Priced out? Does Financial Aid Affect Student Success?

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Abstract: While the literature on postsecondary student success identifies important academic and social factors associated with student outcomes, one question that persists concerns the influence of financial aid. We use the National Student Clearinghouse's StudentTracker service to develop a more complete model of graduation, transfer success, or dropout. Multinomial regression techniques reveal that need aid appears to equalize the odds of success for receiving students, use of loan aid appears to encourage students to search out alternative institutions or drop out entirely, and merit aid appears to increase the likelihood of the receiving student remaining and graduating from their entry institution.

Introduction

As public institutions of higher education continue to face eroding financial support in the form of shrinking state appropriations, these colleges and universities are turning to tuition dollars as a replacement for this declining source of revenue. In response to the subsequent rise in college costs, students are increasingly relying on financial aid to help pay for college. While early financial aid programs utilized grant subsidies to offset the financial barriers associated with post secondary degree attainment, we have witnessed a dramatic shift in the philosophy of higher education in recent decades under which students are required to assume a greater *personal stake* in financing their education through the use of student loans. As a result, students are leaving college with sizable debt burdens, with nearly two-thirds of students graduating from a public college or university left with a debt obligation averaging $17,250 (AASCU, 2006).

As the popularity of student loans as a means of financing higher education continues to climb, the long-term consequences associated with student borrowing are frequently cited as a concern for individuals with a stake in higher educational outcomes (Smith, 2007; Ronstadt, 2009). For example, policy-makers worry that students with high debt burdens will "put off life milestones such as buying a car, owning a home, getting married, or entering certain low-paying professions like teaching or social work" (AASCU, 2006, p. 2). Meanwhile, college administrators are concerned with findings that suggest that students with debt burdens after college may be less likely to enter graduate and first-professional school (Millett, 2003). While the long-term effects of student borrowing are clearly important, the consequences of student financial decisions have important short-term consequences. The American Association of State Colleges and Universities suggests that "It is not uncommon for students, especially low-income students, to drop out of college only after accumulating thousands of dollars in student loan debt.

Nearly one in five students who do not graduate from college leave with $20,000 in student loan debt" (2006, p. 3). Consequently, student financial decisions pose serious challenges for colleges and universities.

Just as students are increasingly relying on borrowing to facilitate their personal educational goals, institutions are increasingly relying on a specific form of financial aid to help achieve different organizational goals. According to Donald Heller (2006) "there has been a fundamental shift in the awarding of scholarships to undergraduates in the United States. More and more, these grants are being made not based on the financial need of the student and her family … but instead, are being awarded using measures of academic merit with consideration of financial need" (p. 2). Given the competition for high-quality students, it is perceived that merit aid provides institutions of higher education a myriad of benefits, such as providing aid to "students who have demonstrated high academic ability; help institutions recruit meritorious candidates for admission; may help states encourage academic excellence in high school and college attendance; and provide some relief for middle-income families who may not qualify for traditional need-based aid but feel squeezed by the continuing growth of college prices" (Redd, 2004, p. 33).

The potential relationship between financial factors and student persistence is of particular importance to public college and university administrators who are finding that justifications for state appropriations are increasingly tied to outcomes on performance indicators, such as institutional graduation and retention rates (Burke & Minassians, 2001; Zumeta, 2001). Despite heightened institutional spending on programs targeted at improving student success, student attrition rates remain at undesirable levels at many of the nation's colleges and universities. One estimate suggests that while institutional retention rates vary, as many as four out of every ten

students that enter college fail to graduate from the institution of entry (Horn, 2006). While recent enrollment trends suggest growth in the popularity of multi-institutional enrollment for students on their way to completing a college degree (Adelman, 2006), most research on student retention continues to simplify the persistence decision to a simple choice: either to reenroll or drop-out.

As spiraling tuition rates strain both individual and institutional budgets at the same time that institutions face mounting pressure to improve graduation rates, it is important to consider if financial aid influences the likelihood of graduation. This question has taken on greater significance as the increased reliance on student loans has forced students to assume a greater personal stake in financing their education. Utilizing a measure of degree attainment that accommodates graduation outcomes beyond the institution of entry, the purpose of this paper is to consider if the type of student aid utilized by students affects the postsecondary trajectory toward graduation. For example, if it is the case that promoting borrowing behavior among students encourages them to more carefully consider alternative educational opportunities, then the increased emphasis on student loans as a means of financing college work against an institution's retention goals. Understanding how the primary forms of financial assistance differentially influence patterns of persistence can aid administrators, trustees, and legislators in weighing the potential returns to institutional investments or changes in tuition policy. Specifically, this research addresses the following research questions:

1. Is there a relationship between the *financial aid package* utilized by students to pay for college during their first semester and their trajectory toward the completion of a college degree?

2. Is a student's postsecondary degree trajectory responsive to the amount of money in the

student's financial aid package?

3. Is there a relationship between the *forms of financial aid* utilized by students and postsecondary completion trajectories?

LITERATURE REVIEW

Interest in the relationship between financial aid and student success is growing (DesJardins, Ahlburg, & McCall, 2002; Dowd, 2004; Singell, 2004; Herzog, 2005; Singell and Stater, 2006; MacCallum, 2008). While the growing body of literature on postsecondary student success has identified important academic and social factors associated with retention and graduation, one question that remains less well explained is how financial aid affects a student's likelihood of success in college. With college costs growing substantially over the last thirty years, there has been a significant shift in the philosophy of funding higher education. As college students are asked to shoulder the increasing costs of their education with student loans, it is important to identify whether this growing financial responsibility is acting as a road-block to success.

Most of the early literature on the impacts of financial aid explored the relationship between financial aid and the matriculation decision, paying little attention to persistence decisions (St. John, 2000; Singell & Stater, 2006, Pascarella & Terenzini, 2005). Focused primarily on the issue of college access, these early studies of student finance attempted to identify how the cost of college (Leslie & Brinkman, 1987; St. John, 1994; Heller, 1997, 2001), the availability of aid (Chapman, 1981), and different aid packages (Hansen, 1983; Ehrenberg & Sherman, 1984: St. John & Noell, 1989) potentially influenced an individual's ability to attend college, as well as their decision about where to go. Where early studies did address the link between financial aid and persistence, much of the early work concentrated on the role of

financial need and the subsequent need-based aid programs (Voorhees, 1985; St. John, 1990; Bettinger, 2004).   For example, exploring the relationship between rising tuition and student retention, St. John (1990) found that persistence decisions are more responsive to the availability of aid (specifically grants, loans, and work study) than they are to the costs of attendance suggesting "persistence rates can be improved if institutions increase need-based aid for currently enrolled students when tuition is increased each year" (p. 387). Consequently, it was largely believed that "students who received financial aid were as likely to persist in college as those who did not, even after adjusting for academic ability" (Pascarella & Terenzini, 2005, p. 408).

As financial aid patterns began to shift away from grant based aid in response to the rising cost of tuition and stagnation in grant award amounts, researchers became increasingly interested in the role of the other types of aid, particularly the dramatic shift toward federal lending that took place during the 1990s in response the creation of the unsubsidized loan program (McPherson & Shapiro, 2002). While early studies on financial aid generally identified a positive association between student loans and persistence (Astin, 1975; Terkla, 1984; Voorhees, 1985; St. John, 1994), later studies questioned this association as more and more students began to borrow. Just as it was perceived that grant aid was no longer sufficient to ensure access to college (Somers & St. John, 1997; DesJardins, Ahlburg, & McCall, 1999), there emerged growing concern that changing patterns of financial aid allocation might begin to undermine persistence and degree outcomes. For example, studying persistence patterns of a cohort of freshmen enrolled at the study institution in Fall 1991, DesJardins, Ahlburg, & McCall (1999) found that while "loans, earnings, and scholarships generally reduce the stopout probabilities, they do not appear to have a profound effect on dropout behavior" (p. 387). Where they did

observe positive effects of loans, they were largely constrained to periods later in the enrollment cycle. Dowd (2004) looks more specifically at the relationship between student borrowing and the likelihood of degree attainment enrolled at public four-year institutions and found that "(l)oans have a positive effect on persistence, but not on degree attainment" (p. 23 of 35). While improving the likelihood of persistence is often considered a desirable goal of financial aid, the ability of student borrowing to improve the retention probabilities of students without similarly affecting the graduation probabilities generates important moral and ethical considerations for institutions. If it is the case that student loans simply defer the departure decision to later point in time, then the associated benefits of the additional year(s) of college must be weighed against the costs of leaving college with a sizeable debt load yet no degree.

While studies have identified that the availability of merit aid is likely to influence a student's decision about which college to attend (Dyranski, 2002; Cornwell, Mustard, & Hope, 2006; Singell & Stater, 2007), less is certain about the long-term benefits associated with this form of financial aid. For example, a study of the state of Georgia's HOPE Scholarship Program found that students retaining their scholarship did outperform their counterparts in terms of persistence and retention, it is difficult to assess the accurately assess the impact of the program as nearly "70% of HOPE recipients overall lost their scholarships after attempting 30 credit hours, and only 13% kept it for 4 years" (Henry, Rubenstein, & Bugler, 2004, pp. 699-700).

While the growing body of literature on financial aid has begun to identify important associations with retention and graduation, very few studies have modeled the student retention decision as an outcome with multiple categories. Where studies have used a multi-outcome dependent variable, they have largely attempted to distinguish between the stop-out, transfer out and persistence behavior of students after the first year (Porter, 2003; Herzog, 2005; Stratton,

O'Toole, & Wetzel, 2008). While first-year retention remains an important piece of the student success puzzle, it is important to note that as schools continue to invest more and more resources in first year retention programs, there is less to explain in first year retention outcomes. For example, more than 85 percent of students enrolled as freshman at the University of Minnesota-Twin Cities return for a second year. Of those that chose not to return after their first year, estimates from the National Student Clearinghouse suggest that as many as 62 percent of these students end up in another post-secondary institution within the next year. To provide a more complete model of the relationship between financial aid and student success in college, we suggest utilizing a measure of degree attainment that more fully incorporates the options available to students.

Redefining Student Success

Currently, federal reporting requirements distort the true picture of student success by limiting graduation counts to completion of a degree at the institution of entry (Adelman, 2006; Stratton, O'Toole, & Wetzel, 2008; Jones-White, Radcliffe, Huesman, & Kellogg, 2010). Because the existing literature relies on this narrow interpretation of student retention as a simple dichotomy, it ignores how factors such as financial aid may differentially relate to a broader interpretation of student success that includes graduation from institutions other than the institution of entry. To facilitate our desire to model the factors such as financial aid that contribute to college completion beyond simply the institution of entry, this study utilized the StudentTracker service offered by the National Student Clearinghouse (NSC) to identify if students who departed the University but completed a degree at another institution of higher education. Jones-White, Huesman, Radcliffe, and Kellogg (2010) employed this technique in their study of student success at the University of Minnesota and suggested that such an

aapproach provides numerous advantages when studying student success including both the ability to distinguish between universal and institutional barriers to student success and the ability to reduce measurement error associated with the dependent variable (p. 171-2).

According to its organizational documents, the National Student Clearinghouse is a non-profit organization that provides third-party enrollment and degree verification for secondary and post-secondary institutions across the country. With more than 3,300 colleges participating in the Clearinghouse's different verification services, the NSC serves as a rich source of data pertaining to the educational career paths of more than 90 percent of college students in the United States (NSC, 2009). Specifically, subscribing to the StudentTracker service offered by the Clearinghouse allows member institutions to query their "database of 93 million post-secondary enrollment and degree records" (NSC, 2009, p. 2).

Both Porter (2002, 2003) and Herzog (2005) utilized data from the National Student Clearinghouse to construct persistence models with multiple outcomes, but constrained their analysis to a student's first-year persistence decision. To accurately identify the graduation outcomes for those students departing the University prior to obtaining a degree, the cohort was initially divided into two groups; those who graduated from the University within six years (just under 66 percent) and those who did not. The list of non-graduates was sent to the National Student Clearinghouse to determine whether the students graduated within six years from another institution. Graduation outcomes were produced for 440 of these students, suggesting that more than 24 percent of students who drop out of the University of Minnesota graduate from another four-year institution within the same six year period. The result is a three outcome variable that indicates whether a student obtained a degree from the University of Minnesota,

obtained a degree from another four-year institution, or failed to earn a degree within the period

of observation. The distribution of these outcomes is illustrated in Figure 1.

[Insert Figure 1 about here.]

Sample

To explore if factors related to student finances affect the reenrollment decision of

freshman at the University of Minnesota-Twin Cities, we utilized tenth-day census data for the

Fall 2002 freshman cohort freshman obtained from the University's data warehouse.   The

University of Minnesota-Twin Cities campus is the state's Land Grant institution and is

classified as a Research University with Very High Research Activity (RU/VH) by the Carnegie

Foundation. In fall 2002, the University enrolled 48,677 students, 28,103 of which were

undergraduate students. The original data sample consisted of 5,188 New High School Students,

which the University defines as first-time, full-time students. After removing cases with missing

observations, the analysis was conducted on the 5,059 students remaining, or 97.5 percent of the

original sample.

Analytic Approach

As in the previous work conducted by Jones-White, Radcliffe, Huesman, and Kellogg

(2010), the dependent variable utilized in this study represents graduation outcomes as an

unordered, categorical variable identifying if the student dropped out (0), obtained a degree from

a transfer institution (1) or obtained a degree from the institution of entry (2), in this case the

University of Minnesota-Twin Cities. Given that the dependent variable consists of three

unordered outcomes, it is necessary to employ a statistical methodology that is capable of

producing consistent and efficient parameter estimates as neither ordinary least squares or

logistic regression is appropriate.   Consistent with the modeling approach utilized by Porter

(2003, Herzog (2005), and Stratton, O'Toole, and Wetzel (2008) to accommodate similar polychotomous dependent variables, this study utilizes the multinomial logit (MNL) to address this specification issue. Formally, this model can be expressed as the probability model:

$$ln\,\Omega_{m|b} = ln\frac{Pr\,(y=m|x)}{Pr\,(y=b|x)} = x\beta_{m|b}\;for\;m=1\;to\;J$$

which Long (1997) suggests can be understood as "simultaneously estimating binary logits for all possible comparisons among the outcome categories" (p. 151). He indicates that by simultaneously estimating all the logits, rather than estimating each pair wise comparison separately, the MNL both "…enforces the logical relationship between the parameters and uses data more efficiently" (Long, 1997, p. 151).

While a polychotomous dependent variable with three outcomes yields six potential choice comparisons, only three of the comparisons are unique, and, therefore, reported in this study. Specifically, this study explores the effects of the independent variables on the following three choice comparisons: dropping out relative to success at the institution of entry, success at a transfer institution relative to success at the institution of entry, and dropping out relative to success at a transfer institution.

Conceptual Framework

This study adopts Beekhoven, De Jong and Van Hout's (2002) combined integration and rational choice approach to understanding student persistence at the University of Minnesota-Twin Cities. Beginning with the premise that "empirical tests of most integration theory-based models do not explain a satisfactory amount of the variance in academic progress," they suggest that our understanding of student departure can be facilitated by incorporating elements of rational choice into our current integration based models (Beekhoven, et. al., 2002, p. 577). In this approach, which suggests that individuals employ cost-benefit analysis in order to maximize

their utility, the "emphasis on financial resources is more specific and explicit" (Beekhoven, et. al., 2002, p. 582). Dowd (2004) utilizes this conceptual framework in her analysis of the effects of income and financial aid on retention and graduation and suggests that such an approach is particularly well suited for studies of financial aid.

In their article, Beekhoven et al (2002) suggest three cost-benefit mechanisms that potentially influence the educational decisions of individuals: 1) financial resources available to the student associated with family income, 2) the social costs the student associates with dropping out, and 3) the subjective expectations the student has about their personal abilities (p. 580). This study expands this interpretation to include concepts of personal finance as related to the consequences of different types of financial aid on the student's post-secondary completion trajectory. Specifically, this article posits that the type of financial aid available to students influences their decision about their path toward graduation by altering the student's perception of costs and benefits associated with degree attainment. Because completion of a college degree does not require students to remain at the institution of entry, inequalities in the cost-benefit structure may induce students to consider other educational alternatives beyond completion at the institution of entry.[1] Consequently, this study hypothesizes that sources of financial aid that require students to take a greater stake in paying for their education will work against institutional retention goals by increasing the likelihood of seeking out other educational alternatives beyond completion at the institution of entry. Conversely, forms of aid that reduce

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[1] Specifically, we suggest that student's perceptions of cost and benefits associated with pursuing a degree at the institution of entry are hindered by incomplete information at the point of entry. This is because while the costs structure associated with college is well defined, students only have an expectation about the relative benefits associated with attendance at the University. As this information asymmetry is reduced through enrollment at the University, students evaluate their future enrollment decision.

the costs associated with going to college are expected to reduce the likelihood of departure by making the perceived benefits associated with success at the institution less costly.

Model Specification

The explanatory variables utilized in this study are based on the student retention literature and reflect characteristics of a student collected both prior to admission and during their first semester. This study is fortunate to build on the published retention studies conducted at the University of Minnesota-Twin Cities and incorporates factors related to student success identified by DesJardins, Ahlburg, and McCall (1999, 2002), Huesman, Brown, Lee, Kellogg, and Radcliffe (2009), and Jones-White, Radcliffe, Huesman, and Kellogg (2010). Table 1 provides the descriptive statistics associated with the variables utilized in the subsequent multinomial logit models and a discussion of the coding of the different variables follows.

[Insert Table 1 about here.]

Academic Background. The first group of variables incorporated into our model control for the precollege academic ability and preparedness. The *composite ACT score* variable reports the score on the ACT examination. Where students submitted SAT rather than the ACT scores, we computed an equivalent score based on the conversion scale provided by the College Board. *First generation college* is a dichotomous variable that captures whether the student is the first in their family to attend college and attempts to identify the familial resources students have available to them. Because the University of Minnesota-Twin Cities allows students to apply to more than one of the University's academic colleges (e.g. College of Liberal Arts, College of Biological Sciences), we created a dichotomous variable to identify whether the student was admitted to their *first-choice college* or not. Its explanatory role is to provide an early indication of the lack of congruence between the student's goals and the University's offerings. *Advanced*

placement credit is a count of the number of credits new high school students were able to transfer in via advanced placement testing. *Remedial course taken* is a dichotomous variable identifying whether the student was enrolled in a remedial course during their first semester, and is a proxy for academic preparation.

Academic Performance. According to previous research on retention and graduation, first-term GPA is often strongly associated with student success (Pascarella & Terenzini, 1991, p. 388). Unfortunately, because of both its explanatory power and strong correlation with other variables in the model, GPA often obfuscates the influence of other variables known to impact persistence. To correct for this, we utilize several alternative variables to measure first semester performance. The first academic performance measure is the *ratio of credit hours earned-to-attempted.* To help with inference, this ratio was multiplied by 100 so that a unit change reflects a $1/100^{th}$ change rather than a change across the total scale. We also include independent measures of the counts of Cs, Ds, and Ws received by the student during the first term.

Demographic Characteristics. In addition to variables controlling for the student's academic preparation and performance, we also include several dichotomous variables to control for the potential influence of demographic characteristics. *Female* is also coded as a dichotomy identified as 1 if the student was a woman, and 0 if not. *Underrepresented minority* is a dichotomous variable to indicate whether the student is from one of the historically underrepresented racial/ethnic groups in higher education: Native American/American Indian, African American, or Hispanic. Because the University of Minnesota-Twin Cities also has a significant population of *Asian* students (11.0 percent), a separate dichotomous variable was also created. Because retention patterns of *student athletes* may not mimic those of the general

population (DesJardins, Ahlburg, & McCall, 1999; Radcliffe, Huesman, Kellogg, & Jones-White, 2009), we incorporated a dichotomous variable to control for these students as well.

Geographic Origin. One of the important features of the University of Minnesota-Twin Cities is that the state of Minnesota participates in a heavily-used reciprocal pricing program with its neighboring states: Wisconsin, North Dakota and South Dakota. These reciprocity agreements allow for students in neighboring states to enroll at the institution under in-state tuition pricing. To account for this reduced pricing system for select out of state students, two dichotomous variables were created to control for geographic origin. *Reciprocity state* identifies those students enrolled from a state participating in the reciprocity agreements. To capture all other *out-of-state* students, another variable was created.

Social Integration. Four measures of social integration are also included in the model. The first is *living on-campus*. This is a dichotomous variable measuring whether or not the student lives in one of the University's dormitories. The second variable we utilize to measure social integration is whether or not the student participates in one of the University's *living learning communities*. The final two variables measure whether or not the student *worked on-campus*. Utilizing dichotomous variables, we capture whether students worked on-campus through either to federal work-study program or other campus employment.

Financial Aid. To assess the impact of financial aid on the student's retention decision we incorporated a series of variables meant to identify the different types of financial aid packaging utilized by the student to finance their first semester of enrollment at the University. Specifically, this study identified seven mutually exclusive packages of aid: *scholarship only*, *loan only*, *need only*, *scholarship and loans*, *loans and grants*, *scholarships and grants*, and a *comprehensive package of aid* that included scholarship, loans and grants. These variables were

coded both as dichotomous variables to identify the effects of the type of package and as monetary value to assess the responsiveness of the size of the award.

To attempt to discern the independent effects associated with of each of the forms of financial aid available type, this study recoded the financial aid variable into three variables identifying is the student utilized any of the three forms of aid analyzed in this study: scholarships, loan, or grants. The first financial aid variable is *grant aid* which is a dichotomous variable that measures if the student accepted need-based financial aid offered through the federal Pell Grant program, the Minnesota state grant program, and SEOG grants. In fall 2002, 39 percent of new high school students received a need award. The average award for students receiving need based aid their first semester was $1,990.83.   The second financial aid variable we incorporated into our model is *scholarship aid*. This variable identifies whether the student accepted aid offered through the admissions office in the form of a scholarship. Approximately 12 percent of students in our sample received merit based aid with an average first term amount of $1,383.46. The third financial aid variable in our model is the amount of *loan aid* the student accepted. This value reflects all loan aid processed through the University and consequently is unable to measure loans given directly to the student and/or his or her parents. Approximately 46 percent of freshman enrolled during fall 2002 accepted a loan award, with the average borrower accepting $3,376.69. The final financial aid measure included is the amount of remaining *unmet financial need* a student had for the semester.

Findings and Interpretations

The multinomial logit model results of six-year student success were produced utilizing Intercooled STATA 9.2 for Windows and are reported in the Tables 2 and 3. Columns I and II

present the logit coefficients[2] and standard errors[3] comparing the likelihood of departure relative to obtaining a degree at the University of Minnesota-Twin Cities. Significant variables in this comparison signify factors affecting the log-odds of dropping out of college rather than persisting to graduation at the institution of entry. Columns III and IV report the coefficients and the associated standard errors for the decision to complete a degree at another institution relative to the decision to obtain a degree at the University of Minnesota. Columns V and VI provide the results comparing transfer success relative to graduation at the University of Minnesota.

Is there a relationship between the financial aid package utilized by students to pay for college during their first semester and their trajectory toward the completion of a college degree?

To evaluate whether or not there a relationship between the *financial aid package* utilized by students and their trajectory toward degree completion, Table 2 presents the results of our multinomial logit model including a series of dichotomous, or dummy, variables identifying whether students utilized any of seven forms of financial aid packaging to finance their first semester of college. These seven forms represented mutually exclusive categories and identified whether students utilized scholarships only, loans only, grants only, scholarships and loans, loans and grants, scholarships and grants, or a comprehensive package including scholarships, loans and grants to pay for college. While Table 2 incorporates an extensive set of variables to control for other factors commonly associated with student success, such as factors related to a student's academic background, first semester performance, demographic characteristics, geographic origin and social integration, our discussion will be limited to the effects of the financial aid variables except to say that the results are consistent with both the literature on student success

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[2] Logit coefficients reflect the *ceteris paribus* change in the log-odds and are interpreted such that positive values increase the likelihood of the comparison outcome relative to the reference, or base, outcome. Negative outcomes, conversely, decrease the likelihood of the comparison outcome relative to the reference outcome.
[3] Significance levels are reported at the 0.001 (***), 0.01(**), 0.05 (*), and 0.10 (#) levels.

and previous findings reported for the University of Minnesota.[4]

[Insert Table 2 about here.]

Financial support through scholarships only has negative impact on the log-odds of both dropping out of college (-1.068, $p \leq 0.01$) and transfer success (-1.02, $p \leq 0.05$) relative to obtaining a degree at the University of Minnesota-Twin Cities suggesting that students with merit aid are more likely to be successful at the University than to either depart or be successful somewhere else. Conversely, utilizing financial aid that consists of loans only positively affects the log-odds of departing (0.284, $p \leq 0.01$) relative to success at the University. Grant only aid does not influence the log-odds of dropout versus University graduation comparison, but is negatively associated with the log-odds of other institutional degree attainment relative to success at the home institution (-0.511, $p \leq 0.05$) and positively associated with dropping out relative to other institutional degree attainment (0.506. $p \leq 0.05$). While aid packages that incorporate both scholarships and loans do not statistically impact any of the choice comparisons, packages utilizing both loans and grants increase the log-odds associated with dropping out relative to graduating from the University (0.254, $p \leq 0.05$). Consistent with the results for scholarships only, packages incorporating both scholarships and grants are negatively associated with the log-odds of both dropping out (-0.983, $p \leq 0.001$) and transfer success (-0.703, $p \leq 0.10$) relative persisting to graduation at the University. Comprehensive aid packages combining scholarships, loans, and grants are only associated with contrast comparing other four-year degree attainment to graduation from the University, decreasing the log-odds of being successful elsewhere (-0.888, $p \leq 0.10$).

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[4] The only small exception is the effect of composite ACT score which has a positive association with the odds of dropping out of school.

To assist with interpretation Figure 2 presents the factor change scores associated with each of the financial aid variable included in Table 2. Because success at the home institution is the reference category, it is situated at one (1) on the odds scale and zero (0) on the logit scale. Lines connecting outcomes indicate where outcome are not statistically distinguishable at the 0.10 level. While some similar patterns do emerge, Figure 2 suggests that the type of financial aid package does differentially impact the odds associated with a student's postsecondary completion trajectory. Several distinct patterns emerge.

[Insert Figure 2 about here.]

The first pattern reflects forms of aid packaging that improve institutional goals by reducing the likelihood of departure both in terms of dropping out and transfer behavior. One prominent of orders the outcomes: drop out, transfer success, home success. For example, having scholarships only (meritp) decreases the odds of both dropping out of college (66%) and being successful at another institution (64%) relative to being successful at the institution of entry, although the odds of these two outcomes are not statistically distinguishable from each other in our model.[5] Relative to success at the home institution, financial aid packaging that combines scholarships and grants (meritneedp) lowers the odds of dropping out by 63% and transfer success by 50%. While this form of aid introduces a little more separation between the odds of dropping out and transfer success, the results are not statistically different from one another. Having the combination of both scholarships and loans (meritloanp) similarly orders the odds of the graduation, although the size of the effect is much smaller and the model is not able to distinguish these outcomes.

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[5] All interpretations of changes in the odds assume all other variables are held constant.

Comprehensive aid packaging (allp) also reduces the odds of both dropping out and transfer success relative to success at the home institution, but it order the odds of the outcomes: transfer success, drop out, home success. Specifically, utilizing a comprehensive aid package to finance college lowers the odds of both transferring and dropping out, although the model is only able to between the transfer success/home success comparison, reducing the associated odds by approximately 59%. Taken together, these results provide begin to provide some initial evidence suggesting that financial aid packages that include merit aid in the forms of institutional scholarships have a powerful effect on the odds of success at the University.

The second pattern reflects packages of aid that hinder institutional retention goals by increasing the likelihood of dropping out and transferring success relative to success at the institution of entry. As illustrated in Figure 2, relying only on student loans (loanp) increases the odds of both dropping out and being successful elsewhere relative to success at the institution of entry, although the effect on the odds is only statistically significant for the dropout/ home success comparison; increasing the odds of dropping out by 33%. This relationship with the odds is consistent with the effects of financial aid packaging combing both grants and students loans (loanneedp), although the impacts on the odds appear slightly reduced, increasing the odds of dropping out by 29%, perhaps in response to the inclusion of the non-repayable grants.

The third pattern reflects packages that equalize the chances of success at the institution of entry. Relying only on grant aid (needp) lowers the odds of transfer success relative to both home success and dropping out, while equalizing the odds of the latter two outcomes. While the ability of need based grants to lower the likelihood of dropping relative to success at the institution of entry is intuitive, the similar effect on the dropout/transfer success is intriguing as it

may presumably suggest either a lack of mobility or lack of information about alternative options for students with financial need.

Is a student's postsecondary degree trajectory responsive to the amount of money in the student's financial aid package?

To assess if a student's postsecondary degree trajectory is responsive to the *amount of money included in different financial aid packages*, the multinomial logit model was rerun replacing the dichotomous financial aid values with the associated dollar amounts. The results are reported in Technical Appendix 1. Figures 3-5 report the changes in probabilities in the likelihood of graduating from the University, graduating from another four-year college, or dropping out for the median student as the value of the aid package changes in increments of 10 percent from its minimum to its maximum.[6]

Figure 3 contains the predicted probabilities associated with the different outcome categories as the dollar amount changes for homogenous forms of financial aid packaging. As the dollar amount of scholarships increases from the minimum, the predicted probability of successfully completing a degree at the University rises quickly, while the predicted probability of either dropping out or completing a degree at another institution drop in tandem. By the time the median amount is reached, ceiling and floor effects minimize additional changes in the predicted probabilities. Increasing reliance on loans, in contrast, lead to steadily declining predicted probabilities of success at the University, while the estimated likelihood of dropping out or earning a degree elsewhere rises. As the amount of loan aid received approaches the

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[6] Specifically, the median freshman enrolled at the University of Minnesota-Twin Cities in 2002 had the following characteristics: a composite ACT score of 25; was not a first-generation college student; was accepted into their preferred program; had no advanced placement credits; was not enrolled in remedial math; completed all of the courses they attempted their first semester and received no Cs, Ds, or Ws; was female; younger than 19; white; and a non-athlete; was from Minnesota; lived on campus but was not in a living learning community; did not have any federal work study or on-campus employment; had no unmet need and no financial aid.

maximum, there is an increased separation between the two latter outcomes, with the predicted probability of dropping out rising relative to that of finishing elsewhere. Grant aid in larger amounts leads to greater predicted probabilities of completing a degree at the University of Minnesota, and a decreasing chance of completing a degree at another institution. The predicted probability of dropping out, however, is quite stable across the range of grant aid amounts, reinforcing the hypothesis that grant aid plays an equalizing role, preventing increased financial need from pricing students out of attaining a degree.

[Insert Figure 3 about here]

Combinations of aid types reflect the mix of trends noted above and are illustrated in Figure 4. Packages that include a combination of scholarships and loans are associated with an increase in the predicted probability of obtaining a degree from the University as the size of the aid package increases. Packages formed from scholarship and grant aid display a similar pattern, but with higher predicted likelihoods of success. Packages formed around loans and grants, however, follow the pattern of loan-only packages, although the declines in the predicted probability of graduating from the University do not decline quite as sharply as the financial aid package approaches the maximum amount.

[Insert Figure 4 about here]

Comprehensive aid packages, including scholarships, loans, and grants, are associated with modest increases in the probability of graduation from the University and steady decreases in the likelihood of the other outcomes as the dollar amount of the package increases. These patterns, depicted in Figure 5, and are very similar to those seen for packages formed from scholarship and loan aid. When contained in a comprehensive package, therefore, the negative impact on

predicted probabilities of success associated with loans appears to be balanced by the positive effects of other forms of aid.

[Insert Figure 5 about here]

Is there a relationship between the forms of financial aid utilized by students and postsecondary completion trajectories?

To assess if there is a relationship between the *forms of financial aid* and the trajectory toward completion, we reran the multinomial logit model with three dichotomous variables identifying which form of aid a student accepted during their first semester at the University. It is our hope that by letting the variables covary, as opposed to focusing on the mutually exclusive aid categories, we might begin to parse out the unique effects associated with scholarships, grants, and loans. Table 3 reports the results for the full model and suggests the type of financial aid awarded to the student differentially influence a student's graduation path, providing evidence in support of our hypothesis that the type of aid utilized by students matters. Of the types of student aid available to students, none is currently as controversial in the literature on financial aid as the concept of merit aid because of its perceived benefits to students who already have access to college (Heller, 2006). Despite these concerns, scholarship aid seems particularly effective from an institutional perspective, as it acts to lessen the likelihood of dropping out (-0.869, $p \leq 0.001$) and decrease the likelihood of transfer behavior (-0.666, $p \leq 0.01$). The partial effect of student loans, however, has a distinctly different effect as it increases the likelihood of dropping out (0.292, $p \leq 0.001$) and increases the likelihood of transfer success (0.306, $p \leq 0.01$). This suggests that students are likely to search for better educational deals when they are forced to take a personal stake in financing their education through student loans.

Need awards, for example, decrease the likelihood of transfer behavior while normalizing the chances of success for students across all institutions relative to dropping out of college.

[Insert Table 3 about here]

To assist with interpretation, Figure 6 plots the odds ratios of the three financial variables of interest in this model: received a scholarship (dmerit), received a loan (dloan), and received a grant award (dneed). As illustrated in Figure 6, the most striking effect in terms of changes in the odds is associated with merit aid. Acceptance of merit aid substantially decreases the odds of dropping out or transferring as opposed to success at the University, by 58% and 49% respectively. While results suggest that the use of scholarships has a greater impact on the dropout/UMN comparison than transfer/UMN comparison, the impact of scholarships on the odds of dropout/transfer are not significant. While the partial effects of grant aid orders the outcomes from success at another four-year institution to success at the University, the effects of this type of aid appear to be more modest and comparisons are statistically indistinguishable from each other. Accepting a student loan increases the odds of either dropping out or obtaining a degree from a different institution relative to success at the University, by 33% and 36% respectively, although the differences between both transferring and dropping out are not statistically significant.

Taken together these results demonstrate the disparate impact of different aid packages. Where the University invests in students, either through need or merit based aid, students are likely to persist and be successful. Where students are left with a high amount of unmet need or are encouraged to finance their education through student loans, students are more likely to seek out educational opportunities potentially more affordable to them.

[Insert Figure 6 about here]

Conclusions

Most existing studies on student retention utilize a strict dichotomy to characterize student success: students either persist or depart. While parsimonious, this interpretation of student success does not accurately reflect the different options available to students in their pursuit of a college degree. Recognizing that students often have educational career paths that lead them to graduation beyond the institution of entry, the results in this study demonstrate how utilizing data from the National Student Clearinghouse, combined with a methodological approach that accommodates the estimation of relationships across polychotomous outcomes, allows for a more comprehensive and reliable understanding of factors associated with student success.

These different influences are clearly illustrated in the results concerning financial aid. The results for our model suggest that, at least for this cohort of college freshmen, the type of financial aid differentially impacts the likelihood of specific academic career path choices. This is consistent with other studies using a similar approach (Herzog, 2005; Stratton, O'Toole, and Wetzel, 2008). As we would hope, students accepting need based aid are no more or less likely to graduate from the either the University or another four-year institution than they are to drop out, suggesting that that need based aid has a potentially equalizing effect on the likelihood of graduation. Where need based aid does appear to matter is in the decision of where to graduate, as students receiving need based aid are less likely to graduate from another institution rather than earning their degree at the University of Minnesota. Taken together, these results provide some initial evidence for administrators at the University of Minnesota that need based aid is successful in helping alleviate the financial barriers to higher education for low-income students.

According to our model, accepting a student loan substantially decreases the likelihood of success at the institution of entry. Students who borrow during their first semester are more

likely to transfer or drop out after their first semester relative to their odds of graduating from the University of Minnesota. Given the increased pressures associated with higher costs of college attendance that encourage students to borrow, this is extremely important as it directly undermines institutional retention goals. Moreover, the institution encourages students to take out loans in order to avoid the substantial opportunity costs of delaying graduation while working to pay for college. To overcome this challenge to student persistence, the University could potentially benefit from first-year programs aimed to help student borrowers make more informed financial decisions.

Perhaps our most interesting finding relates to merit aid. Scholarships, it seems, appear to substantially decrease the likelihood of student departure. While it is difficult to completely disentangle the relationship between merit aid and academic ability, our model suggests that the provision of merit aid increases the likelihood of success at the institution of entry relative to both transfer completion and drop out behavior even after controlling for other factors designed to capture a student's academic ability. This suggests that by lowering the price of attendance relative to other higher educational alternatives, merit aid has the potential to improve the competitive position of the offering institution relative to its competitors. While the concept of merit aid remains highly controversial, it appears that it has the potential to be a highly effective mechanism for college administrators to decrease the likelihood of departure of students.

References

AASCU (American Association of State Colleges and University). (2006). *Student debt burden.* Policy Matters. Vol. 3, No. 8. August.

Adelman, C. (2006). The Toolbox Revisited: Paths to Degree Completion from High School Through College. Washington, DC: U.S. Department of Education [online]. February. Available at: http://www.ed.gov/rschstat/research/pubs/toolboxrevisit/toolbox.pdf

Astin, A. W. (1975). *Financial Aid and Student Persistence*. Los Angeles, CA: Higher Education Research Institute.

Beekhoven, S. De Jong, U., & Van Hout, H. (2002). Explaining academic progress via combining concepts of integration theory and rational choice. *Research in Higher Education*. Vol. 43, No. 5. October.

Bettinger, E. (2004). *How Financial Aid Affects Persistence.* NBER Working Paper Series, Vol. w10242, pp. -, 2004. Available at SSRN: http://ssrn.com/abstract=492355

Braunstein, A, McGrath, M. & Pescatrice, D. (2000). Measuring the impact of financial factors on college persistence. *Journal of College Student Retention.* Vol.(2)3. 191-200.

Buhayar, N. (2007, April 2). "College players struggle to make the grade: Colleges' record mixed when it comes to graduation rates among basketball players." *Online NewsHour Extra.* http://www.pbs.org/newshour/extra/features/jan-june07/ncaa_4-02.html

Burke, J. C. & Minassians, H. (2001). Linking State Resources to Campus Results: From Fad to Trend – The Fifth Annual Survey.

Chapman, D. W. (1981). A Model of Student Choice. *The Journal of Higher Education, Vol. 52, No. 5.* Pp. 490-505.

College Board. (2008). *Trends in College Pricing.* New York, New York: The College Board.

http://professionals.collegeboard.com/profdownload/trends-in-college-pricing-2008.pdf

Cornwell, C., Mustard, D. B. & Sridhar, D. J. (2006). The Enrollment Effects of Merit-Based Financial Aid: Evidence from Georgia's HOPE Program. *Journal of Labor Economics, Vol. 24, No. 4.*

DesJardins, S.L., Ahlburg, D.A., & McCall, B.P. (1999). An event history model of student departure. *Economics of Education Review. 375-390.*

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2002). Simulating the longitudinal effects of changes in financial aid on student departure from college. *The Journal of Human Resources.* Vol. 37, No. 3. 653-679. Summer.

Dowd, A. C. (2004). Income and financial aid effects on persistence and degree attainment in public colleges. *Education Policy Analysis Archives.* 12(21).

Dyranski, (2002). *The Consequences of Merit Aid.* NBER Working Paper No. W9400. Available at SSRN: http://ssrn.com/abstract=364744

Ehrenberg, R. G. & Sherman, D. R. (1984). Optimal financial aid policies for a selective university. *The Journal of Human Resources.* Vol. 19, No. 2. Pp 202-230.

Hansen, W. L. (1983). Impact of Student Financial Aid on Access. *Proceedings of the Academy of Political Science, Vol. 35, No. 2.* Pp. 84-96.

Heller, D. E. (1997). Student price response in higher education: An update to Leslie and Brinkman. *The Journal of Higher Education.* Vol. 68, No. 6. Pp. 624-659.

Heller, D. E. (2001). *The Effects of Tuition Prices and Financial Aid on Enrollment in Higher Education: California and the Nation.* Rancho Cardova, CA: EdFund.

Heller, D. E. (2006). Merit Aid and College Access. *Paper presented at the Symposium on the Consequences of Merit Based Student Aid.* Madison, WI. March.

Henry, G. T., Rubenstein, R. & Bugler, D. T. (2004). Is HOPE Enough? Impacts of receiving and losing merit-based financial aid. *Educational Policy.*

Herzog, S. (2005). Measuring determinants of student return vs. dropout/stopout vs. transfer: A first-to-second year analysis of new freshmen. *Research in Higher Education.* Vol. 46, No. 8. Pp. 883-928.

Horn, L. (2006). *Placing College Graduation Rates in Context: How 4-Year College Graduation Rates Vary With Selectivity and the Size of Low-Income Enrollment* (NCES 2007-161). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Jackson, G. A. (1978). Financial aid and student enrollment. *The Journal of Higher Education.* Vol. 49, No. 6. Pp. 548-574.

Jones-White, D., Radcliffe, P.M, Huesman, R. L. Jr., Kellogg, J. P. (2010). Redefining student success: Applying different multinomial regression techniques for the study of student retention and graduation across institutions of higher education. *Research in Higher Education.* Vol 51, No. 2.

Leslie, L. L., & Brinkman, P. T. (1987). Student price response in higher education in the United States. *The Journal of Higher Education.* Vol. 58. Pp. 181-204.

Long, J. S. (1997). *Regression Models for Categorical and Limited Dependent Variables.* Sage Publications. Thousand Oaks: CA.

Long, J. S. & Freese, J. (2003). *Regression Models for Categorical Dependent Variables Using Stata: Second Edition.* Stata Press. College Station: TX.

MacCallum, M. (2008). Effects of financial aid processing policies on student enrollment, retention and success. *NASFAA Journal of Student Financial Aid.* Vol. 37, No. 2. 17-32.

McPherson, M. S. & Schapiro, M. O. (1991). Does student aid affect college enrollment?: New evidence on a persistent controversy. *The American Economic Review*. Vol. 81, No. 1. Pp. 309-318.

McPherson M. S. & Schapiro, M. O. (2002). Changing patterns of institutional aid: Impact on access and educational policy. In Heller, D. E., (Ed.). *Condition of Access: Higher education for lower income students.* Westport, DT: Praeger Publisher 73-94.

Moline, A. E. (1987). Financial aid and student persistence: An application of causal modeling. *Research in Higher Education.* Vol. 26., No. 2. 130-147.

Millett, C. M. (2003). How Undergraduate Loan Debt Affects Application and Enrollment in Graduate or First Professional School. *The Journal of Higher Education.* Vol. 74, No. 4. Pp. 386-427.

NSC (National Student Clearinghouse). (2009, April 8). *About the National Student Clearinghouse.*

http://www.studentclearinghouse.org/about/pdfs/Clearinghouse_profile.pdf

Pascarella, E. T. & Terenzini, P. T. (1991). How college affects students: Findings and insights from tweny years of research. Jossey-Bass. San Francisco, CA.

Pascarella, E. T. & Terenzini, P. T. (2005). How college affects students: A Third Decade of Research. Jossey-Bass. San Francisco, CA.

Porter, S. R. (2002). Including transfer-out behavior in retention models: Using the NSC EnrollmentSearch data. *AIR professional file* No. 82)

Porter S. (2003). Understanding Retention Outcomes: Using multiple data sources to distinguish between dropouts, stopouts, and transfer-outs. *Journal of College Student Retention, 5*(1), 53-70.

Radcliffe, Peter M., Ronald L. Huesman, Jr., John P. Kellogg, and Daniel Jones-White. (2009). "Identifying Students at Risk: Utilizing Survival Analysis to Study Student Athlete Attrition." *IR Applications 21.* Forthcoming, Spring,

Redd, K. E. (2004). Lots of Money, Limited Options: College Choice and Student Financial Aid. *NASFAA Journal of Student Financial Aid.* Volume 34, Number, 3.

Ronstadt, R. (2009, February 27). Don't Fix the Student Aid System. Kill it. *Chronicle of Higher Education, 55*(25), A36-A37. Retrieved July 31, 2009, from Professional Development Collection database.

Singell, L. & Stater, M. (2006). Going, going, gone: The effects of aid policies on graduation at three large public institutions. *Policy Sci.* 39: 379-403.

Singell, L. D., Jr. Come and stay a while: does financial aid effect retention conditioned on enrollment at a large public university? *Economics of Education Review, 23.* Pp. 459-471.

Smith, L. (2007, June 15). Congress Considers Linking Student Loan Terms to Income. *Chronicle of Higher Education, 53*(41), A17-18. Retrieved July 31, 2009, from Professional Development Collection database.

Splitt, F. G. (2007, April 9). The academic performance of college athletes: No doubt worse than reported.

http://www.thedrakegroup.org/Splitt_Academic_Performance_of_College_Athletes.pdf

Stratton, L. S., O'Toole, D.M., & Wetzel, J.N. (2008). A multinomial logit model of college stopout and dropout behavior. *Economics of Education Review.* 27: 319-331.

Schwartz, J. B. (1985). Student financial aid and he college enrollment decision: the effects of public and private grants and interest subsidies. *Economics of Education Review.* Vol. 4, No. 2. Pp. 129-144.

St. John, E. P. (1990). Price response in enrollment decisions: An analysis of the High School and Beyond senior cohort. *Research in Higher Education.* Vol. 31, No. 4. Pp. 387-403.

St. John, E. P. (1994). Assessing tuition and student aid strategies: Using price-response measures to simulate pricing alternatives. *Research in Higher Education.* Vol. 35, No. 3. 301-334.

St. John, E. P. (2000). The impact of student aid on recruitment and retention: What the research indicates. *New Directions for Student Services.* No. 89. 61-75. Spring.

St. John E. P. & Noell, J. (1989). The Effects of Student Financial Aid on Access to Higher Education: An Analysis of Progress with Special Consideration of Minority Enrollment. *Research in Higher Education, Vol. 30, No. 6.* Pp. 563-581.

Somers, P., & St. John, E. P. (1997). Interpreting price response in enrollment decisions: A comparative institutional study. *Journal of Student Financial Aid.* 29(3). 15-36.

Terkla, D. E. (1984). Does financial aid enhance graduate persistence? Paper presented at the American Educational Research Meeting

Voorhees, R. A. (1985). Student finances and campus-based financial aid: A structural model of analysis of the persistence of high need freshman. *Research in Higher Education, Vol. 22, No. 1.* Pp. 65-92

Zumeta, W. (2001). Public Policy and Accountability in Higher Education: Lessons from the

    Past and Present for the New Millenium. In Heller, D. E., (Ed.). *The States and Public*

    Higher Education Policy: Affordability, Access, and Accountability. The Johns Hopkins

    University Press. Baltimore, MD.

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Academic Background					
Composite ACT Score	5124	24.74	4.13	11	35
First Generation Student	5130	0.36	0.48	0	1
First Choice College	5130	0.71	0.46	0	1
Advance Placement Credits	5130	3.18	6.70	0	59
Remedial Course Taken	5130	0.08	0.27	0	1
First Semester Performance					
Course Completion Ratio	5065	95.03	16.00	0	100
C Count	5130	0.69	0.90	0	5
D Count	5130	0.13	0.39	0	4
W Count	5130	0.15	0.52	0	6
Demographic Characteristics					
Female	5130	0.53	0.50	0	1
Age > 19					
Asian	5130	0.11	0.31	0	1
Underrepresented Minority	5130	0.08	0.26	0	1
Athlete	5130	0.04	0.20	0	1
Geographic Origin					
Out-of-State	5130	0.06	0.24	0	1
Reciprocity State	5130	0.25	0.43	0	1
Social Integration					
Living On Campus	5130	0.62	0.48	0	1
Living Learning Community	5130	0.14	0.35	0	1
Federal Work Study	5130	0.10	0.30	0	1
Oncampus Employment	5130	0.12	0.33	0	1
Financial Aid					
Unmet Need Amount ($1000)	5130	1.62	3.78	0.00	26.35
Scholarship Only	5130	0.03	0.17	0	1
Loan Only	5130	0.21	0.41	0	1
Grant Only	5130	0.11	0.31	0	1
Scholarship & Loan	5130	0.02	0.13	0	1
Loan & Grant	5130	0.20	0.40	0	1
Scholarship & Grant	5130	0.05	0.22	0	1
Scholarship & Loan & Grant	5130	0.03	0.16	0	1
Scholarship Only ($1000)	5130	0.04	0.25	0.00	6.82
Loan Only ($1000)	5130	0.86	2.00	0.00	12.79
Grant Only ($1000)	5130	0.25	0.89	0.00	9.19
Scholarship & Loan ($1000)	5130	0.07	0.59	0.00	7.99
Loan & Grant ($1000)	5130	0.94	1.99	0.00	11.72
Scholarship & Grant ($1000)	5130	0.18	0.90	0.00	9.23
All ($1000)	5130	0.14	0.87	0.00	8.73

Table 2. Multinomial Logit Model of Institutional Degree Attainment, Transfer Degree or Dropout with FINANCIAL AID PACKAGE DUMMY VARIABLES.

	Dropout | UMN			Other 4 Yr | UMN			Dropout | Other 4-Yr		
	I	II		III	IV		V	VI	
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Academic Background									
Composite ACT Score	0.024	0.013	#	-0.017	0.018		0.041	0.020	*
First Generation Student	0.341	0.081	***	0.011	0.114		0.330	0.126	**
First Choice College	-0.148	0.087	#	-0.169	0.122		0.022	0.133	
Advance Placement Credits	-0.037	0.008	***	-0.030	0.011	**	-0.006	0.013	
Remedial Course	1.059	0.141	***	0.063	0.252		0.996	0.256	***
First Semester Performance									
Course Completion Ratio	-0.038	0.003	***	-0.015	0.005	***	-0.023	0.004	***
C Count	0.396	0.040	***	0.145	0.060	*	0.251	0.064	***
D Count	0.689	0.097	***	0.551	0.138	***	0.138	0.135	
W Count	0.938	0.104	***	0.423	0.161	**	0.515	0.161	***
Demographic Characteristics									
Female	-0.175	0.079	*	0.415	0.114	***	-0.589	0.125	***
Age > 19	1.222	0.276	***	-0.587	0.746		1.810	0.741	*
Asian	0.062	0.129		-0.463	0.224	*	0.526	0.237	*
Underrepresented Minority	0.355	0.155	*	-0.088	0.252		0.443	0.262	#
Athlete	-0.678	0.224	**	-0.542	0.290	#	-0.136	0.339	
Geographic Origin									
Out-of-State	0.085	0.162		0.684	0.205	***	-0.599	0.229	**
Reciprocity State	-0.113	0.098		0.605	0.121	***	-0.718	0.140	***
Social Integration									
Living On Campus	-0.320	0.099	***	-0.116	0.151		-0.204	0.162	
Living Learning Community	-0.314	0.142	*	-0.213	0.203		-0.102	0.226	
Federal Work Study	0.073	0.131		0.050	0.178		0.023	0.199	
Oncampus Employment	0.044	0.117		0.012	0.157		0.032	0.177	
Financial Aid Amounts									
Unmet Need Amount ($1000	0.018	0.012		0.046	0.015	**	-0.029	0.017	#
Scholarship Only	-1.068	0.359	**	-1.029	0.485	*	-0.039	0.580	
Loan Only	0.284	0.104	**	0.195	0.138		0.089	0.155	
Grant Only	-0.005	0.141		-0.511	0.222	*	0.506	0.242	*
Scholarship & Loan	-0.360	0.357		-0.156	0.483		-0.203	0.564	
Loan & Grant	0.254	0.110	*	0.140	0.153		0.113	0.169	
Scholarship & Grant	-0.983	0.267	***	-0.703	0.364	#	-0.280	0.433	
Scholarship & Loan & Grant	-0.472	0.308		-0.888	0.527	#	0.416	0.587	
Constant	1.619	0.448	***	-0.543	0.674		2.162	0.677	
Number of obs	5059								
Log likelihood	-3500.9								
LR chi2(46)	1317.97								
Prob > chi2	0								
Pseudo R2	0.1584								

Table 3. Multinomial Logit Model of Institutional Degree Attainment, Transfer Degree or Dropout with DUMMY VARIABLES FOR THE FORM OF FINANCIAL AID.

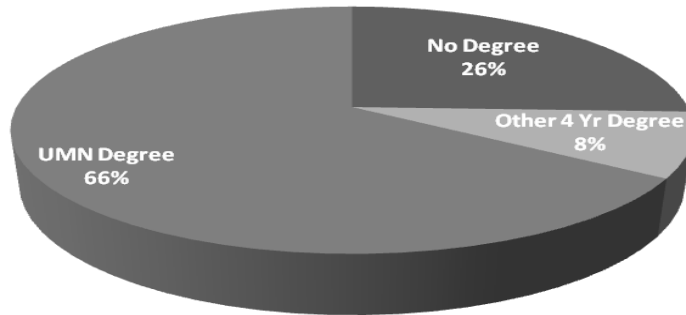|	Dropout | UMN			Transfer | Dropout			Other 4-Yr|Dropout		
	I	II		III	IV		V	VI	
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Academic Background									
Composite ACT Score	0.024	0.013	#	-0.015	0.018		-0.039	0.020	*
First Generation Student	0.341	0.081	***	0.019	0.114		-0.323	0.125	**
First Choice College	-0.147	0.087	#	-0.170	0.122		-0.023	0.133	
Advance Placement Credits	-0.037	0.008	***	-0.031	0.011	**	0.006	0.013	
Remedial Course	1.058	0.140	***	0.071	0.252		-0.986	0.255	***
First Semester Performance									
Course Completion Ratio	-0.038	0.003	***	-0.015	0.005	***	0.022	0.004	***
C Count	0.396	0.040	***	0.143	0.060	*	-0.253	0.064	***
D Count	0.689	0.097	***	0.545	0.138	***	-0.144	0.134	
W Count	0.941	0.104	***	0.419	0.161	**	-0.522	0.160	***
Demographic Characteristics									
Female	-0.173	0.079	*	0.412	0.114	***	0.585	0.125	***
Age > 19	1.219	0.275	***	-0.560	0.746		-1.779	0.740	**
Asian	0.063	0.129		-0.483	0.224	*	-0.547	0.237	**
Underrepresented Minority	0.359	0.155	*	-0.101	0.251		-0.460	0.262	#
Athlete	-0.675	0.223	**	-0.510	0.288	#	0.164	0.337	
Geographic Origin									
Out-of-State	0.087	0.162		0.695	0.204	***	0.609	0.229	**
Reciprocity State	-0.112	0.098		0.607	0.121	***	0.719	0.140	***
Social Integration									
Living On Campus	-0.321	0.098	***	-0.099	0.151		0.222	0.162	
Living Learning Community	-0.315	0.141	*	-0.201	0.203		0.114	0.226	
Federal Work Study	0.071	0.131		0.043	0.178		-0.027	0.198	
Oncampus Employment	0.044	0.117		0.009	0.157		-0.035	0.177	
Financial Aid Amounts									
Unmet Need Amount ($1000	0.016	0.011		0.040	0.014	**	0.024	0.016	
Scholarships (0-1)	-0.869	0.166	***	-0.666	0.238	**	0.204	0.276	
Grants (0-1)	-0.024	0.088		-0.197	0.124		-0.172	0.138	
Loans (0-1)	0.292	0.083	***	0.306	0.116	**	0.014	0.129	
Constant	1.623	0.446	***	-0.597	0.673		-2.220	0.675	***
Number of obs	5059								
Log likelihood	-3503.8								
LR chi2(46)	1312.16								
Prob > chi2	0								
Pseudo R2	0.1577								

Figure 1. Distribution of Six-Year Graduation Outcomes for NHS at the University of Minnesota-Twin Cities, Fall 2002.
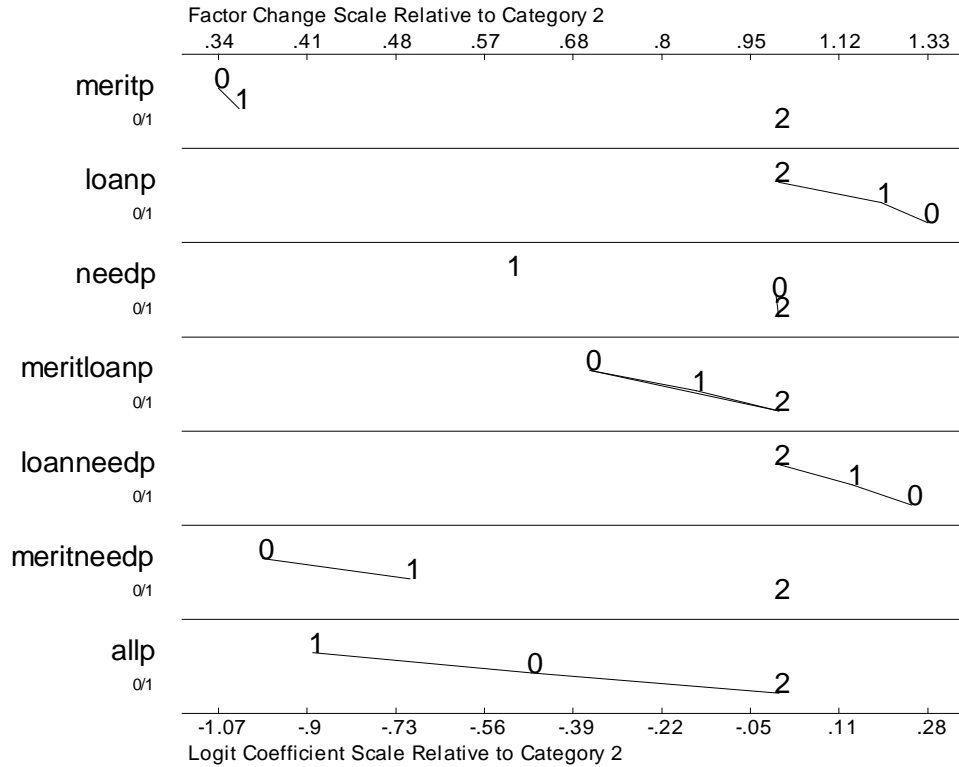
Figure 2. Odds ratio and Log odds plot for a Multinomial Logit model of Degree Attainment with Mutually Exclusive Financial Aid Packages: 0 = No Degree, 1 = Degree at another four-year institution, and 2 = degree at the institution of entry.

Scholarship Only

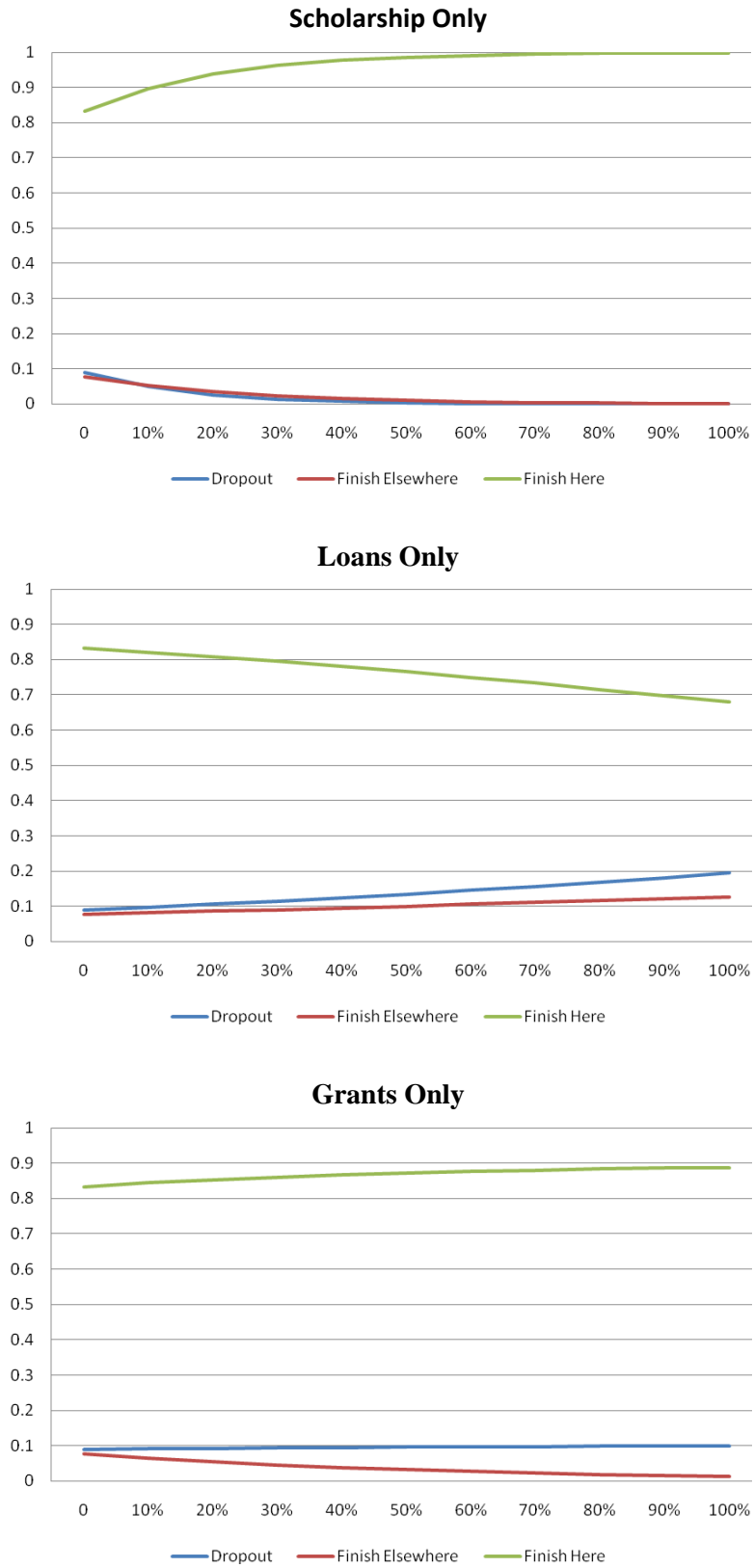**Loans Only**

Grants Only

Figure 3. Predicted Probability of Degree attainment for Homogenous Packages of Financial Aid

Scholarships and Loans

Loans and Grants
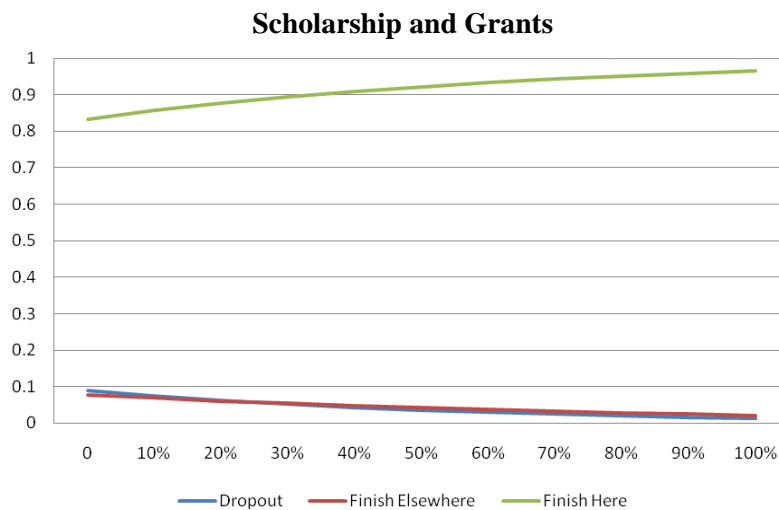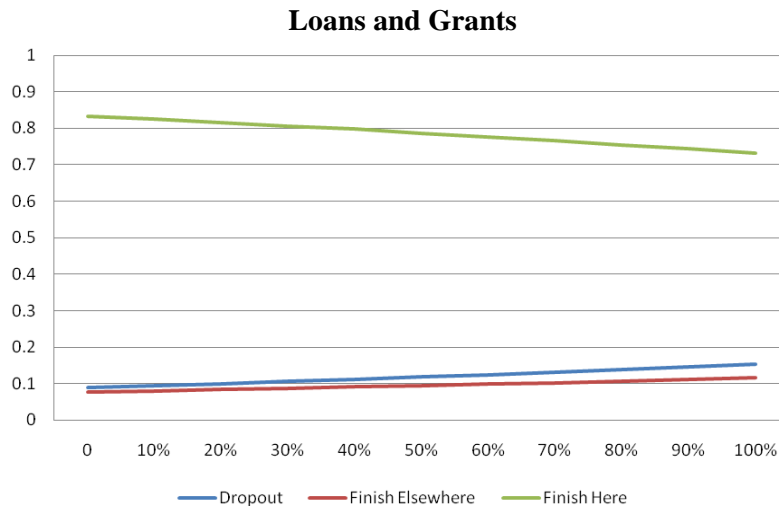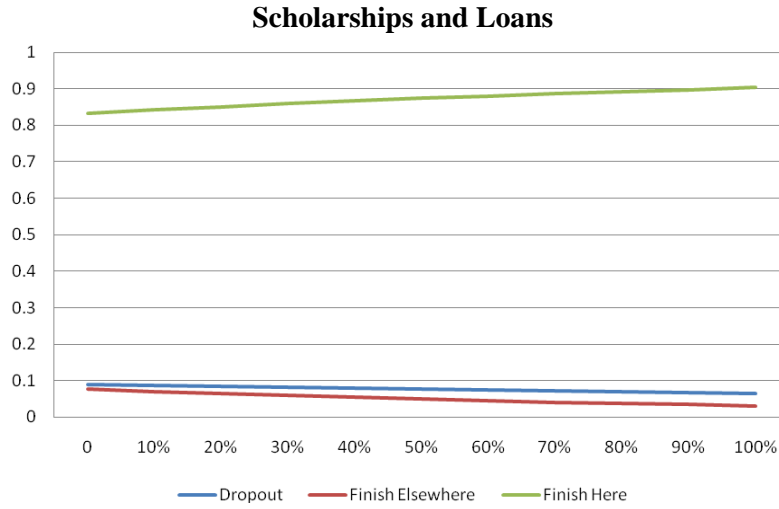

Scholarship and Grants

Figure 4. Probability of Degree attainment for Aid Packages Combining Two Forms of Aid

Comprehensive Aid Package

Figure 5. Probability of Degree attainment for Homogenous Comprehensive Aid Packaging

Factor Change Scale Relative to Category 2

```
        .42      .49      .56      .65      .75      .87     1.01     1.17     1.36
```

dmerit
0/1

dneed
0/1

dloan
0/1

```
       -.87     -.72     -.58     -.43     -.28     -.13      .01      .16      .31
```

Logit Coefficient Scale Relative to Category 2

Figure 6. Odds ratio plot for a Multinomial Logit model of Degree Attainment. Outcomes are classified as: 0 = No Degree, 1 = Degree at another four-year institution, and 2 = degree at the institution of entry.

Technical Appendix 1. Multinomial Logit Model of Institutional Degree Attainment, Transfer Degree or Dropout with FINANCIAL AID AMOUNTS ($1000)

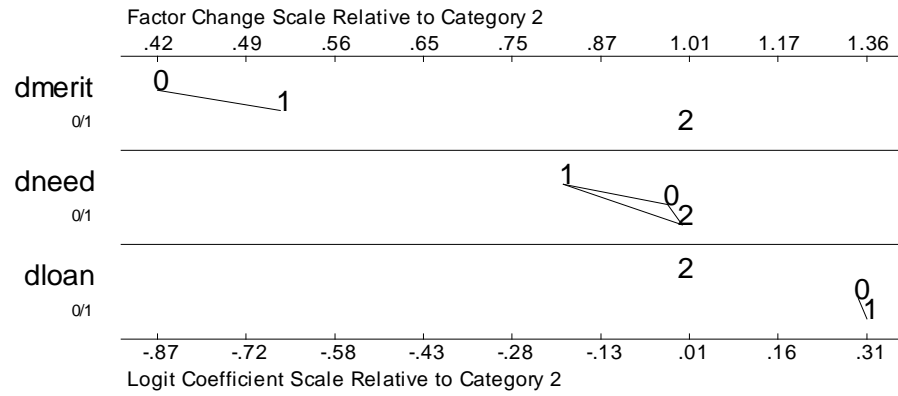|	Dropout | UMN			Other 4 Yr | UMN			Dropout | Other 4-Yr		
	I	II		III	IV		V	VI	
	Coef.	Std. Err.		Coef.	Std. Err.		Coef.	Std. Err.	
Academic Background									
Composite ACT Score	0.025	0.013	#	-0.019	0.018		0.044	0.020	*
First Generation Student	0.338	0.081	***	0.010	0.114		0.327	0.125	**
First Choice College	-0.146	0.087	#	-0.172	0.122		0.026	0.133	
Advance Placement Credits	-0.038	0.008	***	-0.031	0.011	**	-0.007	0.013	
Remedial Course	1.061	0.141	***	0.059	0.252		1.003	0.256	***
First Semester Performance									
Course Completion Ratio	-0.038	0.003	***	-0.015	0.005	***	-0.023	0.004	***
C Count	0.397	0.040	***	0.145	0.060	*	0.252	0.064	***
D Count	0.690	0.097	***	0.550	0.138	***	0.140	0.135	
W Count	0.934	0.104	***	0.427	0.162	**	0.507	0.161	**
Demographic Characteristics									
Female	-0.182	0.080	*	0.408	0.114	***	-0.591	0.125	***
Age > 19	1.226	0.277	***	-0.580	0.747		1.806	0.741	*
Asian	0.060	0.130		-0.448	0.224	*	0.509	0.238	*
Underrepresented Minority	0.362	0.157	*	-0.069	0.252		0.431	0.262	
Athlete	-0.671	0.223	**	-0.503	0.288	#	-0.168	0.337	
Geographic Origin									
Out-of-State	0.070	0.162		0.681	0.205	***	-0.611	0.229	**
Reciprocity State	-0.093	0.099		0.623	0.122	***	-0.716	0.141	***
Social Integration									
Living On Campus	-0.342	0.099	***	-0.139	0.151		-0.203	0.162	
Living Learning Community	-0.350	0.142	*	-0.250	0.204		-0.100	0.227	
Federal Work Study	0.087	0.129		0.045	0.175		0.042	0.195	
Oncampus Employment	0.045	0.117		0.013	0.157		0.032	0.177	
Financial Aid Amounts									
Unmet Need Amount ($1000	0.017	0.011		0.038	0.014	**	-0.020	0.016	
Scholarship Only ($1000)	-0.989	0.342	**	-0.643	0.401		-0.346	0.510	
Loan Only ($1000)	0.077	0.019	***	0.055	0.026	*	0.022	0.029	
Grant Only ($1000)	0.005	0.045		-0.202	0.092	*	0.207	0.096	*
Scholarship & Loan ($1000)	-0.048	0.072		-0.123	0.130		0.074	0.142	
Loan & Grant ($1000)	0.057	0.021	**	0.046	0.029		0.012	0.032	
Scholarship & Grant ($1000)	-0.221	0.063	***	-0.154	0.094		-0.067	0.109	
All ($1000)	-0.093	0.056	#	-0.124	0.092		0.031	0.103	
Constant	1.622	0.450	***	-0.465	0.675		2.087	0.678	***
Number of obs	5059								
Log likelihood	-3496.1								
LR chi2(46)	1327.42								
Prob > chi2	0								
Pseudo R2	0.1596								