Increasing Returns to Education and Progress towards a College Degree

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INCREASING RETURNS TO EDUCATION AND PROGRESS TOWARDS A COLLEGE DEGREE

Abstract

Returns to college have increased, but graduation rates have changed relatively little. Modifying a human capital model of college enrollment to endogenize time-to-graduation, we predict that higher returns to education will both speed graduation and increase enrollment. Some of those new entrants may, however, take longer to graduate. Using the 1989 and 1995 Beginning Postsecondary Studies, we employ a multinomial logit to model the association between individual and family characteristics, and five-year college outcomes: graduation, continued enrollment, and non-enrollment. Between cohort differences arise either because the characteristics of those entering college are different or because the relations between characteristics and outcomes have changed. We utilize a Oaxaca-Blinder style decomposition to distinguish between these two alternatives, attributing differences in characteristics to newly attracted students and differences in the relations between characteristics and outcomes to historically attracted students behaving differently. It is changes in behavior that explain the increased progress we observe.

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INTRODUCTION

The financial returns to a college education increased dramatically in the United States during the 1980's and continued to increase although at a somewhat slower rate in the 1990's. Not surprisingly, more students started college in the 1990s. However, these students need to graduate from college to receive the full rewards associated with a college degree. Thus, it is somewhat surprising to see that five-year graduation rates have generally been declining over the last twenty years. Our goal here is to develop and test a theoretical model that is consistent with these empirical facts.

We develop such a model by modifying a standard human capital model of college enrollment to endogenize time-to-graduation. This model provides a framework for evaluating initial enrollment, graduation, persistence, and dropout. Increasing rates of return should, *ceteris paribus*, increase graduation rates and speed time to graduation. However, these same increasing returns will also attract individuals who would previously not have enrolled in college. If these newly attracted students do not possess the same attributes as the prior set of students, more specifically if they are less able academically or have more constraints upon their time in the form of family or employment commitments, these new entrants may be more likely either to drop out or to proceed at a slower pace towards graduation. Observed trends in attrition and time-to-graduation reflect both how these newly attracted students, as well as how historically represented students, persist and graduate.

We utilize the 1990/94 Beginning Postsecondary Students Longitudinal Study (BPS:90/94) and the 1996/2001 Beginning Postsecondary Students Longitudinal Study (BPS:96/01) to model college graduation, persistence, and non-enrollment for those beginning at four-year institutions. Each survey follows a cohort of nationally representative students from date of first enrollment for a period of five years. "Success" for our purposes is measured both by those who have completed a Bachelor's degree in five years - the usual measure - and by those who are continuing to persist towards a degree, even if they are taking longer than five years to do so. We identify differences in success between the two cohorts and then empirically model the association between individual and family characteristics, and graduation, persistence, and non-enrollment using a multinomial logit specification estimated for each cohort separately. Between cohort differences may arise either because the characteristics of those entering college are different or because the estimated relation between those characteristics and outcomes has changed. We employ a Oaxaca-Blinder style decomposition to distinguish between these alternative explanations and attribute differences in characteristics to newly attracted students and differences in the relation between characteristics and outcomes to historically attracted students behaving differently.

BACKGROUND

The financial benefits associated with a college degree have risen considerably since the 1970s. Barrow and Rouse (2005) use Census data to show that the earnings boost associated with an additional year of education increased rapidly from 8.5% in 1979 to around 12.2% in 1989. This rate increased further in the 1990s, albeit more

slowly. There is also evidence of a sheepskin effect which links a higher return to the receipt of a diploma rather than simply to another year of education (Jaeger and Page 1996). While increases in college tuition[1] (College Board 2007) have acted to offset some of the increased return, it is the opportunity cost associated with attending college – the foregone earnings – that clearly comprises the bulk of the cost. Since the earnings of high school graduates have declined over the last several decades, these foregone earnings costs have also decreased. As a result, the net benefit associated with a college education has increased.

The financial and social returns associated with a college education are not bestowed simply upon enrollment in college, however. To earn these rewards requires that one progress and, in particular, graduate. Therefore it is surprising that national institution-specific five-year graduation rates as published by ACT, Inc. (2008) fell from 54.6% to 50.9% between 1990 and 2001, increasing slightly thereafter. A higher return should encourage not discourage graduation.

THEORETICAL MODEL

Our explanation for this finding is based on a variant of the standard human capital model of the decision to attend college. In this variant, time-to-degree is a choice variable. Individuals decide to attend for the first term and to persist for additional terms in college by weighing the expected benefits of doing so against the expected costs of doing so.

(1) Attend if $$E\left(\sum_{t=K+1}^{T}\frac{(W_C - W_H)}{(1+r)^t} - \sum_{t=0}^{K}\frac{(C + W_H)}{(1+r)^t}\right) \geq 0$$

where
E is the expectations operator
W_C represents the earnings of a college graduate,
W_H represents the earnings of a high school graduate,
W_C minus W_H represents the earnings differential with a college degree *after* graduation.
C represents the direct costs of attending college (tuition less financial aid),
$C + W_H$ represents the combination of direct costs and forgone earnings while *in* college
r is the discount rate,
T is retirement age, and
K represents the number of years it takes to complete college.

The expectations operator (E) captures not only the individual's perception of his/her future wage path, but also his/her perceived probability of graduating and his/her likely graduation date. These may be updated over time with the receipt of additional information (Altonji 1993; Manski 1989). We assume that wages for high school and college graduates are determined in markets and are beyond the control of any individual. We also assume that T is fixed. However, K, the time it takes to complete a degree, is a decision variable in our model. The decisions to initially enroll, to continue attending, and to graduate, as well as the time-to-degree completion are all subject to individual choice.

An increase in the rewards to college will encourage those who would have historically started college to continue on to graduation and if possible to do so more rapidly in order to earn the higher post-graduation return sooner. As a result, observed graduation rates should rise. In addition, an increase in the rewards to college will encourage those previously on the margin, likely those who have been historically underrepresented in college, to enroll. The impact of these new students on the graduation rate is more difficult to evaluate.

First, some of the newly attracted entrants may have more family responsibilities or income constraints that require full-time or part-time employment and restrict the time available for college studies. Having less time to devote to college likely translates to a longer time to graduation: a larger K. A larger K also translates into a lower observed graduation rate for these newly attracted students at the traditional four or five-year point used to measure graduation. Conversely, at that same four or five-year mark, we might observe a higher persistence rate for this subpopulation as some with the higher K simply have not yet graduated.

Second, given differences in student backgrounds, these newly attracted students may be at greater risk of not graduating. Those who perceive a lower probability of graduating or who have a higher degree of uncertainty as to their potential for success may decide to enroll as the new and higher net benefit offsets that risk. Individuals who historically have a low expectation of success in college may revise their expectations upward if they perceive colleges are doing more to retain students as well as seeking to attract a wider diversity of students. This information may come to individuals from high school guidance counselors who urge students to "give it try." With an upward revision in the expectation of graduation, more of these historically underrepresented students will start a college career.

Thus, a higher rate of return will encourage historical students to graduate and to do so faster but will also attract new students who may take longer and/or be less likely to graduate. The net effect on graduation rates could be positive or negative depending upon which effect dominates.

DATA

The data employed in this analysis come from the restricted access Beginning Postsecondary Students (BPS) Longitudinal Studies collected by the National Center for Educational Statistics (NCES) of the Department of Education: the 1990-94 BPS (henceforth the first or 1989 cohort in recognition that most entered college in the fall of 1989) and the 1996-2001 BPS (henceforth the second or 1995 cohort). A major advantage of the BPS Surveys is that they capture the entire population of college-going students, including those who initially enroll in a non-fall term and those who initially enroll part-time – individuals not generally captured in most published statistics (see Stratton and Wetzel, forthcoming, for further details). Furthermore, we can identify all those who graduate with a Bachelor's or are still persisting, even if they transferred between institutions – unlike the typical single-institution measures.

We refine these samples to focus on individuals who were actively seeking an academic postsecondary education, who were interviewed for all three waves of their respective surveys, and for whom basic demographic characteristics are reported. In order to focus on individuals sharing a similar academic goal, we further restrict the sample to include only respondents who initially enrolled at a four-year institution in order to better insure that the academic goal is a Bachelor's degree. While some of those initially enrolling at two-year institutions do so with the intent of seeking a four-year degree, we are not able to distinguish them from those seeking a two-year degree All reported figures utilize the BPS longitudinal weights so as to be nationally representative; all estimates are corrected for the complex survey design.[2] Our final sample consists of 4,001 and 6,301 persons respectively from the 1989 and the 1995 cohorts.

EMPIRICAL MODEL

The BPS samples provide a rich array of information. Detailed data on enrollment is available on a term-by-term basis. We use these data to construct a consistent cross-cohort measure of five-year outcomes. Rather than simply dividing students into those who graduate and those who do not, we distinguish between those who graduate, those who are still persisting at the five-year mark (spring 1994 for the first cohort and spring 2000 for the second cohort), and those who are no longer enrolled. As discussed earlier, five-year graduation rates are rather low. Many students (especially those pursuing non-traditional paths towards graduation) seem to take longer than five years to graduate. As there is evidence from Stratton, O'Toole, and Wetzel (2008) that short term and long term dropout are distinct choices, it makes sense to assume that there are differences between those attending and those not attending at the five-year mark. Of key interest here is whether overall graduation, persistence, and non-enrollment decisions reflect changes in the composition of the student population over time or changes in how particular characteristics relate to enrollment outcomes.

We proceed in three steps. First, we use a multinomial logit specification to model those outcomes. Second, we derive the marginal impact of each control factor on graduation, persistence, and non-enrollment in each survey year. Differences in success between the two surveys may arise either because the characteristics of those entering college are different or because the estimated relations between the factors affecting these choices and actual outcomes have changed. Third, we employ a Oaxaca-Blinder style decomposition to distinguish between these alternative explanations, attributing

differences in characteristics to newly attracted students and differences in the estimated impact of factors to historically attracted students reacting differently across the two surveys.

Detailed personal and background characteristics are available in the BPS Surveys. The factors used in this analysis include race, ethnicity, gender, and age; marital and parental status; geographic controls; high school degree receipt and timing; first year grades; parental education and income; institution type; and financial aid receipt during the first year.

Race and ethnicity are standard control variables. This is the case despite the fact that Barrow and Rouse (2005) find no significant difference in the rate of return to education by race or ethnicity, and Adelman (2006) finds no empirical difference in their outcomes once other factors linked to academic performance are taken into account. We note that, unfortunately, the questions regarding race and ethnicity were different between 1989 and 1995. In 1989, respondents were first asked about their race (White, Black, Other) and then about their ethnicity (Hispanic or not). In 1995, respondents were asked to choose these simultaneously (White non-Hispanic, Black non-Hispanic, Hispanic, …). An attempt was made to recode the 1995 responses to match the 1989 codes, but race is unidentified for many Hispanics. We employ a dummy variable to identify Hispanics of unknown race in the second cohort in order to control for this specification problem. In general that dummy variable is not statistically significant.

The other covariates are expected to influence outcomes via their impact on the returns to education and/or the opportunity cost of time. Altonji (1993) and Dougherty (2005) find that women have higher returns to education than men. Older persons

necessarily have lower returns to education as they have less time to reap the rewards, and furthermore many have higher opportunity costs if they have more work experience and hence higher current wages. Marital status, parental status, and the local unemployment rate likely also influence opportunity costs of time. Regional dummies are incorporated as controls in part because of regional differences in college density. Indicators of delayed enrollment, initial enrollment in other than the fall term, and part-time enrollment are included because Kuh et al (2006), in one of the more comprehensive overviews of student success, identify these as key risk factors in driving college success. Poor academic preparation clearly imposes additional costs on those pursuing a college degree. To this end, we include a dummy variable to identify those students who do not have a standard high school diploma. Consistent with others in the field (Hu and St. John 2001, for example), we proxy for ability by using first year college grades. Because there is some empirical evidence that individuals overstate their GPA (Stratton, O'Toole, and Wetzel 2007), except in the case of those with the lowest grades (< 2.25), we maintain separate variables to distinguish between institution- and respondent-reported GPA, Those missing all grade information are identified separately with a dummy variable. Information on first year grades is also 'new' information that may signal students to revise their expectations regarding the likelihood of graduating.

Monetary and psychological support for college also influences the costs. As such, we control for family income and parental education. Students from lower income backgrounds in particular may find it necessary to work longer hours to help finance their education and that effort and time commitment may hinder their academic progress. Initial enrollment at a public institution is incorporated as a control variable because

public institutions typically charge lower tuition rates; have more older, part-time, and employed students; and are more accommodating of non-traditional enrollment paths. As a result, these institutions may be more supportive of students who need a longer time path to graduation. Financial aid can also counteract income differentials, and Dynarski (2003) reports that financial aid receipt may be positively related to years completed. The BPS data include information about grant, loan, and work study aid; we follow Hu and St. John (2001) in using dummy variables to indicate receipt.[3]

Sample statistics by cohort are presented in Table 1. Covariates are listed first, outcomes last. In each case, differences in the means that are significant between cohorts are denoted with asterisks. Looking first at the demographics, the raw means suggest that there has been an increase in the fraction of women, African Americans, and Hispanics enrolling. Only the latter two are statistically significant. These results must be viewed with some caution, as was discussed in the data construction section, since race and ethnicity were reported differently over time. Surprisingly, there is virtually no change in the fraction of first generation college students. However, the fraction with missing parental education data rose significantly between cohorts and we believe these missing values may mask an increase in first generation enrollment. Those missing information on parental education are less likely to complete a degree and, since lower educational background is associated with not receiving the degree, this suggests that those with missing values are more likely to have less educated parents.

We also see an increase in non-traditional enrollment. The number of older students, the fraction not having a regular high school diploma, the fraction entering in a non-fall term, and the fraction enrolling part-time all increased significantly over time.

Pursuing a part-time schedule necessarily increases the time to graduation. Missing information on this variable from the first cohort, however, makes it difficult to determine how much initial part-time enrollment has actually changed. The fraction of men who have been married or are fathers has increased significantly, while the comparable figures for women are not significantly different. The fraction coming from a low income background increased and the probability of receiving a financial aid package rose substantially. This follows if lower-income students, who are more likely to qualify for financial aid, make up a larger fraction of the student body.

As regards outcomes, the fraction that has graduated within five years increased substantially between cohorts from 48 to 54%, a 12.5% increase. These numbers are lower than the single-institution rates published by the ACT. This difference likely arises because the BPS data includes respondents who initially enrolled in a non-fall term and/or part-time who are less likely to graduate or to do so in five years. The fraction still attending college five years later also increased, from 18.4% to 20.6%. If we define success as graduation or being on a path, even a slower time path, to graduation, then there has been a substantial increase in success as mirrored in the substantial decline in the fraction no longer enrolled from 33.6% to 25.2%. The important question is whether we can determine whether the changes are attributable to newly attracted students or to changes in the behavior of historically enrolled students.

WHO GRADUATES, WHO PERSISTS, AND WHO NO LONGER ATTENDS

We use a multinomial logit model to assess the impact of these factors upon college outcomes. The coefficient estimates from these models are reported in Appendix

Table A1. As coefficient estimates from nonlinear models are difficult to interpret, we report marginal effects for each cohort in Table 2. The first column for each cohort reports the marginal effects on the probability of not attending, the second column reports the marginal effects on the probability of persisting, and the third column reports the marginal effects on the probability of graduating within the available five-year time line. The baseline from which all marginal effects are calculated is that of a white, non-Hispanic, 18 year old male who receives his high school diploma and enrolls full-time in a private college the following fall. He has never married and has no children, has a first year GPA of between 2.5 and 3.24, is dependent upon his college-educated parents who have an annual income of more than $60,000, receives no financial aid, and is from an area in New England with a 5.4% unemployment rate. For the most part these characteristics are those of the sample modal observation except that lower income and financial aid receipt are quite common, as is enrollment in a public college.

The probability with which an individual with these characteristics is predicted to be observed in each outcome is reported in the first row of the table. The probability of still attending rises from 7.4 to 8.0%, about an 8% increase between cohorts. The probability of graduating rises from 79% to 82%, about a 4% increase, while the probability of no longer attending falls from 13% to 10%, about a 23% decline. These baseline probabilities are important because they provide a point of comparison for the marginal effects. For example if one is financially independent, the 16.4% marginal effect in the first column indicates that the probability of not attending rises from 13.1% to 29.5% (= 13.1 + 16.4) in the first cohort if the individual has all the same characteristics as the baseline case, but is financially independent. This is not only a

statistically significant, but also a substantial, marginal effect. We proceed by discussing the impact of household income and parental education, then own family structure and initial enrollment characteristics. This is followed by a discussion of first term grades, financial aid, and basic demographic characteristics.

Household income clearly has a significant and substantial impact on college outcomes. For both cohorts, increased family income is associated with a significantly higher probability of having graduated and a significantly lower probability of not attending five years following matriculation. The magnitude of the effect appears to be greater for the 1989 cohort than for the 1995 cohort. For example, having parents with an annual income of less than $20,000 increases the probability of non-attendance by 19 percentage points or almost 150% in 1989, but only 9 percentage points or just under 100% in 1995, as compared to having parents with an income of over $60,000. As mentioned above, being financially independent also has a substantial impact. There is, in addition, some increase in the probability with which persons from lower income households will be still attending five years later, an effect that is particularly significant for the 1995 cohort.

The impact of parental education on student's college outcomes is also significant, even after controlling for household income, and somewhat larger in magnitude in the second cohort. Having parents who have not completed college (i.e. being a first generation college student) increases the probability of no longer attending by 7.4% in 1989 and by 10.7% in 1995, as compared to having a college-educated parent. Students having less educated parents are also more likely to be still enrolled at the five-year mark, an effect that is statistically significant for the 1995 cohort.

Own household characteristics have little significant relation to college outcomes. Having been married appears to reduce significantly the probability of extended attendance for men in the 1989 cohort, but the point estimate for the second cohort while insignificant has the opposite sign. Women who have been married appear more likely to drop out (up 10 percentage points) and less likely to graduate, the difference from never married women being statistically significant for the 1995 cohort. Being a father appears to be associated with a large shift in probability from graduation to still attending in the first cohort, but parental status is not statistically significantly associated with college outcomes for either men or women.

Initial enrollment characteristics are, however, very important. Those starting at a public institution are significantly more likely to still be enrolled and less likely to have graduated with an average effect of about 6 percentage points. The unemployment rate, which we use as a measure of opportunity cost, does have a small but statistically significant effect on college outcomes, reducing five-year graduation rates either by increasing non attendance (1989 cohort) or by increasing five-year persistence rates (1995 cohort).

The initial enrollment characteristics having the most substantial impact on five-year outcomes are clearly the decision to begin in a non-fall term, the decision to delay enrollment, and the decision to initially enroll part-time. These are the behaviors frequently referred to as non-traditional enrolment. In the case of the 1989 cohort, each of these choices more the doubles the probability of not being enrolled at the five-year mark, all at the cost of reducing the probability of graduating. The impact on continued enrollment is also positive, but not significantly so. The association between delayed

enrollment and college outcomes loses statistical significance in the second cohort; the effect of the other variables moderates somewhat with smaller impacts on graduation rates that are almost equally split between increased non-attendance and increased persistence at the five-year mark. It is worth noting, however, that the impact of delayed enrollment likely does not disappear in the second cohort, but rather shifts to the age twenty or more covariate. Age has little association with outcomes in the 1989 cohort, but a substantial impact in the 1995 cohort and is likely highly correlated with delay, and also with the decision to enroll initially on a part-time basis or in a non-fall term.

Variables reflecting academic ability play a substantial role. Not having a traditional high school diploma is associated with a lower graduation rate and higher non-attendance rate in both surveys, but the magnitude of the effect is larger (over ten percentage points) and statistically significant in the second cohort. Higher first year grades, particularly as reported by the institution, are associated with higher graduation rates and lower non-enrollment and persistence rates – increasing the probability of graduating by 8 percentage points in each cohort. Those individuals self-reporting mid-level grades have lower success rates than those individuals for whom the institution reports mid-level grades (the base case). These results are consistent with students exaggerating their grade reports. Low grades, whether institution or self-reported, have the anticipated significant and substantial negative impact on college outcomes. A baseline student with institution-reported mid-level grades has a 79% (82%) probability of graduating within five years from the 1989 (1995) cohort. An otherwise similar student with low grades has only a 58% (46%) probability of graduating within five years. There is a small (4-8 percentage point) increase in the probability with which low

grade students will still be attending five years following matriculation, perhaps because they succeed only by taking a lighter course load, but for the most part these students drop out. That poor first-year performance should have this effect on college outcomes is not surprising.

Financial aid receipt during the first year also has a significant association with five-year college outcomes. Receiving financial aid but only in the form of a loan significantly increases the probability of graduating and lowers the probability of persisting for the 1989 cohort, but has no significant effect for the 1995 cohort or on non-enrollment for either cohort. Receiving only grant aid in the first year increases the probability of graduating and reduces the probability of all other outcomes, though the effect is relatively modest, increasing the probability of graduating by only 3 to 5.5% percentage points. Those receiving both a loan and a grant have an outcome somewhere between that of grant and loan receipt alone, with marginal significance. The form of financial aid that is most closely and significantly aligned with student five-year outcomes is work study aid. Those receiving a financial aid package including work study have a 7 to 11 percentage point higher probability of graduating, with lower probabilities of both non-enrollment and extended enrollment.

Finally we look at demographic characteristics. Women appear to be significantly less likely to persist in both cohorts and are significantly more likely to graduate in the second cohort. African Americans and Hispanics, who have been historically underrepresented on college campuses, have college outcomes that are surprisingly similar to the baseline white, non-Hispanic student once other factors are taken into account. Point estimates indicate that Hispanics are less likely to have graduated, but no

outcome differential is statistically significant in either cohort. For African Americans, the only difference that is significant for both cohorts is an increased incidence of attendance at the five-year mark.

This brings us to our major research question. We observe both rising graduation rates and, consistent with our model, rising persistence rates.[4] We would like to determine how much of the observed change is due to changes in the composition of the student body and how much is due to different behaviors by those who historically attended college. To answer this question, we utilize a Oaxaca-Blinder style decomposition.

Table 3 shows the breakdown of the cross-cohort differences in the probabilities of graduating, persisting, and not attending at the five-year mark. Reported first are the actual probabilities and the actual cross-cohort differences. The differences predicted by the model are not numerically the same as the actual differences because of the nonlinear nature of the estimation process, but are remarkably close. Finally, we report the Oaxaca-Blinder decomposition of this predicted difference. There are two components to this decomposition: that attributable to differences in the characteristics of the two cohorts and that attributable to differences in the coefficients or the association between characteristics and outcomes. This decomposition can be conducted in either of two ways. In a linear specification, those two alternatives are as follows:

$$(2)\quad \bar{Y}_2 - \bar{Y}_1 = (\bar{X}_2 - \bar{X}_1)\hat{\beta}_2 + \bar{X}_1(\hat{\beta}_2 - \hat{\beta}_1)$$

$$= (\bar{X}_2 - \bar{X}_1)\hat{\beta}_1 + \bar{X}_2(\hat{\beta}_2 - \hat{\beta}_1)$$

The subscripts 1 and 2 identify the first and second cohorts respectively. The bars indicate sample averages. In each alternative, the first term identifies differences

attributable to characteristics (the X) and the second identifies differences attributable to the association (the β). As this is a nonlinear specification, the difference is decomposed by using the sample observations themselves, not simply by using sample mean values. See Fairlie (2005) for details. The results of both decompositions are reported in Table 3.

Differences attributable to characteristics would suggest differences between the entering classes of 1989 and 1995. We have already stated that the higher returns to college should attract more students to enroll and that these students may be marginal in the sense that they possess more risk factors and hence are less likely to graduate and more likely to take longer to do so. We have already seen some evidence of this in the older age of the second cohort. If such characteristics are critical, we would expect to see the predicted probability of graduating decrease and the predicted probability of persisting increase between cohorts. Such differences may be difficult to identify, however, as the new, previously marginal students are only a subset of the total population of undergraduates and, while some of these new students may have a lower probability of graduating or a higher expected time-to-graduation, others may be marginal for different reasons.[5] Our results indicate that the predicted probability of graduating increases slightly and the predicted probability of not attending decreases slightly as a result of changes in characteristics between these cohorts, but in neither case does the difference in characteristics explain more than 10% of the total change.

At the same time, a higher return to college should speed graduation for those attending, particularly historically enrolled students. This shift in outcomes would be attributable not to changes in characteristics, but to changes in the association between characteristics and the five-year outcome. This element of the decomposition is reported

in the final column of Table 3. Here we see that the predicted probability of graduating for each population is about 6 percentage points higher using the 1995 as compared to the 1989 cohort coefficients. The predicted probability of persisting to earn that more remunerative degree also rises by between 1.4 and 2.5 percentage points, while the predicted probability of non-enrollment falls. These results definitely support our modified human capital model in which time to graduation, K, is allowed to be a decision variable.

We conduct a sensitivity test on this model by redefining persistence as attendance in either of the last two terms. This more flexible definition of persistence is worth analyzing because the BPS includes individuals who follow all sorts of non-traditional paths towards graduation. Fully 26% of the 1989 cohort and 20% of the 1995 cohort experience interruptions in their college enrollment for at least one term. It could be that those not attending in the final term of the five year period are, in fact, simply interrupting. This alternative definition of our outcome measure does not change the fraction who graduate, but does shift between two and three percent of the sample from a classification of 'not attending' to a classification of 'attending'. Thus under a broader definition of success that includes persistence, individuals look more successful.

Of course, our model suggests that, faced with a higher return, individuals will attempt to complete their degree in a more timely fashion. Overall we see this as we see fewer students interrupting (or attending part-time) in the second as compared to the first cohort. Like persistence, the enrollment path is itself a string of decisions. With fewer students reclassified as persisting in the second as compared to the first cohort, the actual sample difference in the probability of persisting changes from +2.2% (see Table 3) to -

0.5% while the predicted sample difference changes from +2.0% (see Table 3) to -2.5%, using this more generous measure of persistence. All of this predicted difference in persistence is attributed to changes in the coefficients or the factors influencing college outcomes, not to changes in the cross-cohort characteristics, as our model would suggest.

CONCLUSION

We examine college graduation, persistence, and non-enrollment probabilities in light of increased returns to a college degree using a model that endogenizes the time to degree completion. Such a model suggests that, ceteris paribus, time to graduation should decline as returns rise. However, it also suggests that students who were on the margin before will now find it beneficial to enroll in college. These students may have other demands upon their time or more limited academic abilities that are likely to increase their time to graduation and reduce their likelihood of graduating at all.

We proceed to test these predictions using data on two cohorts (1989 and 1995) of first-time students at four-year colleges. We use a multinomial logit specification to model their five-year outcome: graduation, attendance in final term, and non-attendance in final term. Our covariates include a wide array of family, household, and individual characteristics as well as information on the type of institution attended, financial aid receipt, and first year enrollment status and grades.

. The results identify many factors which have statistically significant and substantial impacts on the five-year college outcome. Low levels of family income (<$20,000) double the probability of not attending and likely dropping out within a five-year time frame when compared with the outcomes associated with a family income of

more than $60,000. There is evidence from the second cohort that lower income increases the probability of longer term enrollment, as well. These differences may reflect that these lower income students are working a substantial number of hours and proceeding slowly through college. Likewise, first generation college students are between 60 and 100% more likely to not be attending as compared to students with a college-educated parent. In general, parental support is a critical determinant of college outcome.

The parental and marital status of the respondent has little substantial or significant impact on college outcomes, but characteristics of their first year are strong signals of success. Starting out as a part-time student, delaying enrollment, or initially enrolling in a non-fall term often act to double the likelihood of not attending. Attending a public rather than a private institution is associated with a higher probability of still attending and a lower probability of having graduated at the five-year mark. This may be because public institutions are more likely to attract and accommodate students planning a longer enrollment period or it could be because overcrowding at such institutions makes it more difficult to complete a course of study in a timely fashion. Academic ability as measured by first year grades is also a decisive factor. High grades increase the probability of having graduated and low grades more than double the probability of not attending at the five-year mark, as compared with the outcomes of middle of the road GPA recipients. Low grades are likely attributable to poor preparation which may be the result of attendance at lower quality schools which are disproportionately located in lower income areas. Family income may, hence, have a doubly negative impact on college success.

Significant, but with a smaller effect, is the association between outcomes and the first year financial aid package. Receipt of work study aid in particular is shown to be associated with higher graduation rates and lower dropout and persistence as compared to no aid receipt. Grant only recipients experience the second best outcomes, while loan-only recipients are only observed more likely to graduate and less likely to persist in the first cohort. That loan-only recipients experience such a small boost may be due to the fact that loans have to be repaid.

Finally it is of some interest to note that the impact of gender, race, and ethnicity are modest at best. Hispanic ethnicity in particular appears to have no significant association with college outcomes for those who start at a four-year institution. This result may be due to the greater tendency of Hispanics to begin their college experience at two-year institutions, which students are excluded from this study. Overall, once family income and background, first year grades, and financial aid are taken into account, race and ethnic background are not particularly important factors in college success.

Finally we analyze changes in actual and predicted outcomes between the two cohorts in order to test the predictions of our model. While the more recent cohort does include more non-traditional students (African American, Hispanic, and older), we find that about 90% of the between-cohort outcome differences are attributable to between-cohort changes in the relation between characteristics and college success. Thus, the higher graduation rates and higher persistence rates observed in the second cohort are attributable not to differences in the characteristics of those enrolled but rather to higher success rates for those with similar characteristics. Preliminary evidence suggests that other choice factors like the decision to enroll part-time and to interrupt enrollment may

also have been influenced by the higher return to a college degree. Overall these findings provide strong support for our model.

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Table 1
Sample Means
By Cohort

Variable	1989 Cohort	1995 Cohort	Significantly Different
Women	53.6%	54.9%	
African American	7.9%	10.8%	***
Hispanic	4.4%	10.5%	***
First Generation	32.9%	33.0%	(a)
Age <= 18	70.0%	63.7%	***
Age 19	21.8%	24.4%	***
Age 20+	8.2%	12.0%	***
No High School Diploma	1.3%	2.1%	***
Began in a non-Fall Term	4.6%	5.9%	***
Do Not Immediately Matriculate	9.8%	16.3%	***
Attended Part-Time First Term	3.8%	7.1%	(a)
Missing First Term Intensity	14.4%	0.0%	(a)
Ever Married Men	1.0%	1.5%	**
Ever Married Women	3.2%	3.0%	
Fathers	0.6%	1.2%	***
Mothers	2.6%	2.9%	
Independent	8.1%	7.6%	
Parents' Income < $20K ($89)	16.2%	20.9%	***
Parents' Income $20-40K ($89)	25.3%	25.4%	
Parents' Income $40-60K ($89)	24.8%	22.8%	**
Parents' Income >= $60K ($89)	25.6%	23.3%	***
Parent has Some College	19.5%	12.0%	(a)
Parent has BA Degree	23.3%	23.8%	(a)
Parent has Graduate Education	21.9%	25.0%	(a)
Parents' Educ. Missing	2.4%	6.2%	***
Matriculated at a Public Institution	67.7%	62.8%	***
Unemployment Rate	5.20	5.67	***
GPA > 3.24 (Instit. Report)	20.3%	26.2%	***
As and Bs or Better (Indiv Report)	4.0%	2.6%	***
Midlevel Grades (All Reports)	44.2%	43.5%	
Mostly Bs or Bs & Cs (Indiv Report)	5.9%	2.6%	***
GPA < 2.25 or Mostly Cs or Worse	28.5%	25.2%	***
Missing Grade Report	2.9%	2.5%	
Received Only a Loan	4.4%	10.3%	***
Received Only a Grant	22.3%	22.7%	
Received Both a Loan & a Grant	14.5%	24.9%	***
Received Work Study +	11.4%	15.4%	***
Graduated in 5 Years	47.9%	54.2%	***
Not Enrolled in 5 Years	33.6%	25.2%	***
Still Attending in 5 Years	18.4%	20.6%	***
Number of Observations	4001	6301	

All means are weighted so as to be representative of the population. Not reported here is information on region of residence and, for the second cohort, a dummy variable identifying Hispanics of unknown race.

*** indicates significant differences at the 1% level, ** at the 5% level, and * at the 10% level. and * at the 10% level.

(a) Not strictly comparable across cohorts because of missing data.

Table 2
Marginal Effects of Multinomial Logit Model of Progress Towards a Degree

	1989 Cohort Results									1995 Cohort Results								
	Not Attending			Persisting			Graduated			Not Attending			Persisting			Graduated		
Baseline Probability	13.09%			7.95%			78.96%			10.35%			7.42%			82.23%		
Variable	Marginal Effect	Std. Error	Signif.	Marginal Effect	Std. Error	Signif.	Marginal Effect	Std. Error	Signif.	Marginal Effect	Std. Error	Signif.	Marginal Effect	Std. Error	Signif.	Marginal Effect	Std. Error	Signif.
Women	0.13%	0.012		-2.42%	0.010	**	2.28%	0.016		-0.84%	0.009		-1.63%	0.007	**	2.47%	0.012	**
African American	-0.19%	0.023		4.27%	0.022	**	-4.07%	0.035		1.58%	0.016		2.51%	0.013	*	-4.09%	0.021	*
Hispanic	3.08%	0.034		0.54%	0.022		-3.63%	0.044		0.80%	0.021		1.86%	0.015		-2.66%	0.028	
First Generation	7.40%	0.022	***	1.38%	0.012		-8.78%	0.025	***	10.66%	0.023	***	2.87%	0.012	**	-13.53%	0.024	***
Age 19	2.76%	0.017	*	-0.28%	0.012		-2.48%	0.022		1.48%	0.010		-0.39%	0.007		-1.09%	0.013	
Age 20+	3.44%	0.043		-2.41%	0.022		-1.02%	0.050		12.32%	0.049	**	3.41%	0.032		-15.73%	0.060	***
No High School Diploma	4.43%	0.056		1.46%	0.038		-5.90%	0.082		11.07%	0.071		4.95%	0.040		-16.02%	0.093	*
Began in a non-Fall Term	13.17%	0.051	**	3.62%	0.036		-16.79%	0.073	**	7.48%	0.032	**	6.65%	0.034	**	-14.14%	0.051	***
Did not Immediately Matriculate	12.16%	0.048	**	1.06%	0.024		-13.22%	0.051	***	1.08%	0.022		-1.98%	0.015		0.89%	0.028	
Attended Part-Time First Term	16.17%	0.062	***	7.68%	0.052		-23.84%	0.080	***	6.93%	0.032	**	6.11%	0.029	**	-13.04%	0.049	***
Ever Married Men	-3.53%	0.044		-4.78%	0.023	**	8.31%	0.058		7.40%	0.075		7.85%	0.057		-15.25%	0.095	
Ever Married Women	9.32%	0.076		4.67%	0.062		-13.99%	0.110		11.16%	0.060	*	3.21%	0.035		-14.36%	0.071	**
Fathers	-0.70%	0.083		14.57%	0.108		-13.87%	0.145		0.90%	0.057		4.37%	0.062		-5.27%	0.100	
Mothers	-0.18%	0.055		3.11%	0.063		-2.92%	0.100		0.46%	0.039		5.34%	0.048		-5.79%	0.073	
Independent	16.41%	0.056	***	4.88%	0.035		-21.29%	0.067	***	10.52%	0.055	*	2.93%	0.030		-13.45%	0.066	**
Parents' Income < $20K ($89)	19.38%	0.043	***	3.85%	0.024		-23.23%	0.044	***	8.70%	0.026	***	4.02%	0.017	**	-12.72%	0.034	***
Parents' Income $20-40K ($89)	9.21%	0.027	***	2.92%	0.018	*	-12.13%	0.031	***	7.63%	0.022	***	3.33%	0.013	***	-10.96%	0.026	***
Parents' Income $40-60K ($89)	5.69%	0.019	***	0.69%	0.014		-6.38%	0.021	***	1.56%	0.016		2.83%	0.011	**	-4.39%	0.022	**
Parent has Some College	3.85%	0.020	*	0.02%	0.013		-3.87%	0.026		6.82%	0.022	***	2.03%	0.012	*	-8.85%	0.026	***
Parent has Graduate Education	1.49%	0.021		-1.19%	0.012		-0.30%	0.024		-1.05%	0.014		-0.16%	0.009		1.21%	0.017	
Parents' Educ. Missing	22.17%	0.072	***	7.58%	0.067		-29.75%	0.097	***	3.98%	0.024	*	3.85%	0.018	**	-7.83%	0.031	**
Matriculated at a Public Institution	2.23%	0.014		5.77%	0.020	***	-7.99%	0.024	***	0.27%	0.010		6.32%	0.016	***	-6.59%	0.019	***
Unemployment Rate	1.44%	0.007	**	-0.41%	0.005		-1.03%	0.009		0.78%	0.005		0.75%	0.004	*	-1.53%	0.007	**
GPA > 3.24 (Instit. Report)	-5.07%	0.015	***	-2.50%	0.011	**	7.57%	0.019	***	-5.29%	0.014	***	-2.71%	0.008	***	8.00%	0.016	***
As and Bs or Better (Indiv Report)	-2.37%	0.039		-4.42%	0.018	**	6.79%	0.043		-3.37%	0.021		-1.64%	0.019		5.01%	0.031	
Mostly Bs or Bs & Cs (Indiv Report)	6.74%	0.028	**	0.79%	0.020		-7.53%	0.036	**	4.50%	0.030		4.18%	0.026		-8.68%	0.045	*
GPA < 2.25 or Mostly Cs or Worse	16.59%	0.031	***	4.01%	0.015	***	-20.60%	0.033	***	27.02%	0.034	***	8.87%	0.021	***	-35.89%	0.030	***
Received Only a Loan	-2.82%	0.025		-5.24%	0.018	***	8.06%	0.033	**	-0.90%	0.014		0.79%	0.011		0.10%	0.020	
Received Only a Grant	-3.63%	0.014	**	-1.95%	0.011	*	5.57%	0.018	***	-2.88%	0.013	**	-0.20%	0.009		3.09%	0.017	*
Received Both a Loan & a Grant	-2.32%	0.017		-1.56%	0.011		3.88%	0.023	*	-2.40%	0.013	*	-0.04%	0.009		2.44%	0.017	
Received Work Study +	-6.18%	0.018	***	-4.54%	0.015	***	10.73%	0.025	***	-5.32%	0.016	***	-2.01%	0.009	**	7.33%	0.019	***

Progress measured based on Spring term of 1994 or 2000, approximately 5 years following initial enrollment.
Base Case: A white, non-Hispanic man no older than age 18 with a high school diploma who immediately enrolls full-time in a private college, has an institution-reported first year GPA of between 2.5 and 3.24, is single, has no children, resides in New England in an area with a 5.4% unemployment rate, is dependent upon his college educated parents who earn over $60K a year, and receives no financial aid.
Not reported: 9 Region dummies, missing grade indicator, and intercept. First Cohort: Missing Part-Time Dummy. Second Cohort: Hispanic*Other interaction.
Asterisks indicate statistical significance. *** at the 1% level, ** at the 5% level, and * at the 10% level for 2-sided tests.

Table 3

Cross-Cohort Differences

	Actual		Actual	Predicted	Decomposing the Predicted Difference: (1)	
	2nd Cohort	1st Cohort	Difference	Difference	Characteristics	Coefficients
Probability of:						
Graduating	54.25%	47.94%	6.31%	6.73%		
					0.60%	6.13%
					0.73%	6.00%
Persisting	20.60%	18.44%	2.16%	1.98%		
					-0.48%	2.46%
					0.61%	1.37%
Not Attending	25.17%	33.62%	-8.45%	-8.71%		
					-0.11%	-8.60%
					-1.34%	-7.37%

(1) There are two alternative differencing techniques. The first row reports differences using first cohort coefficient values, the second row reports differences using second cohort coefficient values.

Appendix Table A1
Multinomial Logit Model of Progress Towards a Degree
By Cohort

	1989 Cohort						1995 Cohort					
	Not Attending vs. Graduated			Still Attending vs. Graduated			Not Attending vs. Graduated			Still Attending vs. Graduated		
	Coefficient	Std. Error		Coefficient	Std. Error		Coefficient	Std. Error		Coefficient	Std. Error	
Women	-0.018	(0.106)		-0.391	(0.124)	***	-0.115	(0.103)		-0.277	(0.098)	***
African American	0.038	(0.215)		0.483	(0.187)	**	0.193	(0.153)		0.343	(0.142)	**
Hispanic	0.259	(0.253)		0.113	(0.302)		0.107	(0.215)		0.257	(0.188)	
First Generation	0.566	(0.130)	***	0.278	(0.152)	*	0.888	(0.115)	***	0.507	(0.118)	***
Age 19	0.223	(0.131)	*	-0.004	(0.168)		0.147	(0.101)		-0.040	(0.103)	
Age 20+	0.246	(0.323)		-0.349	(0.404)		0.996	(0.288)	***	0.590	(0.356)	*
No High School Diploma	0.369	(0.418)		0.246	(0.501)		0.944	(0.452)	**	0.728	(0.432)	*
Began in a non-Fall Term	0.936	(0.296)	***	0.614	(0.385)		0.733	(0.228)	***	0.829	(0.281)	***
Did not Immediately Matriculate	0.840	(0.249)	***	0.308	(0.299)		0.089	(0.222)		-0.321	(0.289)	
Attended Part-Time First Term	1.164	(0.329)	***	1.035	(0.414)	**	0.685	(0.238)	***	0.774	(0.245)	***
Ever Married Men	-0.414	(0.521)		-1.020	(0.699)		0.745	(0.540)		0.927	(0.455)	**
Ever Married Women	0.733	(0.483)		0.657	(0.618)		0.923	(0.356)	**	0.551	(0.404)	
Fathers	0.138	(0.834)		1.235	(0.623)	**	0.149	(0.613)		0.530	(0.642)	
Mothers	0.024	(0.538)		0.368	(0.682)		0.116	(0.443)		0.615	(0.452)	
Independent	1.127	(0.281)	***	0.793	(0.345)	**	0.880	(0.338)	**	0.512	(0.347)	
Parents' Income < $20K ($89)	1.257	(0.190)	***	0.743	(0.236)	***	0.778	(0.181)	***	0.601	(0.174)	***
Parents' Income $20-40K ($89)	0.699	(0.152)	***	0.480	(0.191)	**	0.695	(0.155)	***	0.514	(0.141)	***
Parents' Income $40-60K ($89)	0.445	(0.127)	***	0.167	(0.181)		0.195	(0.168)		0.378	(0.133)	***
Parent has Some College	0.308	(0.153)	**	0.052	(0.191)		0.620	(0.153)	***	0.356	(0.153)	**
Parent has Graduate Education	0.112	(0.178)		-0.159	(0.174)		-0.122	(0.154)		-0.036	(0.136)	
Parents' Educ. Missing	1.464	(0.366)	***	1.142	(0.571)	**	0.425	(0.206)	**	0.518	(0.189)	***
Matriculated at a Public Institution	0.264	(0.118)	**	0.652	(0.145)	***	0.109	(0.114)		0.700	(0.111)	***
Unemployment Rate	0.123	(0.056)	**	-0.039	(0.078)		0.094	(0.051)	*	0.120	(0.052)	**
GPA > 3.24 (Instit. Report)	-0.582	(0.158)	***	-0.469	(0.176)	***	-0.808	(0.121)	***	-0.548	(0.115)	***
As and Bs or Better (Indiv Report)	-0.282	(0.402)		-0.895	(0.365)	**	-0.453	(0.292)		-0.308	(0.344)	
Mostly Bs or Bs & Cs (Indiv Report)	0.516	(0.185)	***	0.195	(0.272)		0.472	(0.256)	*	0.558	(0.273)	**
GPA < 2.25 or Mostly Cs or Worse	1.121	(0.127)	***	0.711	(0.143)	***	1.857	(0.113)	***	1.360	(0.126)	***
Received Only a Loan	-0.339	(0.267)		-1.174	(0.359)	***	-0.092	(0.161)		-0.065	(0.138)	
Received Only a Grant	-0.393	(0.144)	***	-0.349	(0.156)	**	-0.363	(0.148)	**	-0.035	(0.131)	
Received Both a Loan & a Grant	-0.243	(0.170)		-0.267	(0.179)		-0.293	(0.145)	**	-0.401	(0.147)	***
Received Work Study +	-0.767	(0.177)	***	-0.975	(0.217)	***	-0.806	(0.175)	***	-3.057	(0.369)	***

Progress measured based on Spring term of 1994 or 2000, approximately 5 years following initial enrollment.
Base Case: A white, non-Hispanic man no older than age 18 with a high school diploma who immediately enrolls full-time in college, has an institution-reported first year GPA of between 2.5 and 3.24, is single, has no children, resides in New England, and is dependent upon his college educated parents who earn over $60K a year.
Not reported: 9 Region dummies, missing grade indicator, and intercept. First Cohort: Missing Part-Time Dummy. Second Cohort: Hispanic*Other interaction.
Asterisks indicate statistical significance. *** at the 1% level, ** at the 5% level, and * at the 10% level for 2-sided tests.

ENDNOTES

[1] The College Board (2007) reports that between 1977 and 1987 inflation-adjusted tuition and fees rose 40% at private and 21% at public four-year institutions. Between 1987 and 1997, they rose 39% and 49% respectively. Net price is more difficult to determine though the same report indicates that financial aid has been rising at least as rapidly as tuition since the early 1990s.

[2] It was clear following a discussion with NCES personnel that the BPS cohorts were not intended to be compared. We followed their advice to construct a uniform measure of strata, PSU, and weights across the cohorts for use adjusting for the survey design, but recognize that these are but imperfectly assigned.

[3] We explored several different ways to control for financial aid receipt. One specification used dummies to separately identify each type of aid. A second specification used dummies to identify various aid packages (loan only, grant only, loan and grant, and finally work study in conjunction with any other type of aid). As aid is often provided in package form, we present here results from the second specification. Overall, our conclusions are robust to either specification.

[4] The increased graduation rate we observe is not attributable to our ability to observe individuals as they transfer between institutions. We observe rising graduation rates even when we limit our analysis to the initial school attended.

[5] For example, some students with a higher opportunity cost of time may choose to enroll when the returns to a college degree rise.