 given to the coefficients between .62 and .72. However, most of the distribution is grouped near the single-type coefficient or below. Average γ_2^w in this analysis actually shrinks to .093.

(2) Second, I look for heterogeneity in preference in other ways.

(2A) There is evidence of significant difference between men and women. γ_2^w is .178 for women and .060 for men, with elasticities between .016 and .189 for women, and between .004 and .052 for men. Women also have a higher discount factor than men (.956 vs. .872). The general result of the paper holds for both men and women.

(2B) Low- and high-income students are also different. FRPL students have a lower γ_2^w (.082, elasticities between .004 and .071) than others (.163, elasticities between .016 and .174). The main qualitative result holds for both groups.

(3) Third, I make more significant alterations to the model.

(3A) A hyperbolic discounting approach better fits most data than exponential discounting (Laibson et al. 2007). I estimate the model allowing for beta-delta discounting, with the utility during the first year after high school as "now." There is no evidence for present bias. β is .978, very close to 1, and δ rises only slightly to .903.

(3B) Since the decision to go to graduate school is far in the future and high school students may not consider it as seriously, I reassign students who chose "Advanced Degree" to choose "4-Yeae Degree" and dropped Advanced Degree from the model. γ_2^w increases from .126 to .188, which doesn't contradict the main result. Elasticities in this model range from .012 to .136.

(3C) I relax linearity for all variables rated 1-5, instead using a saturated model. Linearity is restrictive for some of these inputs. For example, the coefficients on Enjoy Academics for undergraduate utility are -.211, .107, .293, and .412 for values of 2, 3, 4, and 5 relative to 1. Since 2 is negative relative to 1, this is non-monotonic. In this model, γ_2^w decreases to .117 and consumption value inputs do not become less influential. The general result of the paper holds. The influence of particular variables becomes harder to interpret, but with some small exceptions like the non-monotonicity described here, these results hold as well.

(4) It is possible that students alter their reported beliefs and preferences after making educational decisions so as to rationalize the choice they have already made. Following Attanasio & Kaufmann (2014), in this case stated beliefs should be more extreme for seniors than for juniors. I calculate the senior to junior variance ratio for each wage and employment belief variable, Enjoy Academics, Enjoy Non-academics, and Expect Ease. Senior variance was actually almost always smaller, and in no case was the ratio of senior variance to junior variance unlikely to have occurred under a null distribution generated by randomly assigning junior/senior status 1000 times - the lowest p-value was greater than .3. I fail to find significant evidence in favor of reverse causality.